Country and Industry Convergence of Equity Markets: International Evidence from Club Convergence and Clustering

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Abstract. This study employs the panel convergence methodology developed by Phillips and Sul (2007) to explore the convergence dynamics of international equity markets. The analysis considers both country and industry effects. While traditional portfolio management strategies usually follow a top-down procedure, assuming that country-level effects drive financial aggregates (e.g., stock returns) our empirical results suggest that the equity markets of 33 of the 42 counties in our sample do form a unified convergence club. The empirical findings, however, also show more numerous stock-price convergence clubs in certain industries. That is, country factors play a more important role in explaining the actual convergence in real stock prices than industry factors. Conversely, the volatility of stock prices exhibits much more evidence of convergence than stock prices. These findings should assist portfolio managers in the design and implementation of appropriate portfolio management strategies. Regulatory authorities also can benefit in the design of financial regulation.

Keywords: equity markets convergence, international equity markets, industry effects, panel convergence methodology

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1. Introduction

In recent years, researchers pay more attention to the convergence in international equity markets. This increased interest in the convergence process accompanies the elimination of restrictions on banking and securities transactions, the reduction or the abolition of capital restrictions, the harmonization of legal frameworks and accounting systems for financial reporting, and the encouragement of foreign (direct) investments. That is, recent changes international regulations encouraged dramatic increases in capital flows between countries. In frictionless international financial markets, the culmination of the freeing of capital to flow toward the highest return will lead to the convergence of financial markets, including equity markets. Impediments to the free flow of capital, tendencies of financial investors to a home bias, and so on will prevent the ultimate convergence of equity markets, however.

To the extent that convergence in equity markets occurs, the gains from international portfolio diversification will decrease. The countervailing view argues that certain economies retain their individual national economic and financial characteristics, which will prevent equity markets from full convergence (Adler and Dumas, 1983). In other words, impediments to the free flow of capital, tendencies for a home bias, and so on will maintain the possible gains from international portfolio diversification.

Conventional wisdom argues that investors can improve their risk-return efficiency through international diversification (Grubel, 1968; Levy and Sarnat, 1970; Solnik, 1974). Numerous studies (e.g. Bekaert *et al.*, 2009; Carrieri *et al.*, 2008; Eiling and Gerard, 2007; King *et al.*, 1994; Longin and Solnik, 1995) examine how the correlation across countries' equity markets change over time for developed and emerging market economies, since relatively low correlation across such markets may signal diversification benefits. Mixed evidence emerges as to the movement in cross-country correlations across international equity markets. Christoffersen *et al.* (2010) argue that since most studies employ a factor or multivariate volatility model, these mixed results may partly reflect differences in models rather than real differences in correlations.

Eun and Lee (2010) consider international mean-variance convergence, using a Euclidian distance measure. Their findings, which do not depend on model selection, show that the risk-return characterization for their samples of developed and emerging market economies converge significantly over their sample period (1974 to 2007). They also report that the convergence reflects a declining "country effect", rather than a rising "industry effect". This declining "country effect" implies that convergence of stock markets leads to the fall in the effect of individual country characteristics, whereas the rising "industry effect" implies that convergence of industrial structures across countries as well as a more important industry effect.

This paper re-investigates whether international equity markets exhibit evidence of convergence, where the analysis also distinguishes between country and industry effects as well as returns and volatilities. The paper also departs from the standard approach in the finance literature in testing for convergence and borrows from the literature on the convergence in macroeconomic variables (e.g., convergence of real GDP per capita). While traditional portfolio management strategies usually follow a top-down procedure, assuming that the country effects drive the determination of financial aggregates. This approach, however, receives heavy criticism, since as countries become similar in their industrial structure, a higher degree of industrial stock market convergence will probably occur. Therefore, we explore whether global or local factors determine financial aggregates. International countries exhibit fundamental differences in terms of their national stock markets due to the differentiation of certain factors, such as taxation, reporting and accounting standards, legislation, and differences in the pricing of risk. The degree of convergence should differ among financial aggregates across industrial sectors, since idiosyncratic characteristics across industries result in different relative immobilities across-national production frontiers. Such differences appear as profitability differences and these, in turn, appear as stock market return differences. In addition to different production structures, differences in shock volatilities across industrial sectors could explain convergence or divergence patterns. Finally, international deregulation agreements should affect the degree of convergence across sectors, such as the tradable goods or financial sectors.

In macroeconomics, initial empirical tests of the convergence hypothesis, which focuses on real GDP per capita, consider β-convergence. Without additional control variables, the test considered absolute convergence, whereas with additional control variables, the test examines conditional convergence. Researchers use regressions to test for β-convergence that generally imply a log-linearized solution to a non-stochastic model with an additive error term.

An alternative view of convergence, σ-convergence, argues that a group of economies converge when the cross-section variance of the variable under consideration (e.g., real GDP per capita) declines across time. As noted by Bliss (1999, 2000), however, the underlying assumption of an evolving data distribution introduces difficulties in the interpretation of the test distribution under the null. Moreover, the rejection of the σ-convergence hypothesis does not necessarily mean that economies do not converge; the presence of transitional dynamics in the data can lead to the rejection of the null hypothesis of σ-convergence.

Critics of β-convergence argue that if countries converge to a common equilibrium with identical internal structures, then the dispersion of the variable under study should disappear in the long-run as all countries converge to the same long-run path. If, however, countries converge to convergence clubs or to their own unique equilibrium, the dispersion of this variable will not approach zero (Miller and Upadhyay, 2002). Moreover, in the latter case of country specific equilibrium, the movements of the dispersion will depend on the initial distribution of the variable under investigation relative to their final long-run outcomes. Overall, these two approaches suffer from specific estimation deficiencies associated with the time series used (Caporale *et al.*, 2009).

Finally, the use of cointegration and unit-root tests for determining convergence confronts the researcher with a number of serious drawbacks. First, these tests fail to detect convergence when more than one equilibria exist. In the framework of Azariadis and Drazen's (1990) theoretical growth model, multiple steady-state equilibria can occur. Durlauf and Johnson (1995) also provide empirical evidence in favor of the presence of converging clubs across countries. Second, if the countries do converge, but the data available to the econometrician reflect a time period in which transitional dynamics prevail, cointegration and unit-root tests may not 'catch' the tendency to converge. Thus, to study the issue of convergence requires that the researcher model both transitional dynamics and long-run behavior together in a consistent framework. Unfortunately, standard existing testing methodologies for convergence fail to account for both regularities and, thus, cannot suitably test real economic convergence.

This paper employs a new methodological approach, which overcomes the abovementioned deficiencies, the panel club convergence and clustering procedure recommended by Phillips and Sul (2007). This methodology possesses several advantages. First, we do not need specific assumptions concerning the stationarity of the variables of interest and/or the existence of common factors. Second, this methodology uses a general form of nonlinear time-varying factor models. Third, this approach incorporates the countries' experience in transitional dynamics, while it abstains from the hypothesis of homogeneous technological progress, an assumption extensively employed in the majority of growth studies. This is crucial, since under technological heterogeneity, the examination of either growth convergence or growth determinants by standard panel stationarity tests is not valid (Phillips and Sul, 2006). A number of researchers (e.g., Fritsche and Kuzin, 2008; Caporale *et al.*, 2009) use this methodology to investigate convergence patterns among various markets, such as labor markets and productivity measures.

We apply the Phillips-Sul (2007) methodology to examine the extent of convergence of cross-country equity markets for a sample of developed and emerging market economies. Apergis *et al.* (2011) apply the Phillips-Sul (2007) methodology to consider the convergence of cross-country equity markets for a sample of developed countries. They also consider whether institutional (political) factors (e.g., democratization, socialist or conservative votes, and so on) associate with the two identified convergence clubs. We extend their analysis by considering a larger sample of countries, including both developed and emerging economies as well as by considering convergence of equity markets for industries. In addition, the paper performs the analysis with disaggregated industry stock price data, since convergence may confine itself to financial aggregates in different sectors of the market. That is, Poterba and Summers (1998) argue that investors may more easily arbitrage profitable opportunities away at the industry level rather than the market level.

Section 2 provides a brief survey of the literature. Section 3 outlines the econometric methodology. Section 4 describes the data and reports the empirical findings. Section 5 concludes.

2. Literature Review

Although most studies support a greater degree of integration among international equity markets in recent years, some differences across areas of the world seem to persist (Dickinson, 2000). Errunza *et al.* (1999), Arouri (2004), and Jayasuriya and Shambora (2008) show that U.S. investors experienced significant gains by investing in emerging markets, though those gains are steadily shrinking. Leachman and Francis (1995) attribute the growing integration of financial markets to improved policy coordination across different economic areas, especially in foreign exchange markets. Goetzmann *et al.* (2001) and Hartmann *et al.* (2003) report that highly integrated equity markets make the international diversification potential very low, when compared to the longer-term history of capital markets. Baca *et al.* (2000) and Ferreira (2004) also support this view when they confirm that both country and industry correlations fell significantly since their peak levels in 1998.

Adam *et al.* (2002), Baele *et al.* (2004), and Portes and Rey (2005) not only organize the different definitions of equity convergence, but also provide evidence about the enhanced role of the common currency within Europe for equity market convergence. Hanousek and Filer (2000) also show that integration strengthened significantly in the new European Union countries. Adjaoute and Danthine (2004), Egert and Kočenda (2007) and Cappiello *et al.* (2009) also support these findings. Piesse and Hearn (2002) and Cerny (2004) find a weaker degree of integration for the Asian emerging equity markets. By contrast, Yang *et al.* (2003a) argue that this occurs only over the post-Asian crisis period. Ayuso and Blanco (2000), using a time-varying approach, find a greater degree of integration, at least for the Euro area economies. Bekaert *et al.* (2000) provide evidence that substantiates their results, even accounting for structural breaks. The same results also hold from Hardouvelis *et al.* (2006), who report a lower cost of capital reflecting higher capital market integration in Euroland.

Aggarwal and Kyaw (2005) investigate the convergence trends of three North American Free Trade Agreement (NAFTA) economies and find cointegration between equity prices only over the period after the formation of NAFTA, while Darrat and Zhong (2005) argue that the NAFTA formation contributed to a greater speed of convergence among NAFTA members. Ciner (2006) identifies a high degree of convergence among North American equity markets, especially during the 1990s, on the basis of the boom in information technology stocks as well as by the dismantling of trade barriers. Chukwuogor-Ndu (2007) and Chukwuogor-Ndu and Kasibhatla (2007) also confirm convergence patterns for North American equity markets. Finally, Canarella, Miller, and Pollard (2009), using daily data from 1992 to 2007, examine (i) the long-run relationship between the three NAFTA equity markets, using cointegration techniques, (ii) the dynamic relationships between the three markets, using impulse-response analysis, and (iii) the volatility transmission process between the three markets, using a multivariate generalized autoregressive conditional heteroskedasticity model. They do not find evidence of cointegration between the three NAFTA stock markets nor any tendency toward such a long-run trend relationship. But, they do find significant volatility transmission between the NAFTA stock markets.

To determine convergence in global equity markets, researchers use a variety of approaches. One method uses asset-pricing models to determine whether equity returns reflect global rather than local risk factors (Bekaert and Harvey, 1995; Karolyi and Stulz, 2002). Another method highlights the importance of country-specific effects in convergence among equity markets (Baca *et al.*, 2000; Cavaglia *et al.*, 2000). Adjaoute and Danthine (2000) argue that enhanced European Union (EU) diversification during the 1990s implies a stronger pattern of integration. Moreover, EU factors play a dominant role relative to country-specific factors. Nevertheless, they also argue that strong differences in taxation, reporting, and accounting standards exist in EU capital markets. The introduction of the euro does not eliminate home bias.

Using equity return correlation analysis, Fratzscher (2002) finds a stronger correlation of stock returns, which reflects greater integration among equity markets, especially in Europe, due to the elimination of currency risk as well as from the convergence of monetary policies. Cappiello *et al.* (2009) and Rahman and Khan (2009) confirm these findings, especially for European equity markets that share common characteristics, such as strong liquidity and market capitalization. Yang *et al.* (2003b) consider linkages across equity markets through cointegration. They employ 11 EU equity markets and find long-run linkages among them, especially following the formation of the European Monetary Union (EMU).

Another group of studies uses σ-convergence analysis. In particular, Babetskii *et al.* (2007) find evidence of substantial stock-market integration with respect to new members of the EU. By contrast, Sy (2006) uses the same methodology and reaches the opposite conclusion for the West African Economic and Monetary Union economies. Following Corhay *et al.* (1993) and Engsted and Lund (1997), Rangvid (2001) utilizes recursive common stochastic trend analysis to find convergence for three European equity markets. On the other hand, Gleria *et al.* (2004) employ the truncated Levy flight approach to find a relatively slow convergence among equity markets. Finally, the home-bias-effect method (i.e., investors invest primarily in their own country) suggests that a reduced home bias effect implies a greater degree of integration among international equity markets. Adam *et al.* (2002) and Lane and Milesi-Ferretti (2008) find that the relative size of the local equity market remained stable over time, while the equity home bias diminished, especially in Europe.

A different strand of research investigates convergence patterns in capital markets, focusing on the relative importance of country versus industry effects in driving stock-market returns. Fraser *et al.* (1994) use disaggregated data for various industrial sectors for Europe and the US along with a time-varying methodology. They find that much more convergence among European capital markets can yet occur. Griffin and Karolyi (1998) use 66 industry indices from 25 countries and confirm the dominance of country effects in portfolio selection. By contrast, Baca *et al.* (2000), Cavaglia *et al.* (2000), Isakov and Sonney (2002), and Adjaoute and Danthine (2003) argue in favor of the increasing importance of industry factors over the last twenty years. Brooks and Del Negro (2004) provide an opposing view and report results that support country effects for all industrial sectors, excluding the technology, media, and telecommunication sector in which industry effects work better in determining portfolio diversification issues. Ferreira and Gama (2005) report that industry diversification becomes more effective in risk reduction than geographical diversification over the last twenty years. They attribute these findings to rising industry volatility vis-à-vis country volatility as well as a global trend in the correlations among local industries. Ferreira and Ferreira (2006) use a number of industries in the Euro area. They argue that international financial management requires the identification of country and industry effects in explaining portfolio returns. Their empirical findings show that country effects still dominate the determination of stock market returns. Over the last ten years, however, industry effects gain increasing importance, implying that although international portfolio diversification remains an effective tool for risk reduction vis-à-vis industry diversification its relative importance keeps decreasing over time.

Finally, several studies examine stock market volatility, since such volatility can impair not only the smooth functioning of such markets, but also the performance of the entire economy

(Levine and Zervos, 1996; Bekaert and Harvey, 1997; Poterba, 2000; Arestis *et al.*, 2001). Thus, higher (lower) volatility indicates higher (lower) risks to equity investments and, thus, the shift of funds away from (toward) the stock market to safer investments, leading to lower (higher) stock prices. Ferreira and Gama (2005) provide strong support to the argument that volatility signals endogenous changes in capital markets. More specifically, they argue that changes in volatility reflect changes in trading volumes or practices within industries (industry effects) rather than within geographical regions and, thus, do not reflect changes in macroeconomic fundamentals and/or macroeconomic policies.

3. Econometric Methodology

Phillips and Sul (2007) propose a new econometric approach to test for convergence and the identification of convergence clubs. Their method uses a nonlinear time-varying factor model and provides the framework for modeling the transitional dynamics as well as long-run behavior. More specifically, consider a set of observable series y_{it} of country i such that:

$$y_{it} = \delta_{it}\mu_t , \tag{1}$$

where μ_t is a single common component and δ_{it} is a time varying idiosyncratic element which captures the deviation of country i from the common path defined by μ_t. Within this framework, all N economies (either the entire sample or the cluster) will converge, at some point in the future, to the steady state if $\lim_{k\to\infty}\delta_{it+k} = \delta$ for all *i=1, 2, …, N*, irrespective of whether countries are near the steady state or in transition. This is important, since the paths to the steady state (or states) across countries can differ significantly. Since we cannot estimate δ_{it} directly from equation (1) due to over-parameterization, Phillips and Sul (2006, 2007) eliminate the common component μ_t through rescaling by the panel average as follows:

$$h_{it} = \frac{y_{it}}{\frac{1}{N}\sum_{i=1}^{N} y_{it}} = \frac{\delta_{it}}{\frac{1}{N}\sum_{i=1}^{N} \delta_{it}}. \quad (2)$$

The relative measure h_{it} captures the transition path with respect to the panel average. A formal econometric test of convergence and an empirical algorithm to define club convergence requires that we assume the following semi-parametric form for the time-varying coefficients δ_{it} **:**

$$\delta_{it} = \delta_i + \sigma_{it}\xi_{it} \quad (3)$$

where $\sigma_{it} = \frac{\sigma_i}{L(t)t^{\alpha}}$**,** $\sigma_i > 0$**,** $t \geq 0$**,** and ξ_{it} is weakly dependent over *t*, but *iid(0,1)* over ***i*.** The function $L(t)$, which we set equal to log*t*, varies slowly, increasing and divergent at infinity. Under this specification for δ_{it}**,** the null hypothesis of convergence for all *i* takes the form: $H_0: \;\; \delta_i = \delta, \;\; \alpha \geq 0$ while the alternative hypothesis of non-convergence for some *i* takes the form: $H_A: \;\; \delta_i \neq \delta \;\; or \;\; \alpha < 0$**.** Phillips and Sul (2007) show that we can test the null of convergence in the following regression:[1]

$$\log\left(\frac{H_1}{H_t}\right) - 2\log L(t) = \hat{c} + \hat{b}\log t + \hat{u}_t, \quad (4)$$

for $t = [rT], [rT]+1, \ldots, T$**,** and $r > 0$**.**[2] In this regression, $H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2$ and $\hat{b} = 2\hat{\alpha}$, where h_{it} is defined in equation (2) and $\hat{\alpha}$ is the least squares estimate of α. Under the null hypothesis of convergence, the dependent variable diverges whether $\alpha > 0$, or $\alpha = 0$. In this case, we can test the convergence hypothesis with a t-test of the inequality, $\alpha \geq 0$. The t-test statistic follows the standard normal distribution asymptotically and is constructed using a

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[1] The analytic proof under the convergence hypothesis for this regression equation appears in Appendix B of Phillips and Sul (2007).

[2] Following Phillips and Sul (2007), we choose r values in the interval [0.2, 0.3].

heteroskedasticity and autocorrelation consistent standard error. Phillips and Sul (2007) call the one-sided t-test, which is based on $t_{\hat{b}}$, the log*t* test due to the presence of the log(t) regressor in equation (4).[3]

The possible existence of multiple equilibria is an important issue in the empirical convergence literature. In this case, rejecting the null hypothesis that all countries in the sample converge does not imply the absence of different convergence clubs in the panel. In this study, we implement the club convergence and clustering procedure proposed by Phillips and Sul (2007) as follows. First, order the N countries according to the value of the final times series. Second, form all possible core groups C_k by selecting the first k highest countries, with $k = 2, 3, ..., N$. Third, test for convergence using the $\log t_k$ test within each subgroup of size k. Fourth, define the core group $C*$ of size k^* as the group for which the maximum $\log t_{k^*}$ statistic occurs, given, of course, that all $\log t_k$ statistics over which we maximize supports the convergence hypothesis. Fifth, equation (3) finds that all the countries, according to the log*t* test, converge to the same steady state with the core group $C*$. Sixth, this identifies the first convergence club in the panel. Seventh, for the remaining countries (if any), repeat the procedure to determine the next convergence club, if more exist. Finally, terminate the process when the remaining economies fail to converge.

Finally, we test the robustness of the initial convergence test on the entire sample of countries as follows. In those cases where we cannot reject the null hypothesis of convergence for all countries, we proceed and implement the club convergence test. Typically, the club convergence test supports the initial test for overall convergence of all countries. Exceptions do

[3] The log*t* test exhibits favorable asymptotic and finite sample properties.

occur. See discussions below.

4. Empirical Analysis

4.1 Data

Our sample consists of markets characterized by diversity in terms of the size of capitalization, liquidity, breath, and depth. In particular, we investigate the following 42 countries: Argentina (ARG), Austria (AUT), Belgium (BEL), Brazil (BRA), Canada (CAN), Chile (CHL), China (CHN), Colombia (COL), Cyprus (CYP), the Czech Republic (CZE), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), India (IND), Indonesia (IDN), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Luxembourg (LUX), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), Norway (NOR), Pakistan (PAK), Peru (PER), the Philippines (PHL), Poland (POL), Portugal (PRT), Singapore (SGP), South Africa (ZAF), Spain (ESP), Sweden (SWE), Switzerland (CHE), Thailand (THA), Turkey (TUR), the United Kingdom (GBR), and the United States (USA). Datastream provided the monthly and daily data on stock market indices. The data span the period January 1980 to December 2008. Although data beyond 2008 exist, we stop at 2008 to leave out the break out of the recent financial crisis, which deserves a special treatment. In addition, we obtained data for a great variety of industrial sectors. In particular, we separate the industries under investigation into two types: general categories and specific sectors. The general categories include basic materials (41), consumer goods (38), consumer services (36), financials (36), healthcare (27), industrial (39), oil-gas (27), technology (19), telecommunications (23), and utilities (24), while the specific sectors include aero-defense (7), construction materials (35), electronics (18), engineering (23), general industries (26), services (16), and transportation (26).[4]

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[4] The number of countries included in each category appears in parentheses.

We construct monthly realized volatility by summing squared daily returns over the corresponding months. Andersen *et al.* (2001) and Barndorff-Nielsen and Shephard (2001, 2002) demonstrate that realized volatility constructed from high frequency data provide an unbiased and efficient estimator of returns volatility. In our case, high frequency data is not available; therefore, we compute realized volatility from daily returns. In addition, we also collect consumer price indexes (CPIs) from each country from Datastream to deflate nominal stock price indexes. The real index matters for capital gains, especially in a long-term analysis.

For all data, we use the Hodrick-Prescott filter procedure to extract the trend component from the natural logarithms of the series under examination. We adopt this procedure since convergence is a long-run (or trend) concept. That is, using the actual series potentially contaminates our results, since financial aggregates contain a substantial amount of short-run variation. We also use the time-varying parameter framework by Stock and Watson (1998) to decompose the trend component. Since the results do not change much, we do not report them but they are available upon request. Since the Phillips-Sul convergence methodology depends on the relative transition parameters, all panel cross-section means must be positive, which in our case holds, since the means of our variables are positive. Finally, we used the GAUSS software for the empirical analysis.

4.2 Convergence of the Stock Market Index and Its Volatility

The top half of Table 1 reports the results of the panel convergence methodology for real stock market indices, while the bottom half reports the results for their volatility. The first column reports the result of testing full convergence, (i.e., convergence among all sample countries), while columns 2 to 4 display the results of the club clustering procedure.

We reject the null hypothesis of full convergence for the real stock market indices. The results of the club clustering algorithm for the stock market indices show that over the period under investigation two convergent clubs exist. More specifically, the first club contains 33 equity markets while the second club includes 8 equity markets – Argentina, Italy, Japan, Malaysia, Pakistan, Philippines, Singapore, and the UK. Finally, the equity market of Thailand follows an independent path not convergent with either clubs 1 or 2. The lack of full convergence of international equity markets, and, more importantly, the formation of two convergent clubs, calls for the investigation of alternative factors that may contribute to such divergent patterns for real equity prices. Accordingly, we investigate whether country or industry effects lead to such behavior.

Apergis *et al.* (2011) find two convergence clubs for their sample of developed countries. Our sample of developed countries includes Germany and Spain, which they exclude. They include Australia and New Zealand, which do not appear in our sample. They find Japan as a non-convergence country. We find Japan included with other Southeast Asian countries – Malaysia, Singapore and Thailand – as well as Italy and the U.K.

Table 1 also shows that we cannot reject the null hypothesis of full convergence for stock market volatility. In other words, the results of the club convergence algorithm indicate the presence of a single convergent club.

4.3 Convergence of the General Industries Indices and Their Volatilities

This sub-section examines whether the non-convergence patterns of the stock market indices signal any potential industry effects. We begin with the presentation of general industry categories. Table 2 reports the convergence results for basic materials in terms of both the stock market indices and their volatilities. The top of Table 2 shows that we reject the null hypothesis of full convergence for the basic materials real stock indices. The results of the club convergence algorithm, however, indicate the presence of only one club with all countries included, except Malaysia, which belongs in the non-converging club. The bottom of Table 2 shows that we cannot reject the null hypothesis of full convergence for basic materials stock market indices volatility. In other words, the results of the club convergence algorithm indicate the presence of a single convergent club.

Tables 3 reports the results for the consumer goods stock market index, finding that three convergence clubs exist for consumer goods. In other words, there exists more divergence in stock market indices for consumer goods. This implies more room for diversifying an investor's portfolio across countries in consumer goods. Table 3 also reports different findings for club convergence of the consumer goods volatility measures, finding 5 convergence clubs for consumer goods and indicating a high degree of divergence. By contrast, with respect to the consumer services index, the results in Table 4 display a different picture. In terms of the index level, the analysis finds 4 convergence clubs, while for volatility, the analysis fails to reject the null hypothesis of full convergence for the countries participating in the sample.

Table 5 through 11 report the findings for the rest of the generalized indices – financial, healthcare, industrial, oil-gas, technology, telecommunications, and utilities indices. These findings generally fall within the limits of the basic materials and the consumer goods and services indices. Applying the convergence club algorithm to the financial, healthcare, industrial, oil-gas, technology, telecommunications, and utilities indices generates 4, 2, 4, 4, 3, 2, and 2 convergence clubs, respectively, sometimes with and sometimes without a non-converging country club. Also, when we examine the convergence clubs for the volatilities of the stock market indices for the financial, healthcare, industrial, oil-gas, technology, telecommunications, and utilities indices, we find 1, 1, 1, 1, 3, 4, and 1 convergence clubs, respectively. With two exceptions, the volatilities form fewer convergence clubs than the stock market indices themselves. The exceptions, the technology and telecommunications indices, exhibited 3 and 4 clubs, respectively, for their stock market indices. Moreover, in these two cases, the countries in the level clubs do not show a similar pattern with the volatility clubs.

All in all, the preceding empirical analysis suggests that considerable heterogeneity exists in the structure of our country sample and in terms of industry classification. This heterogeneity suggests that differences will exist in how economic shocks affect the course of capital markets in each economy. In terms of volatility, however, a different picture emerges. Ferreira and Gama (2005) support the argument that volatility signals endogenous changes in capital markets. More specifically, they argue that changes in volatility reflect changes in trading volumes or practices within industries rather than within geographical regions and, thus, do not reflect changes in macroeconomic fundamentals, in macroeconomic policies, or in the institutional and political environment of the stock markets. According to our results, several sectors (i.e., basic materials, finance, industrial, oil-gas, and utilities), exhibit a single convergence club in terms of the volatility of their stock prices. Health care also finds one club, but one country, Portugal, does not belong to this club and does not converge.

4.4 Convergence of the Specific Industries Indices and Their Volatilities

Tables 12 through 18 report the convergence results for the aero-defense, construction materials, electronics, engineering, general industries, services, and transport indices and their volatilities. As before, the top and bottom of the tables reports the convergence results for the stock market indices and their volatilities, respectively. The convergence club algorithm identifies 2, 3, 4, 3, 3, 4, and 2 clubs for the real stock market indices of the aero-defense, construction materials, electronics, engineering, general industries, services, and transport industries, respectively. In terms of volatility, the algorithm displays the presence of a single convergence club (in which all countries belong) in indices with the exception in the services and transport sectors in which the analysis identifies 4 and 2 clubs, respectively. Once again, we generally find that fewer volatility clubs exist when compared to the levels of stock market index clubs.

5. Conclusions

This study examines the convergence of international equity markets and their volatilities. It also departs from the standard approach in the finance literature in testing for convergence and borrows from the literature on the convergence of macroeconomic variables. That is, we implement the methodology of Phillips and Sul (2007), which uses a non-linear time-varying factor model with common and idiosyncratic components and which allows for technical progress heterogeneity across countries.

The empirical findings suggested that international equity markets do not form a homogeneous convergence club. Since a country's equity market aggregates the markets of individual industries, these findings may reflect specific endogenous characteristics within industries that prevent convergence at the industry level rather than country-specific factors. For example, country-specific factors may relate to differences in the level of development or in macroeconomic policies. On the other hand, industry-specific factors may reflect differences in human capital availability or diffusion of technical advances across international borders.

As a result, we repeat the empirical analysis across industries. The new empirical findings display even less convergence at the industry level, as characterized by more convergence clubs. That is, the heterogeneity across industries increases relative to that for the stock market indices themselves. Therefore, industry-related effects tend to dominate country-related effects, indicating that geography seems less important for portfolio diversification. The results are consistent with those reported by Campa and Fernandes (2006), who find that the driving force for the rise in global industry shocks is the faster transmission of shocks across industries and not across countries when it comes down to explaining financial aggregates.

In sum, our findings on the country and industry effects of convergence provide support for a diminishing country effect. That is, the presence of multiple convergence clubs within industries suggests that the industries do not converge toward a uniform structure. As such, room may still exist for significant benefits from diversifying across countries within a given industry. Conversely, the relatively large cross-country convergence club for the overall stock markets suggests less room for significant benefits from diversifying across geographical stock markets.

The convergence of volatilities tells a different story. We find one convergence club for the volatilities of the stock market indices. In addition, although we do find evidence of convergence clubs for industry level volatilities, fewer such clubs generally exist as compared to the clubs for the stock market indices from which the volatilities derive. Stated differently, we find more evidence of convergence in the second moment of the stock market indices than in the first moment. Such convergence may provide a precursor to convergence in the stock market indices themselves. That is, investors choose those markets with the higher expected return and tend to provide the impetus for convergence of the stock market indices. If such convergence continues, then the diversification advantages of portfolio investment across countries will prove less attractive.

These results seem crucial for portfolio managers and policy makers. That is, the convergence of stock market indices and their volatilities magnifies the importance of spillover effects between capital markets, since shocks emerging from a specific country or industry in an economy can quickly spread to other industries or countries. Our findings also seem important for regulators. More specifically, improved convergence of stock market indices and volatilities may impair the efficacy of the regulatory framework within a country or industry. Therefore, a new capital market architecture and regulatory framework may become necessary.

Finally, future empirical work can extend this work to a broader examination of the role of other factors, such as capital controls, liquidity restrictions, and regulation issues across industries and across countries in explaining stock market convergence patterns.

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Table 1: Club Convergence: Stock Market

Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	AUT, BEL, BRA, CAN, CHL, CHN, COL, CYP, CZE, DNK, FIN, FRA, DEU, GRC, HUN, IND, IDN, IRL, ISR, KOR, LUX, MEX, NLD, NOR, PER, POL, PRT, ZAF, ESP, SWE, CHE, TUR, US	ARG, ITA, JPN, MYS, PAK, PHL, SGP, UK	THA
logt Test	-5.094	8.963	15.834	
Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES			
logt Test	16.772			

Note: The abbreviations for the 42 countries in the whole sample are as follows: Argentina (ARG), Austria (AUT), Belgium (BEL), Brazil (BRA), Canada (CAN), Chile (CHL), China (CHN), Colombia (COL), Cyprus (CYP), the Czech Republic (CZE), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), India (IND), Indonesia (IDN), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Korea (KOR), Luxembourg (LUX), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), Norway (NOR), Pakistan (PAK), Peru (PER), the Philippines (PHL), Poland (POL), Portugal (PRT), Singapore (SGP), South Africa (ZAF), Spain (ESP), Sweden (SWE), Switzerland (CHE), Thailand (THA), Turkey (TUR), the United Kingdom (GBR), and the United States (USA).

Table 2: Club Convergence: Basic Materials

Level			
Club Type	**Only One Club**	**First Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	ARG, AUT, BEL, BRA, CAN, CHL, CHN, COL, CZE, DNK, FIN, FRA, DEU, GRC, HUN, IND, IDN, IRL, ISR, ITA, JPN, KOR, LUX, MEX, NLD, NOR, PAK, PER, PHL, POL, PRT, SGP, ZAF, ESP, SWE, CHE, THA, TUR, UK, US	MYS
logt Test	-4.845	2.120	
Volatility			
Club Type	**Only One Club**	**First Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES		
logt Test	10.096		

Note: See Table 1. This Table includes all countries except Cyprus.

Table 3: Club Convergence: Consumer Goods Index

Level							
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Fifth Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	BRA, CHN, COL, DNK, FRA, DEU, GRC, IND, IDN, JPN, LUX, NLD, NOR, PAK, SGP, ZAF, ESP, SWE, CHE	CAN, CHL, HUN, ITA, KOR, MYS, PER, TUR, UK, US	ARG, AUT, CYP, CZE, MEX, PHL, PRT, THA			IRL
log*t* Test	-680.701	2.263	-0.605	-0.377			
Volatility							
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Fifth Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	AUT, BRA, CHN, CZE, GRC, IDN, NOR, PRT, SGP, TUR	MYS, PAK, PHL, THA	CAN, CHL, COL, CYP, DNK, FRA, DEU, IND, ITA, JPN, KOR, LUX, MEX, NLD, PER, ZAF, SWE, CHE, UK, US	HUN, ESP	ARG, IRL	
log*t* Test	-1.943	15.016	-1.286	1.035	-1.637	6.640	

Note: See Table 1. The 38 countries in this table include Argentina, Austria, Brazil, Canada, Chile, China, Colombia, Cyprus, the Czech Republic, Denmark, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, the Netherlands, Norway, Pakistan, Peru, the Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 4: Club Convergence: Consumer Services Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	ARG, BEL, CHL, CHN, COL, GRC, IRL, NOR, ZAF, SWE	CAN, FIN, HUN, ISR, MEX, NLD, SGP, CHE, US	CYP, FRA, KOR, MYS, DEU, IND, ITA, JPN, LUX, PRT, ESP, TUR, UK	AUT, IDN, PAK, PHL, THA
log*t* Test	-12.425	4.070	7.821	0.347	-1.570
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES				
log*t* Test	36.042				

Note: See Table 1. The 37 countries in this table include Argentina, Austria, Belgium, Canada, Chile, China, Colombia, Cyprus, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, the Netherlands, Norway, Pakistan, the Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 5: Club Convergence: Financials Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	BRA, CHN, COL, CYP, HUN, IND, PAK	AUT, BEL, CAN, CHL, CZE, DNK, FIN, GRC, IRL, ISR, LUX, MEX, NLD, NOR, POL, SGP, ZAF, ESP, SWE, CHE, TUR, UK, US	ARG, DEU, ITA, JPN, KOR, MYS, PHL, PRT	IDN, THA
log*t* Test	-34.659	20.706	2.020	23.178	5.344
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES				
log*t* Test	14.757				

Note: See Table 1. The 41 countries in this table include Argentina, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, the Netherlands, Norway, Pakistan, the Philippines, Poland, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 6: Club Convergence: Healthcare Index

Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	AUT, BEL, DNK, DEU, ISR, KOR, PAK, ESP, SWE, TUR	CAN, FIN, FRA, HUN, IND, IDN, IRL, ITA, JPN, NLD, PRT, SGP, ZAF, CHE, THA, UK, US	
log*t* Test	-15.035	-1.618	-1.234	
Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	AUT, BEL, CAN, DNK, FIN, FRA, DEU, HUN, IND, IDN, IRL, ISR, ITA, JPN, KOR, NLD, PAK, SGP, ZAF, ESP, SWE, CHE, THA, TUR, UK, US		POR
log*t* Test	-15.641	22.204		

Note: See Table 1. The 27 countries in this table include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, the Netherlands, Pakistan, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 7: Club Convergence: Industrial Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	BRA, GRC, IND, IDN, KOR, PER	CHN, CZE, FIN, IRL, CHE	AUT, BEL, CAN, CHL, DNK, FRA, DEU, ISR, JPN, NLD, NOR, PHL, PRT, SGP, ZAF, ESP, SWE, TUR, UK, US	ARG, CYP, ITA, LUX, MYS, MEX, PAK, THA
log*t* Test	-52.669	45.474	1.863	2.451	1.046
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES				
log*t* Test	29.562				

Note: See Table 1. The 39 countries in this table include Argentina, Austria, Belgium, Brazil, Canada, Chile, China, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico, the Netherlands, Norway, Pakistan, Peru, the Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 8: Club Convergence: Oil-Gas Index

	Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	AUT, BRA, COL, CZE, IRL	CAN, FRA, ISR, ITA, KOR, NLD, NOR, SGP, ZAF, ESP, THA, UK, US	CHL, IND, PAK	ARG, JPN, MYS, PHL, TUR	LUX
log*t* Test	-42.766	3.945	3.645	10.064	1.186	
	Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES					
log*t* Test	15.573					

Note: See Table 1. The 27 countries in this table include Argentina, Austria, Brazil, Canada, Chile, Colombia, the Czech Republic, France, India, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Malaysia, the Netherlands, Norway, Pakistan, the Philippines, Singapore, South Africa, Spain, Thailand, Turkey, the United Kingdom, and the United States.

Table 9: Club Convergence: Technology Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	BEL, FIN	NLD, CHE, TUR, US	CAN, JPN, NOR, SWE, UK	CZE, FRA,DEU, IND, ISR, ITA, SGP, THA
log*t* Test	-34.433	1.200	2.887	19.891	-37.209
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	CAN, IND, NOR, SGP, SWE, CHE, THA, TUR	FIN, ISR, JPN, NLD,	BEL, FRA, DEU, ITA, UK, US	CZE
log*t* Test	-11.279	44.592	22.980	21.974	

Note: See Table 1. The 19 countries in this table include Belgium, Canada, the Czech Republic, Finland, France, Germany, India, Israel, Italy, Japan, the Netherlands, Norway, Singapore, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 10: Club Convergence: Telecommunications Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	BEL, IND, ISR, MEX, PER, ESP, SWE	ARG, BRA, CAN, CHL, DEU, ITA, JPN, KOR, MYS, NLD, PHL, SGP, THA, TUR, UK, US		
log*t* Test	-11.873	6.325	-1.108		
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	IND, ITA, MEX, PER, TUR,	CHL, ISR, MYS, SWE, US	ARG, PHL, THA	BEL, BRA, CAN, DEU, JPN, KOR, NLD, SGP, ESP, UK
log*t* Test	-38.001	5.760	27.521	1.620	93.721

Note: See Table 1. The 23 countries in this table include Argentina, Belgium, Brazil, Canada, Chile, Germany, India, Israel, Italy, Japan, Korea, Malaysia, Mexico, the Netherlands, Peru, the Philippines, Singapore, Spain, Sweden, Thailand, Turkey, the United Kingdom, and the United States.

Table 11 Club Convergence Utilities Index

Level			
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**
Countries Included	ALL COUNTRIES	AUT, BEL, CAN, CHL, COL, CZE, DEU, IND, ITA, LUX, NOR, ESP, CHE, UK, US	ARG, BRA, HUN, JPN, KOR, MYS, PAK, PHL, TUR
log*t* Test	-23.375	0.193	21.375
Volatility			
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**
Countries Included	ALL COUNTRIES		
log*t* Test	20.088		

Note: See Table 1. The 24 countries in this table include Argentina, Austria, Belgium, Brazil, Canada, Chile, Colombia, the Czech Republic, Germany, Hungary, India, Italy, Japan, Korea, Luxembourg, Malaysia, Norway, Pakistan, the Philippines, Spain, Switzerland, Turkey, the United Kingdom, and the United States.

Table 12: Club Convergence: Aero-Defence Index

Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Nonconverging countries**
Countries Included	ALL COUNTRIES	FRA, UK, US	BRA, CAN, ITA	IND
log*t* Test	-39.480	2.167	0.151	
Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	
Countries Included	ALL COUNTRIES			
log*t* Test	115.121			

Note: See Table 1. The 7 countries in this table include Brazil, Canada, France, India, Italy, the United Kingdom, and the United States.

Table 13: Club Convergence: Construction Materials Index

	Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Not Converging Countries**
Countries Included	ALL COUNTRIES	CHN, DNK, FIN, IND, IRL, NOR, PHL, ZAF, ESP, TUR	AUT, BEL, CAN, COL, FRA, DEU, GRC, IDN, ISR, ITA, JPN, KOR, MEX, NLD, PER, POL, PRT, SWE, CHE, THA, UK, US	ARG, MYS	CYP
log*t* Test	-47.499	0.667	3.946	-0.107	
	Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**		**Not Converging Countries**
Countries Included	ALL COUNTRIES				
log*t* Test	19.120				

Note: See Table 1. The 35 countries in this table include Argentina, Austria, Belgium, Canada, China, Colombia, Cyprus, Denmark, Finland, France, Germany, Greece, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Malaysia, Mexico, the Netherlands, Norway, Peru, the Philippines, Poland, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, the United Kingdom, and the United States.

Table 14: Club Convergence: Electronics Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	CHN, IND, SWE	CAN, ITA, NLD, CHE, US	FIN, FRA, DEU, JPN, KOR, THA	BEL, DNK, SGP, UK
log*t* Test	-18.224	28.018	8.150	-0.743	3.041
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES				
log*t* Test	19.408				

Note: See Table 1. The 18 countries in this table include Belgium, Canada, China, Denmark, Finland, France, Germany, India, Italy, Japan, Korea, the Netherlands, Singapore, Sweden, Switzerland, Thailand, the United Kingdom, and the United States.

Table 15: Club Convergence: Engineering Index

Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**
Countries Included	ALL COUNTRIES	FRA, GRC, IDN, KOR, PER	AUT, CHN, FIN, DEU, IND, NLD, PAK, ESP, SWE, CHE, UK, US	BEL, CAN, ITA, JPN, NOR, SGP
log*t* Test	-13.714	26.536	0.654	14.576
Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**
Countries Included	ALL COUNTRIES			
log*t* Test	26.609			

Note: See Table 1. The 23 countries in this table include Austria, Belgium, Canada, China, Finland, France, Germany, Greece, India, Indonesia, Italy, Japan, Korea, the Netherlands, Norway, Pakistan, Peru, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Table 16: Club Convergence: General Industries Index

Level				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**
Countries Included	ALL COUNTRIES	ARG, CHN, KOR	AUT, BEL, CAN, CHL, CZE, DNK, DEU, GRC, JPN, MEX, NLD, PAK, SGP, ZAF, CHE	COL, FIN, ISR, ITA, MYS, PHL, UK, US
log*t* Test	-148.141	0.600	-1.176	8.868
Volatility				
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**
Countries Included	ALL COUNTRIES			
log*t* Test	6.287			

Note: See Table 1. The 26 countries in this table include Argentina, Austria, Belgium, Canada, Chile, China, Colombia, the Czech Republic, Denmark, Finland, Germany, Greece, Israel, Italy, Japan, Korea, Malaysia, Mexico, the Netherlands, Pakistan, the Philippines, Singapore, South Africa, Switzerland, the United Kingdom, and the United States.

Table 17: Club Convergence: Services Index

Level					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	ARG, CHN, SWE	DEU, IRL, LUX, MYS, NLD, ESP	FRA, ZAF, CHE	CAN, JPN, UK, US
log*t* Test	-15.437	6.285	1.927	12.419	-1.416
Volatility					
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**	**Third Convergence Club**	**Fourth Convergence Club**
Countries Included	ALL COUNTRIES	CHN, LUX	IRL, JPN, MYS, NLD, ZAF	ARG, FRA, ESP, SWE, UK, US	CAN, DEU, CHE
log*t* Test	-6.856	-1.172	0.027	0.134	16.208

Note: See Table 1. The 16 countries in this table include Argentina, Canada, China, France, Germany, Ireland, Japan, Luxembourg, Malaysia, the Netherlands, South Africa, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Table 18: Club Convergence: Transport Index

Level			
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**
Countries Included	ALL COUNTRIES	AUT, BEL, CAN, CHL, CHN, DNK, FRA, DEU, IND, ITA, JPN, KOR, MEX, NLD, NOR, PHL, SGP, ZAF, ESP, UK, US	CYP, CZE, MYS, CHE, THA
log*t* Test	-1.681	3.646	0.119
Volatility			
Club Type	**Only One Club**	**First Convergence Club**	**Second Convergence Club**
Countries Included	ALL COUNTRIES	CHL, CHN, CYP, DNK, IND, JPN, KOR, NOR, PHL, SGP, ESP, UK, US	AUT, BEL, CAN, CZE, FRA, DEU, ITA, MYS, MEX, NLD, ZAF, CHE, THA
log*t* Test	-18.929	8.932	-0.025

Note: See Table 1. The 26 countries in this table include Austria, Belgium, Canada, Chile, China, Cyprus, the Czech Republic, Denmark, France, Germany, India, Italy, Japan, Korea, Malaysia, Mexico, the Netherlands, Norway, the Philippines, Singapore, South Africa, Spain, Switzerland, Thailand, the United Kingdom, and the United States.