Global Stock Return Comovements: Trends and Determinants

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Abstract

This article analyses global stock return comovements for 37 advanced and emerging countries over the period 1996–2015. The article reports that the comovements were greater in advanced countries than in emerging ones, but increased more rapidly in emerging countries than in advanced ones. Such comovements had upward and downward trends in 23 and 7 of the sample countries, respectively. The driving forces behind these comovements were country fixed effects and country-specific time-varying factors. These factors include the increasing openness of international trade and finance, business climate, and institutional opaqueness, all of which worked in line with an information-driven comovement theory. The time-varying factors also include indicators representing monetary policy and capital controls, supporting a policy implication of a global financial cycle hypothesis: a monetary policy dilemma.

JEL classification: F3; G1; O1

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1. Introduction

In the midst of increasing globalisation, international trade and capital mobility are hallmarks of cross-country market integration, a view succinctly noted in one of the seminal studies in this field: "It is generally believed that increased capital market integration should go hand-in-hand with increased cross-country correlation" (Bekaert et al., 2009, p. 2591). Such international capital market comovement "is a key topic in finance, as it has important implications for asset allocation, risk management, and international diversification" (Chuluun, 2017, p. 53). In particular, the study of international stock market comovement has long been at the heart of finance, traditionally by investigating the mode and presence of a trend in its degree, and more recently by specifying its determinants. Since the global financial crisis in 2008, global financial market comovement has attracted much interest also in international finance literature as some costs to the comovement due to monetary policy spillovers have become more discernible (Passari and Rey, 2015). One policy implication of a global financial cycle hypothesis – a monetary policy dilemma – is drawing increased attention from both academics and policy makers. It puts the Mundellian trilemma into question by arguing that domestic short-term interest rates cannot influence domestic financial asset prices without controlling the country's capital account, regardless of its exchange rate regime. Can monetary authorities affect the degree of global comovement (DGC) of national stock returns, and if so how? This question is a primary motivation behind this article, because stock prices are an important element of domestic financial stability. One lesson of the global financial crisis appears to be that domestic financial instability and its negative effects on the real economy can have grave consequences.

In the global financial cycle hypothesis, a global financial cycle synchronises international capital movements and asset price changes across countries, and two factors – global investors' risk preference and global uncertainty – are regarded as important global common factors (GCFs) which drive that cycle (Rey, 2013; Rey, 2016; Passari and Rey, 2015; Coeurdacier et al., 2015). The two factors are affected by United States (U.S.) monetary policy (Rey, 2013; Passari and Rey, 2015) and are reflected well in the implied volatility of U.S. stock prices, or the Chicago Board Option Exchange Volatility Index (VIX) (Bekaert et al., 2013). U.S. monetary policy and VIX are determinants of gross capital inflows to individual countries (IMF, 2016; Hoggarth et al., 2016) as well as determinants of sudden large-scale changes in international capital movements in those countries (Forbes and Warnock, 2012). Bruno and Shin (2015; 2017), moreover, argue that increasing easiness of U.S. dollar debt finance for internationally-active companies helps the global financial cycle relax domestic financial conditions by activating domestic risk-taking and credit channels.

The dominance of some GCFs would be reasonable in a stock market of imperfect and asymmetric information. In such a market, information is a non-rival good, high fixed costs are necessary to gather and process new information, and it is very cheap or free to replicate information that has already become available. According to Veldkamp's (2005; 2006) "information-driven comovement theory," the lower price and greater popularity of a particular piece of information encourages investors to purchase it because they expect other investors to buy it too. As the number of investors gaining information on a specific stock increases, stock comovements increase; in the extreme case of full comovement, one piece of information on a specific stock is used to infer the values of all other stocks.

Supposing here a global stock market of that kind of imperfect information, in which (i) 37 stocks are traded, (ii) the issuers' names are those of my sample countries, and (iii) information costs to be paid by investors differ from country to country. Based on the information-driven comovement theory, two types of information can be produced there. One is low-cost soft information: information helping investors to infer a number of countries' fundamental values. This information is the source of global stock return comovements. GCFs can fall into this category of information. Globalisation helps low-cost soft information cover more countries' stocks by enhancing the interdependences amongst different countries' fundamentals. This means that globalisation advances in tandem with increases in those countries' DGCs. There has recently been empirical confirmation of this relationship. The increasing responsiveness of European national stock prices to U.S. stock prices would be the result of financial integration (Baele and Soriano, 2010). National DGCs are positively associated with both trade liberalisation and financial liberalisation (Beine and Candelon, 2011).[1] Chuluun (2017) has supported the positive association between the level of national DGCs and the progress of international trade and finance by conducting an extensive network

[1] In their case, a national DGC is a country's pairwise stock-return correlations adjusted for the boosting effect of high volatility.

analysis of 49 countries over the period 2001–2014.[2] These studies suggest that, with continued globalisation, national DGCs should have tended to increase over time.

The other category of information produced is high-cost hard information: information enabling investors to learn a specific country's fundamental value. More of this type of information is produced as doing so is more profitable. This profitability depends on two factors. The first is good prospects for an investment asset's value because information has increasing-returns in an asset's value. What this means in the hypothetical global stock market is that when investors believe that a particular country has better economic prospects, they are more willing to gather the expensive hard information, implying a smaller national DGC for that country. The second factor is the level of fixed costs necessary to produce information on a specific country. What this means in the global stock market is that a reduction in the costs stimulates investors' demand for hard information on the country, resulting in a smaller national DGC for that country. The necessary fixed costs can be reduced by advances in information technology and by a reduction in institutional opaqueness in individual countries. One example of the latter is a country fixed effect: the nature of the country's legal system. Institutional factors helping reduce information costs may be more effective in common-law countries than in civil-law ones. Such factors include respect for private property (Levine, 1997),[3] the level of disclosure (Jaggi and Low, 2000), and the quality of accounting information (Ball et al, 2000). Thus, if information costs continue to decline, national DGCs will tend to decrease over time.

By analysing the presence and mode of trends in national DGCs, this article contributes towards the literature on financial globalisation in general and towards empirical finance research on stock market integration in particular. The literature has found mixed evidence for how national DGCs have changed (See Appendix A). A recent seminal study, Bekaert et al. (2009), finds that there is no evidence of an upward trend in national DGCs of 23 developed countries over the period 1980–2005, except for European stock returns. Their DGC is inter-country correlations of market index returns as well as those explained by

[2] In her case, a national DGC is the stock-return correlation between a national market index and a world portfolio. She finds that the DGC tends to be higher in a country occupying a more central position in its networks of international trade and finance.

[3] La Porta et al. (1998) argue that laws and enforcement mechanisms are a more effective way to distinguish financial systems than the dichotomy of markets and banks. Additionally, Levine (2002) stresses that the level and quality of financial services has an impact on economic growth, and that the dichotomy of markets and banks is less relevant to financial development because the two can be complementary in their services.

changes of the returns' responsiveness to GCFs. The present study is closely related to Pukthuanthong and Roll (P&R, 2009) in taking corrective measures to gauge national DGCs more flexibly and to cover more countries than Bekaert et al. (2009). P&R (2009) report an upward trend for the simple average of national DGCs of 81 countries, including emerging ones, from the 1960s to 2007. To gain a proxy for a national DGC, I follow P&R's (2009) method. I perform three tasks which P&R (2009) do not: firstly, I pin down the previously-accumulated mixed evidence by referring to a recent period after the global financial crisis; secondly, I analyse the presence and mode of trends in individual countries' DGCs by using a time-series econometric method; and lastly, I investigate the determinants of national DGCs by using panel-data econometric methods.

This latter task – investigating the determinants of national DGCs – has formed another strand of the literature. To the best of my knowledge, this article is the first to test, at a global level, predictions made by the global financial cycle hypothesis and the information-driven comovement theory, with reference to national DGCs. As for the latter theory, in particular, existing studies support the relevance of domestic business climate and institutional factors to domestic stock market synchronicity (DSMS), that is, to comovements of individual corporate stocks' returns or volatilities within a country (Morck et al., 2000; Jin and Myers, 2006; Brockman et al., 2010; Riordan and Storkenmaier, 2014). According to these articles, different countries have different DSMSs, and an individual country's DSMS changes over time.[4] This article addresses, from an inter-country perspective, the question that these two observations naturally raise: What is the relevance of a national stock market's information production to its own DGC? This article finally orientates itself towards policy implications and perhaps falls within the field of comparative economics too, because its investigation of the determinants of national DGCs highlights the fact that institutional development and relevant polices are important for the autonomous pricing function of a national stock market.

The methodology of this article consists of three steps. The first step is to measure the DGCs for 37 advanced and emerging countries over the period 1996–2015, by following P&R (2009). That is, a multi-factor model is applied to national stock returns; and then, a national DGC is defined as the percentage of total variation in national stock returns accounted for by four GCFs. A detailed account of the four GFCs is beyond the scope of this article.

[4] I briefly discuss the application of information-driven comovement theory to a DSMS and a DGC in Appendix B.

The second step is to analyse the presence and mode of trends in national DGCs by country and by country group. This step finds an upward trend in a global DGC, or the simple average of all national DGCs. This suggests that the global positive trend found by P&R (2009) up to 2007 should have persisted for another eight years beyond the 2008 financial crisis. The step also finds "upward trends" in national DGCs for 23 out of the 37 samples, whilst finding "downward trends" in national DGCs for seven advanced countries. National stock markets converged more in advanced countries than in emerging countries. Such convergence happened more rapidly in emerging countries than in advanced countries.

The third step of the methodology is to make a panel data regression so as to identify the driving forces behind national DGCs. My panel-regression equation is aligned well with the data. The driving forces behind national DGCs were country fixed effects and country-specific time-varying factors. These factors work in line with the global financial cycle hypothesis and the information-driven comovement theory. Factors contributing towards an upward trend in a national DGC are increasing openness of international trade and finance as well as a rise in a country's economic presence in the world. A downward trend in a national DGC is a consequence of a reduction in information costs, measured by (i) indices based on a questionnaire regarding the status of the rule of law and democracy, as well as by (ii) the accessibility of a country's stock market to foreign investors. Improvements in business prospects contribute towards decreasing national DGCs, whilst changes in foreign bank loans contribute towards increasing them. The monetary policy dilemma is supported by the following facts: (i) a country's short-term interest-rate differentials with respect to the U.S. do not explain the level of the country's DGC when its capital account is fully open; (ii) a negative association between those interest-rate differentials and the national DGC emerges and becomes more prominent as capital account openness declines; and, (iii) the flexibility of foreign exchange rates is an insignificant determinant of a country's DGC. Meanwhile, I check the robustness of my empirical findings in four ways, one of which conducts a panel-data co-integration analysis to avoid any spurious regression.

This article proceeds as follows. Section 2 explains the choice of sample countries, the selection of national stock price indices, and the specification of national DGCs. Section 3 estimates national DGCs and examines the presence and mode of trends in individual countries' DGCs and grouped national DGCs. Section 4 constructs a panel-data regression model for national DGCs. Section 5 reports the regression results. Section 6 concludes.

2. Measuring National DGCs

2.1. National Stock Prices

I start by assuming the role of a character in the global stock market described above – an index investor who rolls over a one-week U.S. dollar debt and manages a GDP-weighted sum of national stock indices quoted in U.S. dollars, without hedging foreign exchange risks.

I use a dataset of national stock prices on a weekly basis over the period 1996–2015 covering 37 advanced and emerging countries; in alphabetical order, Argentina (ARG), Australia (AUS), Austria (AUT), Belgium (BEL), Brazil (BRA), Canada (CAN), China (CHN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hong Kong (HKG), India (IND), Indonesia (IDN), Ireland (IRL), Italy (ITA), Japan (JPN), Malaysia (MYS), Mexico (MEX), the Netherlands (NLD), New Zealand (NZL), Norway (NOR), the Philippines (PHL), Portugal (PRT), Russia (RUS), Saudi Arabia (SAU), Singapore (SGP), South Africa (ZAF), South Korea (KOR), Spain (ESP), Sweden (SWE), Switzerland (CHE), Thailand (THA), Turkey (TUR), the United Kingdom (GBR), and the United States (USA). This sample includes 24 developed countries and areas, 23 of which are also analysed by Bekaert et al. (2009). In addition to these countries, the sample includes 13 emerging countries belonging to the Group of Twenty (G20) and/or the Executives' Meeting of East Asia and Pacific Central Banks (EMEAP), an Asia and Pacific forum. The sum of the sample countries' GDPs accounted for 87.5% of world GDP in 2015.

I outline here the basis on which I have selected national stock indices; Appendix C shows definitions and sources of data in more detail. To best reflect fundamentals of national stocks, I choose an index consisting of broadly tradable shares; e.g., Standard & Poor's 500 rather than the Dow Jones Industrial Average for USA. When such a broad index is unavailable, I use a benchmark market index that consists of fewer equities. When such a second-best index is young with limited historical data, I use an alternative market index, such as Morgan Stanley Capital International (MSCI) country indices. As a result, I do not consider stock markets for start-up companies, which seem to have poor market liquidity. Prices of the selected stock indices are converted into U.S. dollars with reference to currency exchange rates in the markets.

2.2. Estimating National DGCs

2.2.1. Basic Policy

Following P&R (2009), I define a country's DGC (degree of global comovements) as the percentage of total variation in its stock excess returns accounted for by four GCFs. The percentage is a determination coefficient adjusted for the degree of freedom (R_{adj}^2) gained by estimating the following four-factor model every sample year using weekly data:

$$ER_t = \beta_0 + \beta_1 GCF1_t + \beta_2 GCF2_t + \beta_3 GCF3_t + \beta_4 GCF4_t + e_t, \tag{1}$$

where t is a weekly point of time, ER is a national stock excess return, GCFs are GCFs considered, β_0 is a constant term assumed to be zero, other βs are coefficients, and e is normally-distributed errors.

The R_{adj}^2 of Eq. (1) is written as:

$$\begin{aligned} R_{adj}^2 &= 1 - \{\sum \acute{e}^2 / \sum(ER - \overline{ER})\,(ER - \overline{ER})\} \times \{(n-1)/(n-4)\} \\ &= R\_DGC, \end{aligned} \tag{2}$$

where $\acute{e}$ is estimated residuals, $\overline{ER}$ is the mean, n is the number of observations, and 4 is the number of GCFs. In general, the finance literature regards such a R_{adj}^2 as a share of non-diversifiable systematic risks in ER's total risks. The non-diversifiable systematic risks here are supposed to come from GCFs. As discussed in Appendix A, such a formulation of national DGCs appears to be flexible, compared to the analysis in Bekaert et al. (2009) of a trend in national DGCs by using estimators (βs in the case of Eq. (1)). This is because the formulation makes it unnecessary to assume that the volatility of country-specific errors (e) is zero. Thanks to this, the formulation allows national DGCs to increase "over time even if factor exposures (βs) or factor volatilities decrease rather than increase, as long as country-specific residual volatility is not zero" (P&R, 2009, terms in parentheses added by the author).

Therefore, I make ordinary least squares (OLS) estimations of Eq. (1) with around 52 weekly observations every sample year for all individual sample countries. Based on Eq. (2), I gain one *R_DGC* for one sample country every sample year.

2.2.2. Specifying GCFs in Two Ways

In finance theory, there are two kinds of multi-factor models, depending on views on explanatory factors of securities' returns and the associated risk premiums (Zhou, 1999). I use a model which can explain national *ER*s better, or a model which reports larger *R_DGC*s. Using a world stock portfolio that consists of both advanced and emerging countries and covers Asian, African, and Latin American regions as well, can help take full account of information incorporated into stock price changes in all parts of the globe.

The first model regards the factors as being latent, as in models of arbitrage pricing theory (APT). The principal component analysis, a method often used with APT based models, enables specifying *GCFs* by using principal components.

I conduct principal component analyses every sample year by using weekly data of all individual sample countries' *ER*s. P&R (2009) regard as *GCFs* the first ten principal components whose percent cumulative eigenvalues are around 90%. In my case, using the first four principal components meets this criterion, as shown in Fig. 1. Notably, my principal component analyses are based on individual countries' *ER* weighted by their own GDP percentage shares. This is because treating all countries' *ER*s equally has the risk of coming up with biased principal components (Brown, 1989). I do not use market capitalisation weights, for the following three reasons. Firstly, the selected national stock price indices do not allow accurate comparisons of national stock market capitalisations because not all of them are broad market indices and they are constructed in different ways. Secondly, it is not possible to use identical indices for all sample countries. For example, MSCI country indices do not cover some of the 13 emerging countries, nor do they have sufficient long-term historical data. Lastly, using national GDPs as weights helps not only to take appropriate account of the size of national economies, but also to avoid any potential bias caused by using the values of country-specific market capitalisations as weights. As argued by Blackburn and Chidambaran (2011), using market capitalisation values as weights has the risk of disproportionally weighting countries with highly-capitalised stock markets, including financial superpowers such as USA, as well as city-economies functioning as international financial centres like HKG and SGP.

[Fig. 1 near here]

The second model specifies *GCF*s with data-based and meaningful indicators, as in the extended Capital Asset Pricing Model of Fama and French (1993; 1998; 2012). I follow Fama and French (2012); that is, the four *GCF*s are the market, size, value, and momentum factors.[5] *GCF1* is the market factor that comprehensively controls for changes in factors which commonly affect all national stock prices, including changes in world business climate, global uncertainty, global risk appetite, etc. *GCF2* is the size factor representing the anomaly that smaller capitalised national stocks tend to yield larger returns in the future. *GCF3* is the value factor representing the anomaly that there are fundamentally cheaper national stocks which tend to produce larger returns in the future. *GCF4* is the momentum factor representing the anomaly that rising national stocks tend to yield larger returns in the future.

Applying a world Fama-French model, I specify *GCF*s as follows. A proxy for *GCF1* is the averages of those 37 national stock indices' excess returns with weights of nominal GDPs. This weighting method is used for the reasons given above.

To control for *GCF2*, *GCF3*, and *GCF4*, I refer to Fama and French (2012) who make a market-capitalisation weighted sum of liquid stock prices in 23 advanced countries and calculate widely-used indicators for the three anomalies without regard to their nationalities. Because of the nature of data availability, I am unable to calculate such indicators by nationality, with reference to the 37 constituent national stock indices. For example, regarding *GCF3*, price-book value ratios are not available for all sample years and national stock indices. Specifically, from Kenneth R. French's digital data library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/), for *GCF2* I use *SMB* (the difference between the returns on diversified portfolios of small stocks and big stocks), and for GCF3, I use *HML* (the difference between the returns on diversified portfolios of high book-to-market stocks and low book-to-market stocks) in *Fama/French Global 5 Factors*

[5] I look at these four conventional factors here in order to equalise the number of GCFs with the APT-based model. By analysing numerous individual stocks' excess returns across 49 countries over the period 1981–2003, Hou et al. (2011) report that the cash-flow-to-price factor is a GCF of great explanatory power. In my case, indicators representing this factor are not available for all sample years and national stock indices.

[Daily]. For *GCF4*, I also use *WML* (the difference between the returns on diversified portfolios of the top-30% strong stocks and the bottom-30% weak stocks) in *Global Momentum Factor (Mom) [Daily]*.

[Fig. 2 near here]

Fig. 2 plots four *GCF*s in the world Fama-French model and shows that *GCF1* occasionally appears to be negatively-correlated with *GCF3* and positively-correlated with *GCF4*. As shown in Fig. 3, I investigate the multicollinearity that could occur amongst *GCF*s by calculating the variance-inflation factors (VIFs) for them according to Snee and Marquardt (1984), and I find all VIFs too small to cause multicollinearity.

[Fig. 3 near here]

2.3. Comparing Two Kinds of National DGCs

I close Section 2 by discussing which multi-factor model is better for gauging national stock returns' DGCs, the APT-based or the Fama-French model. Fig. 4 plots the simple average of national *R_DGC*s gained by estimating the two models. These two kinds of global DGCs show very similar behaviour over time, and the APT-based one is larger in all sample years than the Fama-French model-based one.[6] Therefore, I analyse the APT-based national DGCs in the following sections.

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[6] Given space constraints, I present only three observations on the results of 740 plain OLS estimations of Eq. (1) for each of the APT-based model and the Fama-French model. In the following recitation, (i) italic numbers refer to the APT model, (ii) numbers with single quotation marks refer to the Fama-French model, and (iii) the 10% significance level is applied. The three observations are as follows. Firstly, estimated β_0s are insignificantly different from zero in *642* or '640' regressions and are significantly almost zero in *98* or '100' regressions. I conjecture that the aforementioned assumption that β_0 is 0 is accepted for both of the APT-based and Fama-French models. Secondly, on the above-assumed normality of *e*, the Jarque-Bera test does not reject null hypotheses that *e*s have the normalities in *571* or '496' regressions, but the tests do in *169* or '244' regressions. The rejections take place more frequently in emerging countries than in advanced ones. Although the rejection ratios – *22.8%* or '33.0%' – appear to insufficiently low, I do not think that the ratios will prevent me from using the APT-based and Fama-French models for the purpose of gauging national DGCs. This is because the normality assumption does not directly affect their size (although its collapse affects statistical significances of estimated βs). Lastly, very small negative R_{adj}^2s are gained in *22* or '30' regressions. These R_{adj}^2s appear irregular because a R_{adj}^2 is interpreted here as the percentage of non-diversifiable systematic risks in total risks of *ER*. Therefore, I regard the negative R_{adj}^2s as 0.

[Fig. 4 near here]

3. Behaviours of National DGCs

3.1. Individual and Grouped National DGCs Based on the APT

This section analyses stock returns' DGCs (degree of global comovements) for individual countries. They are *R_DGC*s defined in Eq. (2). I plot *R_DGC*s by country and by group in Fig. 5. Country groups are all sample countries, advanced countries, emerging countries, European countries, and Asia Pacific countries. The last group consists of 11 countries whose central banks belong to the above-mentioned EMEAP consisting of JPN, AUS, NZL, KOR, HKG, SGP, CHN, IDN, MYS, THA, and PHL. As shown in Fig. 6, I also calculate the sample-period averages of those individual and grouped national DGCs.

[Fig. 5 near here]

[Fig. 6 near here]

Four observations arise from Figs. 5 and 6. Firstly, national DGCs have been larger in advanced countries than in emerging countries. Secondly, the differences between these two DGCs have reduced over time. Thirdly, the European DGC has for many years been larger than other country groups' DGCs, suggesting that European stock markets are likely to have been integrated most with each other. Lastly, a handful of economic powers tend to have large DGCs. Especially, USA's DGC looks almost constant and slightly less than one in all sample years whilst so does CHN's DGC after 2005

The last observation evokes a subtle aspect of *GCF*s. As mentioned above, in the APT-based model, my principal component analyses are based on national GDP-weighted *ER*s (stock excess returns). Therefore, when a larger economy country is referred to, its *ER* has greater potential to affect all four of the *GCFs*. Regressing a larger economy country's *ER* on such *GCFs* has a larger risk of endogeneity. Therefore, I calculate 740 correlation coefficients between *GCF1* and estimated residuals ($\hat{e}$s in Eq. (1)) for all sample countries, and find only two statistically significant correlation coefficients. I also do so for *GCF2*, *GCF3*, and *GCF4*, and find only five, eight, and nine statistically significant correlation coefficients, respectively. Although most of such statistically significant coefficients are found for USA, their values are no more than around 0.30 on an absolute value basis in many cases.[7] Consequently, I do not take the risk of endogeneity to be a concern as a whole; namely, I regard *R_DGCs* as being based on statistically consistent estimators here. Doing so, however, would be too rough in particular for USA and CHN's DGCs which are stable and close to one. In my framework, this means that USA and CHN's *ERs* are almost fully explained by GCFs and not affected by country-specific information. The theoretical distinction between cheap soft information and expensive hard information on country fundamentals cannot make sense for the two countries. Such a drawback is left in this section and will be considered in Section 5.

3.2. A Time-Trend Model

I investigate the presence and mode of trends in individual and grouped national DGCs. Specifically, I estimate the following equation:

$$L\_DGC_\tau = C + a_{TT} TT_\tau + e_\tau, \tag{3}$$

where *L_DGC* is the generalised logit-transformation of the square root of *R_DGC*. The logit-transformation is applied in order to transform its range [0, 1] to [0, +∞]. That is,

$$L\_DGC_\tau = \ln\{(1 + \sqrt{R\_DGC_\tau})/(1 - \sqrt{R\_DGC_\tau})\}. \tag{4}$$

As for Eq. (3), τ is a yearly-point of time, C is a constant term, and a_{TT} is a coefficient, TT is a time-trend term, and e is residuals which denote the deviations of *DGC* from the trend. TT is

[7] In the world Fama-French model, *GCF1* (the market factor) is the GDP-weighted average of national *ER*s. In the same vein, when a larger economy country is referred to, its *ER* has greater potential to affect this *GCF1*. I calculate 740 correlation coefficients between the *GCF1* and estimated residuals ($\hat{e}$s), and find *no* statistically significant correlation coefficient. Even in this case, USA and CHN's DGCs are very high as in the APT-based case.

a straight line increasing by one from one as τ goes by, and therefore a_{TT} is a coefficient showing the presence and mode of a time trend.

I estimate Eq. (3) using the OLS method and investigate the stationarity of estimated e ($\hat{e}$) with the Augmented Dickey-Fuller (ADF) test. In general, the OLS estimation does not come up with normally-distributed residuals when the dependent variable is a logit-transformed variable. Beyond this, if the order of integration is zero for $\hat{e}$, or $\hat{e}$ is stationary, then the OLS method produces asymptotically efficient estimators, whilst if the order of integration is one for $\hat{e}$, OLS estimators in the differenced regression will be asymptotically efficient (Canjels and Watson, 1997). If $\hat{e}$ is not stationary in Eq. (3), I will proceed to estimate the following equation using the OLS method and investigate the stationarity of residuals with the ADF test:

$$\Delta L\_DGC_\tau = C + \mathring{a}_{TT}TT_\tau + \dot{e}_\tau, \tag{5}$$

where Δ stands for the first difference, $\mathring{a}_{TT}$ is a coefficient, $\dot{e}$ denotes the deviations of ΔL_DGC from the trend, and other variables and notations are the same as in Eq. (3).

3.3. Estimation Results

Table 1 shows the results of estimating Eq. (3) for all individual and grouped national DGCs and Eq. (5) for relevant DGCs.

[Table 1 near here]

As for individual sample countries, firstly, I find upward trends for 23 countries. These countries include all of the emerging countries. Amongst the 23 DGCs, CHN's DGC has a much steeper slope than do other DGCs. Secondly, I find downward trends for USA, JPN, GBR, IRL, NLD, AUS, and NZL. Notably, USA's DGC is never constant after applying a logit-transformation to it. Amongst these seven countries, USA and JPN's DGCs have much steeper slopes than do other DGCs, whilst the negative slopes of other countries' DGCs are very gentle. Lastly, I find no trends for FRA, DEU, BEL, GRC, PRT, ESP, and HKG. Amongst the 14 countries whose DGCs do not have upward trends, nine countries are European.

As for country groups, I find (i) upward trends for all sample countries, emerging countries, and Asia Pacific countries, (ii) a downward trend for advanced countries, and (iii) no trend for European countries. P&R (2009) also find an upward trend in a DGC at a global level by analysing many more than 37 countries up until 2007. The upward trend found for my all sample countries' DGCs suggests that such an trend should have persisted for another eight years beyond the 2008 financial crisis. Both the upward trend for emerging countries and the downward trend for advanced countries are in line with the above-mentioned observation that emerging countries' DGCs have been catching up with those of advanced countries. As shown by the by-country results above, CHN led this catch-up process, and USA and JPN were the major sources of the downward trend for advanced countries. Such a downward trend is not found by Barai et al. (2008) and Bekaert et al. (2009), both of which report no trends in these cases. The result (iii) above – no trend for European countries – is different from Bekaert et al.'s (2009) finding of an upward trend for those countries. These differences can be attributed mainly to three factors. One is the difference in the end of a sample period of time: 2005 in their cases and 2015 in mine. The second is the difference in the range of sample countries, which may affect the GCF values: only advanced countries in their case whilst emerging countries are added in mine. The final factor is in the measurement of national DGCs, as discussed in the previous section.

Although a positive trend in a specific country's DGC suggests a reduction in diversification effects gained by investing in the country's market index, such an investment might still be efficient if there is a positive trend in that index's returns. Therefore, I investigate the presence and mode of trends in national stock excess returns. The dependent variables are the annual averages of individual countries' and groups' *ER*s, or A_ER_τ. As in the trend-analyses above, τ is a yearly-point of time, and I regress A_ER_τ on C and TT, and regress ΔA_ER_τ on these variables, if necessary. As shown in Table 2, none of the A_ER_τs have upward trends; specifically, they have horizontal trends, except for Russian A_ER_τ which has a very slightly negative trend. Thus, a national stock market whose DGC has an upward trend has been reducing its attractiveness as a destination for internationally diversified stock investments.

[Table 2 near here]

4. Determinants of National DGCs

4.1. A Panel-Data Regression Model

Country-specific factors determine the level of a national stock returns' DGC (degree of global comovements), by its construction. My selection of the determinants aims at testing predictions made by the information-driven comovement theory and the global financial cycle hypothesis. I construct the following regression equation:

$$
\begin{aligned}
L\_DGC_{i,\tau} = {} & C + h_1 SOT_{i,\tau} + h_2 IOT_{i,\tau} + h_3 SOIF_{i,\tau-1} + h_4 \Delta SOIF_{i,\tau} + h_5 ICCC_{i,\tau} \\
& + h_6 GDPG_{i,\tau} + h_7 ICT_{i,\tau} + h_8 STOCK\#_{i,\tau} + h_9 RoL_{i,\tau} + h_{10} VaA_{i,\tau} + h_{11} PFI_{i,\tau} \\
& + h_{12} |FBL_{i,\tau-1}| + h_{13} |ID_{i,\tau}| + h_{14} |ID_{i,\tau}| \times ICCC_{i,\tau} + h_{15} FXRD_{i,\tau} \\
& + h_{16} GDPS_{i,\tau} + IE_i + \varepsilon_{i,\tau}, \qquad (6)
\end{aligned}
$$

where *L_DGC* is the national DGCs that Section 3 measures by applying the APT-based model and defining with Eq. (4), i stands for individual sample countries, τ stands for a yearly-point of time, C is a constant term, hs are coefficients, IE stands for the fixed effect for i which will be explained in detail later, and ε is residuals. Meanwhile, time effects common to all is in individual sample years (τs) are not needed because, in Eq. (1), GCFs (global common factors) include such common effects.

4.2. Independent Variables

This subsection explains 16 regressors and *IE*. (Appendix C explains in detail the definitions and sources of all the regressors.) The 11 regressors in the first and second lines of Eq. (6) deal with the information-driven comovement theory. Since the GCFs can be regarded here as low-cost soft information on countries' fundamentals, open international trade and finance can help such GCFs cover more countries by enhancing interdependencies amongst the national fundamentals. Therefore, there seems to emerge a positive association between the level of national DGCs and the openness of international trade and finance, for which latter openess *SOT*, *IOT, SOIF*, and *ICCC* work as proxies.

SOT and *IOT* control for the openness of international trade. *SOT* is the sum of imports and exports over GDP, representing trade openness in terms of volume. Such a representation may not work well when a country's trade partners are not diversified because its overall trade volume can change significantly due to specific factors affecting its major partners. Therefore I also use *IOT* – the institutional openness in trade – as a regressor. A proxy for this is the *Index of Trade Freedom* that The Heritage Foundation calculates for individual countries by considering restrictions such as tariffs, taxes, and bans. I expect *SOT* and *IOT*'s estimators ($\hat{h}_1$ and $\hat{h}_2$) to be positive.

SOIF and *ICCC* control for the openness of international finance. *SOIF* is the size of gross exposures to international finance over GDP. This represents financial openness in terms of volume. Both residents' foreign assets and their liabilities to foreigners are summed up. Portfolio stocks, portfolio bonds, and bank lending/borrowing are covered. Forbes (2012) uses such an *SOIF* as a proxy for the thickness of international financial linkage. To see the effect of changes in *SOIF*, I use as a regressor its first difference ($\Delta SOIF$) at a current point of time (τ). Accordingly, I use as a regressor *SOIF* at a previous point of time ($\tau - 1$). *ICCC* stands for the institutional closedness of capital account controls. It is an index constructed by Fernández et al. (2015) who review the presence of capital control restrictions for individual countries on both inflows and outflows. This index runs from zero through one, with zero meaning full openness. I expect *ICCC*'s estimator ($\hat{h}_5$) to be negative and the other estimators ($\hat{h}_3$ and $\hat{h}_4$) to be positive. As explained below, $\hat{h}_5$ will be an estimator referring to a rare case.

GDPG, ICT, STOCK#, RoL, VaA and *PFI* address whether or not a national DGC tends to be smaller in a country whose information is more profitable to gather and process. I assume here that the profitability of information production changes in both cyclically and structurally. The cyclical change, on the one hand, reflects pro-cyclical changes of gross profits of information production, depending on the domestic business climate. My proxy for that is *GDPG*: the output gap calculated by subtracting potential growth rates from annual percentage changes in local-currency real GDP. The potential growth rates are based on local-currency real GDP smoothed by applying the Hodrick-Prescott filter with a multiplier of 100. I expect *GDPG*'s estimator ($\hat{h}_5$) to be negative because a larger *GDPG* means a better economic climate, hence a more profitable information production.

On the other hand, the profitability of information production can improve structurally in response to a reduction in information costs. To control for information-cost factors, I prepare six indicators. The first indicator stands for the development of information and communication technology, *ICT*. In line with Brockman et al. (2010), a proxy for this is per capita GDP, a country's wealth.[8] Because a larger per capita GDP is assumed to mean better information technology and hence a greater reduction in the information costs, I expect its estimator ($\hat{h}_7$) to be negative. *STOCK#* is the number of listed stocks. An increase in this number requires investors to expand the scope of gathering and processing firm-specific information: a factor in pushing up costs.[9] I expect its estimator ($\hat{h}_8$) to be positive. I control for institutional opaqueness with *RoL* and *VaA*. I take these variables from the World Bank's *World Governance Indicators*. *RoL* is an abbreviation of "rule of law," representing the quality of contract enforcement, property rights, the police, the courts, etc. *VaA* is an abbreviation of "voice and accountability," representing the progress of democracy, including the feasibility of political participation as well as the security of freedoms of expression, association, and the press. Their larger values mean less institutional opaqueness; therefore, I expect their estimators ($\hat{h}_9$ and $\hat{h}_{10}$) to be negative. For the same purpose, I also use *PFI* as a regressor. This indicator stands for the accessibility of a country's stock market to foreign investors: a ratio of the value of foreigners' stock investments to the market capitalisation of all listed stocks in a country. Two countries with international financial linkages of the same thickness (*SOIF* and Δ*SOIF*), two countries of the same wealth (*ICT*), and two countries of the same *RoL* and *VaA* may all have different *PFI*s. I posit that such differences come from

[8] For this proxy, I do a robustness check by using the Networked Readiness Index (NRI) which is compiled and published by The World Economic Forum. The NRI represents the development and usage of information and communication technology by individuals, enterprises, and public organisations in individual countries. I calculate cross-country correlation coefficients between per capita GDP and the NRI for 36 sample countries, all samples excluding SAU, in each year over the period 2007–2015. The correlation coefficients are very high: 0.81 in 2007, 0.80 in 2008, 0.81 in 2009, 0.77 in 2010 and 2011, 0.84 in 2012–2014, and 0.87 in 2015. I also calculate time-series correlation coefficients for each of the 36 countries. 23 countries gain positive coefficients, amongst which 16 coefficients are statistically significant. Only one country, THA, gains a statistically significant and negative coefficient. Eventually, per capita GDP should work as a good proxy for *ICT* over my sample period 1997–2015.

[9] Abstracting from how many stocks are actually listed in a country, it is assumed that 37 country stocks are traded and the fixed information cost differs by country stock in my hypothetical global stock market. Suppose here two cases for a country's stock market of a fixed information cost per stock. One case is where 100 companies are listed whilst the other case is where 50 companies are listed. The average fixed cost necessary for producing information on all listed companies is twice greater in the first case than in the second case. I add as a regressor *Stock#* to control for this effect. It should be noted that the effect is different from what Morck et al. (2000) and Jin and Myers (2006) attempt to control for in analysing countries' DSMS (domestic stock market synchronicities). In their case, a DSMS decreases due to its own construction as the number of listed company increases.

the difference in information costs which foreign stock investors incur in the two countries' stock markets due to manifold and time-varying institutional opacity unrelated to *RoL* and *VaA*. I expect *PFI*'s estimator ($\hat{h}_{11}$) to be negative.

The four regressors in the third line of Eq. (6) – |*FBL*|, |*ID*|, |*ID*| × *ICCC*, and *FXRD* – deal with the global financial cycle hypothesis whose implications are twofold: firstly, foreign creditors help a global financial cycle affect national stock prices by acting on domestic credit and risk-taking channels, thereby increasing the national DGC; and secondly, monetary policy is faced with a dilemma – to insulate domestic monetary policy from the impact of the global financial cycle, it is necessary to control capital inflows even when the foreign exchange rate is flexible.

|*FBL*| is a proxy for changes in the ease with which residents can obtain foreign-currency debt finance. It is the absolute value of an annual change of the outstanding amounts of loans made by foreign banks over GDP. The annual change is equivalent to residents' new borrowing from foreign banks minus their loan-repayments to the banks. I refer to a previous point of time (τ – 1) because it may take some time for the net foreign bank credit to affect equity prices as a result of acting on the domestic credit and risk-taking channels. I expect |*FBL*|'s estimator ($\hat{h}_{12}$) to be positive. I consider the monetary policy dilemma by using |*ID*|, |*ID*| × *ICCC*, and *FXRD*. |*ID*| is the absolute value of interest-rate differentials with respect to the U.S. To be specific, |*ID*| is one-year yields on sovereign bonds denominated in local currencies. If its estimator ($\hat{h}_{13}$) is statistically significant and negative, the implication will be that national short-term interest rates have created country-specific changes in stock returns: a disconfirmation of that dilemma. To see how the impact of |*ID*| on national DGCs varies depending on the capital account closedness (represented by *ICCC*), I add an interaction term, |*ID*| × *ICCC*. If its estimator ($\hat{h}_{14}$) is statistically significant and negative, the implication is that the impact of |*ID*| on national DGCs declines as the capital account becomes liberalised. As long as this interaction term exists, the estimator $\hat{h}_{13}$ to |*ID*| now refers to a specific case where *ICCC* is zero – that a country's capital account is fully open. By the same token, the estimator $\hat{h}_5$ to *ICCC* now refers to such a rare case where |*ID*| is zero. To control for the flexibility of foreign exchange, I add *FXRD*: a dummy variable which is one for countries with floating exchange rate regimes, and zero for other countries. A combination of (i) statistically insignificant $\hat{h}_{13}$, (ii) statistically significant and negative $\hat{h}_{14}$,

and (iii) a statistically insignificant estimator to *FXRD* ($\hat{h}_{15}$) is good corroboration for the monetary policy dilemma.

GDPS deals with a built-in character of the DGCs. It is the percentage share of world GDP. *GDPS*'s estimator ($\hat{h}_{16}$) could be positive because, as mentioned above, national DGCs have the potential to become larger for countries with larger GDPs.

Finally, IE_i stands for i's *heterogeneities* incorporated into omitted variables and unobservable factors. One example of an omitted variable is i's location: in the context of economic geography, borders and distance impede trade much more than do tariffs and transportation costs (Head and Mayer, 2013). The other example is i's legal system tradition, civil or common law, which can affect information costs. Section 1 introduced previous analyses which show that, compared to civil-law countries, respect for private property tends to be greater in common-law countries, the level of disclosure tends to be relatively high, and the quality of accounting information tends to be relatively high. All of these characteristics should reduce the costs.

5. Estimating Determinants of National DGCs

5.1. Estimation Procedures

To specify the presence and character of *IE*s for national stock returns' DGCs (degree of global comovements), I select one from three candidate models: firstly, a pooling model represented by dropping *IE*s from Eq. (6); secondly, a fixed-effect model, or Eq. (6) in which *IE*s are country-specific constants; and lastly, a random-effect model, or Eq. (6) in which *IE*s are country-specific stochastic variables. I do so by following a conventional procedure.[10]

When the polling model is rejected, I also need to deal with four potential irregular aspects of residuals ($\varepsilon_{i,\tau}$) so as to gain asymptotically consistent estimators ($\hat{h}$s): firstly, cross-section heteroskedasticity; secondly, period heteroskedasticity; thirdly, contemporaneously

[10] Firstly, I estimate the pooling model using the OLS method, and I estimate the fixed-effect model with the least-squares dummy variables (LSDV) method. Secondly, I justify the addition of constant *IE*s by checking with the F-test by how many and how significantly that addition reduces residual squared sums. Thirdly, if the fixed-effect model is selected, then, to compare it with the random-effect model, I test a null hypothesis with the Hausman test that *IE*s are uncorrelated with explanatory variables.

correlation; and lastly, serial correlation. If these problems arise, they will reduce the reliability of the results of t-tests on the estimators. Meanwhile, the risk of the first and second aspects could be acute for my dependent variables (*L_DGC*s) because they are logit-transformed variables (Kataoka, 2005).

I use an unbalanced panel dataset that includes 31 sample countries over the period 1997–2015: the six countries excluded due to data constraints are ARG, EPS, FIN, IRL, MEX, and SAU. Some of variables used are in levels. Multicollinearity could occur amongst such variables. Therefore, I calculate the VIFs (variance-inflation factors) for all pairs of two level-variables for all sample countries. Looking at the numerous VIFs shown in Appendix D, 14 are larger than the criterion. They are related to either or both *SOT* and *ICT*. Although they are left for the feasibility of the panel-data regression, the drawback will be adjusted by doing a robustness check. Another robustness check is to exclude USA and CHN from the samples. As discussed in Section 3, their DGCs are too large to be in line with the distinction between cheap soft information and expensive hard information on their fundamentals.

5.2. Estimation Results

Table 3 shows the results of estimating Eq. (6). I select the fixed-effect model for two reasons. Firstly, the F-test justifies a better alignment of the fixed-effect model with the data at a significance level of 1% than the pooling model, meaning that national DGCs are affected by country-specific constant factors (*IE*s). Secondly, the p-value of a χ^2 statistic of the Hausman test is 0%; that is, a null hypothesis that the random-effect model is more appropriate than the fixed-effect model can be rejected.

[Table 3 near here]

The R_{adj}^2 of the weighted-generalised least squares (GLS) estimations of the fixed effect model is 0.77, suggesting good alignment of my specification of DGC determinants with the data. Using the statistical software package, *EViews 10*, I cope with the above-mentioned four potential irregular aspects of residuals ($\varepsilon_{i,\tau}$) with reference to two kinds of adjusted standard errors.[11] Regressors with fixed-effect estimators which are statistically significant based on both of the adjusted standard errors include 10 regressors: *IOT* (+), *SOIF* (+), *GDPG* (–), *STOCK#* (+), *RoL* (–), *VaA* (–), *PFI* (–), |*FBL*| (+), |*ID*| × *ICCC* (–), and *GDPS* (+). The signs in parentheses stand for the coefficient $\hat{h}$s' signs.

[Table 4 near here]

I conduct four kinds of robustness checks. The first concerns *SOT* and *ICT*. As mentioned above, they are strongly correlated with each other or strongly correlate with other level-variables for a few sample countries. I drop either or both *SOT* and *ICT* from Eq. (6), and I separately make weighted-GLS estimations of the fixed-effect model used above. As shown in Table 4, in all cases, the statistical significance and signs of estimators for the 10 effective regressors listed above are secured.

The second check deals with two outlier DGCs: USA and CHN's ones. As analysed in Section 3, USA and CHN's *L_DGC*s have changed clearly over time but been so much larger than other countries' DGCs that it could be unreasonable to apply the information-driven comovement theory to them. To see whether or not this aspect damages the main findings, I make weighted-GLS estimations of the fixed-effect model used above by using sample countries in exclusive of the two countries. As shown in the rightmost column of Table 4, the statistical significance and signs of estimators for the 10 effective regressors listed above are secured.[12]

The third check deals with the risk of endogeneity which can damage the asymptotical consistency of panel-data GLS estimators in general. I do so by supposing a potential

[11] *EViews 10*'s option for a panel-data regression, *White period*, is used to gain standard errors adjusted for the risks of $\varepsilon_{i,\tau}$'s period heteroskedasticity and serial correlation, whilst *White cross-section* to gain those adjusted for the risks of $\varepsilon_{i,\tau}$'s cross-section heteroskedasticity and contemporaneously correlation. In estimating the fixed-effect model by GLS, I additionally use its option *Cross-section weights*, which also enables controlling for the risk of $\varepsilon_{i,\tau}$'s cross-section heteroskedasticity. Thus, for example, when *Cross-section weights* and *White period* are used together for making GLS estimations of that model, cross-section heteroskedasticity, period heteroskedasticity, and serial correlation are collectively controlled for. Reed and Ye (2011) demonstrate that estimators gained by using the weighted-GLS method together with each of the two options for adjusted standard errors are excellent in terms of the estimators' asymptotical efficiency and the accuracy of confidence intervals across them.

[12] There is an unlucky exception. The p-value of an estimator to *STOCK#* is 0.15 (more than a significance level of 10%) when controlling for the risks of ε's cross-section heteroskedasticity and contemporaneously correlation collectively. *STOCK#* gains a statistically significant coefficient when adjusting for the risks of ε's cross-section heteroskedasticity, period heteroskedasticity, and serial correlation collectively. For only *STOCK#*, I expediently ignore the risk of contemporaneously correlation errors.

causality that a greater DGC explains institutional changes. A country's larger DGC may reflect the advance of globalisation in the country. Therefore, one example is that if the people benefit from that advance, a larger DGC may have the greater potential to encourage the people to make institutional reforms to gain more from globalisation. Amongst the effective regressors, *IOT*, *STOCK#*, *RoL*, *VaA*, and *PFI* control for institutional factors. I detect the risk of endogeneity for only *IOT* by investigating the validity of a fundamental assumption that residuals (ε) have strong exogeneity with respect to the effective regressors.[13] To minimise the risk, I regard *IOT*'s lagged values as a good instrument variable; that is, I use $IOT_{i,\tau-1}$ instead of $IOT_{i,\tau}$ in Eq. (6).[14] As shown in Table 5, even in this type of regression, the statistical significance and signs of estimators to the effective regressors are secured.

The last check addresses the risk of spurious regression. My panel-data regression could be at this risk for two reasons: firstly, most of the sample countries have DGCs with trends; and secondly, so too could some regressors in levels. I respond to this risk by conducting a panel co-integration analysis using the effective regressors listed above (including $|ID|$, not $|ID| \times ICCC$). With these ten regressors and the LSDV method, I estimate a fixed-effect-type Eq. (6) and gain the following:

$$\begin{aligned} L\_DGC_{i,\tau} = {} & h_0C + 0.024IOT_{i,\tau} + 0.001SOIF_{i,\tau-1} \\ & - 0.022GDPG_{i,\tau} + 0.257STOCK\#_{i,\tau} - 0.011RoL_{i,\tau} - 0.015VaA_{i,\tau} - 0.016PFI_{i,\tau} \\ & + 0.006|FBL_{i,\tau-1}| - 0.019|ID_{i,\tau}| + 0.362GDPS_{i,\tau} + \varepsilon_{i,\tau} + IE_i. \end{aligned} \tag{7}$$

Then, I conduct ADF tests on the residuals ($\varepsilon_{i,\tau}$) with the degree of lag(s) up to five. All ADF test statistics suggest that the residuals should be stationary; that is, Eq. (7) is not a

[13] I take the following two steps. Firstly, I add as a regressor one of these regressors at a subsequent point of time; for example, in the case of *IOT*, both $IOT_{i,\tau}$ and $IOT_{i,\tau+1}$ are used as regressors. Lastly, I conduct five weighted-GLS estimations of the fixed effect model by using individual added variables. The p-values of estimators to each of the five regressors gained by making weighted-GLS estimations are as follows: 0.06 and 0.01 for $IOT_{i,\tau+1}$; 0.11 and 0.19 for $STOCK\#_{i,\tau+1}$; 0.73 and 0.71 for $RoL_{i,\tau+1}$; 0.26 and 0.18 for $VaA_{i,\tau+1}$; 0.17 and 0.42 for $PFI_{i,\tau+1}$. These values are based on the two kinds of adjusted standard errors, White period and White cross-section, respectively. Thus, I judge that *IOT* is at risk of endogeneity.

[14] This specification of the instrument variable is based on two assumptions. The first is an untestable one that *IOT* at $\tau - 1$ are not correlated with residuals (ε) at τ. The second assumption is that *IOT*'s "at $\tau - 1$" values are closely correlated with "at τ" values. I support this assumption as follows. I regress IOT_τ on $IOT_{\tau-1}$, a constant term, and individual effects by using a weighted-GLS method. As a result, I find that an estimator to $IOT_{\tau-1}$ is statistically significant and positive.

spurious relationship but a long-term stable relationship.[15] This can be said despite the fact that *L_DGC*s are logit-transformed variables. The signs of the estimated coefficients are the same as in the baseline estimation.

Thus, the driving forces behind national DGCs are country fixed effects (*IE*) as well as country-specific time-varying factors. In line with the information-driven comovement theory, I find that a country's DGC is positively associated with (i) increasing institutional openness of international trade, *IOT*, (ii) increasing openness of international finance – the level of international claims/obligations (*SOIF*) –, and (iii) increasing information costs for investing in stocks in the country, those represented by *Stock#*, *RoL*, *VaA*, and *PFI*. Cyclical changes in national DGCs are related to both (i) economic prospect (*GDPG*) in line with that theory and (ii) net foreign bank loans (|*FBL*|) in line with the global financial cycle hypothesis. The policy implication of this hypothesis, the monetary policy dilemma, is confirmed by three statistical relationships: firstly, a country's short-term interest-rate differentials with respect to the U.S. (|*ID*|) are irrelevant to the country's DGC when its capital account is fully open, or when *ICCC* is zero; secondly, as the capital account openness declines, |*ID*| is more negatively associated with a national DGC; and lastly, the flexibility of a country's foreign exchange rates (*FXRD*) is an insignificant determinant of the country's DGC. Meanwhile, a country's DGC increases as its economic presence increases in the world, by the formulation of a DGC.

6. Concluding Remarks

Although national stock returns have not been on an increasing trend, there are upwards in stock returns' DGCs (degree of global comovements) for many countries as well as in the simple average of all national DGCs. National stock markets converged more in advanced countries than in emerging ones, whilst the convergence happened more rapidly in emerging countries than in advanced ones. This is explained by the increased mobility of goods and capital as well as the rise in emerging countries' economic presence in the world.

[15] These tests are based on regressions including intercepts but not trends. The ADF statistics gained are as follows: 3.08 (1, 0.00), 4.62 (2, 0.00), 5.07 (3, 0.00), 5.87 (4, 0.00), and 5.11 (5, 0.00). The numbers in the parentheses are the degree of lags and p-values in sequence. Critical values proposed by Kao (1999) are used.

Still, there are downward trends in some of the DGCs of advanced countries. Such trends can be explained in part by reductions in information costs related to institutional opaqueness, measured by domestic progress in achieving the rule of law and democracy, as well as the accessibility of stock markets to foreign investors. Previous studies have not found clear empirical evidence for upward trends on national DGCs when they analyse only advanced countries' stock markets. One reason for this would be that information on country idiosyncrasies is gathered and processed well in their stock markets. Adding emerging countries to the range of sample countries not only enables the distillation of GCFs (global common factors) from more parts of the world, but also increases the number of sample countries with relatively high information costs. If institutional opaqueness declines in emerging countries, the upward trends in their national DGCs may also blur.

Monetary authorities have the potential to affect a national DGC. A country's stock price being greatly sensitive to GCFs may confound policy makers seeking financial stability. A set of statistical observations support the monetary policy dilemma. Capital account restrictions would be beneficial in reducing a country's DGC of stock returns by making the country's interest-rate policy more effective. However, beyond the level of its DGC, or the scope of this article, those restrictions have the risk of reducing the benefits for economic growth of stock market liberalisation, as confirmed empirically by Bekaert et al. (2005). A safer policy would be to reduce information costs incurred by investors, including foreign ones, so as to orientate their information-production towards individual countries' idiosyncrasies. To this end, expanding information disclosure and increasing market transparency would merit implementation. The rule of law and democracy provide a foothold for that.

Finally, average national DGCs may stagnate if economic growth rates decline in emerging countries, if the institutional opacity diminishes, especially in these countries, and if globalisation makes little progress.

Appendix A: A brief survey of empirical studies on the DGCs

To justify the potential gains to investors from international diversification, early financial articles investigate the inter-temporal stability of bilateral correlation coefficients amongst major countries. Watson (1978; 1980) and Meric and Meric (1989) support this stability whilst Maldonado and Saunders (1981) do not. Beyond this disagreement, Forbes and Rigobon (2002) demonstrate that simple correlation coefficients can be biased, resulting in the false appearance of correlation during periods of high volatility. With a computational method of adjusting for such a bias, they find that there was no significant increase in many unconditional cross-country correlation coefficients of national stock markets even in times of crises, including the 1987 U.S. crash, the 1994 Mexican crisis, and the 1997 Asian crisis.

Testing for changes in a cointegrating vector for pairs of national stock indices also deals with correlations between two countries' stock prices. Based on a constant correlation GARCH model, Longin and Solnik (1995) report that the hypothesis of a constant conditional correlation is rejected. Based on a dynamic conditional correlation GARCH model, Barari et al. (2008) show that estimated dynamic conditional correlations in stock returns between the U.S. and other G7 countries are clearer for iShares than for national stock market indices, but they do not discover an upward trend over the period 1996–2005. Although they find an increasing statistical significance for cointegration amongst G7 countries since 2001, it is impossible to establish different degrees of association for a cointegration because it is binary (Croux et al., 2001); in other words, a more statistically significant cointegration between two variables does not necessarily mean a stronger correlation between the two.

Bekaert et al. (2009) obtain a similar result for 23 developed stock markets over the period 1980–2005: there is no evidence of an upward trend for national DGCs, except for the European stock markets. They analyse inter-country correlations of market index returns as well as those explained by changes in the returns' responsiveness to global common factors (GCFs) – the betas (βs) that the authors estimate by applying both APT-based and Fama-French-type multi-factor models.

Two articles challenge Bekaert et al. (2009). Blackburn and Chidambaran (2011) warn that using a market-capitalisation-weighted average of national stock markets as a world stock portfolio has the risk of disproportionally weighting countries with highly-capitalised stock markets, including financial superpowers such as USA, as well as city-economies functioning as international financial centres such as HKG and SGP. Looking at the same 23 stock markets used by Bekaert et al. (2009), Blackburn and Chidambaran (2011) make a canonical correlation analysis in order to retrieve comoving components from pairs of national stock returns. They define the components as common factors to the pairs. These common factors are a combination of weights which maximises correlation between a weighted-sum of historical data of stock returns in one country and a weighted-sum of those in another country. They gain maximised correlations for one country with respect to other countries individually, and show that, from the mid-1990s through 2010, the average pairwise correlation for individual countries increased, as did the average pairwise correlation amongst all pairs.

P&R (2009) argue that the analyses of Bekaert et al. (2009) of trends in national DGCs by referring to individual countries' estimators (βs) may be narrow. This is because such analyses must assume residual volatility to be zero so as to attribute increases of national DGCs to increases in the size and volatility of βs. P&R (2009) show that rejecting this assumption can reduce the reliability of inter-country correlations of market index returns as indicators of national DGCs. This is because such correlations can be changed by the volatility of βs as well as the volatility of the GFCs themselves. As a result, they propose a method of (i) calculating the percentage of total variation in a country's stock returns accounted for by GCFs and (ii) regarding it as a national DGC. They report an upward trend for the simple average of the national DGCs of 81 countries, including developing ones, from the 1960s to 2007.

Appendix B: A brief review of information-driven comovement theory

In Veldkamp's (2006) model, one piece of information is allowed to be produced for the learnable part of the future value of an individual stock at a fixed cost – χ. There is competition amongst information producers, and χ is the same for all stocks. The model's predictions central to this article are the following. The producers charge more for less popular information than for that which is more popular. The lower price and greater popularity of a particular piece of information encourages investors to purchase it because they expect other investors to buy it too. As the number of investors gaining information on a specific stock increases, stock comovements increase; in the extreme case of full comovement, one piece of information on a specific stock is used to infer the values of all other stocks. As the number of assets whose specific information is produced increases, stock comovements decrease; in the extreme case of no comovement, different information is used to learn different values of different stocks. A reduction in χ facilitates an increase in the variety of information produced.

Her model has a straightforward affinity with international comparisons of countries' own DSMS (domestic stock market synchronicity). A less financially developed country tends to have a larger DSMS due to weak property rights (Morck et al., 2000) and manifold institutional opacity (Jin and Mayers, 2006). These articles take a country's DSMS to be the average of the percentage shares accounted for by a domestic market index return and a U.S. market index return in total variations of individual corporate stock returns. More recently, Brockman et al. (2010) find that business climate is negatively associated with a DSMS, and that this association tends to be weaker in countries with greater institutional opaqueness. Riordan and Storkenmaier (2014) find that a DSMS tends to be larger when less firm-specific information are produced. The two articles' definition of DSMS is the average of percentage shares of individual stocks' return volatilities accounted for by market-wide and industry-specific volatilities in a national stock market.

In this article on a DGC, a global stock market is assumed to exist with 37 country stocks. The fixed costs are assumed to differ by country: a country i's fixed cost (χ_i) is equal to a global constant (χ^*) plus a country-specific add-on (x_i). This additional minor assumption does not damage the information-driven comovement theory's key predictions mentioned above. A reduction in x_i contributes towards expanding the variety of information produced in the global stock market.

Appendix C: Definitions and sources of data

[Table C1 here]

Appendix D: VIFs amongst independent variables in levels

[Table D1 here]

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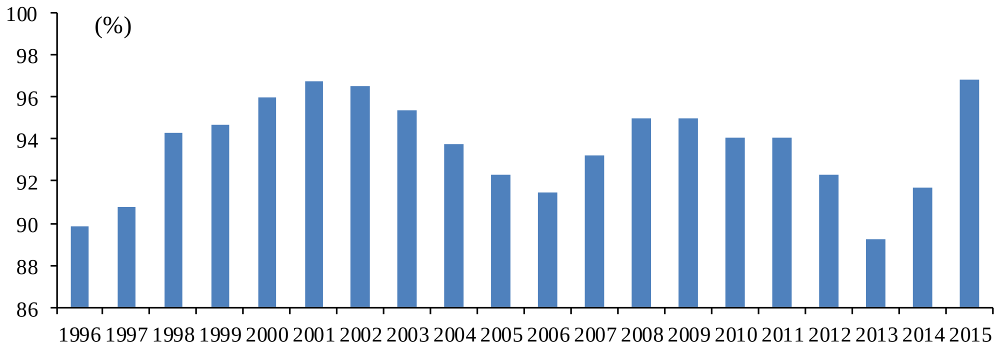
Figures

Fig. 1. Percent Cumulative Eigenvalues of the First Four Principal Components



Note: Principal component analyses are made every sample year for all sample countries by using weekly data of individual sample countries' GDP-weighted *ER*s (excess returns of national stock price indices).

Fig. 2. Annual Averages of Weekly Data of Four *GCF*s Used in the Fama-French Model

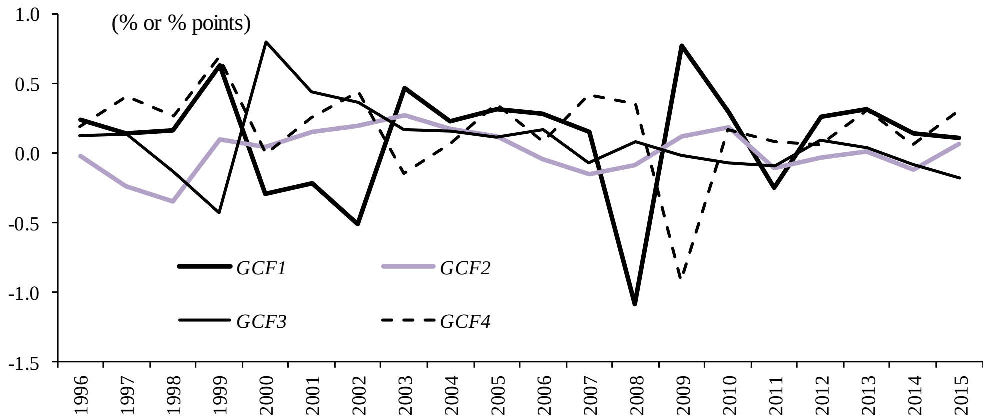
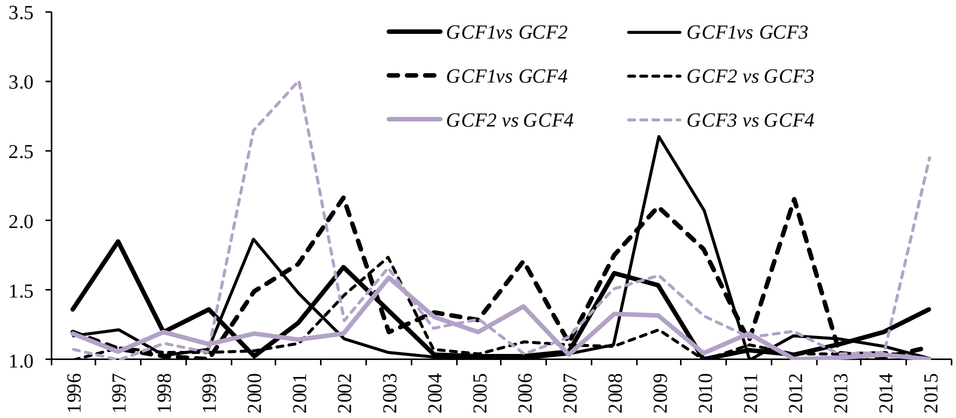
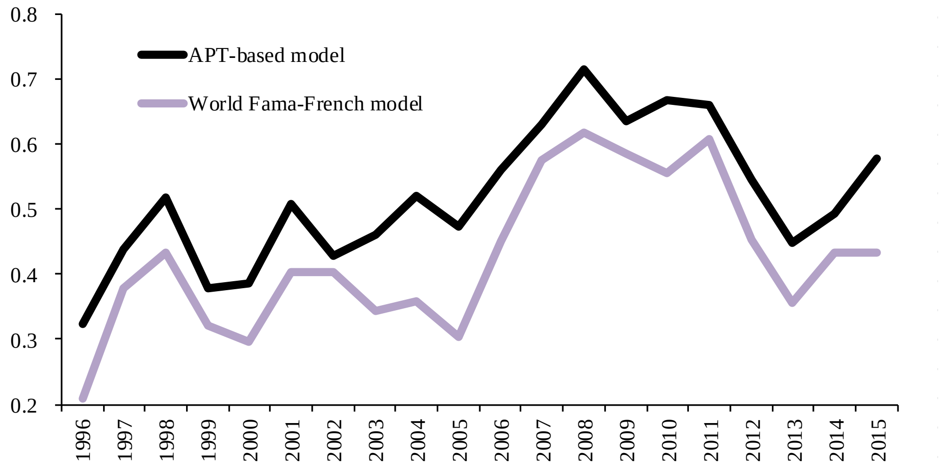


Fig. 3. VIFs (Variance-Inflation factors) amongst Four *GCF*s in the Fama-French Model



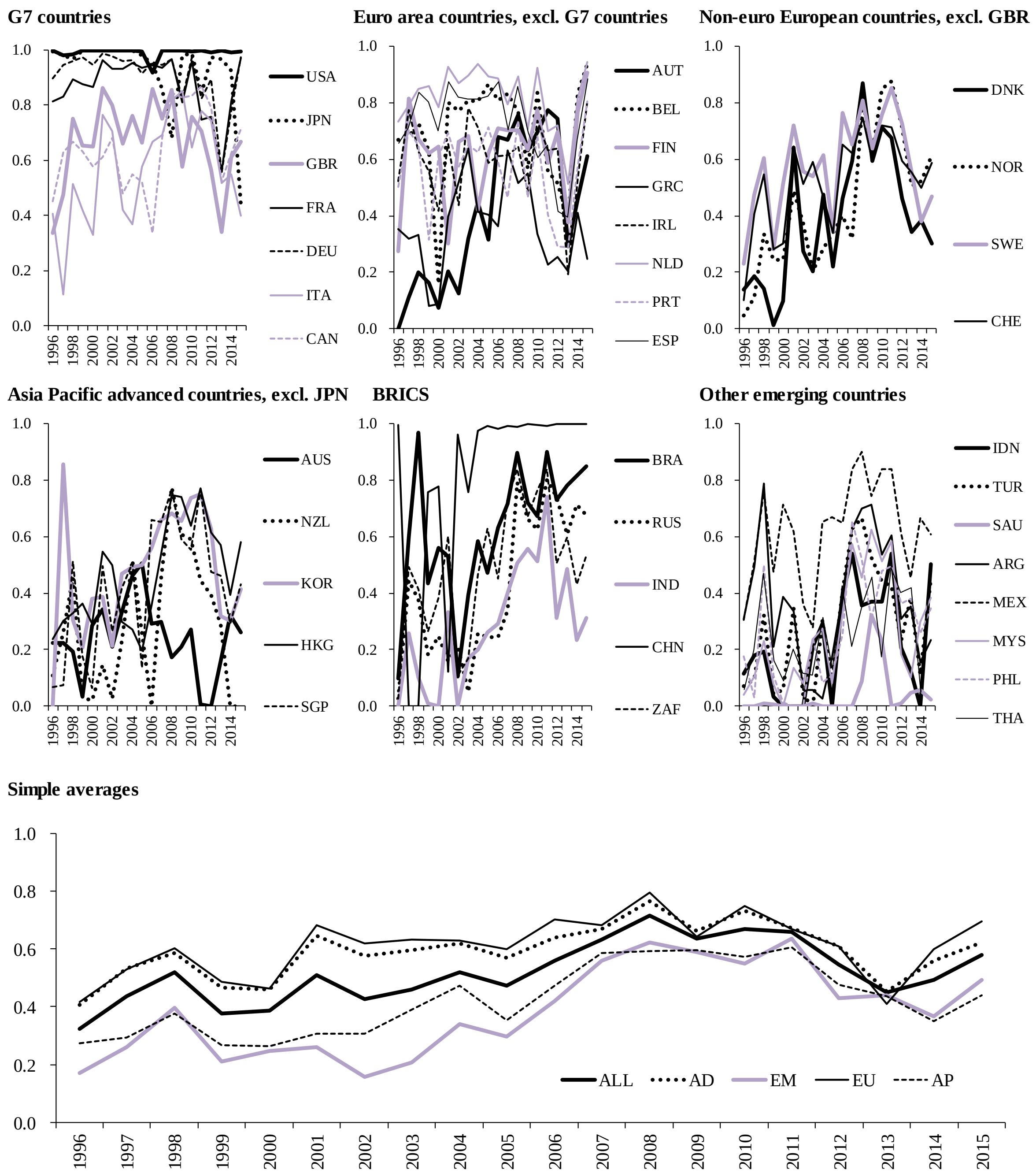
Note: A VIF is defined as $1/\{1 - (\text{correlation coefficients})^2\}$. The VIFs are calculated every sample year using weekly data of *GCF*s. All the VIFs are much smaller than 10, the criterion proposed by Snee and Marquardt (1984), defining negligible risk of multicollinearities caused by *GCF*s.

Fig. 4. Global DGCs obtained by Estimating the APT-Based and Fama-French Models



Note: The global DGCs are the simple averages of national DGCs, or *R_DGC*s defined in Eq. (2).

Fig. 5. APT-Based *R_DGC*s by Country and by Group

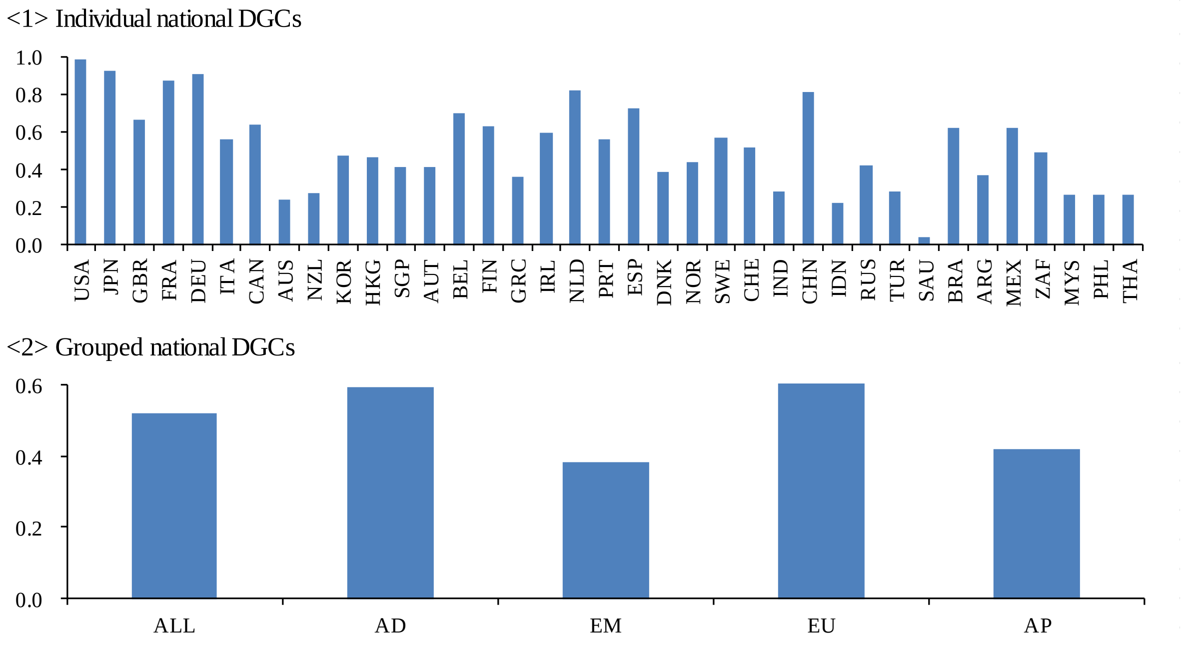


Note 1: A national DGC at τ (a yearly point of time) is a *R_DGC* defined in Eq. (2), or a R_{adj}^2 gained by estimating Eq. (1) for individual sample countries with around 52 weekly observations.

Note 2: ALL stands for all sample countries, AD for advanced countries, EM for emerging countries, EU for European countries, and AP for Asia Pacific countries.

Note 3: The distinction between advanced and emerging countries is based on the International Monetary Fund's *World Economic Outlook*.

Fig. 6. 1996–2015 Averages of APT-Based *R_DGC*s by Country and by Group



Note 1: ALL stands for all sample countries, AD for advanced countries, EM for emerging countries, EU for European countries, and AP for Asia Pacific countries.

Note 2: The distinction between advanced and emerging countries is based on the International Monetary Fund's *World Economic Outlook*.

Tables

Table 1

Results of Time-Trend Analysis for National DGCs

[Individual national DGCs: G7 countries]

		USA	JPN	GBR	FRA	DEU	ITA	CAN
Eq. (3)	a_{TT}	-0.141	-0.262	-0.001	-0.010	-0.069	0.047	0.041
	ADF	<3> -4.069 ***	<1> -2.230	<1> -1.884	<1> -1.697	<1> -2.409	<1> -1.945	<3> -3.338 **
Eq. (5)	ADF	- -	<1> -2.798 *	<1> -3.464 **	<1> -1.823	<1> -2.4408	<1> -4.210 ***	- -

[Individual national DGCs: other euro area countries]

		AUT	BEL	FIN	GRC	IRL	NLD	PRT	ESP
Eq. (3)	a_{TT}	0.105	0.025	0.037	0.003	-0.002	-0.009	-0.008	-0.030
	ADF	<1> -1.630	<1> -1.845	<1> -3.490 **	<3> -1.095	<1> -3.345 **	<1> -1.856	<1> -2.170	<1> -1.817
Eq. (5)	ADF	<1> -3.846 **	<1> -2.175	- -	<1> -1.801	- -	<1> -4.598 ***	<1> -1.931	<1> -1.877

[Individual national DGCs: other advanced countries]

		AUS	NZL	KOR	HKG	SGP	DNK	NOR	SWE	CHE
Eq. (3)	a_{TT}	-0.013	-0.009	0.036	0.057	0.060	0.064	0.098	0.036	0.049
	ADF	<1> -2.523	<1> -1.856	<1> -1.859	<1> -2.196	<1> -1.389	<1> -1.444	<5> -3.291 **	<1> -1.463	<1> -1.656
Eq. (5)	ADF	<1> -3.900 ***	<1> -4.598 ***	<1> -4.612 ***	<1> -2.365	<1> -3.986 **	<1> -3.614 **	- -	<1> -3.142 **	<1> -2.970 *

[Individual national DGCs: BRICS]

		IND	CHN	RUS	BRA	ZAF
Eq. (3)	a_{TT}	0.079	0.398	0.103	0.071	0.069
	ADF	<5> -3.375 **	<1> -3.644 **	<4> -3.051	<3> -1.926	<4> -3.058
Eq. (5)	ADF			<1> -4.095 ***	<1> -6.291 ***	<1> -5.056 ***

[Individual national DGCs: other emerging countries]

		IDN	TUR	SAU	ARG	MEX	MYS	PHL	THA
Eq. (3)	a_{TT}	0.044	0.053	0.029	0.003	0.040	0.057	0.057	0.032
	ADF	<1> -2.603	<1> -1.662	<1> -3.466 **	<3> -3.944 ***	<5> -1.803	<1> -1.801	<1> -2.409	<1> -2.449
Eq. (5)	ADF	<1> -3.555 **	<1> -3.168 **	- -	- -	<5> -3.908 ***	<1> -2.987 *	<1> -3.914 ***	<1> -4.571 ***

[Grouped national DGCs: Simple averages]

		ALL	AD	EM	EU	AP
Eq. (3)	a_{TT}	0.031	-0.003	0.080	0.021	0.044
	ADF	<1> -2.054	<1> -2.108	<4> -4.496 ***	<1> -1.976	<1> -1.511
Eq. (5)	ADF	<1> -4.112 ***	<5> -3.930 ***		<1> -2.219	<1> -2.800 *

Note 1: This table reports results of estimating Eq. (3) ($L\_DGC_\tau = C + a_{TT}TT_\tau + e_\tau$), and Eq. (5) ($\Delta L\_DGC_\tau = C + \mathring{a}_{TT}TT_\tau + \grave{e}_\tau$). The number of observations is 20 for all estimations.

Note 2: ADF tests conducted here are based on the Dickey-Fuller regressions including intercepts but not trends.

Note 3: Figures in < > represent the degree of lags, chosen by the Schwarz Bayesian Criterion amongst lags up to five.

Note 4: ***, **, and * stand for 1%, 5%, and 10% statistical significances, respectively. Critical values proposed by Cheung and Lai (1995) are used.

Note 5: White-on-black country names indicate that their DGCs are judged to have downward trends. Shaded country names indicate that their DGCs are judged *not* to have trends.

Note 6: ALL stands for all sample countries, AD for advanced countries, EM for emerging countries, EU for European countries, and AP for Asia Pacific countries.

Note 7: The distinction between advanced and emerging countries is based on the International Monetary Fund's *World Economic Outlook*.

Table 2

Results of Time-Trend Analysis for National *ER*s

[Individual national A_ERs: G7 countries]

		USA	JPN	GBR	FRA	DEU	ITA	CAN
Eq. (3)'	a_{TT}	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADF	<1> -3.113	<1> -3.612	<2> -4.047	<2> -2.916	<1> -2.351	<1> -3.878	<1> -3.641
		**	**	***	*		**	**
Eq. (5)'	ADF	-	-	-	-	<4> -6.070	-	-
		-	-	-	-	***	-	-

[Individual national A_ERs: other euro area countries]

		AUT	BEL	FIN	GRC	IRL	NLD	PRT	ESP
Eq. (3)'	a_{TT}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADF	<1> -3.236	<1> -2.750	<1> -2.183	<1> -2.614	<1> -2.524	<1> -2.307	<1> -2.599	<1> -2.235
		**	*						
Eq. (5)'	ADF	-	-	<1> -3.527	<1> -4.297	<1> -3.991	<4> -4.179	<1> -4.321	<1> -3.973
		-	-	**	**	**	**	**	**

[Individual national A_ERs: other advanced countries]

		AUS	NZL	KOR	HKG	SGP	DNK	NOR	SWE	CHE
Eq. (3)'	a_{TT}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADF	<1> -3.029	<1> -2.787	<1> -2.889	<1> -4.599	<1> -3.871	<1> -4.309	<1> -3.895	<1> -4.139	<4> -5.307
		*	*	*	***	**	***	**	***	***
Eq. (5)'	ADF	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-

[Individual national A_ERs: BRICS]

		IND	CHN	RUS	BRA	ZAF
Eq. (3)'	a_{TT}	0.000	0.000	-0.001	0.000	0.000
	ADF	<1> -3.924	<1> -3.912	<1> -4.380	<1> -2.434	<1> -2.937
		***	***	***		*
Eq. (5)'	ADF	-	-	-	<1> -4.699	-
		-	-	-	***	-

[Individual national A_ERs: other emerging countries]

		IDN	TUR	SAU	ARG	MEX	MYS	PHL	THA
Eq. (3)'	a_{TT}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADF	<1> -3.396	<1> -3.397	<1> -2.182	<1> -4.378	<1> -2.968	<1> -3.583	<1> -3.182	<1> -2.473
		**	**		***	*	**	**	
Eq. (5)'	ADF	-	-	<1> -3.096	-	-	-	-	<2> -4.026
		-	-	*	-	-	-	-	**

[Grouped national A_ERs: Simple averages]

		ALL	AD	EM	EU	AP
Eq. (3)'	a_{TT}	0.000	0.000	0.000	0.000	0.000
	ADF	<1> -3.718	<1> -3.351	<1> -3.491	<1> -3.103	<1> -3.934
		**	**	**	**	***
Eq. (5)'	ADF	-	-	-	-	-
		-	-	-	-	-

Note 1: This table reports results of estimating Eq. (3)' ($A\_ER_\tau = C + a_{TT}TT_\tau + e_\tau$), and Eq. (5)' ($\Delta A\_ER_\tau = C + \mathring{a}_{TT}TT_\tau + \dot{e}_\tau$). A_ER is the annual averages of individual sample countries' weekly excess returns (*ER*s). The number of observations is 20 for all estimations.
Note 2: ADF tests conducted here are based on the Dickey-Fuller regressions including intercepts but not trends.
Note 3: Figures in < > represent the degree of lags, chosen by the Schwarz Bayesian Criterion amongst lags up to five.
Note 4: ***, **, and * stand for 1%, 5%, and 10% statistical significances, respectively. Critical values proposed by Cheung and Lai (1995) are used.
Note 5: White-on-black country names indicate that their DGCs are judged to have downward trends. Shaded country names indicate that their DGCs are judged *not* to have trends.
Note 6: ALL stands for all sample countries, AD for advanced countries, EM for emerging countries, EU for European countries, and AP for Asia Pacific countries.
Note 7: The distinction between advanced and emerging countries is based on the International Monetary Fund's *World Economic Outlook*.

Table 3

Results of Baseline Estimations

Dependent variable: *L_DGC*

Model		A: Pooling	B: Fixed effect			C: Random effect	
Specification of *IE*		No	Yes: Constant			Yes: Stochastic	
Estimation method		OLS	LSDV	Weighted GLS		GLS	
Adjustments on residuals (μ)		-	-	White period	White cross-section	White period	White cross-section
				CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	PH & SC are adjusted for.	CSH & CCE are adjusted for.
Regressors	Estimators	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant	*C*	2.6448	-6.7054	-4.9407	-4.9407	-1.0520	-1.0520
Size of trade (import & export)	*SOT*	-0.0031 ***	0.0005	0.0011	0.0011	-0.0016 *	-0.0016 *
Institutional openness of trade	*IOT*	0.0082	0.0270 ***	0.0273 ***	0.0273 ***	0.0148 *	0.0148 ***
Size of gross exposure to international finance	*SOIF*	0.0015 ***	0.0011	0.0011 ***	0.0011 **	0.0012 **	0.0012 ***
-	Δ*SOIF*	0.0002	-0.0002	-0.0005	-0.0005	-0.0005	-0.0005
Institutional closedness of a capital account	*ICCC*	-0.0976	-0.3876	-0.2049	-0.2049	-0.2627	-0.2627
Economic prospect	*GDPG*	-0.0295 **	-0.0238 **	-0.0267 **	-0.0267 *	-0.0240	-0.0240 **
Information & communication tech	*ICT*	-0.2114	3.7418	3.1091	3.1091	1.5369	1.5369
# of listed stocks per capita	*Stock#*	-0.6004 ***	0.2424	0.3109 **	0.3109 **	-0.2648 **	-0.2648 **
Rule of Law	*RoL*	0.0396 ***	-0.0239	-0.0299 ***	-0.0299 ***	0.0028	0.0028
Voice and Accountability	*VaA*	-0.0209 ***	-0.0131	-0.0179 *	-0.0179 *	-0.0129	-0.0129
Presence of foreign investors	*PFI*	-0.0140 ***	-0.0155 ***	-0.0125 ***	-0.0125 *	-0.0125 **	-0.0125 **
Changes of foreign bank loans	|*FBL*|	-0.0011	0.0059	0.0063 ***	0.0063 **	0.0051	0.0051
Interest-rate differentials (vis-à-vis USA)	|*ID*|	0.0202 ***	0.0052	0.0044	0.0044	0.0050	0.0050
Interaction term	|*ID*| ×*ICCC*	-0.2054 ***	-0.1651 ***	-0.1831 ***	-0.1831 ***	-0.1274 ***	-0.1274 **
Foreign exchange regime dummy	*FXRD*	-0.4384 ***	-0.0449	-0.0875	-0.0875	-0.1160	-0.1160
GDP share	*GDPS*	0.2327 ***	0.3599 ***	0.4031 ***	0.4031 ***	0.2856 ***	0.2856 ***
R_{adj}^2		0.75	0.84	0.77		0.44	
F-test on H_0: Model A > Model B		7.77 (p-value: 0.00)					
Hausman test on H_0: Model C > Model B			52.39 (p-value: 0.00)				

Note 1: This table reports results of estimating Eq. (6): $L\_DGC_{i,\tau} = C + h_1SOT_{i,\tau} + h_2IOT_{i,\tau} + h_3SOIF_{i,\tau-1} + h_4\Delta SOIF_{i,\tau} + h_5ICCC_{i,\tau} + h_6GDPG_{i,\tau} + h_7ICT_{i,\tau} + h_8STOCK\#_{i,\tau} + h_9RoL_{i,\tau} + h_{10}VaA_{i,\tau} + h_{11}PFI_{i,\tau} + h_{12}|FBL_{i,\tau-1}| + h_{13}|ID_{i,\tau}| + h_{14}|ID_{i,\tau}| \times ICCC_{i,\tau} + h_{15}FXRD_{i,\tau} + h_{16}GDPS_{i,\tau} + \mu_{i,\tau} + IE_i$. The number of observations is 397.

Note 2: Random effect estimators depend on the Swamy-Arora method which uses residuals gained in the within (fixed-effect) and between-means regressions.

Note 3: Shading indicates regressors with statistically significant estimators and a specification of *IE* with statistical adequacy.

Note 4: CSH stand for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors.

Note 5: ***, **, and * stand for 1%, 5%, and 10% statistical significances.

Table 4

Results of Robustness Checks (1)

Dependent variable: *L_DGC*		***SOT* is omitted**		***ITC* is omitted**		**Both are omitted**		**USA & CHN are omitted**	
Model		Fixed effect							
Specification of *IE*		Constant							
Estimation method		Weighted GLS							
Adjustments on residuals (μ)		White period	White cross-section	White period	White cross-section	White period	White cross-section	White period	White cross-section
		CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.
Regressors	Estimators	ĥs	ĥs	ĥs	ĥs	ĥs	ĥs	ĥs	ĥs
Constant	*C*	-3.5777	-3.5777	1.9564 *	1.9564 ***	2.0854 ***	2.0854 ***	-4.1063	-4.1063
Size of Trade (import & export)	*SOT*			0.0013	0.0013			0.0012	0.0012
Institutional openness of trade	*IOT*	0.0264 ***	0.0264 ***	0.0301 ***	0.0301 ***	0.0287 ***	0.0287 ***	0.0266 ***	0.0266 ***
Size of gross exposure to international finance	*SOIF*	0.0014 ***	0.0014 ***	0.0014 ***	0.0014 **	0.0016 ***	0.0016 ***	0.0013 ***	0.0013 **
-	$\Delta SOIF$	-0.0004	-0.0004	-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	-0.0004
Institutional closedness of a capital account	*ICCC*	-0.2171	-0.2171	-0.2762	-0.2762	-0.2810	-0.2810	-0.1980	-0.1980
Economic prospect	*GDPR*	-0.0259 **	-0.0259 *	-0.0272 ***	-0.0272 *	-0.0261 **	-0.0261 *	-0.0243 **	-0.0243 *
Information & communication tech	*ICT*	2.5535	2.5535					2.7275	2.7275
# of listed stocks per capita	*Stock#*	0.3175 **	0.3175 *	0.3421 **	0.3421 *	0.3462 **	0.3462 *	0.3047 **	0.3047
Rule of Law	*RoL*	-0.0303 **	-0.0303 ***	-0.0211 **	-0.0211 ***	-0.0291 **	-0.0291 ***	-0.0308 **	-0.0308 ***
Voice and Accountability	*VaA*	-0.0169 *	-0.0169 *	-0.0211 **	-0.0211 *	-0.0196 **	-0.0196 *	-0.0172 *	-0.0172 *
Presence of foreign investors	*PFI*	-0.0124 ***	-0.0124 *	-0.0126 ***	-0.0126 *	-0.0129 ***	-0.0129 *	-0.0117 ***	-0.0117 *
Changes of foreign bank loans	*|FBL|*	0.0066 ***	0.0066 **	0.0059 ***	0.0059 *	0.0063 ***	0.0063 *	0.0059 ***	0.0059 **
Interest-rate differentials (vis-à-vis USA)	*|ID|*	0.0047	0.0047	0.0039	0.0039	0.0043	0.0043	0.0038	0.0038
Interaction term	*|ID| ×ICCC*	-0.1845 ***	-0.1845 ***	-0.1854 ***	-0.1854 ***	-0.1853 ***	-0.1853 ***	-0.1793 ***	-0.1793 ***
Foreign exchange regime dummy	*FXRD*	-0.1058	-0.1058	-0.1308	-0.1308	-0.1408	-0.1408	-0.0975	-0.0975
GDP share	*GDPS*	0.3997 ***	0.3997 ***	0.4253 ***	0.4253 ***	0.4179 ***	0.4179 ***	0.5424 ***	0.5424 ***
R_{adj}^2		0.74		0.74		0.74		0.63	

Note 1: This table reports results of estimating Eq. (6) after dropping either/both *SOT* or/and *ICT*. The number of observations is 397.

Note 2: Shading indicates regressors with statistically significant estimators and a specification of *IE* with statistical adequacy.

Note 3: CSH stand for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors.

Note 4: ***, **, and * stand for 1%, 5%, and 10% statistical significances.

Table 5

Results of Robustness Checks (2)

Dependent variable: *L_DGC*

Model		A: Pooling	B: Fixed effect			C: Random effect	
Specification of *IE*		No	Yes: Constant			Yes: Stochastic	
Estimation method		OLS	LSDV	Weighted GLS		GLS	
Adjustments on residuals (μ)		-	-	White period	White cross-section	White period	White cross-section
				CSH, PH, & SC are adjusted for.	CSH & CCE are adjusted for.	PH & SC are adjusted for.	CSH & CCE are adjusted for.
Regressors \ Estimators		$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s	$\hat{h}$s
Constant	*C*	2.7792	-4.9810	-1.8592	-1.8592	-0.7577	-0.7577
Size of trade (import & export)	*SOT*	-0.0032***	0.0004	0.0009	0.0009	-0.0017	-0.0017
Institutional openness of trade	$IOT_{\tau-1}$	0.0083	0.0272***	0.0272***	0.0272***	0.0141*	0.0141***
Size of gross exposure to international finance	*SOIF*	0.0015***	0.0012	0.0013***	0.0013**	0.0012**	0.0012***
-	$\Delta SOIF$	-0.0001	0.0000	-0.0002	-0.0002	-0.0004	-0.0004
Institutional closedness of a capital account	*ICCC*	-0.1088	-0.5132	-0.4088	-0.4088	-0.3139	-0.3139
Economic prospect	*GDPR*	-0.0290	-0.0207	-0.0238**	-0.0238*	-0.0225	-0.0225
Information & communication tech	*ICT*	-0.2757	3.0894	1.8831	1.8831	1.4342	1.4342
# of listed stocks per capita	*Stock#*	-0.6008***	0.2573	0.3156**	0.3156*	-0.2661**	-0.2661
Rule of Law	*RoL*	0.0400***	-0.0233*	-0.0279**	-0.0279***	0.0037	0.0037
Voice and Accountability	*VaA*	-0.0210***	-0.0194*	-0.0232**	-0.0232**	-0.0136	-0.0136
Presence of foreign investors	*PFI*	-0.0141***	-0.0173	-0.0123***	-0.0123**	-0.0125***	-0.0125**
Changes of foreign bank loans	$\lvert FBL \rvert$	-0.0008	-0.0151***	-0.0067***	-0.0067**	0.0056*	0.0056
Interest-rate differentials (vis-à-vis USA)	$\lvert ID \rvert$	0.0200	0.0046	-0.0036	-0.0036	0.0048	0.0048
Interaction term	$\lvert ID \rvert \times ICCC$	-0.2036***	-0.1602**	-0.1752***	-0.1752***	-0.1229***	-0.1229***
Foreign exchange regime dummy	*FXRD*	-0.4371***	-0.0660	-0.1280	-0.1280	-0.1150	-0.1150
GDP share	*GDPS*	0.2324***	0.3637***	0.4130***	0.4130***	0.2853***	0.2853***
R_{adj}^2		0.75	0.84	0.74		0.42	
F-test on H_0: Model A > Model B		7.81 (p-value: 0.00)					
Hausman test on H_0: Model C > Model B			53.12 (p-value: 0.00)				

Note 1: This table reports results of estimating the following equation: $L\_DGC_{i,\tau} = C + h_1SOT_{i,\tau} + h_2IOT_{i,\tau-1} + h_3SOIF_{i,\tau-1} + h_4\Delta SOIF_{i,\tau} + h_5ICCC_{i,\tau} + h_6GDPG_{i,\tau} + h_7ICT_{i,\tau} + h_8STOCK\#_{i,\tau} + h_9RoL_{i,\tau} + h_{10}VaA_{i,\tau} + h_{11}PFI_{i,\tau} + h_{12}\lvert FBL_{i,\tau-1}\rvert + h_{13}\lvert ID_{i,\tau}\rvert + h_{14}\lvert ID_{i,\tau}\rvert \times ICCC_{i,\tau} + h_{15}FXRD_{i,\tau} + h_{16}GDPS_{i,\tau} + \mu_{i,\tau} + IE_i$. The number of observations is 397.

Note 2: Random effect estimators depend on the Swamy-Arora method which uses residuals gained in the within (fixed-effect) and between-means regressions.

Note 3: Shading indicates regressors with statistically significant estimators and a specification of *IE* with statistical adequacy.

Note 4: CSH stand for cross-section heteroskedasticity, PH for period heteroskedasticity, SC for serial correlation, and CCE for contemporaneously correlated errors.

Note 5: ***, **, and * stand for 1%, 5%, and 10% statistical significances.

Table C1

Definitions and Sources of Data Used

Indicators	Notations	Definitions	Sources	Notes
National economic size.	*GDPS*	Percentages of nominal GDP in world GDP.	IMF, *World Economic Outlook* (WEO).	In U.S. dollar volume.
Excess returns of national stock.	*ER*	{(National stock prices at *t* / National stock prices at *t-1*) – 1 week interest rates of US dollar at t-1}.	Bloomberg	% points. National stock pirces are quoted in U.S. dollar. The interest rates are linearly interpolated with FF effective rates and 1-year Treasury bill yields.
National stock prices.	-	Argentina Merval Index for ARG, All Ordinaries Index for AUS, MSCI Austria for AUT, Belgian All-Share Index for BEL, MSCI Brazil for BRA, S&P/Toronto Stock Exchange Composite Index for CAN, Shanghai Stock Exchange Composite Index for CHN, OMX Copenhagen 20 for DNK, OMX Helsinki All-Share Index for FIN, CAC All-Tradable for FRA, HDAX for DEU, Athex Composite Share Price Index for GRC, Hang Seng Index for HKG, Standard &Poor's BSE Sensex Index for IND, Jakarta Composite Index for IDN, ISEQ All-Share Index for Ireland, MSCI Italy for ITA, Tokyo Stock Price Index for JPN, FTSE Bursa Malaysia EMAS Index for MYS, MSCI Mexico for MEX, AEX for NLD, MSCI New Zealand for NZL, OBX for NOR, PSEi Index for PHL, PSI All-Share Index for PRT, CS First Boston Russian Stock Market Index for RUS, Tadawul All-Share Index for SAU, MSCI Singapore for SGP, FTSE/JSE Africa All Shares for ZAF, Korea Composite Stock Price Index for KOR, Madrid Stock Exchange General Index for ESP, OMX Stockholm 30 for SWE, Swiss Market Index for CHE, Bangkok SET Index for THA, Borsa Istanbul 100 for TUR, FTSE All-Share Index for GBR, and Standard & Poor's 500 for USA.	See the above.	In U.S. dollar value.
Market factor.	Fama-French *GCF1*	GDP-weighted averages of 37 countries' *ER* s.	See the above.	% points. Nominal GDPs are taken from IMF, WEO. This is applicable to all indicators divided by nominal GDPs.
Size factor.	Fama-French *GCF2*	A global portfolio is a market-capitalisation weighted sum of liquid corporate stock prices in 23 advanced countries. All stocks are sorted into big and small stocks by market capitalisation. Big stocks are those in the top 90% whilst small stocks are those in the bottom 10%. Stocks in each stock group are sorted into three sub-groups by three ratios gained by dividing (i) market equity, (ii) operating profits, and (iii) changes of total assets by book equity. Stocks in each sub-group are classified in to bottom 30%, middle 40%, and top 10%. As a result, big stocks consist of nine portfolios, and so do small stocks. *SMB* is the average excess return on the nine small portfolios minus the average excess return on the nine big portfolios.	*Fama/French Global 5 Factors [Daily]*	% points.
Value factor.	Fama-French *GCF3*	*HML* = 1/2(Excess return on small stocks with bottom-30% book-to-market equity ratios + excess return on big stocks with bottom-30% book-to-market equity ratios) – 1/2(Excess return on small stocks with top-10% book-to-market equity ratios + excess return on big stocks with top-10% book-to-market equity ratios).	See the above.	See the above.
Momentum factor.	Fama-French *GCF4*	*WML* (the difference between the returns on diversified portfolios of top-30% strong stocks and bottom-30% weak stocks) .	*Fama/French Global Momentum Factor (Mom) [Daily]*	See the above.

Table C1 (cont.)

Indicators	Notations	Definitions	Sources	Notes
Size of trade	*SOT*	(Exports + Imports) / (Nominal GDP).	World Bank, *World Development Indicators* (WDI).	%
Institutional openness of trade.	*IOT*	Index of Trade Freedom.	The Heritage Foundation	A larger *IOT* means a freer trade.
Size of gross exposure of international finance.	*SOIF*	(International gross portfolio investment <assets and liabilities> + International gross bank loans <assets and liabilities>) / (Nominal GDP).	IMF, *Balance of Payments Statistics* (BOPS); BIS, *Locational Banking Statistics* (LBS).	%
Institutional closedness of a capital account	*ICCC*	Index on the presence of regulations on capital inflows and outflows.	Fernandez et al. (2015)	0 to 1. 0 means full openness.
Economic prospect	*GDPG*	Output gap = real GDP growth rates – real GDP trend growth rates. The latter is based on real GDP smoothed by applying the Hodrick-Prescott filter with a multiplier of 100.	World Bank, WDI.	% points.
Information & communication tech	*ICT*	Natural logarithm of per capita GDP ($) in constant 2010 U.S. dollars.	See the above.	
# of listed companies percapita	*STOCK#*	Natural logarithm of the number of listed companies per 1,000,000 people.	World Bank, *Global Financial Development Database.*	
Rule of Law	*ROL*	An index reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particuler the enforcement of contracts, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Bank, *Worldwide Governance Indicators.*	Percentile rank among all countries ranges from 0 (lowest) to 100 (highest) rank.
Voice and Accountability	*VaA*	An index reflecting perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	See the above.	See the above.
Presence of foreign investors	*PFI*	(International stock portfolio investment liabilities) / (Market capitalisation of listed companies)	IMF, BOPS; World Bank, WDI.	%
Changes of foreign bank loans	|*FBL*|	Absolute values of {(international bank-loan liabilities at *t*) / (Nominal GDP at t)} - {(International bank-loan liabilities at t-1) / (Nominal GDP at t-1)}	BIS, LBS; World Bank, WDI.	% points.
Interest-rate differentials	|*ID*|	Absolute values of spreads vis-a-vis USA on 1-year sovereign bond yields.	Bloomberg	% points.
Foreign Exchange Regime Dummy	*FXRD*	1 for countries with Floating regimes; 0 for other countries	IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions.*	

Table D1

VIFs (variance inflation-factors) amongst Independent Variables in Levels

			USA	JPN	GBR	FRA	DEU	ITA	CAN	AUS	NZL	KOR	HKG	SGP	AUT	BEL	GRC	NLD	PRT	DNK	NOR	SWE	CHE	IND	CHN	IDN	RUS	TUR	BRA	ZAF	MYS	PHL	THA
SOT	v, v.	*IOT*	3.3	1.2	2.4	2.1	6.0	2.8	4.2	1.4	1.3	1.0	1.0	1.1	2.2	4.2	1.7	3.3	2.3	4.7	1.2	2.1	6.4	5.2	1.3	1.3	1.2	1.6	1.2	2.0	1.4	1.2	1.5
	v, v.	*SOIF*$_{-1}$	6.9	7.6	3.0	2.7	10.4	1.9	1.2	1.1	1.0	5.9	3.8	1.6	1.0	2.2	1.0	2.5	1.1	1.2	1.1	3.3	1.1	7.4	1.0	1.0	1.0	1.9	2.3	2.6	2.2	2.6	1.3
	v, v.	*ICT*	2.4	22.7	1.3	3.2	25.9	1.0	1.7	1.3	1.0	3.1	13.5	1.1	15.9	4.3	1.0	2.1	1.1	3.9	1.0	5.0	7.2	10.6	1.3	2.2	1.4	2.0	1.1	3.0	4.0	5.9	2.3
	v, v.	*STOCK#*	2.8	3.7	1.8	1.5	1.1	1.6	3.2	1.3	1.0	1.6	6.9	2.6	2.1	1.4	1.0	2.5	1.4	1.8	2.0	2.6	1.3	7.1	1.2	1.6	1.3	1.3	2.5	2.3	1.5	2.9	1.3
	v, v.	*RoL*	1.6	1.1	1.1	1.2	1.1	2.1	1.8	1.2	2.4	1.5	2.7	1.3	1.0	1.3	1.6	2.1	1.6	1.7	1.1	1.6	1.4	2.6	1.0	1.5	2.0	1.1	1.0	1.0	1.5	1.1	2.3
	v, v.	*VaA*	2.9	1.1	1.1	1.1	2.4	1.1	1.6	1.1	1.1	1.1	3.4	1.3	1.6	1.2	1.6	1.0	2.9	1.3	1.1	1.3	1.4	1.1	1.4	1.5	1.3	1.0	1.5	2.4	1.1	1.4	2.1
	v, v.	*PFI*	2.9	2.9	1.1	1.2	2.2	1.0	1.7	1.4	1.2	1.0	1.3	1.1	1.1	1.7	1.0	1.2	1.1	1.5	1.2	1.0	1.6	1.4	1.1	1.2	1.0	1.1	1.4	1.5	1.0	1.0	1.2
	v, v.	*GDPS*	4.1	9.8	3.2	3.9	5.9	2.6	1.5	1.1	2.0	1.0	7.5	1.0	1.8	2.2	1.4	2.5	3.1	1.6	1.0	1.4	1.1	3.6	1.0	2.7	2.1	1.1	1.2	1.0	7.9	4.8	1.0
IOT	v, v.	*SOIF*$_{-1}$	9.4	1.6	9.6	6.1	4.8	1.4	1.7	1.9	1.2	1.0	1.0	1.1	1.0	2.9	1.8	4.8	2.1	2.4	5.9	4.6	1.1	5.6	1.5	1.3	1.0	2.6	2.6	2.6	1.8	1.1	1.0
	v, v.	*ICT*	2.8	1.3	2.9	3.4	7.0	1.0	4.6	2.8	2.5	1.0	1.1	6.4	2.4	3.8	1.2	3.4	1.5	1.8	3.7	3.0	5.5	11.5	10.6	1.4	1.9	3.6	4.5	6.3	2.5	1.7	2.1
	v, v.	*STOCK#*	5.5	1.4	1.5	2.9	1.1	1.1	3.5	2.1	1.0	1.0	1.0	1.1	1.4	1.9	1.0	2.8	2.8	1.5	1.1	3.3	1.3	2.6	4.6	1.2	1.2	1.5	2.8	5.2	1.0	3.6	2.3
	v, v.	*RoL*	1.5	1.0	1.1	1.1	1.2	2.1	1.5	1.1	1.5	1.0	1.0	2.0	1.0	1.3	2.1	2.0	2.3	1.5	1.0	3.5	1.3	2.5	1.3	1.1	1.4	1.3	1.4	1.0	1.1	3.4	3.4
	v, v.	*VaA*	3.8	1.7	1.3	1.4	1.9	1.4	2.3	1.2	1.5	1.0	1.0	1.7	1.5	1.5	1.4	1.0	4.8	1.0	1.7	1.8	1.4	1.2	8.0	1.1	2.1	1.0	2.1	2.1	1.2	4.2	2.5
	v, v.	*PFI*	3.7	1.2	1.6	1.5	2.9	1.0	2.9	1.3	1.1	1.0	1.0	1.7	1.0	3.4	1.5	1.3	1.9	2.1	1.8	1.0	1.5	1.3	1.2	1.2	1.2	1.2	1.2	2.1	1.5	2.0	1.0
	v, v.	*GDPS*	3.3	1.3	1.8	1.5	2.8	3.3	1.7	3.6	1.7	1.0	1.2	2.5	1.3	1.4	1.1	1.3	1.4	1.7	1.6	1.9	1.0	9.6	2.9	1.3	1.5	2.2	1.5	1.4	1.6	1.0	1.4

Table D1 (cont.)

			USA	JPN	GBR	FRA	DEU	ITA	CAN	AUS	NZL	KOR	HKG	SGP	AUT	BEL	GRC	NLD	PRT	DNK	NOR	SWE	CHE	IND	CHN	IDN	RUS	TUR	BRA	ZAF	MYS	PHL	THA
SOIF $_{-1}$	v, v.	*ICT*	4.9	4.5	2.2	7.7	5.7	1.6	2.0	4.8	1.1	4.8	9.6	1.2	1.0	7.2	1.7	13.8	3.5	1.2	3.0	10.3	1.3	5.7	1.0	1.0	1.3	2.1	1.9	2.8	5.0	1.9	1.4
	v, v.	*STOCK#*	9.2	3.5	1.5	2.2	1.1	2.4	1.2	7.1	1.2	1.7	5.1	1.6	2.2	1.1	1.0	1.5	3.5	1.4	1.1	2.3	1.4	3.7	1.1	1.0	1.3	1.1	1.4	3.7	1.6	1.7	1.4
	v, v.	*RoL*	1.8	1.2	1.1	1.1	1.1	3.3	1.0	1.3	1.0	1.7	1.3	1.0	1.3	1.2	1.1	1.3	1.7	1.0	1.2	1.9	1.9	1.8	1.0	1.0	1.3	1.1	1.5	1.1	1.0	1.0	1.0
	v, v.	*VaA*	4.6	1.1	1.3	1.5	2.7	1.0	1.4	1.9	1.0	1.1	1.3	1.1	1.0	1.2	1.1	1.0	1.4	1.0	9.5	2.0	1.7	1.3	1.0	1.0	1.2	1.0	1.0	1.7	1.0	1.0	1.3
	v, v.	*PFI*	5.1	2.5	1.6	1.4	2.2	1.0	1.6	1.0	3.4	1.0	1.8	1.1	2.9	1.5	1.2	1.5	3.0	1.1	1.4	1.0	1.0	1.7	1.0	1.1	1.2	1.0	1.7	2.2	1.0	1.0	1.5
	v, v.	*GDPS*	3.3	5.5	1.9	1.6	3.3	1.2	1.1	2.2	1.1	1.0	1.9	1.7	2.1	1.1	1.1	1.1	1.0	3.4	1.6	1.7	1.7	2.0	1.0	1.0	1.1	1.3	1.8	1.0	3.5	2.1	1.4
ICT	v, v.	*STOCK#*	6.7	3.3	1.0	1.4	1.2	1.5	1.9	8.1	1.0	4.7	9.7	1.2	2.0	1.1	1.8	1.2	2.7	2.0	1.1	1.9	1.1	3.3	13.8	9.0	2.0	1.6	2.7	6.8	1.1	7.4	5.3
	v, v.	*RoL*	1.5	1.1	1.2	1.1	1.1	1.1	1.2	1.3	1.0	2.0	2.5	3.2	1.0	1.2	1.0	1.2	1.8	2.4	1.0	2.0	1.9	2.7	1.6	2.6	1.1	1.6	2.6	1.0	1.4	1.2	9.0
	v, v.	*VaA*	2.4	1.2	3.0	1.4	2.6	1.1	3.1	1.6	2.3	1.6	2.4	1.5	1.6	1.2	1.1	1.0	1.2	1.7	2.6	1.6	1.9	1.2	5.8	2.0	15.6	1.0	1.7	2.1	1.1	1.7	6.7
	v, v.	*FBL*	2.3	3.2	1.6	1.3	2.0	1.0	4.9	1.2	1.0	1.2	1.5	1.6	1.1	1.7	1.1	1.3	1.6	1.2	1.9	1.0	1.6	1.2	1.1	1.0	1.2	1.4	1.0	1.9	1.1	1.1	1.0
	v, v.	*GDPS*	1.4	8.0	1.1	1.5	7.4	1.2	2.3	2.8	1.8	1.1	3.5	2.7	1.7	1.3	2.0	1.1	1.0	1.1	2.8	1.5	1.2	16.8	8.2	12.0	5.0	4.0	2.0	1.4	6.9	4.1	1.9
STOCK#	v, v.	*RoL*	1.6	1.0	1.0	1.0	1.0	1.3	1.4	1.6	1.4	2.2	5.3	2.0	1.2	1.1	1.0	2.6	1.6	1.4	1.0	1.9	1.1	2.8	1.5	1.6	1.1	1.7	1.2	1.0	1.1	1.7	3.4
	v, v.	*VaA*	2.5	1.1	1.0	1.4	1.2	1.1	1.6	1.9	1.0	1.9	2.2	1.1	1.5	1.1	1.4	1.0	2.0	2.4	1.2	1.6	1.1	1.3	5.1	2.7	1.9	1.1	2.4	2.1	1.0	3.0	4.5
	v, v.	*PFI*	4.4	4.3	1.0	1.4	1.1	1.1	1.8	1.1	1.6	1.5	1.6	1.3	1.2	1.9	1.2	1.3	3.4	1.6	1.3	1.0	1.2	1.3	1.0	1.0	1.0	1.4	1.1	2.6	1.0	1.2	1.0
	v, v.	*GDPS*	2.1	3.5	5.2	1.5	1.1	1.3	1.9	2.2	1.0	1.1	3.9	1.0	2.7	1.2	1.2	1.6	1.1	1.2	1.0	2.3	1.2	1.5	5.1	4.1	1.8	1.6	1.0	1.2	1.2	1.7	2.9
RoL	v, v.	*VaA*	1.7	1.0	1.2	1.1	1.0	1.0	1.1	1.1	1.0	1.3	1.7	1.1	1.0	1.2	2.0	1.1	1.9	1.3	1.1	1.4	4.0	1.0	1.5	1.1	1.1	1.5	1.1	1.0	1.0	2.5	7.7
	v, v.	*PFI*	1.9	1.1	1.0	1.0	1.2	1.1	1.2	1.0	1.0	1.5	1.3	1.1	1.3	1.1	1.1	1.3	1.4	1.0	1.1	1.0	1.1	1.0	1.5	1.0	1.0	1.2	1.0	1.2	1.0	1.0	1.0
	v, v.	*GDPS*	1.6	1.1	1.0	1.3	1.3	1.3	1.2	1.0	1.2	1.0	3.4	1.3	1.1	1.1	1.6	2.2	1.1	1.0	1.0	1.4	1.5	2.5	2.0	2.3	1.3	2.0	2.4	1.0	1.4	1.0	1.5
VaA	v, v.	*PFI*	3.3	1.3	1.6	1.2	1.3	1.0	3.0	1.0	1.0	1.7	1.1	1.0	1.0	1.2	1.0	1.0	1.5	1.1	2.0	1.0	1.3	1.1	1.3	1.0	1.1	1.0	1.0	1.6	1.0	1.5	1.0
	v, v.	*GDPS*	2.6	1.1	1.0	1.0	2.0	1.5	2.9	1.4	1.4	1.2	2.3	1.1	1.1	1.2	1.8	1.0	2.3	1.0	3.1	1.7	1.2	1.5	2.2	1.7	3.9	1.1	1.0	1.1	1.1	1.1	1.5
PFI	v, v.	*GDPS*	3.0	3.5	1.1	1.3	1.9	1.0	2.1	1.1	1.0	1.0	1.2	2.2	1.2	1.4	1.0	1.0	1.0	1.8	1.3	1.0	1.1	1.1	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0

Note: Shading indicates the VIFs which are larger than 10, the criterion proposed by Snee and Marquardt (1984), defining negligible risk of multicollinearities caused by two relevant regressors.