How Global is Globalization?

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Abstract

We examine a balanced panel of globalization indices for 129 countries over the years 1991-2010. We report evidence of cross-country sigma convergence in the overall globalization index. Sigma convergence also holds for each of the economic, political, and social globalization indices, as well as each sub-index within these indices. However, the evidence for stochastic convergence, based on panel unit root tests, is only strong for the political globalization index. Regarding the economic and social dimensions of globalization, respectively, we find evidence for stochastic convergence only in the flows and cultural proximity sub-indices. For the OECD subsample, evidence supports stochastic convergence for the overall, economic and political globalization indices. Evidence to support regional convergence among the non-OECD nations on various globalization dimensions is much more limited. Our findings indicate that globalization convergence is truly global only on the political dimension.

1 Introduction

An International Monetary Fund (IMF) website aptly describes globalization as "an extension beyond national borders of the same market forces that have operated for centuries at all levels of human economic activity".[1] Such market forces are increasingly evident in the flows of goods, people, and ideas across countries' borders. As a result, countries are generally more integrated; more *globalized* than ever before.

However, the pace of globalization has not been uniform across countries. As Frankel (2000) notes, the "two main drivers of economic globalization are reduced costs to transportation and communication in the private sector, and reduced policy barriers to trade and investment on the part of the public sector" (p. 2). The latter are constituted by legal institutions and can be extended to include barriers to migration and to the exchange of information. The evolution of these institutions in any individual country is a complex process and, undoubtedly, there are also interdependencies across the processes of different countries.

In this paper we investigate how truly global is globalization. Regarding the extent of integration, are all or most countries converging towards a common benchmark? Or is convergence only occurring within certain groups (or *clubs*) of countries, each with their own benchmark? Alternatively, have some countries simply stalled in the globalization process? Furthermore, do the answers to these questions differ depending on the particular dimension of globalization considered? We explore a panel of 129 countries covering the years 1991-2010 and seek to characterize countries' globalization processes by utilizing the KOF globalization indices values (Dreher, 2006). These indices include an overall globalization index, but also constituent economic, social, and political indices; as well as sub-indices within the economic and social categories.

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[1] `http://www.imf.org/external/np/exr/ib/2008/053008.htm`

The KOF index has provided a measure of globalization for numerous empirical studies. For example, higher KOF index values have been empirically linked to higher rates of economic growth (Dreher, 2006); also to increased subjective evaluations of well-being (Hessami, 2011) and life expectancies (Bergh and Nilsson, 2010b). Particularly relevant to this study, Harger et al. (2017) report that globalization is positively related to cross-country income convergence rates.[2] Furthermore, higher KOF index values are associated with lower rates of inflation (Samimi et al., 2012).[3]

Our work is related to that of Arribas et al. (2009). These authors propose a *standard of perfect integration* (SPII) that "characterizes a world where frontiers and distance do not matter" and "describes the conditions under which the world economy would operate as a global village" (p. 127). They then analyze, using various measures of globalization, how close the world has approached the SPII.[4] The perspective on globalization explored here is different and complements that of Arribas et al. (2009). Rather than relative to an ideal, we simply seek evidence of benchmarks towards which countries may be actually converging. To the extent that the average KOF index values are increasing over time, this evidence meaningfully characterizes globalization processes.

We consider two related concepts of convergence: *sigma convergence* and *stochastic convergence*. The former is perhaps the most straightforward convergence concept. Based on some index of globalization, sigma convergence describes a situation where the dispersion of cross-country index values decreases over time.[5] Alternatively, stochastic convergence holds when shocks to a country's globalization index value relative to some benchmark (e.g., the world average) have only temporary effects. Thus, the ratio of a country's index relative to the benchmark is stationary. While sigma convergence is what matters in some ultimate sense, looking at cross-country coefficients of variation neglects the fact that variation over time can arise from temporary shocks. Failing to observe sigma convergence, a researcher may be overlooking important long-run tendencies towards convergence. Alternatively, an observation of sigma convergence may be an artifact of a particular history of shocks rather than systematic forces tending towards long-run convergence.[6]

In a broad sense, the extent to which a country is globalized implies the quality of various institutions. Our study, then, is also related to a small number of existing studies on cross-country institutional convergence. Nieswiadomy and Strazicich (2004) report sigma convergence during 1972-2001 for cross-country values of Freedom House's political rights and civil liberties indices. Testing for unit roots in the time series for individual countries, these authors report evidence in favor of stochastic convergence for about half of the 136 countries in their sample. For up to 142 countries covering the period 1970-2010, Savoia and Sen (2016) analyze scores for legal system quality, corruption, and bureaucratic quality from the International Country Risk Guide (ICRG) and the Fraser Institute's Economic Freedom of the World (EFW) project. They report

[2]While the KOF social globalization index, specifically, has been positively linked to within-country income inequality, particularly within developing economies (Bergh and Nilsson, 2010a), it has been negatively linked to gender inequality (Potrafke and Ursprung, 2012). With regards to cross-country inequality, Milanovic (2013, 2016) and Bourguignon (2015) have all argued that increased globalization has worked to decrease it.

[3]Samimi et al. (2012), alternatively, fail to find an independent link between a more conventional measure of trade openness and inflation. Increased globalization has also been hypothesized to fiscally constraint governments by subjecting them to increased budgetary pressures from without. Dreher et al. (2008b) report evidence based on the KOF index that fails to confirm this so-called *disciplining hypothesis*.

[4]They report: "The distance to the theoretical potential of trade integration is still considerable, since we have no reached the halfway point [yet] the ground covered over the last forty years is quite remarkable, as it represents advances in international integration of more than 75%" (Arribas et al. 2009, p. 142).

[5]The importance of sigma convergence in regards to per capita incomes is highlighted by Friedman (1992) and Quah (1993). In particular, these authors contrast sigma convergence to the alternative concept of *beta convergence* that is the focus of numerous empirical studies of economic growth (e.g., Barro and Sala-i Martin 1992; Mankiw et al. 1992; Islam 1995; Sala-i Martin 1996; Caselli et al. 1996; Evans 1997; Higgins et al. 2006). Beta convergence occurs when the partial correlation between a variable's growth rate and its initial level is negative; likewise, in the context of empirical studies based on the neoclassical growth model, when an economy's income level grows faster, all else equal, the greater the distance between its initial level and its steady-state level. Importantly, because steady-states can differ across countries and random shocks can occur, beta convergence is not sufficient (though necessary) for sigma convergence (Young et al., 2008). (The "beta" and "sigma" terminologies arise from the empirical growth literature and signify, respectively, the coefficient on initial per capita income in a growth regression and the standard notation for a standard deviation.)

[6]Using U.S. state level data on per capita income from 1930-2009, Heckelman (2013) explores beta convergence, sigma convergence, and also stochastic convergence. Beta convergence is rooted in the well-established neoclassical growth theory. (See the previous footnote 5.) Alternatively, sigma convergence and stochastic convergence are concepts agnostic to the underlying mechanisms. This agnosticism makes sense in a study of globalization convergence since the processes leading to more or less globalization are complex interactions between agents in varied political and market institutions.

evidence from 5-year period panel regressions of so-called beta convergence (see footnote 5). Elert and Halvarsson (2012) also report evidence of cross-country beta convergence in the EFW index. Heckelman and Mazumder (2013) report that convergence in financial reforms since the 1970s has been largely a regional (rather than global) phenomenon.

Our study contributes to the literature that links dimensions of globalization to entrepreneurial activity. Audretsch and Sanders (2007) link increased globalization to countries moving from industrial- to entrepreneurial-based economies. While not directly contradicting this link, existing studies report a negative relationship between the KOF indices and measures of entrepreneurship (Bjørnskov and Foss, 2012; Petrova, 2013). However, Bjørnskov and Foss (2012) only report a negative relationship for the KOF social globalization, information flows sub-index *after* controlling for the Fraser Institute's Economic Freedom of the World (EFW) index (Gwartney et al., 2012), which includes indicators of trade openness that overlap with that of the KOF economic globalization index. Bjørnskov and Foss (2012) report that the EFW index itself is positively linked to entrepreneurship. Also, Coyne and Williamson (2012) report that trade openness positively correlates with cultural traits (e.g., trust in impersonal interactions' self-determination) that are conducive to entrepreneurship (**?**Harper, 2003). While the evidence is mixed, the clear interest in relationships between globalization are entrepreneurship can be informed by the extent to which globalization is truly a global phenomenon.

We report evidence of global sigma-convergence for all KOF indices and sub-indices. However, strong support for stochastic convergence is only associated with the political dimension of globalization. In an OECD subsample of countries we report evidence supporting stochastic convergence in the overall globalization index, as well as the economic globalization index (in addition to the political globalization index), but not for the social globalization index or any of its sub-indices. For non-OECD countries taken as a whole, our results match the full sample results, suggesting that non-OECD countries are not a "club" unto themselves. We also fail to find strong evidence to support regional convergence "clubs" within the non-OECD subsample for any dimensions of globalization considered.

Moving forward, we describe our data in Section 2. The results of our analysis are found in Section 3. Our conclusions are laid out in Section 4.

2 Data

Our measure of globalization is based on the KOF index, which encompasses economic, social, and political dimensions of globalization. The index is described in Dreher et al. (2008a,b). Drawing on the KOF data, we construct and then analyze a balanced panel of 129 countries with annual coverage of the years 1991-2010.

Economic globalization is comprised of two component sub-indices: actual *flows* of trade, FDI, investment, and income payments to foreign nationals; and policy *restrictions* on trade and capital flows measured by hidden import barriers, tariffs, taxes, and capital controls. The former represents "outcomes of the game" whereas the latter represents "rules of the game". The latter may therefore be one of many potential factors which directly influence the former. Social globalization is comprised of three sub-indices: *personal contact* representing international telephone traffic, transfers, international tourism, foreign population, and international letters; *information flows* captured by internet users, cable television subscribers, and newspapers; and *cultural proximity* for which the number of McDonald's restaurants, the number of Ikea stores, and trade in books are used as proxies. Each of these sub-indices captures alternative ways in which individuals may learn of ideas and customs from outside their domestic borders. Finally, political globalization is measured by the number of embassies, membership in international organizations, participation in UN Security Council missions, and international treaties. For every category, each component is normalized on a scale of 0 to 100, where higher values represent greater degrees of globalization. The indices and sub-indices are weighted averages of their respective sub-indices or components. The overall index represents a weighted index of the economic, social, and political indices.

The KOF data set begins in 1970 but missing data is an issue, in particular for the earlier years. We focus on a sample for which each country has complete time series for every sub-index. To limit the loss of countries, then, we begin the sample period in 1991. In addition to yielding a sample with substantially more countries than if we started earlier, 1991 also corresponds to the breakup of the Soviet Union into several

independent countries. The breakup also resulted in substantially greater autonomy for the Soviet Union's erstwhile satellites. These newly independent and former satellite countries constitute a considerable part of our "Former Soviet Union & Central and Eastern Europe" regional subsample. Our final sample includes annual observations on 129 nations from 1991 to 2010.

The mean values for the three indices (economic, social, and political) and the overall index are plotted in Figure 1. Each index has a clear upward trend. However, all three indices have somewhat leveled off in recent years. (Average economic globalization, as measure by the KOF index, has actually fallen notably since its 2007 high.) In Table 1 we report the mean values of each index for each year, 1991-2010, and in Table 2 we report the yearly means for the constituent sub-indices of economic and social globalization. In the course of our analysis below we also consider various subsamples of countries. First, we consider OECD versus non-OECD (Figure 2). Second, from the latter we consider various regional subsamples. The countries constituting each of these subsamples are reported in Table 3.[7]

Figure 1. Globalization indices, mean levels.

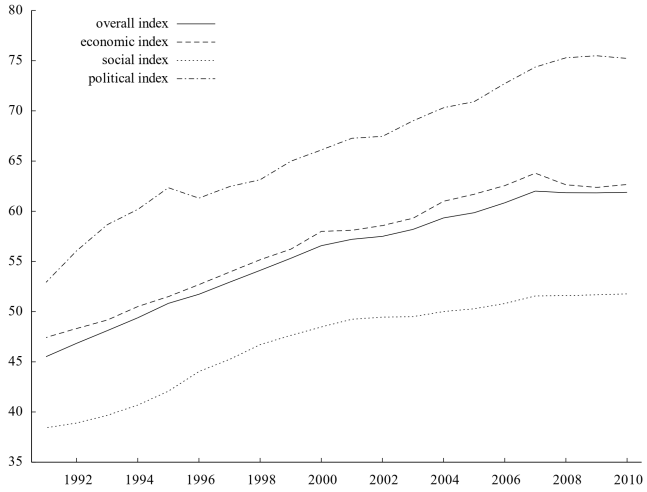
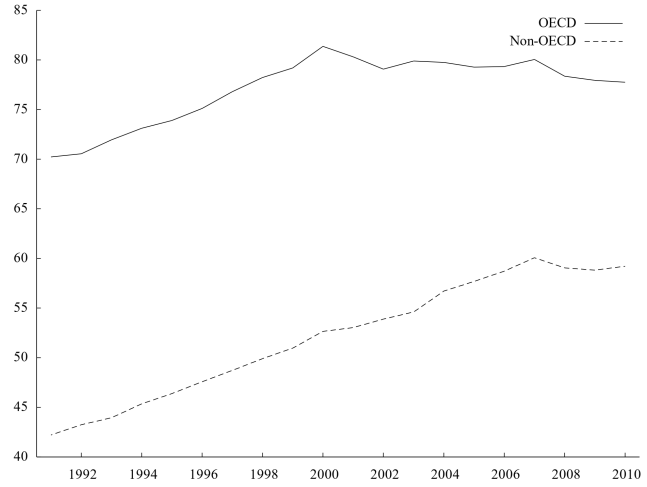


Figure 2. Economic Globalization Index.



[7]Summary statistics for individual country overall, economic, political, and social globalization indices are provided in an appendix (available upon request) table A1. Likewise, summary statistics for individual country economic and social globalization sub-indices are provided in appendix table A2.

Table 1. Summary statistics for yearly cross-sections of globalization indices, 1991-2010.

	Overall		Economic		Social		Political	
Year	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1991	45.508	0.379	47.422	0.386	38.425	0.547	52.922	0.439
1992	46.840	0.371	48.321	0.371	38.902	0.547	56.068	0.426
1993	48.109	0.368	49.156	0.368	39.666	0.552	58.660	0.410
1994	49.387	0.351	50.509	0.350	40.692	0.549	60.191	0.382
1995	50.828	0.341	51.501	0.347	42.072	0.540	62.343	0.345
1996	51.724	0.339	52.694	0.343	44.033	0.523	61.312	0.351
1997	52.930	0.334	53.939	0.343	45.243	0.504	62.458	0.340
1998	54.108	0.320	55.172	0.335	46.713	0.480	63.143	0.322
1999	55.310	0.309	56.214	0.330	47.627	0.464	64.978	0.304
2000	56.569	0.301	57.991	0.320	48.471	0.455	66.110	0.302
2001	57.203	0.296	58.103	0.313	49.241	0.452	67.272	0.296
2002	57.500	0.286	58.571	0.296	49.447	0.446	67.463	0.289
2003	58.196	0.280	59.308	0.293	49.501	0.446	69.015	0.270
2004	59.341	0.269	60.994	0.283	50.007	0.442	70.315	0.256
2005	59.860	0.260	61.698	0.274	50.285	0.440	70.923	0.246
2006	60.840	0.252	62.554	0.268	50.806	0.433	72.724	0.230
2007	62.004	0.250	63.788	0.268	51.564	0.428	74.370	0.212
2008	61.839	0.249	62.640	0.272	51.591	0.428	75.296	0.203
2009	61.829	0.245	62.378	0.263	51.680	0.423	75.495	0.204
2010	61.898	0.243	62.665	0.260	51.767	0.420	75.235	0.205

Note: CV stands for coefficients of variation (standard deviations deflated by means to account for changing mean values over time).

Table 2. Summary statistics for yearly cross-sections of economic and social globalization sub-indices, 1991-2010.

Index	Economic		Economic		Social		Social		Social	
Sub-index	Flows		Restrictions		Personal Contact		Info. Flows		Cultural Proximity	
Year	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
1991	47.970	0.445	47.041	0.486	46.582	0.474	42.996	0.505	25.127	1.126
1992	48.900	0.419	47.881	0.482	46.862	0.469	43.678	0.509	25.657	1.117
1993	49.507	0.409	48.951	0.471	47.009	0.468	44.539	0.516	26.952	1.093
1994	51.196	0.385	49.920	0.467	47.321	0.467	45.565	0.515	28.723	1.021
1995	52.244	0.376	50.868	0.464	47.605	0.467	47.093	0.504	31.117	0.949
1996	52.876	0.376	52.619	0.436	48.044	0.464	49.117	0.483	34.554	0.860
1997	54.552	0.361	53.457	0.435	48.382	0.463	51.724	0.444	35.315	0.843
1998	56.138	0.350	54.323	0.432	48.623	0.465	54.447	0.406	36.667	0.812
1999	57.318	0.347	55.210	0.423	48.736	0.466	56.675	0.368	36.930	0.808
2000	60.065	0.328	56.010	0.420	49.106	0.464	58.086	0.349	37.641	0.800
2001	60.105	0.322	56.155	0.408	49.041	0.468	59.383	0.337	38.744	0.788
2002	60.271	0.319	56.911	0.377	49.245	0.467	60.553	0.322	37.941	0.814
2003	61.000	0.312	57.649	0.375	49.355	0.465	60.849	0.320	37.649	0.823
2004	62.477	0.301	59.553	0.356	49.800	0.459	61.522	0.315	38.003	0.821
2005	63.605	0.297	59.841	0.337	50.168	0.456	61.960	0.311	38.042	0.829
2006	65.185	0.298	59.961	0.313	50.323	0.454	62.554	0.306	38.879	0.813
2007	66.499	0.287	61.117	0.317	51.156	0.439	63.344	0.302	39.595	0.812
2008	65.340	0.289	59.972	0.322	51.069	0.441	64.010	0.295	38.982	0.833
2009	64.413	0.283	60.370	0.313	50.898	0.439	64.495	0.284	38.908	0.835
2010	65.044	0.284	60.328	0.305	51.005	0.435	64.443	0.279	39.187	0.835

Note: CV stands for coefficients of variation (standard deviations deflated by means to account for changing mean values over time).

Table 3. OECD and regional country subsamples.

OECD	Sub-Saharan Africa	Latin American & Caribbean	North African & Middle Eastern	Asian & Pacific	Former Soviet Union & Central and Eastern Europe
Australia	Angola	Argentina	Algeria	Bangladesh	Albania
Austria	Benin	Bahamas	Bahrain	Cambodia	Armenia
Belgium	Botswana	Barbados	Cyprus	China	Azerbaijan
Canada	Burkina Faso	Bolivia	Egypt	Fiji	Bulgaria
Denmark	Burundi	Brazil	Iran	India	Croatia
Finland	Cameroon	Chile	Israel	Indonesia	Estonia
France	Central African Rep.	Colombia	Jordan	Korea	Georgia
Germany	Chad	Costa Rica	Kuwait	Malaysia	Hungary
Greece	Coite d'Ivoire	Dominican Rep.	Malta	Mongolia	Kazakhstan
Iceland	Ethiopia	Ecuador	Morocco	Nepal	Kyrgyz Republic
Ireland	Ghana	El Salvador	Oman	Pakistan	Latvia
Italy	Kenya	Guatemala	Saudi Arabia	Papua New Guinea	Lithuania
Japan	Lesotho	Guyana	Syria	Philippines	Macedonia
Luxembourg	Madagascar	Honduras	Tunisia	Singapore	Moldova
Netherlands	Malawi	Jamaica		Taiwan	Poland
New Zealand	Mali	Mexico		Thailand	Romania
Norway	Mauritius	Nicaragua		Vietnam	Russia
Portugal	Mauritania	Panama			Serbia
Spain	Mozambique	Paraguay			Slovenia
Sweden	Namibia	Peru			Ukraine
Switzerland	Niger	Trinidad & Tobago			
Turkey	Nigeria	Uruguay			
United Kingdom	Rwanda	Venezuela			
United States	Senegal				
	Sierra Leone				
	South Africa				
	Tanzania				
	Togo				
	Uganda				
	Zambia				
	Zimbabwe				

3 Results

In this section we report evidence regarding the hypotheses of sigma convergence and cross-country stochastic convergence in the cross-country data.

3.1 Sigma Convergence

Sigma convergence occurs when the dispersion in globalization index values falls over time. Due to the increasing levels of globalization documented in Figure 1 and Table 1 our preferred measure of dispersion is the coefficient of variation, also utilized by Skidmore et al. (2004); Nieswiadomy and Strazicich (2004); Young et al. (2008); Aziakpono et al. (2012). As displayed in Figure 3, the coefficients of variation (CV) for the overall index and each of the economic, social, and political indices have all clearly trended downward during our sample period. (Not depicted are the CVs for the constituent economic and social sub-indices which are also trending downward.)[8] The formal test for sigma convergence involves regressing the coefficient of variation against a time trend component. A negative and significant coefficient on the time trend supports sigma convergence.

In Table 4 we report the results of several variants of the sigma convergence test. The specifications corresponding to the (numbered) table columns are:

(1) $CV_t = \beta_0 + \beta_1 t + \varepsilon_t$;

(2) $CV_t = \beta_0 + \beta_1 \log(t) + \varepsilon_t$;

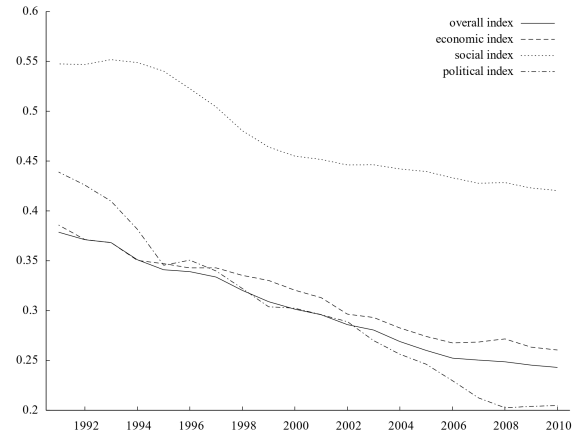
(3) $\log(CV_t) = \beta_0 + \beta_1 t + \varepsilon_t$;

(4) $\log(CV_t) = \beta_0 + \beta_1 \log(t) + \varepsilon_t$.

Specifications (1)-(4) together cover a range of conceivable ways that a CV may exhibit a decreasing trend.

[8] In an appendix (available upon request) table A3 we report CVs for the OECD and five regional subsamples for the years 1991, 2000, and 2010. With the exception of the North African & Middle Eastern subsample, the CVs fall continuously across those three years. Even for that exception, the 1991 and 2010 CVs are virtually identical.

Figure 3. Coefficients of Variation.



Rows in Table 4 correspond to the KOF indices as well as the constituent sub-indices for the economic and social dimensions. We report the t-statistics associated with the null hypothesis that $\beta_1 = 0$, derived from HAC standard errors that are robust to serial correlation.

As it turns out, the evidence for sigma convergence is quite strong regardless of the particular specification. In each and every case (specification and index combination) the null hypothesis (which corresponds to no sigma convergence) is rejected with better than 99% confidence. Our conclusion is that the decline during 1991-2010 in the dispersion of globalization index values is statistically significant. This is true for the overall KOF globalization index; for the economic, social, and political globalization indices; also for the economic sub-indices (*flows* and *restrictions*) and social sub-indices (*personal contact*, *information flows*, and *cultural proximity*). Regarding sigma convergence, then, we conclude that globalization is occurring globally, and in a very comprehensive sense.

Table 4. Sigma convergence tests on KOF Coefficient of Variation: time trend t-statistics.

		(1)	(2)	(3)	(4)
CV		linear	linear	log	log
Time trend		linear	log	linear	log
Overall		-21.20***	--7.300***	--26.00***	-6.845***
Economic		-19.64***	-7.790***	-13.65***	-9.269***
	Flows	-10.42***	-15.05***	-9.691***	-20.94***
	Restrictions	-22.63***	-5.335***	-13.69***	-6.265***
Social		-10.59***	-6.039***	-12.36***	-5.457***
	Personal Contact	-5.445***	-3.263***	-5.867***	-10.06***
	Information Flows	-10.74***	-5.472***	-9.697***	-5.472***
	Cultural Proximity	-3.018***	-7.477***	-2.651**	-6.439***
Political		-17.47***	-8.194***	-8.107***	-27.82***

Notes: *,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Each regression also includes a constant term (not reported). T-statistics are derived from HAC standard errors, bandwidth 2 (Bartlett kernel).

3.2 Stochastic Convergence

Our initial tests indicated strong evidence in support of sigma convergence. However, as argued by Carlino and Mills (1993), a country cannot be said to be truly converging if it cannot return to its convergence path following a shock which temporarily pushes it off its previous stochastic path. In other words, such shocks cannot have permanent effects. In practice, this concept of stochastic convergence is tested by performing checks for stationarity of countries' *relative* positions; in this case, the log of the ratio of a country's globalization index value to the sample average for that year.

Simple unit root tests of the Dickey-Fuller variety are notorious for having low power. With our short

sample time period of 20 years, this problem is enhanced. Therefore we instead rely on two panel unit root tests, one developed by Levin et al. (LLC) (2002) and the other by Im et al. (IPS) (2003). Both of these tests are widely employed and both are based on the conventional augmented Dickey-Fuller (ADF) test specification:

$$(5)\quad \Delta \log(\tfrac{KOF_{it}}{\overline{KOF}_t}) = \alpha \log(\tfrac{KOF_{i,t-1}}{\overline{KOF}_{t-1}}) + \textstyle\sum_{j=1}^{\rho} \beta_{ij} \Delta \log(\tfrac{KOF_{i,t-j}}{\overline{KOF}_{t-j}}) + \epsilon_{it} \quad ,$$

where KOF_{it} is country i's globalization index value in year t, and $\overline{KOF}_t$ is the cross-country average index value in t. The null hypothesis of the ADF test is that there is a unit root ($\alpha = 0$) while the alternative hypothesis is one-sided ($\alpha < 0$).

The LLC test replaces $\Delta \log(\frac{KOF_{it}}{\overline{KOF}_t})$ and $log(\frac{KOF_{it}}{\overline{KOF}_t})$ in (5) with transformed variables. The transformed variables are constructed by, first, regressing both $\Delta \log(\frac{KOF_{it}}{\overline{KOF}_t})$ and $log(\frac{KOF_{it}}{\overline{KOF}_t})$ on ρ lags of $\Delta \log(\frac{KOF_{it}}{\overline{KOF}_t})$. Second, the fitted values are subtracted from $\Delta \log(\frac{KOF_{it}}{\overline{KOF}_t})$ and $log(\frac{KOF_{it}}{\overline{KOF}_t})$. Third, the two new series each of which has values corresponding to particular countries is divided by the standard error of a regression based on (5) using data only from that country. The resulting transformed data are free from serial correlation and deterministic components. The LLC test is then based on specification (5) using the panel of transformed variables.

The LLC test assumes a common unit root parameter (α). Thus the null of no unit root for any country is tested against the alternative that every country has a unit root. Alternatively, the IPS test allows for heterogeneity by simply pooling together individual country ADF tests. A separate regression of (5) is run for each country, i, resulting in a group of root estimates ($\alpha_i, i = 1, ..., N$). The IPS test statistic is based on calculating the average of t-statistics associated with unit root null hypotheses across the N root estimates. Under IPS, the null of no unit roots is tested against the alternative that at least one country has a unit root. LLC may be more efficient because fewer parameters need to be estimated, but can also be misspecified if the assumption of parameter homogeneity is overly restrictive.

By construction, the IPS test may fail to reject the null due to one single country having a unit root when even all the remaining countries are converging. Further, Westerlund and Breitung (2009) demonstrate that LLC has greater local power than does IPS. Thus IPS may be prone to greater false negatives. Yet, the potential misspecification from requiring a common unit root may lead LLC to false positive results. Because there is no clear choice, we interpret stochastic convergence to be supported only if the unit root null is rejected by both tests.

In columns (1) and (2) in Table 5 we present test statistics for the LLC and IPS panel unit root tests on the full samples of log relative globalization indices.[9] Assuming a common unit root parameter, the LLC test rejects (at better than the 1% level) a unit root for each index and sub-index. The IPS test, however, only rejects the unit root null for the political index (among the main indices). While IPS does not reject a unit root for the economic and social indices, it does reject (at the 1% level) for the economic flows and social cultural proximity sub-indices. Regarding the economic and social dimensions of globalization, then, stochastic convergence is only strongly supported for these latter sub-indices. We note, in particular, that there is not strong evidence (i.e., rejection of the nulls by both the LLC and IPS tests) of stochastic convergence in economic restrictions. Of the two KOF economic sub-indices, the restrictions sub-index is the one directly linked to institutional quality. In other words, we are unable to conclude that the institutional frameworks to facilitate international economic flows are stochastically converging.[10]

We find it interesting that, despite the lack of evidence for restrictions, the actual international economic flows *do* seem to be converging. Thus, countries appear to be overcoming remaining differences in *policy* openness in the sense that their economies' shares of international goods and financial flows are still converging. We stress that the flows component represents *shares* rather than total trade and capital movements.

[9]For all our panel unit root tests we choose the number of lags, up to four maximum, which yields the smallest Modified Akaike value. LLC tests are estimated using Bartlett kernel with Newey-West bandwidth selection.

[10]Elert and Halvarsson (2012) report evidence of beta convergence in the *freedom to trade internationally* sub-index of the Fraser Institute's Economic Freedom of the World index. covering tariffs, non-tariff trade barriers, and capital controls, this sub-index overlaps to a large extent with the KOF economic restrictions sub-index. Elert and Halvarsson's finding is not inconsistent with our own. Empirically, beta convergence involves a country's index value growing faster the lower its initial starting value. Alternatively, stochastic convergence involves a country's index value tending towards a benchmark that is a function of the *group of countries'* index values.

Changes in trade policy would be expected to impact both the numerators and the denominators (GDP) of the share components. If restrictions hamper trade in general, then it could still be the case that greater restrictions imposed by the least open economies result in larger trade shares if trade restrictions were to slow the growth in overall GDP (by also hampering consumption and investment) at a greater rate than just for trade. As such, the share of GDP determined by trade could rise, implying convergence in trade flows on a *relative* (to GDP) scale, even when total trade is shrinking.

Table 5. *t*-statistics from stochastic convergence tests on KOF index values: full, OECD, and non-OECD samples.

		(1) World ($N = 129$)	(2)	(3) OECD ($N = 24$)	(4)	(5) non-OECD ($N = 105$)	(6)
		LLC	IPS	LLC	IPS	LLC	IPS
Overall		-8.489***	-0.445	**-5.160*****	**-1.730****	-6.536***	-0.527
Economic		-3.128***	1.836	**-5.772*****	**-2.729*****	-4.364***	-0.468
	Flows	**-7.473*****	**-3.061*****	-2.355***	-0.903	**-6.333*****	**-2.687*****
	Restrictions	-2.692***	3.491	-1.510*	-0.219	-3.521***	0.724
Social		-6.879***	0.417	-3.398***	0.809	-3.960***	1.092
	Personal Contact	-2.289**	1.635	-1.899**	1.224	-1.733**	0.718
	Information Flows	-5.279***	2.536	-2.715***	-0.128	-4.332***	2.003
	Cultural Proximity	**-40.341*****	**-23.420*****	-1.911**	3.288	**-41.927*****	**-21.490*****
Political		**-10.630*****	**-4.169*****	**-14.657*****	**-8.074*****	**-16.304*****	**-7.845*****

Notes: *,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Null hypothesis for all tests is a unit root (non-convergence). Bolded indicates both test-statistics consistent with convergence. *N* represents number of countries.

Although we are unable to conclude that stochastic convergence on the economic and social dimensions of globalization is occurring world-wide, convergence clubs may exist where groups of nations are converging among themselves. In the remaining columns (3)-(6) of Table 5 we report panel unit root tests when separating the sample into OECD versus non-OECD countries. For these tests, the world average $\overline{KOF}_t$ in the IPS and LLC formulations now represents the sub-sample OECD or non-OECD average for that year.

Comparing across all columns, we see that the test results for the non-OECD sample match the interpretations from the World sample results. This is not too surprising given that the non-OECD sample is five times as large as the OECD sample. Differences are found, however, among the OECD subsample considered in isolation in columns (3) and (4). In particular, we find that OECD nations are forming a club in terms of overall globalization as well as for economic globalization. Convergence for political convergence is also strongly supported among the OECD nations but we do not interpret this as a "club" because we previously supported convergence among all nations in the full sample (columns (1) and (2)).

Table 6. *t*-statistics from stochastic convergence club tests on KOF index values: non-OECD sample stratified by region.

	(1) SSA ($N = 31$)	(2)	(3) LAC ($N = 24$)	(4)	(5) MENA ($N = 14$)	(6)	(7) ASIA ($N = 16$)	(8)	(9) FSUCEE ($N = 20$)	(10)
	LLC	IPS	LLC	IPS	LLC	IPS	LLC	IPS	LLC	IPS
Overall	-0.783	0.821	-2.418***	-0.944	-1.947**	-1.084	-1.132	0.727	-2.912***	-0.537
Economic Restrictions	-0.556	1.564	-1.520*	-0.098	-0.597	0.194	-1.614*	0.792	-0.116	1.795
Personal Contact	-2.025*	-0.130	-1.492*	-0.489	2.019	2.271	-1.231	0.482	-0.673	1.333
Information Flows	-2.172**	1.780	-1.825**	-0.253	-1.190	1.165	-2.339***	-0.481	-2.370***	0.200

Notes: *,**, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Null hypothesis for all tests is a unit root (non-convergence). Bolded indicates both test-statistics consistent with convergence. *N* represents number of countries.

Finally, in Table 6 we further breakdown the non-OECD nations into potential regional clubs for the sub-indices (and overall index) where we failed to find strong evidence of convergence. The regions are classified as Sub-Saharan Africa (SSA), Latin America and Caribbean (LAC), Middle East and North Africa (MENA), Asia and Pacific Rim (ASIA), and Former Soviet Union and Central and Eastern Europe (FSUCEE).[11] As

[11] Country classifications are presented in Table 3.

before, the average (sub-)index value in each year used to determine convergence comparisons is computed separately for each region sub-sample. We do not find strong evidence consistent with convergence into regional globalization clubs. The IPS test fails to reject the unit root null for any of the globalization measures, and even the LLC tests fail to reject the null as often as they do reject the null, in each region except for LAC.

4 Conclusions

In this study, we test for convergence on globalization. Globalization is measured by indices representing economic, social, and political globalization. Based on a sample of 129 nations, we find an upward trend in the average level of each measure of globalization. We also find the global dispersion of each measure has been significantly declining over time supporting the notion of global convergence of globalization.

Panel unit root tests for stochastic convergence paint a less consistent picture. The full sample of nations is stochastically converging only for political globalization, and one individual sub-index on each of the economic, and social, dimensions of globalization. Some critics of globalization express concern that nations will lose their autonomy and cultural identities. Yet, while we find convergence on the political dimension (representing integration into multi-national organizations, treaties, and presence of embassies, etc.) and greater similarity in *exposure* to other cultures (through trade and capital flows, and the establishment of McDonald's and IKEAs) economic *policies* on trade and capital movement restrictions, and overall social globalization, are not converging.

We also find limited evidence of convergence clubs, except for an OECD club on the economic globalization dimension. There is not strong evidence to support non-OECD nations converging on any aspects of globalization that does not hold for the full world sample, and regional convergence among the non-OECD nations for any remaining globalization attributes appears weaker still. Thus, when globalization convergence is occurring, it appears to be global or not at all. As a result, with the exception of political globalization, the benefits from increased globalization would not be expected to be manifested equally across the globe. At least along the economic and social dimensions, globalization is less than fully global.

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