IS THE WORLD BECOMING SMALLER?
GLOBALIZATION AND CONVERGENCE ACROSS COUNTRIES

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Abstract

We seek to establish whether distances between pairs of countries have decreased or not over the last half century. We consider various dimensions of distance, including demographic, economic, financial, knowledge, political, global connectedness, and cultural. Using a new methodology that enables the calculation of the minimum volume ellipsoid encompassing all countries during the 1960-2009 period, we find no evidence that the world has become smaller. We also investigate if distances between countries within specific subcomponents of the global system have become smaller. Taking into account core-semiperiphery-periphery clusters or trade blocs does not produce evidence of shrinkage within each subcomponent either. Finally, we predict that subcomponents are becoming more distant from one another. We find that core-semiperiphery-periphery subcomponents and trade blocs are becoming more distant from one another.
“Certainly,” returned Ralph. “I agree with Mr. Fogg. The world has grown smaller, since a man can now go round it ten times more quickly than a hundred years ago.”
—Gauthier Ralph and Phileas Fogg in Jules Verne’s Around the World in Eighty Days (1873:19).

Introduction

One of the most common ways of defining globalization involves the metaphor of a shrinking world. The globalizing processes caused by sweeping economic, financial, political and technological forces have led a number of social scientists to conceptualize globalization in terms of its effects on the actual and perceived magnitude of changes in space (for reviews, see Guillén 2001a; Hargittai and Centeno 2001; Sklair 1991). Thus, sociologist Anthony Giddens (1990:64, 1991:21) proposed to regard globalization as a decoupling or “distanciation” between space and time, and Roland Robertson (1992:8) argued that globalization “refers both to the compression of the world and the intensification of consciousness of the world as a whole.” Other social scientists have also dwelled upon the shrinking metaphor. For instance, geographer David Harvey (1989) and political scientist James Mittelman (1996) observed that globalization entails a “compression” of space and time, social anthropologist Thomas Eriksen (2007:16) proposed that “a minimal definition of globalization could delimit it simply as all the contemporary processes that make distance irrelevant,” and management scholar C. Gopinath (2008:30) argued that “digital technology has seemingly shrunk the world… Distances are not significant anymore.”

In this paper we examine the extent to which there is institutional convergence in the world using a spatial approach in terms of distance between pairs of nation-states. Social scientists have emphasized that, in spite of popular images, globalization is far from being a
uniform, irreversible, and inexorable trend. Rather, they propose that it is a fragmented, incomplete, discontinuous, contingent, and in many ways contradictory and puzzling process (Gilpin 2000:294; Guidry et al. 1999; Held et al. 1999:431), thus casting doubt on the argument that the world is shrinking or converging. Giddens (1990:64, 175) noted that globalization “is a process of uneven development that fragments as it coordinates. […] The outcome is not necessarily, or even usually, a generalized set of changes acting in a uniform direction, but consists in mutually opposed tendencies.” In another book, Giddens (1991:21–22) asserted that “globalization has to be understood as a dialectical phenomenon, in which events at one pole of a distanciated relation often produce divergent or even contrary occurrences at another” (see also Held et al 1999:431, 441). In a similar vein, anthropologist Jonathan Friedman (1994:210–211) asserted that globalization is the product of cultural fragmentation as much as it is the result of modernist homogeneity. Other scholars also saw globalization as a process that preserves local variations. Thus, Zelizer (1999) argued that “the economy […] differentiates and proliferates culturally in much the same way as other spheres of social life do, without losing national and even international connectedness,” while Robertson (1995:34–35) saw globalization as the “linking of localities.”

Social scientists have also empirically examined different aspects of convergence and the shrinking of the world as a result of globalization. Empirical research focused on the impact of globalization on various economic outcomes, including variations in the patterns of organization of national capitalist economies (Boyer 1996; Soskice 1998, Streeck 1991; Garrett 1998), convergence in income and output levels (Barro 1997; Bond et al. 2001), the resilience of national systems of innovation, trade, and investment (Doremus et al. 1998; Storper and Salais 1997), and the interaction among business firms and states (Orrù et al. 1997; Stopford and
Strange 1991; Guillén 2001b), among others. These studies show contradictory results ranging from non-convergence (Soskice, 1998 and Garrett, 1998) to convergence (Barro, 1997; Bond et al., 2001), with some convergence studies finding institutional and/or policy convergence that exhibits distinctive national and regional patterns (Polillo and Guillén 2005; Henizs et al. 2005).

Drawing on sociological and political theories of globalization, we formulate predictions about the effect of globalization on dyadic distances between nation-states. We consider a broad range of socio-economic and institutional dimensions of nation-states, including demographic, economic, financial, knowledge, political, global connectedness, and cultural variables to examine convergence between countries. We use a new methodology for measuring the volume that encompasses the distances between nodes (nation-states) and its evolution over time, which enables us to assess empirically whether the world is becoming greater or smaller, taking into account subcomponents such as regions, blocs, and core-periphery structures. We generally find little overall convergence, though there is increasing similarity within some clusters in the global system.

**Globalization, Institutions, and Convergence**

We define institutional variation and convergence in the wake of globalization in spatial terms. From this perspective, increasing convergence in the world would be the result of reduced distance between nodes. Following the world-society approach, we adopt the nation-state as the locus of institution-building and therefore the fundamental node in the global system (Meyer et al. 1997). During the 20th century the expansion of rationalized state activities acquired a momentum of its own, fueled by the “exigencies of global social organization whose logic and
purposes are built into almost all states.” From this perspective, nation-states are seen as exhibiting convergent structural similarity, although there is a “decoupling between purposes and structure, intentions and results.” World-society researchers argued that conformity came both from the world-culture of rationalized modernity and from domestic groups that made claims on the state following the consensus over the formal acceptance of “matters such as citizen and human rights, the natural world and its scientific investigation, socioeconomic development, and education” (Meyer et al. 1997:145, 148, 152–154, 161).

The contemporary intellectual origins of the convergence thesis are to be found in modernization theory. Rostow (1960) proposed that nation-states evolve from “undeveloped” to “developed” via five stages as long as the right value incentives are in place: traditional society, preconditions for take-off, take-off, maturity, and high mass-consumption. Each stage was seen as a prerequisite for the next because new political, economic, and social institutions were supposed to make possible ever more economically advanced and differentiated activities over time (see also Kerr et al. 1960). Political scientists (e.g. Apter 1965) refined the argument when asserting that the primary engine of change was a piecemeal shift from traditional to modern values, i.e., a transformation of authority structures, a perspective also embraced by many sociologists (see the review by Smelser 1976:144-163). Modernization theorists thought of economic, political and social development as contributing to a “shrinking” of the world, a convergence of economies and societies, a trend towards homogeneity, or at least towards a restricted set of alternatives (Kerr et al. 1960; see also Albrow 1997:49; Robertson 1992:91; Waters 1995:13-19). World trade, migration and flows of capital should all work to take resources and consumption goods from where they are cheap to where they are dear. As they travel with increasing speed and volume (given falling transportation and communication costs),
these commodity and production factor flows should erode the differences between productivity and living standards across continents and national economies (Dowrick and DeLong, 2003). Even further, Bell (1973) argued for a technologically-driven convergence of postindustrial societies.

While the concepts of globalization and convergence have been widely used in the social sciences, there is a relative dearth of empirical studies (Drezner, 2001; Guillén 2001a). Studies on structural convergence are often limited to the advanced industrial states of the OECD, which neglects the impact of developing and emerging economies on convergence patterns.

Traditional approaches within the economics literature have focused on analyzing the contribution of physical capital to output in order to examine relative levels of development across countries. Economists have empirically tested the hypothesis that per capita output and incomes across economies will converge over time, and that income levels of poor countries will tend to converge towards the income levels of rich countries. In a famous study using a panel of 80 countries with three observations per country for the periods 1965-1975, 1975-1985 and 1985-1990, Barro (1997) found that the speed of convergence is about 2.5% per year. Subsequent empirical research has addressed endogeneity concerns from regression models by using panel data methods. For instance, using a system GMM estimator, Bond et al (2001) reported a similar convergence rate of about 2 percent. Overall, these models revealed a tendency for the economic system to reach a situation of steady-state income convergence. However, they also showed that while the poor do eventually catch up with the rich, the speed at which this happens is rather low: it takes 35 years to close just half of the gap between the rich and the poor countries (Quah, 1996).
In this paper we broaden the concept of cross-national convergence beyond income disparities to include a full set of institutional characteristics. The convergence thesis argues that since the end of World War II globalizing processes have eroded national boundaries, making state structures, policymaking, political institutions, the economy, social and cultural practices, and norms and traditions more similar across countries (for reviews of the theoretical and empirical literature, see Guillén 2001a; Held et al. 1999; Campbell 2004; Evans 1997; Berger and Dore eds. 1996; Inglehart and Baker 2000; Strange 1996). In spatial terms, increasing similarities imply shorter distances between countries, and therefore a “smaller” world. Thus, we formulate the general prediction that globalization has reduced the size of the world as it generates convergence:

**Hypothesis 1:** Distance between nation-states is decreasing over time, thus reducing the size of the world.

**Convergence within Global Subcomponents**

Very much in response to modernization and convergence theories, social scientists have challenged the premise that postwar socioeconomic change was homogeneous in its effects. During the 1950s and 1960s dependency scholars noted that developing countries were dependent on more advanced ones, often former colonizers, for capital, technology and access to markets, with important implications not only for the economy but also for the political system. Dependency theorists observed that the terms of trade between advanced (core) countries and developing (peripheral) countries tended to evolve against the latter, who would become more
impoverished as they engaged in international trade (Prebisch 1950; Frank 1967; Furtado 1970; Bruton 1998). Thus, the tendency of capitalist development was to create exploitative relationships between developed and underdeveloped countries, i.e. a duality of effects as a result of global economic forces, which affected different subcomponents of the global system in different ways. They also predicted that development efforts resulted in the gradual displacement of the small-scale local bourgeoisie not connected to foreign and state capital, with the “triple alliance” of state-owned enterprises, subsidiaries of foreign multinationals, and local business groups gaining in importance (Evans 1979; Frank 1967; Cardoso and Faletto 1973).

Economic theories of growth that incorporate technological differences across regions also predict divergence in income levels and growth rates across regions (Grossman and Helpman, 1991). Even if trade across countries may facilitate convergence, growth rates and productivity gaps within industries across countries might persist when factor endowments are different because of the mismatch between labor skills available in more developing countries versus more sophisticated technologies imported from more developed countries, for example. This suggests that fundamental differences in initial conditions across countries can impact both the diffusion of technology across countries and resulting convergence.

Building on the dependency perspective, Wallerstein (1974) proposed another influential theory of development that emphasized systemic patterns of dependence in the global political economy and the emergence of subcomponents in the global system. He saw underdevelopment as the result of a country’s integration into the modern “world-system” created by the capitalist development of Western Europe since the sixteenth century. In this view, global capitalist forces have not only generated oppression and duality between the “core,” on the one hand, and the undeveloped “periphery” and developing “semi-periphery,” on the other, but also a momentum
of their own as the capitalist world-system inexorably experiences a series of recurrent crises that result from its inherent contradictions (see also Ragin and Chirot 1984:292-294). Unlike dependency theorists, however, states (and not social classes) are central to world-system analysis because they manage the social problems generated by the expansion of world capitalism and thus contribute to the stabilization of the world-system (Waters 1995:22-26). Recent empirical research has found that the world-system is indeed formed of core, semi-peripheral, and peripheral subcomponents in terms of the role that countries play in global economic, financial, political, diplomatic, and military affairs (Van Rossem 1996; Smith and White 1992; Chase-Dunn et al. 2000). Building on this insight, world-society scholars were among the first to point out that “the world as a whole shows increasing structural similarities of form among societies without, however, showing increasing equalities of outcomes among societies” (Meyer & Hannan 1979:3, 13–15). This cross-national institutional diversity has been the dominant theme in much recent theorizing about nation-states and their effects on the society, the economy, and the culture (Campbell 2004; Orrù, Biggart, and Hamilton 1997; Dobbin 1994; Guillén 2006).

A third theory emphasizing the emergence of subcomponents in the global system has to do with trade blocs. The first modern trade bloc was the German Zollverein of 1834, which created a customs union among the various German-speaking principalities. Beginning in the 1980s, the world witnessed the emergence of continental-size trade blocs such as the European Union (EU), the North American Free Trade Agreement (NAFTA), and the Mercosur, among others. A simple functional analysis highlights that trade blocs tend to be formed by countries geographically adjacent or close, with similar trade policies or regimes, and sharing a desire to organize regionally. While they are an attempt to enhance trade, in practice they destroy, divert,
and create trade in complex ways (De Melo and Panagariya 1992; Mansfield and Milner 1999). Nevertheless, based on a variety of empirical models, a consensus has emerged in the political economy literature that regional trade agreements are trade-creating for member states (Thursby and Thursby 1987; Frankel and Rose 2000; Rose 2000), but could lead to trade diversion or destruction relative to non-members. For example, Bayoumi and Eichengreen (1997) found that the formation of the European Economic Community reduced the annual growth of trade between members and industrialized non-members by 1.7 percentage points, while Leonardi (1995) analyzed per capita income convergence relative to the period 1970-1995 and found convergence at both the regional and national level for European countries. Soloaga and Winters (2001) showed that the European Union (EU), the European Free Trade Association (EFTA) and the North American Free Trade Agreement (NAFTA) led to a decline in levels of trade with third countries. Moreover, the formation of a trade bloc requires political commitments and extensive institution building and policy coordination among member countries (Gilpin 1987; Mansfield and Milner 1999; Fligstein and Sweet 2002).

In addition to generating convergence among member countries, trade blocs tend to diverge from one another. Perhaps the most important reason for divergence across trade blocs is that they tend to have very different characteristics. For example, some entail a coordination of overall trade policy (e.g. a customs union such as the EU) while others are limited to the removal of internal barriers (the NAFTA), and some blocs entail deeper agreements over matters such as labor mobility, taxes, regulation, antitrust policies, and even monetary matters. There are other reasons why trade agreements generate convergence within the bloc but divergence across blocs. Trade blocs have often resulted in pressures to initiate political reforms (as in Southern and Eastern Europe prior to accessing the EU), enhanced power in global trade negotiations, and an
extension of influence over weaker nation-states, especially in the developing world (Mansfield and Milner 1999).

Dependency, world-system, and political-economic trade-bloc theories emphasize the emergence of a multi-layered world as a result of economic and sociopolitical development, one in which countries within each subcomponent—developed and developing, core and periphery, or trade blocs—become more similar to one another while each component becomes more distinct than the others. In other words, convergence is expected within components while divergence obtains across components. Thus, we predict that

**Hypothesis 2:** Distances within each subcomponent of the global system of nation-states decrease over time, thus reducing the size of each subcomponent.

**Hypothesis 3:** Distance across subcomponents of the global system of nation-states is increasing over time, thus expanding the size of the world.

**Data**

We approach cross-national institutional variation and convergence taking into account the dimensions that the world-society approach (Meyer et al. 1997) associates with social change on a global scale, including demographic, economic, financial, knowledge, political, global connectedness, and cultural dimensions (Berry, Guillén and Zhou, 2010). These dimensions can be operationalized following Whitley’s (1992) sociological analysis of national business systems, Henisz and Williamson’s (1999) and La Porta et al.’s (1998) economic frameworks of
national governance institutions, Nelson and Rosenberg’s (1993) concept of national innovation institutions, and Inglehart and Baker’s (2000) theory of cross-national cultural change. National business systems are “particular arrangements of hierarchy-market relations becoming institutionalized and relatively successful in particular contexts” (Whitley 1992:10). Countries differ to varying degrees in terms of the characteristics of their business systems, specifically their economic, financial, and administrative practices. Whitley (1992:231) argued that such differences originate in demographic, geographic, cultural, and political institutions, which make some countries more different, or distant, than others from a given focal country.

National governance systems refer to the “set of incentives, safeguards, and dispute-resolution processes used to order the activities of various corporate stakeholders” such as owners (i.e. shareholders), managers, workers, creditors, suppliers and customers (Kester, 1996:109). They originate in administrative, legal and political institutions that historically make certain stakeholders more powerful in certain countries than others (Glendon et al. 1994; Henisz & Williamson 1999; Henisz 2000; La Porta et al. 1998). While this theoretical tradition emphasizes a smaller set of institutional dimensions than the theory of business systems, the underlying logic is also one of institutional variation that produces longer distances between countries.

National innovation systems refer to configurations of institutions that foster the development of technology and innovation (Nelson and Rosenberg 1993). A central tenet documented by this literature is that countries differ in their ability to produce knowledge and in the extent to which they can leverage that knowledge by being connected to other countries (Porter 1990; Furman et al. 2002). Finally, we also took into consideration the model of cultural
change proposed by Inglehart and Baker (2000), in which cross-national cultural values are considered to be the result of the intersection of forces tending towards modernization (including economic and political influences) and those tending to preserve traditions.

As described in Table 1, we included several variables for each of our seven measures of cross-national institutional variation. We consulted several sources to create the seven measures of cross-national institutional variation. For the economic, financial, demographic and global connectedness measures, our data came from the World Bank’s World Development Indicators database. For the political measure, we used data from Henisz’ POLCONV database, Freedom House, and the World Trade Organization. The knowledge measures came from the U.S. Patent and Trademark Office and the Institute for Scientific Information. Finally, the cultural measures are all based on the World Values Surveys. Each data source, year availability, and country coverage are summarized in Table 2.¹

Methods

We measured patterns in global convergence through a multidimensional modeling approach. We relied on a panel of data where we observe characteristics of nation-states across many years. For a given distance dimension (e.g. political, economic, cultural), we observed a set of $k$ variables² each year for each country being considered in the analysis. We can thus think of countries as points lying in a $k$-dimensional characteristic space, where the points move over time. Convergence can be conceptualized as the process of these points moving closer together—

¹ Data used in our analysis are available from http://www.lauder.wharton.upenn.edu/ciber/research/faculty.asp
² $k$ is in general different for each distance dimension
that is, countries becoming less distant over time. Figure 1 depicts a three-dimensional example at one point in time.

We use changes in global volume to measure the process of country points compressing or expanding over time. To quantify the extent of the compacting of distance across nations, we analyze the minimum-volume ellipsoid (MVE) measure. For each year, we first calculate the $k$-dimensional ellipsoid of minimum volume that contains all of the country points. The volume of this ellipsoid is the MVE measure. Let $V_t \subseteq \mathbb{R}^k$ be the set of $k$-dimensional country points in year $t$ (as in Figure 1a). Formally, the minimum volume ellipsoid in year $t$ is the $k$-dimensional ellipsoid $\{v \in \mathbb{R}^k: (v - \hat{c}_t)^T \hat{A}_t^{-1}(v - \hat{c}_t) = k\}$, where $\hat{A}_t$ is a $k \times k$ matrix and $\hat{c}_t$ is a $k \times 1$ vector that jointly solve

$$
\min \log(\det(A_t))
$$

$$
s.t. \quad (v - c_t)^T A_t^{-1} (v - c_t) \leq k \quad (v \in V_t).
$$

We compute a different $(\hat{A}_t, \hat{c}_t)$ pair for each year and then calculate the associated ellipsoid volume for each year. Because we have data for several distance dimensions, we calculate a separate volume for each distance dimension in each year. We use the \texttt{cluster} package (Maechler, Rousseeuw, Struyf, and Hubert 2005) in the R statistical software (R Development Core Team 2010) to compute the minimum volume ellipsoid of a set of points.

As an example of our approach, consider Figure 1a, which depicts one year of our political distance data for all country points in a $k = 3$-dimensional political space. The minimum volume ellipsoid enclosing the country points is shown in Figure 1b. This is, by definition, the smallest ellipsoid that contains all the points, and it thus is a good estimate of the
political “size” of the world in 1972. If we repeat the process for 1973 and later years and find progressively smaller volumes, we consider this to be evidence of convergence along the political dimension. In our first hypothesis, we consider the global system as a whole. For our second and third hypotheses, we consider subcomponents of nation-states and compare our minimum volume ellipsoid measures both within and across these subcomponent groupings.

Figure 2 provides an example of how these subcomponent patterns might look when examining the patterns suggested by the second and third hypotheses. Frame (a) in figure 3 shows country-level data for a particular year. When attempting to measure global volumes, we would enclose the points in the minimum volume ellipsoid shown in frame (b). If we suspect distinct group patterns, we would define the subcomponents and enclose each set of subcomponent points in its own minimum volume ellipsoid as in frame (c). Frame (d) in Figure 3 shows the group ellipsoids along with the world ellipsoid. If subcomponents have their own distinct patterns over time, then it is easy to imagine a scenario where within-subcomponent convergence coexists with worldwide divergence.

There are a few useful features of the MVE measure. One of the most appealing properties of the MVE measure is that it is invariant to affine transformations of $V_t$.\footnote{If we were to premultiply each $v \in \bigcup V_t$ by the same fixed nonzero matrix and add a $k$-vector to each product, the resultant volumes would not be affected except perhaps by a constant multiple. Since the MVE measure is an index, the constant multiple is irrelevant and would not affect our inference.} This implies that the MVE measure is not affected by time-invariant issues of scale or correlation in the data. This is particularly useful for our purposes since the $k$ variables are in general measured in different units and are correlated with each other. Second, the ellipsoid volumes are indices, so that multiplying any time series of volumes by a fixed constant does not affect our inference. A
third appealing feature of this method is that the assumption of an ellipsoidal pattern closely approximates the shape of the actual data. Finally, the MVE method has a nice intuitive interpretation that lends itself to our hypotheses and for consideration of how small the world has become over time.

This methodology is different from the approach used in the economics literature on convergence. For example, Barro (1997) estimated a regression of economic growth rates on national incomes to examine whether national incomes will converge to the same steady-state level. Our definition of convergence is broader—we analyze convergence across multiple distance dimensions each containing multiple variables, and thus use a measure of joint convergence.

For comparison and robustness, we calculate volume indices using two other methods: a mean-based and a median-based measure of the size of the world. The mean-based volume algorithm finds the mean Mahalanobis distance between each country point and the centroid of the set of points. It then calculates the volume of a $k$-sphere with radius equal to the aforementioned mean. The median-based calculation proceeds similarly, but replaces the mean of distances to the centroid with the median. While the mean-based calculation is relatively simple and provides a good description of the process being modeled, it is susceptible to the problem of extreme observations. The median-based measure, though more robust to outlying observations, only describes the volume occupied by half of the countries. Both the mean- and median-based measures assume spherical volumes, and thus will not approximate the shape of $V_t$ as closely as the MVE volume. However, these two measures act as robustness checks for the MVE volume and also highlight different aspects of the data.
Results

The first hypothesis predicted smaller distances over time and hence a smaller world. Figure 3 shows the volume ellipsoid calculations for each of the seven distance dimensions over time. There are different time periods reflected in each of these graphs due to data availability across dimensions. In general, the graphs in Figure 3 show that world volumes increased over time for the economic, cultural, demographic, financial, and global connectedness dimensions. The knowledge and political volumes appear to exhibit more cycles over time than the other variables, but also reveal increasing trends. These graphs suggest that global volume is not monotonically decreasing as a function of time for any of the seven dimensions of distance.

To formally test hypothesis 1, we implement a variant of Kendall’s tau test. Kendall’s tau is a nonparametric statistic that measures the rank correlation between two sets of data. By estimating the rank correlation between the volumes and the years in which they were measured, we can obtain a quantity that summarizes the extent to which the volumes exhibit time trends. We specify a tau test where the null hypothesis is zero correlation (no trend) and the alternative hypothesis is negative correlation (decreasing trend). These tests, reported in Table 5, fail to reject the null hypothesis at the 5% significance level for any of the seven distance dimensions. Thus, we do not find evidence in favor of the first hypothesis.4

We implemented several robustness checks. We found that the MVE volume measure is positively correlated with both the mean-based and median-based volume measures. Since the median-based volume measure is less sensitive to outliers, the positive correlation implies that

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4 A regression of volumes on time show similar patterns of rejection. Kendall’s tau, however, is less restrictive due to its ordinal nature.
inference based on the MVE measure is not heavily influenced by outlying countries. Furthermore, the MVE volume measure is robust to issues of scale and time-invariant correlation in the country-level data. To evaluate the claim that distances between countries may have become smaller in recent years as opposed to during the entire 1960-2009 period, we calculated the tau trend test for the 1985-2009 period. With the exception of the knowledge distance dimension, we do not find evidence of smaller distances and volumes at the 5% significance level (results available upon request).

In the second hypotheses, we argued that smaller distances and volumes may be expected within subcomponents of the global system of nation-states. We considered two different groupings of nation-states to examine subcomponents of the global system, including: core-semiperiphery-periphery groups, and trade blocs. We start by discussing the core-periphery grouping results.

We used the core, semi-periphery and periphery country groupings from Van Rossem (1996) that are reported in Table 3 to calculate the minimum ellipsoid volumes for the core-periphery subcomponents of the global system. These volumes are plotted in figures 4a, 4b and 4c. Visually, there are appear to be no trends of smaller distances or volumes. Table 6 shows the results of the Kendall’s tau trend tests, which shows little to no evidence of convergence within the core, semiperiphery, and periphery subcomponents.5

We also calculated all volume measures and tests for three free trade areas (the Association of Southeast Asian Nations, ASEAN, the Central European Free Trade Agreement,

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5 For all subcomponents, we calculate the tau trend tests restricting the years to 1985-2009. The rejection patterns, reported in tables 9 through 12, are very similar to the full set of volumes (1960-2009), indicating a lack of evidence for recent convergence.
CEFTA, and the South Asian Association for Regional Cooperation, SAARC). We report the results in Figures 5a, 5b and 5c, respectively. We took into account when a country became part of the trade bloc (see Table 4). In general, the graphs in Figures 5a, 5b and 5c reveal a similar lack of convergence. We report the Kendall’s tau estimates in Table 6. Only two of them were significant: demographic in the core and knowledge in the semiperiphery, indicating that there is a decline in volume over time.

Next we examined the patterns within trade blocs (Figure 5). We show results for ASEAN, CEFTA, SAARC, Andean Pact, Mercosur, SACU, Caricom, EU27, the Eurozone-11, and NAFTA. As reported in Table 7, only Mercosur, SACU, Mercosur and NAFTA show some evidence of decreasing volumes over time, but only along one or at most two dimensions (NAFTA). In sum, we find little support for Hypothesis 2 that distances and volumes within subcomponents of the global system are dropping over time.

To examine Hypothesis 3 on distances and volumes between subcomponents, we also calculated Kendall’s tau tests (see Tables 8 and 9). We find that core-semiperiphery-periphery subcomponents and trade blocs are becoming more distant from one another, indicating that globalizing processes have exerted different effects within and between subcomponents.

**Discussion and Conclusion**

***This section needs to be written after all empirical results are verified.***
References


FIGURE 1
COUNTRIES IN 3-DIMENSIONAL POLITICAL CHARACTERISTIC SPACE, 1972
FIGURE 2
EXAMPLE OF SUBCOMPONENT VOLUME CALCULATION
FIGURE 3
GLOBAL VOLUMES, 1960-2009

NOTE.—All volume time series are calculated using MVE method and are scaled to equal 1 in 2000. The penultimate graph, labeled “Global”, refers to the volume measure for the global connectedness distance dimension.
FIGURE 4a: Core-Periphery Results
CORE COUNTRY VOLUMES, 1960-2009

NOTE.—All volume time series are calculated using MVE method and are scaled to equal 1 in 2000. The penultimate graph, labeled “Global”, refers to the volume measure for the global connectedness distance dimension.
FIGURE 4b: Core-Periphery Results
SEMIPERIPHERY COUNTRY VOLUMES, 1960-2009

NOTE.—All volume time series are calculated using MVE method and are scaled to equal 1 in 2000. The penultimate graph, labeled “Global”, refers to the volume measure for the global connectedness distance dimension.
FIGURE 4c: Core-Periphery Results
PERIPHERY COUNTRY VOLUMES, 1960-2009

NOTE.—All volume time series are calculated using MVE method and are scaled to equal 1 in 2000. The penultimate graph, labeled “Global”, refers to the volume measure for the global connectedness distance dimension.
FIGURE 5a: TRADE BLOC RESULTS

Free Trade Agreement - ASEAN
FIGURE 5E: TRADE BLOC RESULTS

Free Trade Agreement CEFTA
FIGURE 5c – TRADE BLOC RESULTS

Free Trade Agreement - SAARC
FIGURE 5d: TRADE BLOC RESULTS

Customs Union ANDEAN Community

Year
Volume
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.2
0.4
0.6
0.8
1.0
1.2
0.5
1.0
1.5
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0.2
0.4
0.6
0.8
1.0
1.2
Economic Knowledge Financial Global Political
FIGURE 5e: TRADE BLOC RESULTS

Customs Union - MERCOSUR

![Graph showing trade bloc results for Economic, Knowledge, Financial, Global, and Political categories from 1995 to 2010. The x-axis represents years (1995, 2000, 2005, 2010), and the y-axis represents volume (0.0 to 1.5). The graph illustrates fluctuations in trade volumes across different categories over the specified period.]
FIGURE 5f – TRADE BLOC RESULTS

Customs Union - SACU

Year
Volume
Economic
Demographic
Knowledge
Financial
Global
Political

FIGURE 5g: TRADE BLOC RESULTS

Common Market - CARICOM
FIGURE 5h: TRADE BLOC RESULTS

Common Market - EU - 27
FIGURE 5G: TRADE BLOC RESULTS

Monetary Union – Eurozone 11
FIGURE 6: NAFTA RESULTS USING MINIMUM VOLUME HYPERSPHERE VOLUMES

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
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<td>1995</td>
<td>0.6</td>
</tr>
<tr>
<td>2000</td>
<td>0.7</td>
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<tr>
<td>2005</td>
<td>0.8</td>
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<tr>
<td>2010</td>
<td>0.9</td>
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</table>

- Economic
- Demographic
- Knowledge
- Financial
- Global
- Political
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Component Variables:</th>
</tr>
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<tbody>
<tr>
<td><strong>1. Economic</strong></td>
<td>GDP per capita, 2000 USD</td>
</tr>
<tr>
<td>Income</td>
<td>Exports of goods and services (% GDP)</td>
</tr>
<tr>
<td>Exports</td>
<td>Imports of goods and services (% GDP)</td>
</tr>
<tr>
<td>Imports</td>
<td></td>
</tr>
<tr>
<td><strong>2. Financial</strong></td>
<td>Domestic credit to private sector (% GDP)</td>
</tr>
<tr>
<td>Private Credit</td>
<td>Market capitalization of listed companies (% GDP)</td>
</tr>
<tr>
<td>Stock Market Cap</td>
<td>Number of listed companies (per one million population)</td>
</tr>
<tr>
<td>Listed Companies</td>
<td></td>
</tr>
<tr>
<td><strong>3. Political</strong></td>
<td>Political stability measured by considering independent institutional actors with veto power</td>
</tr>
<tr>
<td>Policy Making Uncertainty</td>
<td>Democracy Score</td>
</tr>
<tr>
<td>Democratic character</td>
<td>Government consumption (% GDP)</td>
</tr>
<tr>
<td>Size of the state</td>
<td></td>
</tr>
<tr>
<td><strong>4. Cultural</strong></td>
<td>WVS question on obedience and respect for authority</td>
</tr>
<tr>
<td>Power distance</td>
<td>WVS questions on trusting people and job security</td>
</tr>
<tr>
<td>Uncertainty avoidance</td>
<td>WVS questions on independence and the role of government in providing for its citizens</td>
</tr>
<tr>
<td>Individualism</td>
<td>WVS questions on the importance of family and work</td>
</tr>
<tr>
<td>Masculinity</td>
<td></td>
</tr>
<tr>
<td><strong>5. Demographic</strong></td>
<td>Life expectancy at birth, total (years)</td>
</tr>
<tr>
<td>Life expectancy</td>
<td>Birth rate, crude (per 1,000 people)</td>
</tr>
<tr>
<td>Birth rate</td>
<td>Population ages 0-14 (% of total)</td>
</tr>
<tr>
<td>Population under 14</td>
<td>Population ages 65 and above (% of total)</td>
</tr>
<tr>
<td>Population under 65</td>
<td></td>
</tr>
<tr>
<td><strong>6. Knowledge</strong></td>
<td>Number of patents per one million population</td>
</tr>
<tr>
<td>Patents</td>
<td>Number of scientific articles per one million population</td>
</tr>
<tr>
<td>Scientific Articles</td>
<td></td>
</tr>
<tr>
<td><strong>7. Global Connectedness</strong></td>
<td>International tourism, expenditures (% GDP)</td>
</tr>
<tr>
<td>International Tourism Expend</td>
<td>International tourism, receipts (% GDP)</td>
</tr>
<tr>
<td>International Tourism Receipts</td>
<td>Internet users per 1,000 people</td>
</tr>
<tr>
<td>Internet use</td>
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Table 2: Data Sources, Year Availability, and Country Coverage

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Source</th>
<th>Years Available</th>
<th># of Countries (in 2004)</th>
</tr>
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<td>Source</td>
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<td># of Countries (in 2004)</td>
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<td>WDI</td>
<td>1960-2005</td>
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<tr>
<td>Imports</td>
<td>WDI</td>
<td>1960-2005</td>
<td>165</td>
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<tr>
<td>2. Financial</td>
<td>Private credit</td>
<td>WDI</td>
<td>1960-2005</td>
</tr>
<tr>
<td></td>
<td>Stock market Cap</td>
<td>WDI</td>
<td>1988-2005</td>
</tr>
<tr>
<td></td>
<td>Listed companies</td>
<td>WDI</td>
<td>1988-2005</td>
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<td>3. Political</td>
<td>Policymaking uncertainty</td>
<td>POLCONV</td>
<td>1960-2005</td>
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<tr>
<td></td>
<td>Democracy score</td>
<td>Freedom House</td>
<td>1960-2003</td>
</tr>
<tr>
<td></td>
<td>Size of the state</td>
<td>WDI</td>
<td>1960-2005</td>
</tr>
<tr>
<td></td>
<td>Uncertainty avoidance</td>
<td>WVS</td>
<td>1980-2004</td>
</tr>
<tr>
<td></td>
<td>Individualism</td>
<td>WVS</td>
<td>1980-2004</td>
</tr>
<tr>
<td></td>
<td>Masculinity</td>
<td>WVS</td>
<td>1980-2004</td>
</tr>
<tr>
<td>5. Demographic</td>
<td>Life expectancy</td>
<td>WDI</td>
<td>1960-2004</td>
</tr>
<tr>
<td></td>
<td>Birth rate</td>
<td>WDI</td>
<td>1960-2004</td>
</tr>
<tr>
<td></td>
<td>Population under 14</td>
<td>WDI</td>
<td>1960-2005</td>
</tr>
<tr>
<td></td>
<td>Population under 65</td>
<td>WDI</td>
<td>1960-2005</td>
</tr>
<tr>
<td></td>
<td>Scientific articles</td>
<td>WDI &amp; ISI</td>
<td>1960-2003</td>
</tr>
<tr>
<td></td>
<td>International tourism Receipts</td>
<td>WDI</td>
<td>1995-2004</td>
</tr>
<tr>
<td></td>
<td>Internet users</td>
<td>WDI</td>
<td>1995-2004</td>
</tr>
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<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semiperiphery</td>
<td>Sweden, Switzerland, India, Egypt, Austria, Nigeria, Czech Republic, Iran, Argentina, Romania, Algeria, Pakistan, Mexico, Iraq, Poland, Turkey, Portugal, Libya, Greece, Indonesia, Thailand</td>
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<td></td>
</tr>
<tr>
<td>Periphery</td>
<td>Venezuela, Kuwait, Denmark, Kenya, Ethiopia, Morocco, Philippines, Norway, Korea, Senegal, Syria, Peru, Bulgaria, Finland, Cuba, Hungary, Malaysia, Tunisia, Colombia, Tanzania, United Arab Emirates, Ivory Coast, Sudan, Ecuador, Jordan, Bangladesh, Ghana, Zimbabwe, Israel, Sri Lanka, Chile, Uruguay, Zambia, Costa Rica, Ireland, New Zealand, Mozambique, Cameroon, Panama, Guinea, Bolivia, Nicaragua, Angola, Guatemala, Somalia, Myanmar, Gabon, Oman, Dominican Republic, Haiti, Congo, El Salvador, Honduras, Paraguay, Qatar, Singapore, Jamaica, Yemen, Liberia, Laos, Uganda, Madagascar, Cyprus, Nepal, Malta, Mali, Trinidad and Tobago, Sierra Leone, Central African Republic, Iceland, Bahrain, Mauritania, Togo, Papua New Guinea, Niger, Rwanda, Burkina Faso, Burundi, Benin, Guyana, Guinea-Bissau, Mauritius, Suriname, Botswana, Djibouti, Seychelles, Fiji, Malawi, The Gambia, Lesotho, Equatorial Guinea, Antigua &amp; Barbuda, Belize, Cape Verde, Taiwan, Barbados, Chad, Swaziland, Bahamas, Sao Tome &amp; Principe, Hong Kong, Grenada, Tonga, Comoros, Maldives, Samoa, Netherlands Antilles, Greenland, Brunei, Bermuda, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Namibia, Solomon Islands, Faeroe Islands, Gibraltar, Guam, New Caledonia, American Samoa, French Polynesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade Bloc</td>
<td>Nations and their Years of Participation*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAFTA</td>
<td>Canada (1992), Mexico (1992), United States (1992)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
*Years of participation are given in parentheses. A single year indicates that the country entered the bloc and is still a member.
TABLE 5
TREND TEST FOR WORLD VOLUMES, 1960-2009

<table>
<thead>
<tr>
<th>Distance Dimension</th>
<th>Correlation</th>
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</thead>
<tbody>
<tr>
<td>Economic</td>
<td>0.76</td>
</tr>
<tr>
<td>Demographic</td>
<td>0.62</td>
</tr>
<tr>
<td>Cultural</td>
<td>0.67</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-0.14</td>
</tr>
<tr>
<td>Financial</td>
<td>0.60</td>
</tr>
<tr>
<td>Global</td>
<td>0.78</td>
</tr>
<tr>
<td>Political</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

NOTE.— Test statistics are Kendall’s tau estimates of rank correlation between world volumes and time. Significance implies that the volume of the world is decreasing over time.

TABLE 6
TREND TEST FOR WITHIN CORE, SEMIPERIPHERY, AND PERIPHERY VOLUMES, 1960-2009

<table>
<thead>
<tr>
<th>Distance Dimension</th>
<th>Core</th>
<th>Semiperiphery</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>0.36</td>
<td>0.61</td>
<td>0.72</td>
</tr>
<tr>
<td>Demographic</td>
<td>-0.40*</td>
<td>0.44</td>
<td>0.60</td>
</tr>
<tr>
<td>Knowledge</td>
<td>0.75</td>
<td>-0.30*</td>
<td>-0.19</td>
</tr>
<tr>
<td>Financial</td>
<td>0.62</td>
<td>0.48</td>
<td>0.67</td>
</tr>
<tr>
<td>Global</td>
<td>0.71</td>
<td>0.27</td>
<td>0.76</td>
</tr>
<tr>
<td>Political</td>
<td>-0.12</td>
<td>0.45</td>
<td>0.38</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

NOTE.— Test statistics are Kendall’s tau estimates of rank correlation between subcomponent volumes and time. Significance implies that the volume of the subcomponent is decreasing over time.
**TABLE 7**
*TREND TEST FOR WITHIN TRADE BLOC VOLUMES*

<table>
<thead>
<tr>
<th></th>
<th>ASEAN</th>
<th>CEFTA</th>
<th>SAARC</th>
<th>Andean Community</th>
<th>Mercosur</th>
<th>SACU</th>
<th>CARICOM</th>
<th>EU</th>
<th>Eurozone</th>
<th>NAFTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic</td>
<td>0.70</td>
<td>0.52</td>
<td>0.55</td>
<td>0.28</td>
<td>0.14</td>
<td>0.14</td>
<td>0.76</td>
<td>0.77</td>
<td>-0.33</td>
<td>0.57</td>
</tr>
<tr>
<td>Demographic</td>
<td>0.62</td>
<td>0.53</td>
<td>0.63</td>
<td>-</td>
<td>-0.32**</td>
<td>0.43</td>
<td>0.34</td>
<td>0.24</td>
<td>-0.34***</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>0.61</td>
<td>-0.07</td>
<td>0.34</td>
<td>0.16</td>
<td>-0.13</td>
<td>0.38</td>
<td>0.73</td>
<td>0.39</td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td>0.19</td>
<td>0.24</td>
<td>0.51</td>
<td>0.24</td>
<td>0.31</td>
<td>0.27</td>
<td>-0.47</td>
<td>0.45</td>
<td>-0.20</td>
<td>0.70</td>
</tr>
<tr>
<td>Global</td>
<td>0.65</td>
<td>0.85</td>
<td>0.93</td>
<td>0.71</td>
<td>0.59</td>
<td>0.43</td>
<td>0.87</td>
<td>0.80</td>
<td>-0.64**</td>
<td>0.08</td>
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<tr>
<td>Political</td>
<td>0.66</td>
<td>0.05</td>
<td>0.33</td>
<td>0.16</td>
<td>-0.72***</td>
<td>0.40</td>
<td>0.18</td>
<td>0.38</td>
<td>-0.44</td>
<td>-0.26*</td>
</tr>
</tbody>
</table>

p<0.05,  **p<0.01,  ***p<0.001

**NOTE.**— Test statistics are Kendall’s tau estimates of rank correlation between trade bloc volumes and time. Significance implies that the volume of a subcomponent is decreasing over time.
TABLE 8
TREND TEST FOR BETWEEN WORLD-SYSTEM SUBCOMPONENT DYADIC DISTANCES, 1960-2009

<table>
<thead>
<tr>
<th></th>
<th>Core</th>
<th>Semiperiphery</th>
<th>Periphery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
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<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.31***</td>
<td>0.23</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.58***</td>
<td>0.52**</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.88***</td>
<td>0.32**</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.66***</td>
<td>0.41**</td>
<td>0.69***</td>
</tr>
<tr>
<td></td>
<td>0.51***</td>
<td>0.54**</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>-0.28</td>
<td>-0.13</td>
<td>-0.24</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

NOTE.—Test statistics are Kendall’s tau estimates of rank correlation between dyadic distances and time. The column and row names indicate the world-system subcomponents between which dyadic distances are calculated. Within each cell the test statistics for different distance dimensions are arranged into columns in the following order: column 1 is economic, demographic, knowledge, and column 2 is financial, global connectedness, and political. Significance implies that the distance between subcomponents is increasing over time.
### TABLE 9

**TREND TEST FOR BETWEEN TRADE BLOC DYADIC DISTANCES**

<table>
<thead>
<tr>
<th>ASEAN</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>CEFTA</th>
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<th>-</th>
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</thead>
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<tr>
<td>0.75**</td>
<td>-0.44</td>
<td>-</td>
<td>-</td>
<td>0.06</td>
<td>-0.16</td>
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<td>0.60***</td>
<td>-0.38</td>
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<td>-</td>
<td>0.50**</td>
<td>-0.76</td>
<td>0.25</td>
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<tr>
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<td>-0.50</td>
<td>0.19</td>
<td>0.51**</td>
<td>0.54**</td>
<td>0.60***</td>
<td>0.03</td>
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</table>

<table>
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<td>0.58**</td>
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<td>0.71**</td>
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<td>0.53**</td>
<td>0.63***</td>
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<table>
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</thead>
<tbody>
<tr>
<td>0.58***</td>
<td>-0.60</td>
<td>0.62**</td>
<td>0.43**</td>
<td>0.23</td>
<td>-0.39</td>
<td>0.19</td>
<td>0.03</td>
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<tr>
<td>0.83***</td>
<td>-0.38*</td>
<td>0.18</td>
<td>-0.03</td>
<td>-0.18</td>
<td>0.78***</td>
<td>0.28</td>
<td>0.75***</td>
<td>-0.28</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mercosur</th>
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<th>-</th>
<th>SACU</th>
<th>-</th>
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<tbody>
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<td>0.48**</td>
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<td>-0.81</td>
<td>0.47**</td>
<td>-0.64</td>
<td>-0.07</td>
<td>-0.10</td>
<td>-0.06</td>
<td>-0.32</td>
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</tr>
<tr>
<td>0.51**</td>
<td>0.85***</td>
<td>0.75**</td>
<td>0.45**</td>
<td>0.40**</td>
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<td>0.92***</td>
<td>0.43*</td>
<td>0.87***</td>
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</tr>
<tr>
<td>0.78***</td>
<td>-0.38*</td>
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<td>0.02</td>
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<table>
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<tbody>
<tr>
<td>0.61***</td>
<td>-0.57</td>
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<td>0.26</td>
<td>-0.48</td>
<td>0.67***</td>
<td>0.02</td>
<td>0.81***</td>
<td>-0.54</td>
<td>0.61***</td>
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<td>-0.58</td>
<td>0.14</td>
<td>-0.35</td>
<td>-0.10</td>
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<td>-0.34</td>
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<td>0.80***</td>
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<td>-0.40</td>
<td>0.22</td>
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<td>0.10</td>
<td>-0.02</td>
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<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>0.33*</td>
<td>0.07</td>
<td>0.49**</td>
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<td>0.57***</td>
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**NOTE.**— Test statistics are Kendall’s tau estimates of rank correlation between dyadic distances and time. The column and row names indicate the trade blocs between which dyadic distances are calculated. Within each cell the test statistics for different distance dimensions are arranged into columns in the following order: column 1 is economic, demographic, knowledge, and column 2 is financial, global connectedness, and political. Significance implies that the distance between subcomponents is increasing over time.