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Abstract

We examine the intra-market comovement of returns within each of 33 economies' stock exchanges operating from 1995 through 2013, and we use a model-free comovement gauge to explore the differences across the countries. We find that the stability of international macroeconomic trilemma policies, the number of crises, and the extent of turnover overshadow the empirical relevance of many institutional variables previously thought to be important for intra-market comovement, including country risk, corruption, and investor protections.

We also use a much longer, nearly-constant sample of U.S. firms to examine compositional explanations of the well-known U.S. comovement decline, and to decompose the comovement into trend and cycle. The longer sample findings challenge the compositional explanations of the downward trend; additionally, they suggest that the most recent uptick reflects shorter-term conditions, rather than a trend reversal.

Together, these findings help to explain the dramatic changes in the relative rankings of countries' return comovement over the last several decades.

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1 Introduction

A firm's return reflects both the individual vagaries of its underlying business and the conditions shared by other businesses in the economy as a whole. Within each market, the relative importance of the two parts – the individual part and the economy-wide part – varies over time and across countries. Using a market model to separate the individual and economy-wide parts for the market as a whole, Roll (1988) noted that his measure of the individual part had accounted for most of the variation in U.S. returns. The market-wide portion was relatively small. Later, Morck, Yeung, and Yu (2000) showed that measures of the market-wide portion, which they called synchronicity, had fallen over time as U.S. markets evolved in the twentieth century. They also showed that their synchronicity measures were larger within individual emerging markets and seemed to decline in the individual markets that increased their financial openness. They interpreted declines in synchronicity as evidence of increasing informational efficiency in some of the individual markets.[1] More deeply, they suggested declining intra-market synchronicity may evince a market's improved financial institutions: investor protections that ultimately support greater economic dynamism.

However, in more recent work re-examining U.S., the same authors (Morck, Yeung, and Yu, 2013) and others now note that the decline in U.S. synchronicity has

[1]Their interpretation reflects the private informational side of Roll's (1988) assessment that the degree of individual variation might represent (p. 566) "the existence of either private information or else occasional frenzy unrelated to concrete information." On the other side of Roll's assessment are models that allow rational and irrational agents to coexist in equilibrium. See, for example, the emblematic models of Russell and Thaler (1987) in a consumer economy, De Long, Shleifer, Summers, and Waldmann (1990) in a purely financial model, and Barberis and Shleifer (2003) for a model with cross-sectional implications

partly reversed itself since the late nineties. That is, U.S. stock returns have become more synchronized in the current century. If the earlier decline in synchronicity was evidence of rising efficiency due to better financial institutions, then one might be tempted to interpret the subsequent reversal in synchronization as the opposite: falling efficiency and deteriorating financial institutions. This temptation is partly forestalled by the sense that U.S. institutional financial arrangements as a whole seldom change abruptly. To the extent that institutions evolve only relatively slowly, sudden changes in synchronization are likely to reflect other considerations. Likewise, as noted both by Alves, Peasnell, and Taylor (2010) and by Morck, Yeung, and Yu (2013), the intra-market synchronicity rankings of countries change substantially between periods. Major changes in international rankings make it hard to convincingly interpret a market's ranking as an indicator of its relative financial institutional development.[2]

This paper provides evidence for a new (though complementary) explanation, namely that international financial policy instability and crises underlie the striking repositioning of countries' relative comovement rankings. That is, while intra-market return comovement indeed may reflect the kinds of investor protections that have been suggested, it also may reflect a different aspect of institutions: macroeconomic policy instability, along with other changes that are more transitory in nature. Macroeconomic policy stability is itself a time-varying institutional backdrop to mar-

[2] Besides changes in financial institutional development, some explanations have focused on specific market features, including, e.g., index inclusion (Barberis, Shleifer, and Wurgler (2005); Chen, Singal, and Whitelaw (2016)), analyst following (Chan and Hameed (2006); Claessens and Yafeh (2013); Hameed, Morck, Shen, and Yeung (2015)), and correlated trading (Kumar and Lee (2006); Kumar, Page, and Spalt (2016)).

kets' informational efficiency.

We use an international panel that includes observations of policy instability (measured in terms of the international financial policy trilemma, discussed in section 4.2.1) and crises within each country; and we compare the empirical importance of such variables to the relevance of standard measures of countries' institutional quality. The panel includes 33 economies that have had stock markets in place since 1995. Our key results show that international macroeconomic policy instability and crises are important in explaining intra-market comovement behavior. In international panel regressions, such considerations are better able to account for return comovement within a market than are such things as its country risk, its corruption, and its investor protections.

Our work relies on a model-free gauge of comovement. The model-free gauge is closely related to the conventional comovement measure, the R^2 from a market model. Since using the R^2 measure requires imposing a particular empirical version of the market model, conclusions about comovement may inadvertently arise from limitations in the particular model's relevancy or from model instability. So, we use the related, but atheoretic gauge of comovement instead. Specifically, we decompose the total market variation within an economy into two parts: the sum of individual variances and the sum of covariances; then the comovement within each market is gauged using the average covariance of returns in that market relative to the average individual variance of returns in that market.[3] Using the model-free gauge,

[3]While we focus on the behavior of intra-market return comovement, which requires the use of a time series to estimate variances and covariances within each market, we note that the approach builds directly on the work of Allen and Bali (2007), Goyal and Santa-Clara (2003), and Garcia, Mantilla-Garcia, and Martellini (2013). Those authors focus on returns' idiosyncratic portions,

we examine the behavior of return comovement within each of the markets in the international panel, and we also reexamine the comovement of U.S. returns over a longer period.

Extending the U.S. series to the earlier period (not available for the rest of the international panel) allows us to do three additional things. First, it allows us to address a notable, compositional explanation of the nearly century long decline in the return comovement within the United States. Brown and Kapadia (2007) argue that changes in the market's mix of firms explain the downward pattern. To explore this possibility, we construct a sample that is invulnerable to the compositional criticism: a sample of 'old' firms that have been listed for nearly all of the sample. We find that return comovement within the United States exhibits similar behavior in both the full U.S. sample and the nearly constant-composition U.S. subsample. Thus, compositional changes do not explain the U.S. trend.

Second, the longer U.S. series allows us to apply well-known time series filters to the model-free measure of comovement to explore the meaning of a recent upturn in U.S. comovement. Such filters are used widely to obtain smoothed-curve representations of economic time series. These representations are designed to separate long-term trend from short-term cyclical fluctuations. The trend and cycle decomposition provides an explicit framework for assessing whether the recent U.S. comovement upturn is a cyclical phenomenon or the reversal in the long trend. We find that the recent upturn is at least partly due to cyclical factors.

which they estimate with the cross-sectional variation of returns. The model-free measure also builds on the related work of Goetzmann, Li, and Rouwenhorst (2005), who constructs such a measure with market indices to study the comovement across markets.

Third, we use the longer series to replicate and slightly extend the standard synchronicity (i.e. R^2) results for U.S. returns. Using the R^2 measure, we confirm the model-free result that the comovement of 'old' firms follows the same pattern as the larger sample; and we discuss some aspects of the construction of the R^2 measure that may confound its interpretation. In particular, we note that using the R^2 to make inferences about informational efficiency requires that the empirical relevance of the underlying model is unchanging. This requirement motivates the use of a model-free gauge.

Section 2 describes the model-free gauge. The long, U.S. sample is explored in section 3; and section 4 presents the international data and the panel results.

2 A Model-Free Comovement Measure

The model-free, variance-based decomposition begins with the market return, r_m, to a portfolio of N firms: $r_m = \sum_{i=1}^{N} \omega_i r_i$, where r_i is the return to the i^{th} firm, and ω_i is the weight of each firm in the portfolio, and we omit the time subcripts. The weights may be chosen arbitrarily, and we use equal weights in the empirical implementation below. Constructing the portfolio over a particular period, it is straightforward to decompose the portfolio's return variance, σ_m^2, into the sum of two parts: a part made up of the underlying individual returns' variances, and a part made up of their covariances.

$$\sigma_m^2 = \frac{1}{N^2} \sum_{i=1}^{N} \sigma_i^2 + \frac{1}{N^2} \sum_{i=1}^{N} \sum_{\substack{j=1 \\ i \neq j}}^{N} \sigma_{i,j}^2. \tag{1}$$

In essense, the pure comovement portion of returns is captured by the second of the two terms in equation 1.

Next, we look at the sample counterparts of each of these two terms. We denote the sample value of each individual return variance by s_i^2, the sample value of each covariance by $c_{i,j}^2$. We denote their corresponding average values by s^2 and c^2, where $s^2 = \frac{1}{N}\sum\limits_{i=1}^{N} s_i^2$; and, $c^2 = \frac{1}{N^2-N}\sum_{i=1}^{N}\sum_{j=1_{i\neq j}}^{N} c_{i,j}^2$. In terms of these two averages, the sample portfolio variance is:

$$\hat{\sigma}_m^2 = \frac{1}{N}s^2 + \frac{N-1}{N}c^2. \tag{2}$$

This compact expression allows us to readily see that we can construct the average covariance without having to calculate all of the covariances between every pair of firms. That is, the average covariance can be expressed simply in terms of the market variance and the average of the individual variances:[4]

$$c^2 = \frac{N}{N-1}\big(\hat{\sigma}_m^2 - \frac{1}{N}s^2\big). \tag{3}$$

Finally, we construct a gauge of comovement using c^2 as a share of the average individual variance, s^2:

$$\frac{c^2}{s^2} = \frac{N}{N-1}\big(\frac{\hat{\sigma}_m^2}{s^2} - \frac{1}{N}\big). \tag{4}$$

This simple, variance-based comovement gauge, $\frac{c^2}{s^2}$, comes from the decomposition of the total market variance into its average variance and average covariance

[4]The value weighted average covariance and individual variance portions are given by: $c_{vw}^2 = \frac{N}{N-1}\big(\hat{\sigma}_m^2 - \frac{1}{N}s_{vw}^2\big)$ and $s_{vw}^2 = \sum\limits_{i=1}^{N}\omega_i\hat{\sigma}_i^2$.

pieces.[5] So, it is independent of any model. It also avoids the piecemeal estimation procedure that is needed in order to cobble together a lengthy time series for the index-model-based comovement gauges.[6] This covariance share is simple to calculate, is derived from a straightforward variance decomposition, and is easy to compare with the well-known R^2 comovement measure.[7]

We next calculate this comovement gauge for the sample of all U.S. returns for each month from 1926-2013, then (in section 3.2) we compare the model-free measure with the traditional, index-model based R^2 measure of comovement that is common in the literature. In section 4, we construct the model-free gauge for the international panel of stock returns, and we examine the relative importance of institutional influences – such as investor protections and corruption – and macroeconomic influences, such as crises and international policy instability.

3 U.S. Comovement

3.1 $\frac{c^2}{s^2}$ in the United States

The United States has been the starting point for most comovement studies, and U.S. returns data are readily available for a relatively long time period. So, we begin by constructing the $\frac{c^2}{s^2}$ measure for the United States. We use data from the Center

[5] As mentioned in section 1, this measure builds on the work of Allen and Bali (2007), Goyal and Santa-Clara (2003), Garcia, Mantilla-Garcia, and Martellini (2013), and Goetzmann, Li, and Rouwenhorst (2005).

[6] An index-model based R^2 measure requires periodically re-estimating the underlying model since each firm's coefficients evolve over time. See footnote 16 for an explanation of how the evolution of the estimates of an index model's coefficients can contaminate the behavior and interpretation of the model's R^2 measure.

[7] Additionally, this measure, $\frac{c^2}{s^2}$, will equal the average correlation coefficient when $\sigma_i^2 = \sigma_j^2 \; \forall i, j$; and, like the correlation coefficient, $\frac{c^2}{s^2} \leq 1$.

for Research in Securities Prices (CRSP) from 1926 through 2013. The data include ordinary common stocks of companies headquartered in the United States.[8] We construct the comovement gauge annually for the United States from 1926 through 2013 using the returns of a random sample of 400 firms.[9]

Figure 1 shows the resulting measures. The yearly average covariance shares, $\frac{c^2}{s^2}$, are given by the dots, and the red line fits a simple, linear trend. As shown, the covariance share exhibits a downward trend for the sample period as a whole.

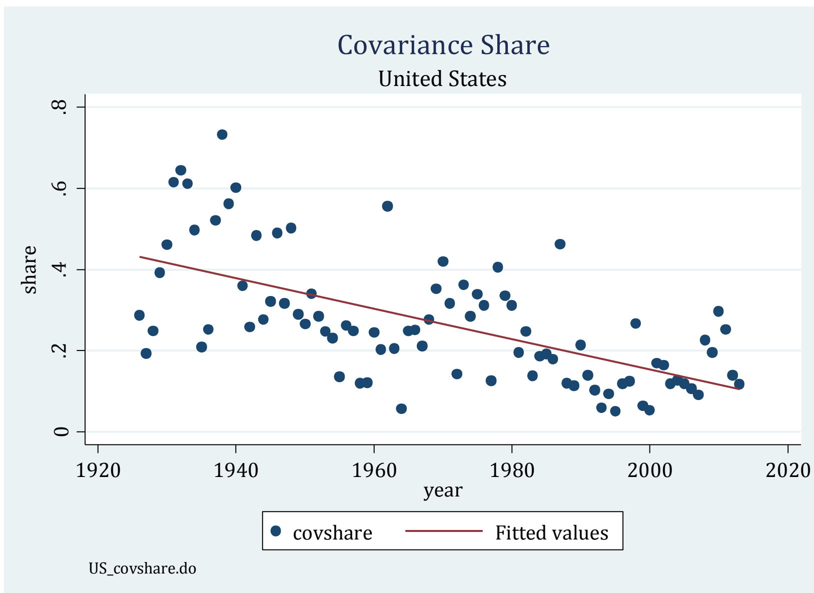

Figure 1: U.S. Covariance Share, $\frac{c^2}{s^2}$

As discussed above, the long decline has been interpreted as evidence of improved informational efficiency. However, a number of authors have proffered additional ex-

[8]Our dataset excludes those with fewer than eleven monthly observations, those classified as utilities or as bank and financial firms, and those with a price below $3.00 in any year.

[9]Our results are unaffected by various other sample choices as discussed below.

planations for the observed secular decline in comovement, including several hypotheses about changes over time in the nature of listed firms themselves. For example in a careful study, Brown and Kapadia (2007) account for earlier reported decline in terms of the increasing number of new, riskier firms over the sample period. Here, we address this concern by recalculating the model-free comovement measure for a constant sample: a sample that includes only 'old' firms.[10,11] If the long decline is explained by such firm dynamics, then we should expect that the trend would be absent from our sample of old firms.

Figure 2 illustrates the results. As shown, the trend persists in the sample with a constant set of firms. While the comovement share is slightly larger, and its decline is slightly more modest for the old firms, the differences are minor, and they are not statistically significant at any standard confidence levels. Firm demographics cannot explain the long decline observed in this sample.

We also construct separate, smaller portfolios of 50 random firms, the fifty smallest firms, and the 50 largest firms. The patterns are again the same, and we cannot reject the hypotheses that any of the portfolios differ in terms of either their levels or their trends. In addition to the one-year windows used here, we also construct

[10]Specifically, our 'old' firms sample includes 62 firms, all those in CRSP with at least 84 years of data. That is, we exclude firms with more than three missing years. We also repeat the exercise for only those firms that existed for the complete period. (By allowing for three years of missing data, we are able to increase the sample size from 35 to 62 firms.) The results are similar for both samples.

[11]Dasgupta, Gan, and Gao (2010) also discuss firm demographics, but the issue they raise is somewhat different. They point out that comovement should be higher for old firms since investors know more about those firm's time-invariant characteristics. So, keeping the composition constant, as we do here, might by itself suggest that the comovement for such a sample would rise over time as investors get to know the firms. However, the empirical relevance of this point diminishes for a fixed set of firms once the firms are established enough that agents have already learned most of what they can about the firms' stable fixed characteristics.

portfolios with variances and covariances computed over two-year windows. Again, the patterns are the same.

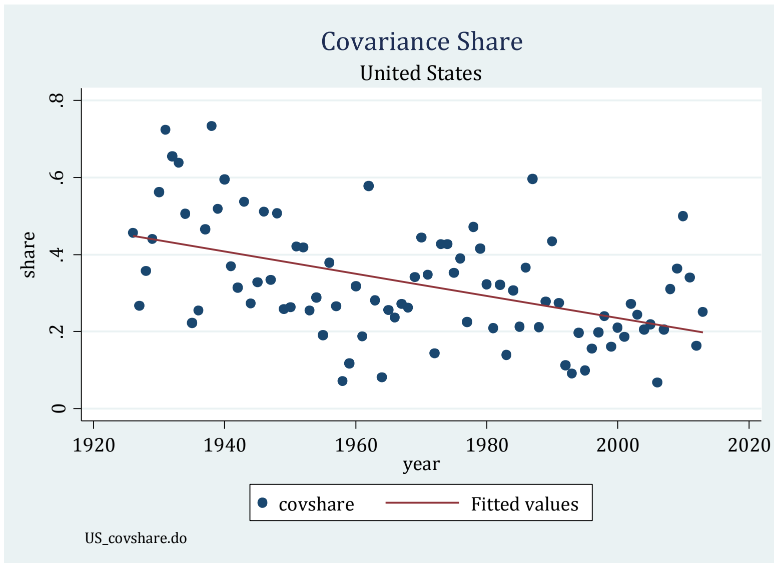

Figure 2: U.S. Old Firms Covariance Share, $\frac{c^2}{s^2}$

While we have calculated a simple, long-term linear trend, the potential roles of shorter-term conditions and policies suggests a richer exploration of the trend. The behavior of return comovement potentially encompasses both short-term, cyclical changes and slow-moving, secular changes. Return comovement may move systematically with business cycle and policy instability in ways that are relatively temporary. For example, comovement may vary over the business cycle because information production rises with aggregate economic activity, as in Veldkamp (2005) and Veldkamp (2006). Or, it may be cyclical because risk premia increase more in bad times than in good, as described by Mele (2007).[12] At the same time, the institutional framework of financial markets as a whole may continue to change. The arguably slower and more persistent institutional changes may generate a non-constant trend around which the cyclical portion moves. The potential importance of both components – substantial secular changes over relatively long time periods and meaningful fluctuations over the business cycle – suggests that trend and cycle decompositions might be useful. Such decompositions can help distinguish the slow-moving, more persistent institutional influences from the business cycle influences that are more likely to be reversed.

This decomposition is captured by modeling comovement in each period, t, as having two components, a deterministic or stochastic trend, $(\frac{c^2}{s^2})_t^T$ and stationary cyclical part, $(\frac{c^2}{s^2})_t^C$. That is, in each period:

$$(\frac{c^2}{s^2})_t = (\frac{c^2}{s^2})_t^T + (\frac{c^2}{s^2})_t^C$$

There are many different techniques available to decompose the comovement measure into its trend and cycle components. Here, we use two well-known methods: the Butterworth filter and the Hodrick-Prescott filter, which both treat the trend and cycle as uncorrelated with each other as they allow the trend to change.[13] As before, the decomposition is performed for an annually randomized 400-firm sample.

Figure 3 depicts the estimated trend components using the two techniques. Like

[12]The trend and cycle decomposition is closely related to the empirical work of Brockman, Liebenberg, and Schutte (2010). Building on the theoretical work of Veldkamp (2005), they find an empirical link between return comovement and economic activity.

[13]These approaches are described in StataCorp. (2013), which itself references Butterworth (1930), Hodrick and Prescott (1997), and Baum (2006).

the simple, linear trend, both estimated trend components decline over most of the twentieth century. Using either decomposition technique, the trend comovement reaches its nadir in the late nineties, then it begins to rise. However, the reversal seems to be short-lived: the smoothed comovement share renews its decline at the end of the sample. Thus, results from standard time-series filtering technique support the idea that the recent reversal is at least in part due to cyclical factors.

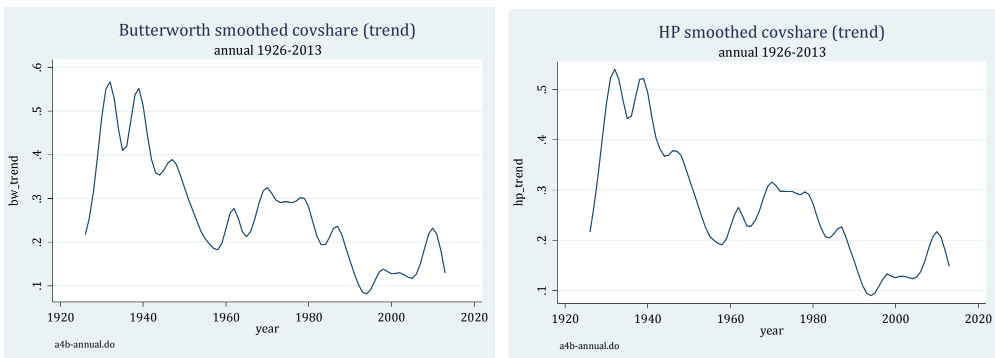

Figure 3: Trend component of $\frac{c^2}{s^2}$

3.2 The R^2 Comovement Measure

This subsection focuses on the most widely-used gauge of the comovement of returns, the average R^2 from regressions of individual returns on a market return. The R^2 measure, used by Roll (1988) and many others since then, is motivated by the Capital Asset Pricing Model (CAPM) and the model's simplest empirical incarnation, the single index model. While Roll (1988) begins with the single index model for the United States, he also includes a five-factor model; and many other researchers incorporate specific additional factors, such as the Fama and French

(1993) factors (size and book-to-market ratio), momentum (as in Carhart (1997)), or industry, regional, and global returns. Here, we begin by replicating and extending the benchmark U.S., single-index model results of Morck, Yeung, and Yu (2000).

Following others, we denote the average R^2-based gauge of this synchronicity by f_R. So, in each sub-sample period, t, with equally-weighted returns, we have:

$$f_{R,t} = \frac{1}{N}\sum_{i=1}^{N} R^2_{i,t} = \frac{1}{N}\sum_{i=1}^{N} \frac{\hat{\beta}^2_{i,t}\hat{\sigma}^2_{m,t}}{\hat{\beta}^2_{i,t}\hat{\sigma}^2_{m,t} + \hat{\sigma}^2_{\epsilon_i,t}},$$

where $R^2_{i,t}$ is the R^2 from the regression of the i^{th} return on the market return in the subsample; $\hat{\beta}_{i,t}$ is the i^{th} stock's estimated coefficient on the market return in the subsample; $\hat{\sigma}^2_{m,t}$ is the sub-sample variance of the market return; and $\hat{\sigma}^2_{\epsilon_i,t}$ is the residual, sub-sample variance. That is, the market model's average ability to explain returns in each subperiod provides a comovement gauge in that subperiod.

3.2.1 Replicating and Extending f_R for U.S. Data

Here, we use the same U.S. data as above to construct the R^2 measure and replicate and extend Morck et. al. (2000, 2013). Following Roll (1988), Morck et. al. (2000, 2013), and others, we use five year estimates of the βs and monthly returns. However, unlike in previous studies, we construct the R^2 measures using annual subsamples so that we can begin to consider the role of the business cycles.[14]

[14] We also separately calculate f_R using the full five-year sub-periods as in Morck, Yeung, and Yu (2000), and again find the decline and reversal. In addition, while we report the results from annual returns constructed from monthly data, we also separately calculate the R^2 using daily and weekly observations to construct the annual returns. The results differ little. Most importantly, the measures exhibit the same long decline and recent reversal.

Here, we report the U.S. results for value-weighted returns, but the results change little when equally-weighted returns are used.

This benchmark R^2 measure of comovement is shown in the blue line in figure 4, which uses the same randomized sample of 400 firms. The overall pattern replicates Morck, Yeung, and Yu's (2000) finding that the R^2 declines over much of the twentieth century, and it replicates and extends the later finding (Morck, Yeung, and Yu, 2013) that the measure seems to reach its nadir and begin to reverse itself after the mid-nineties.[15] The vertical line indicates the end of the 2003 to 2007 boom and the onset of the financial and economic crisis. Since the onset of the financial crisis, the measure has returned to its levels of the 1960s and 1970s.

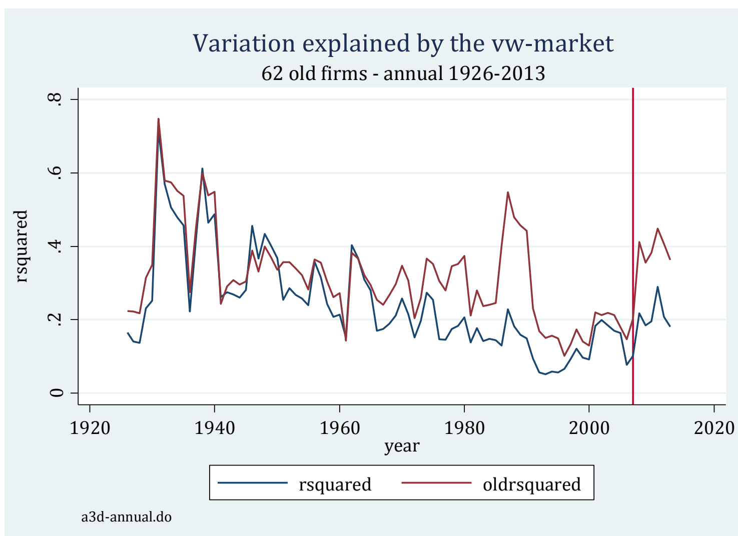

Figure 4: R^2 of the single index model: old-firm sample

As we did with the model-free measure, we must again consider the compositional

[15]Morck, Yeung and Yu's (2013) data ends at 2010. Here, we extend the sample through 2013.

arguments of Brown and Kapadia (2007) and others who suggest that the decline may represent changing firm demographics. So, we recalculate the average R^2 for the smaller sample that includes only the 62 'old' firms. The result of this exercise is shown by the red line in figure 4. While the long decline is no longer quite as compelling, we can see that, like the overall R^2 measure, the average old-firms' R^2s also reaches its nadir in the mid-nineties and rises afterward.

3.2.2 Generic R^2

While many researchers have recently used the R^2 as a comovement gauge, returning to the R^2 statistic's traditional meaning provides additional insight. Typically (and as characterized by Roll's 1988 address on the subject), an R^2 statistic is used to describe the empirical fit of a model. That traditional meaning reminds us that the numerical value of the R^2 is influenced largely by two things: the variability of the explanatory variables, and the empirical validity of the model.[16] An R^2 increases with variability in the explanatory variables; and it increases with the model validity.

In this case, the explanatory variable is the market return. So, even without any knowledge of such things as informational efficiency, property rights, or compositional changes, we should expect the average R^2 to rise in periods of greater market volatility and fall in periods of tranquility. Figure 5 depicts these patterns for the same U.S. returns used above. The figure's red line gives the standard deviation of

[16] In addition, for each firm, $R_i^2 = \frac{\hat{\beta}_i^2 \hat{\sigma}_m^2}{\hat{\sigma}_i^2}$. So, its value also changes as $\hat{\beta}_i^2$ changes when it is re-estimated in every sub-period, whether every year or every five years. While β_i must sum to one across all firms, the sum across firms of its squared value can change over time. Thus, the periodic reestimation of the β_is also affects the average R^2. We find the $\hat{\beta}_i^2$ term itself does indeed fall over much of the sample period, and then rise. However the quantitative significance of this in accounting for the change in the average R^2 is modest.

the U.S. market return, and the blue line gives the average U.S. R^2. While the two measures do not move in lock step, periods of substantial declines in R^2 are accompanied by periods of decline in market volatility; and the recent rise in R^2 has been accompanied by a rise, albeit an uneven one, in the standard deviation of the market return. This observation is in keeping with the findings of Bekaert, Hodrick, and Zhang (2012), who carefully attribute time variation in related variables to overall market volatility.

Since the R^2 also depends on the model's validity, an interpretation of comovement as being indicative of informational efficiency requires a joint hypothesis. Specifically, in addition to the hypothesis of interest, it requires the auxiliary hypothesis that the relevance of the market model is unchanging. The relevance of a particular market model will change if, for example, the importance of other factors changes over time or across countries. If the model's validity is changing, the R^2 will change as well, and the corresponding changes would be conflated with the interpretation of the R^2. Ignoring the change in validity would lead to incorrect inferences. In general when a model's R^2 falls, one may reasonably be concerned that the model's relevance is declining. So, model relevance complicates inferences about informativeness.[17]

[17] Morck, Yeung, and Yu (2000), and others have used the proportion of firms with returns moving in the same direction as a model-free gauge. Specifically, the measure counts the number of firm returns of the same sign as a fraction of the total number of firms. While this fraction captures a sense of directionality without recourse to a model, it exhibits two important drawbacks. First, it lumps small and large movements together. That is, it does not take into account the *extent* of the comovement; instead it is all or nothing. Second, the measure rises and falls with the magnitude of the mean return. This latter problem is particularly important when comparing time periods or countries, where the average nominal returns can differ greatly. Time periods with high nominal returns, for example, will appear to have more comovement.

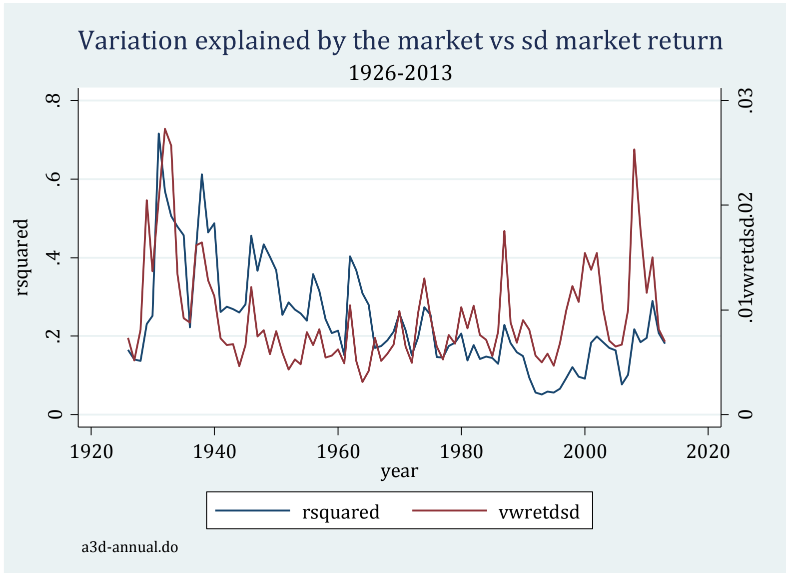

Figure 5: Variability of explanatory variable and R^2

4 International Data

In this section, we explore the $\frac{c^2}{s^2}$ comovement measure in an international panel of economies. The use of international data is important for its own sake – to illustrate the patterns of return comovement in other countries. In addition, the inclusion of additional variables in a panel can help to expose the country characteristics that may be determining the comovement patterns both within the United States and elsewhere. In particular, it can give us the statistical power needed to explore the role of such things as economy-wide investor protections and corruption, or of macroeconomic conditions, crises, and policy stability. Many characteristics of the U.S. economy that may be related to its observed decline in return comovement have been changing in concert over the period we have examined. We attempt to parse the empirical roles of some of these potentially important characteristics by looking across economies where the characteristics have changed to different extents and at different points in time. So, in this section, we first construct and describe the covariance gauges for the economies in the panel; then we explore how they are linked to some of the key characteristics that have been suggested by the literature and for which we were able to obtain data.

The international panel includes 33 economies that have had stock exchanges operating over the period 1995 to 2013.[18] Twenty are OECD countries; and, among those, twelve are European. The remainder are non-OECD countries. The return data are taken from Datastream.

4.1 Individual Country Return Comovement

We construct each economy's comovement gauge using equally-weighted portfolios of fifty randomly chosen stocks each period.[19] Figures 6 through 10 display the comovement gauges for the OECD countries outside Europe, for the European OECD countries, and for the non-OECD economies. The most striking feature of these graphs as a whole is that the return comovement patterns – their trends, levels, and variability – differ across countries.

While most countries exhibit a decline in return comovement, about one-fifth of them exhibit an overall comovement rise over the sample period. All but one of those

[18]We use 1995 as a starting point in the regressions to allow for a representative balanced panel. When data are available, we use somewhat longer series when looking at the countries individually.

[19]While we have not yet constructed value-weighted international portfolios, as mentioned in the discussion of U.S. data in section 3.2.1, we found no statistically significant differences across the equally-weighted and value-weighted portfolios, or between portfolios made of different sizes, ranging from 50 to 400.

with increasing comovement are outside of Europe. As shown in figure 6, the non-European OECD countries that exhibit an increase in return comovement include Australia and Canada, which have quite low levels of comovement to begin with; Chile, for which the rise is negligible; and the United States, which was discussed in detail in section 3. Within Europe, shown in figures 7 and 8, only the Netherlands exhibits an overall rise over the sample period. Among the non-OECD countries, shown in figures 9 and 10, Sri Lanka exhibits an upward trend in return comovement. For the most part, where we do observe increases in return comovement, they appear to be relatively minor.

Perhaps surprisingly, the overall level of return comovement does not seem to be closely tied to a prominent marker of affluence and development, namely, whether or not a country is part of the OECD. The U.S. and Japan (figure 6) have relatively high comovements, but so does China (figure 9). Likewise, Canada (figure 6) has consistently low values, but so does South Africa (figure 10).

On the surface, these patterns seem entirely at odds with the detailed and influential study of Morck, Yeung, and Yu (2000), who concluded that richer countries exhibit lower comovement than poorer ones. Their measures of comovement – at that time – put the United States at the very opposite end of the spectrum from where it is here. Their more recent work, Morck, Yeung, and Yu (2013), provides a series of snapshots documenting that their rankings have changed; and the graphs here show that their earlier result, based on a 1995 cross-section, was obtained just as the United States neared its comovement lows. Together with their recent work, the patterns we document emphasize that relative comovement rankings change contin-

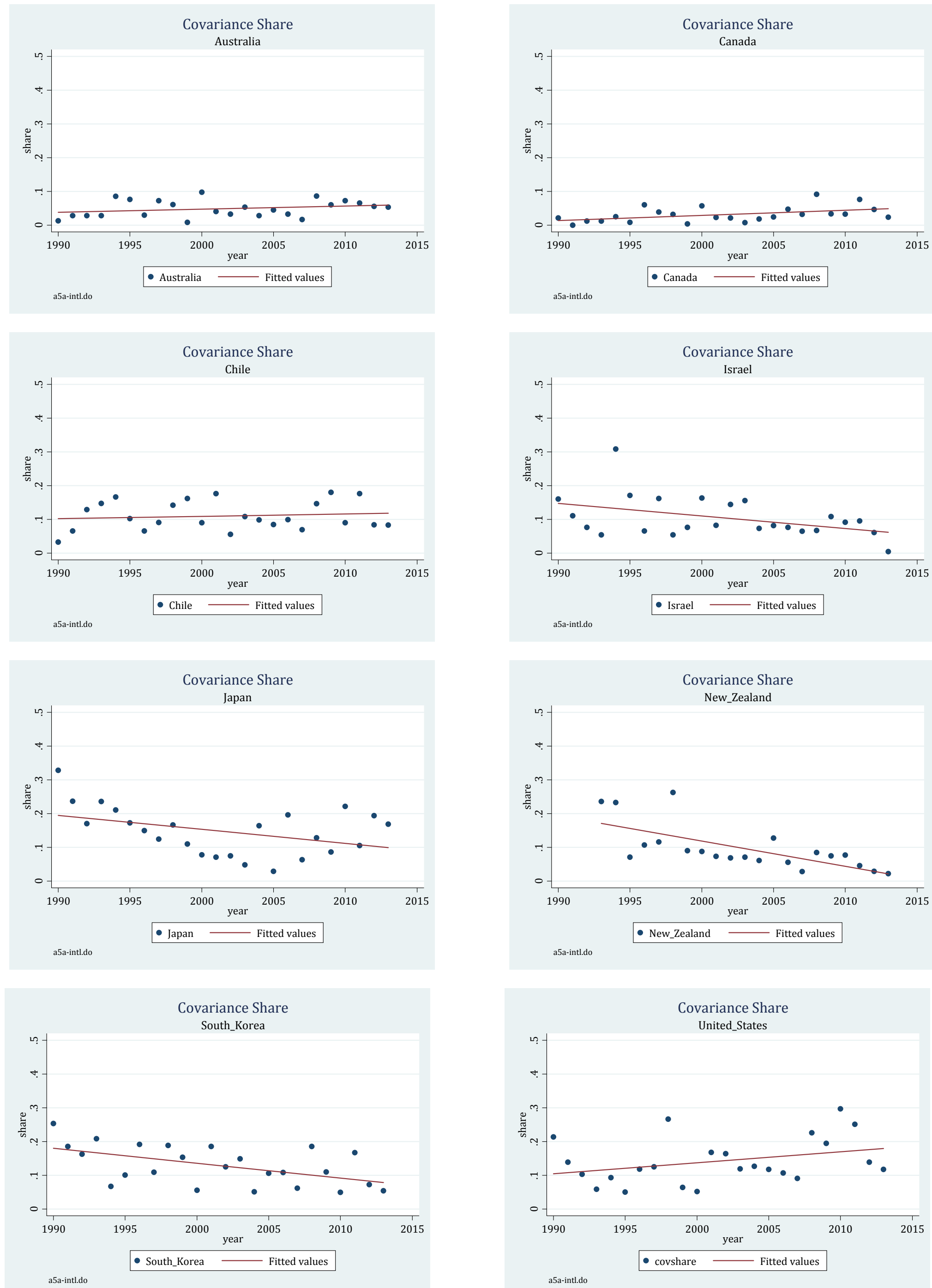

Figure 6: OECD Non-Europe, Covariance Share

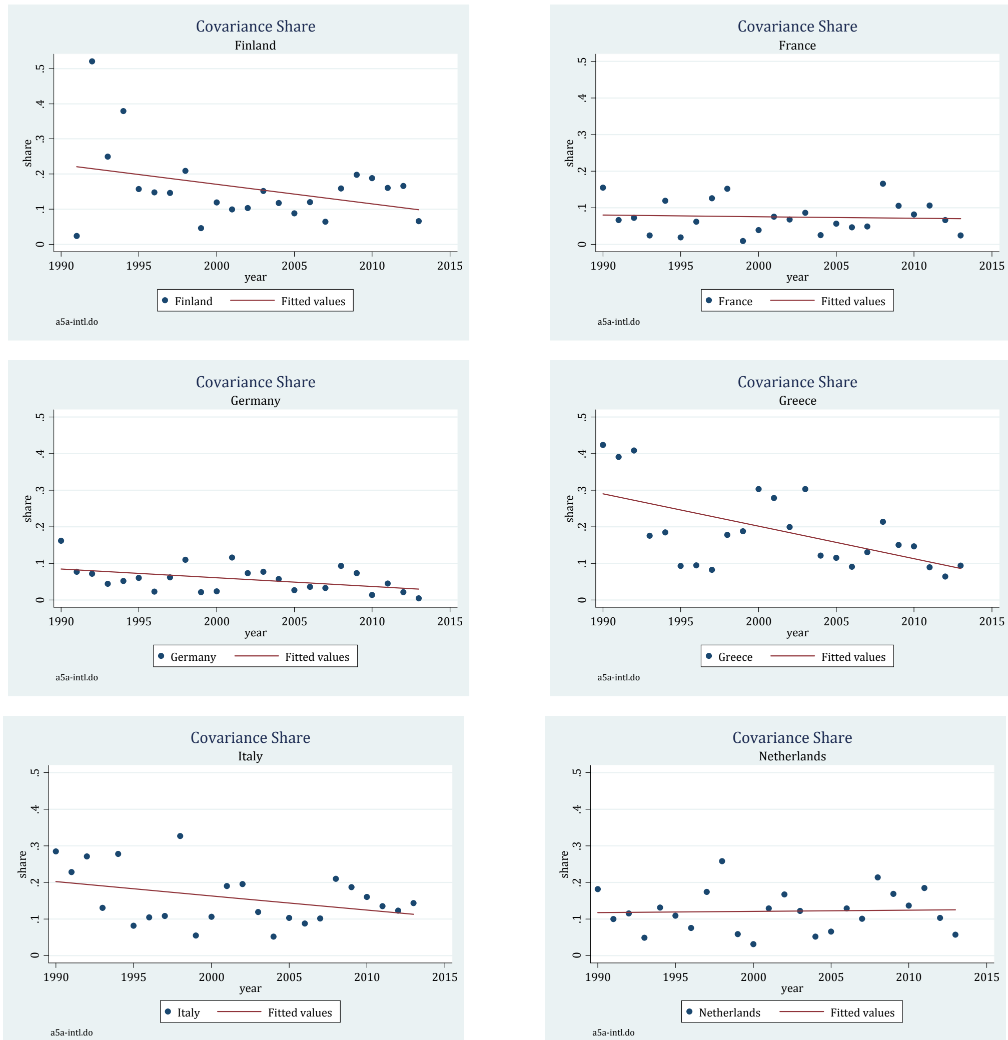

Figure 7: OECD Europe – Part 1, Covariance Share

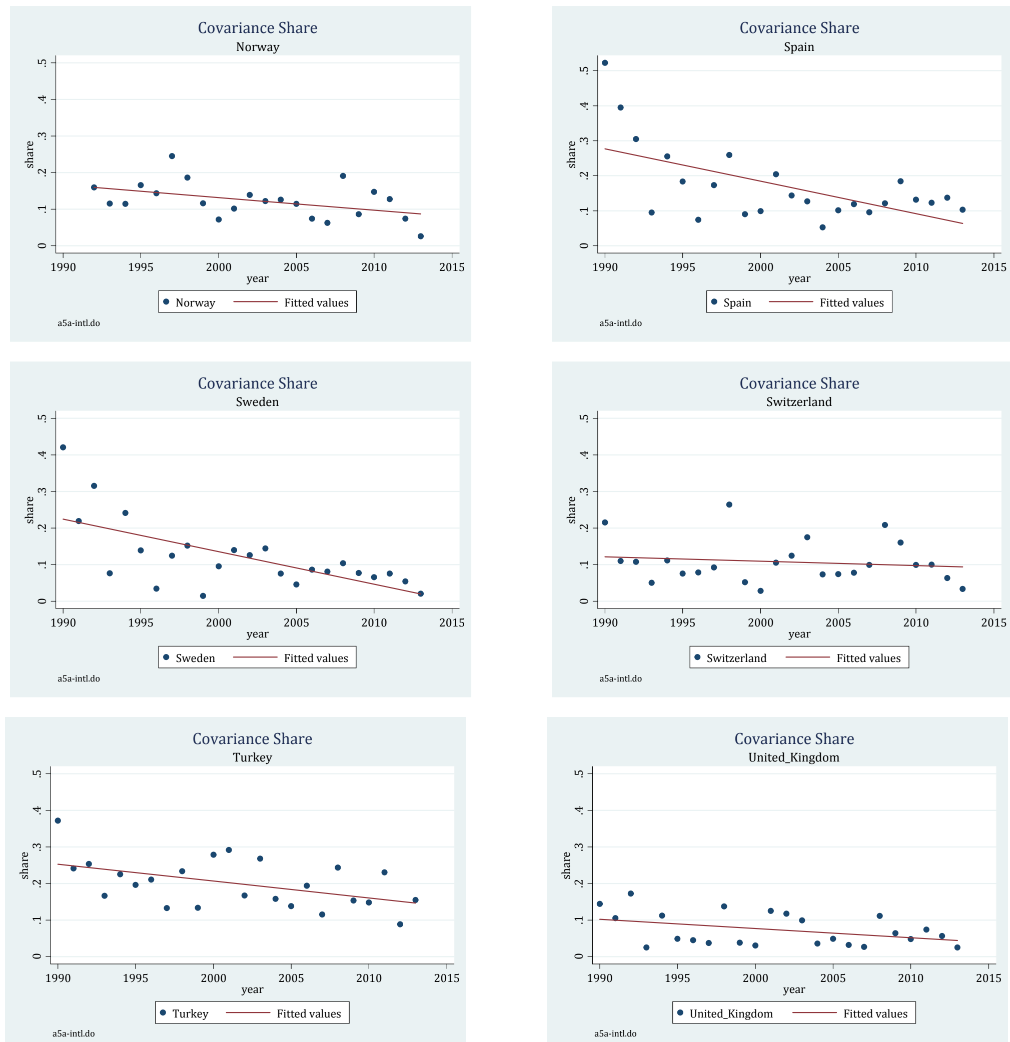

Figure 8: OECD Europe - Part 2, Covariance Share

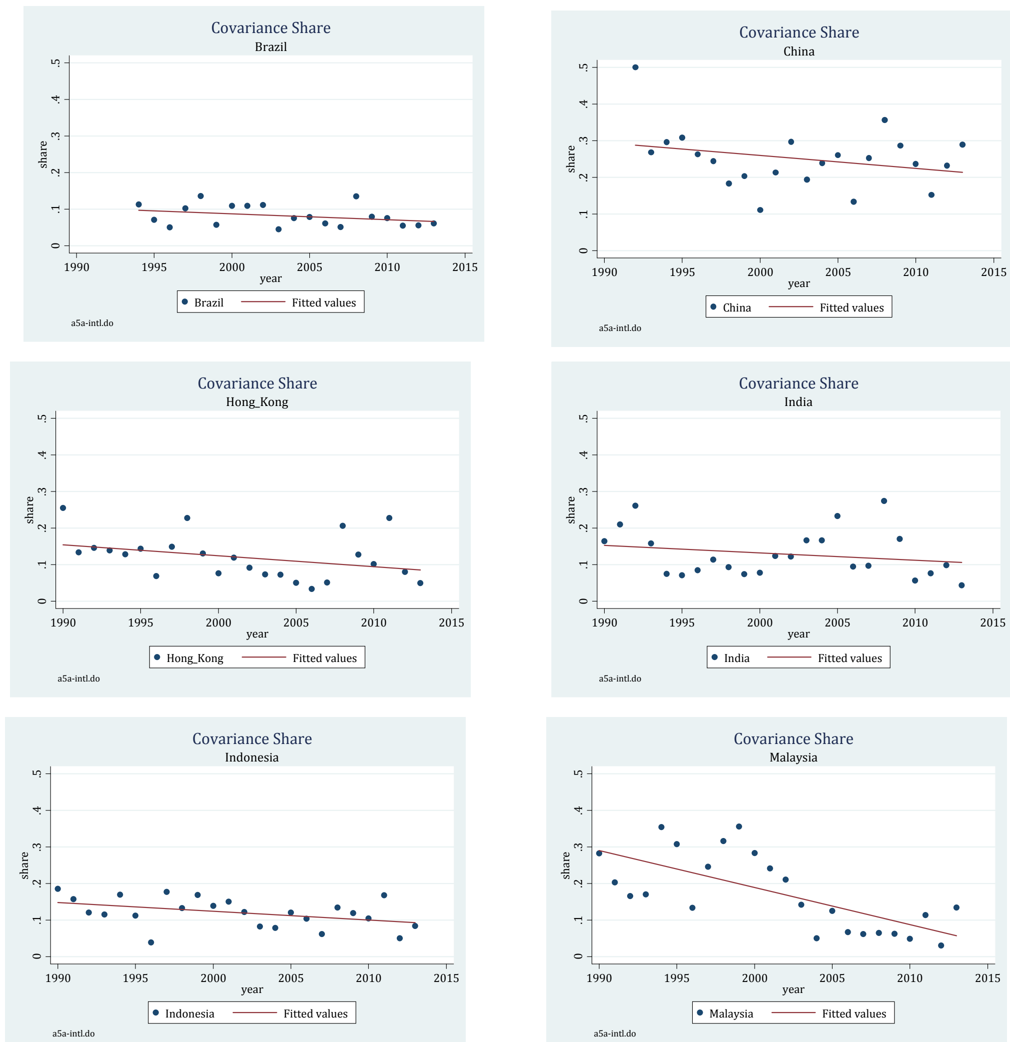

Figure 9: Non-OECD - Part 1, Covariance Share

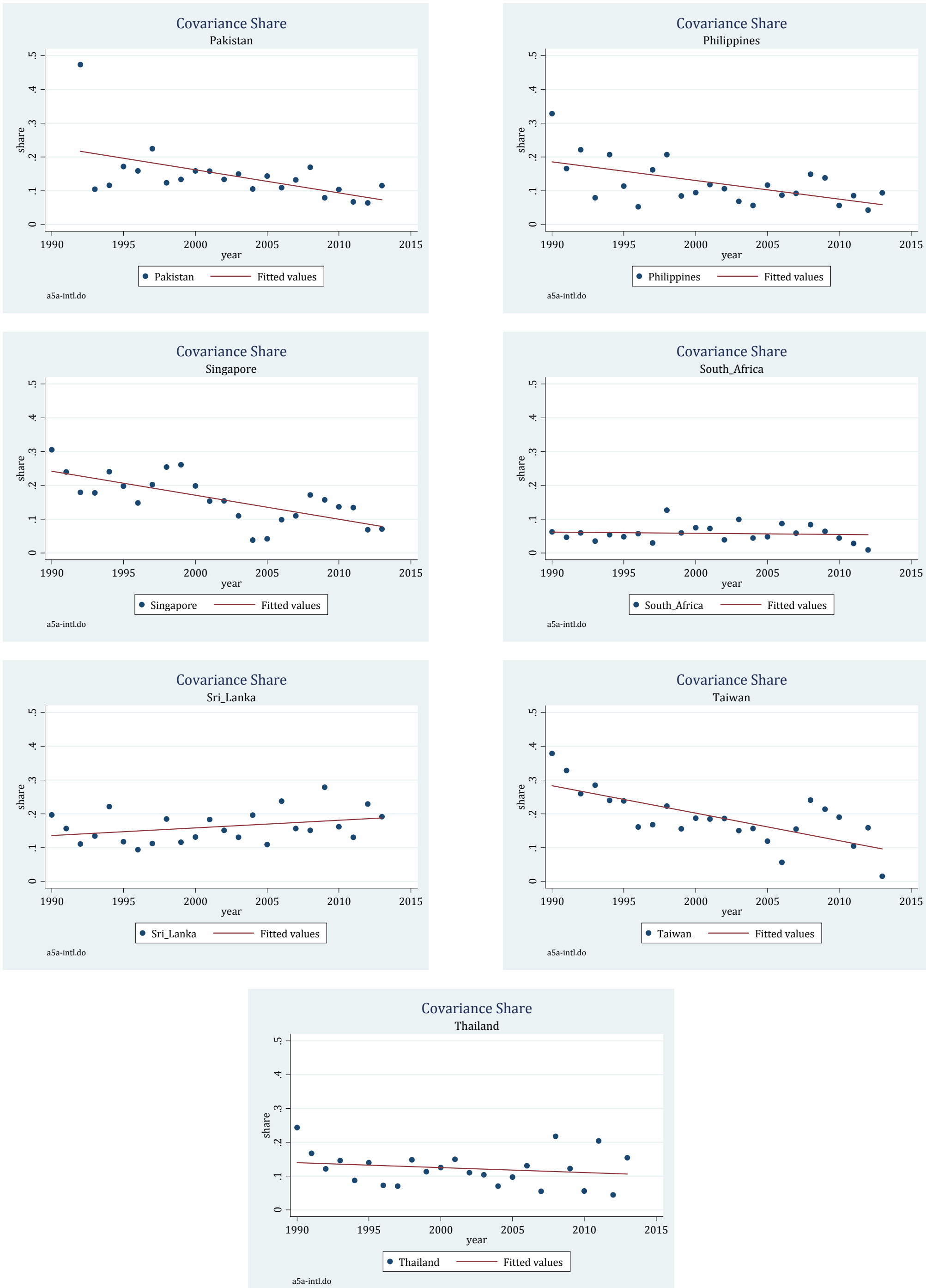

Figure 10: Non-OECD - Part 2, Covariance Share

ually and dramatically. In the following section, we use a panel regression to explore the observed comovement patterns more systematically.

4.2 International Panel Regressions

In addition to Morck, Yeung, and Yu (2013), a number of other studies emphasize in one way or another that the international rankings of return comovement measures are sensitive to the year in which they are constructed.[20] In this section, we use panel regressions to explore more systematically our observed international patterns of comovement as well as the literature's earlier findings.[21] We begin with the earlier finding that stock returns comove more within poor (low per capita GDP) countries than within rich (high per capita GDP) ones. We use multivariate regressions to see if per capita GDP can better explain return comovement once we account for crises and the stability of international macroeconomic policy, and for other characteristics that have been suggested by the recent literature.We find that we cannot resuscitate the role of per capita GDP: it remains only tenuously linked to comovement. That is, a country's level of economic development – whether it is rich or poor – does not seem to matter for return comovement.

Prior literature also suggests that various forms of property rights may drive comovement behavior. Notably, Morck, Yeung, and Yu (2000) argue that property rights explain the largest differences in comovement that they observe across coun-

[20]See, for example, Brandt, Brav, Graham, and Kumar (2010), and Alves, Peasnell and Taylor (2010).

[21]Note that, as in most of the extant literature, the problem of endogenous regressors prevents us interpreting regression results causally. However, the multivariate regressions do allow us to compare the explanatory power of policy and macroeconomic variables relative to most of the institutional variables examined in the past.

tries. Jin and Myers (2006) then provide a model to show that in the presence of limited information, poor investor protections lead to a higher R^2. So, we explore whether measures that are often considered to be related to property rights – such as indicators of investor protections, disclosure, and corruption – can help explain the patterns of comovement. We confirm that many of these measure are significant in bivariate regressions. However, we find that none of these variables appear to matter in multivariate regressions. Instead, comovement appears to be linked to various, shorter-lived aspects of countries' conditions.

We find that comovement is linked over time to detrended GDP growth, which – in contrast to the level of per capita GDP – represents the stage of the business cycle, not whether a country is rich or poor. It is also linked to economic crises, and it is linked to the stability of international macroeconomic policies. Specifically, comovement is higher during GDP downturns, during economic crises, and when international macroeconomic policies are unstable. We also find that stock market turnover helps explain comovement: greater turnover goes hand in hand with greater comovement.[22] Overall, these variables appear to be more important than investor protections in explaining changes in the observed international comovement rankings.

4.2.1 Regressors

To examine the potential role of investor protections, we begin by including the Djankov, La Porta, de Silanes, and Shleifer (2008) anti-self-dealing index, the Spamann (2010) corrected antidirector rights index, and the World Bank's Business

[22]The role of turnover is in keeping with the finding of Karolyi, Lee, and Van Dijk (2012) that comovement is greater in countries with high turnover. It is also related – though more loosely – to the findings of Gassen, LaFond, Skaife, and Veenman (2015) and Chan, Hameed, and Kang (2013) who connect the R^2 measure of comovement to liquidity.

Extent of Disclosure Index. In addition, we include an indicator of corruption: Transparency International's corruption perceptions index. Because of its prominence in the literature, we also include the International Country Risk Guide's Composite Political, Financial, and Economic Risk Rating, which is a amalgam of 22 country characteristics.

To examine the role of shorter-term conditions, we include detrended GDP growth (as distinct from the per capita GDP level), inflation, and stock market turnover. These data are taken from the IMF's International Financial Statistics. In addition, we include a crisis variable constructed from the indicators defined in Reinhart and Rogoff (2011).[23]

To these standard measures, we add an indicator of international macroeconomic policy stability. Specifically, we use a gauge of the stability of a country's triad of: exchange rate arrangements, financial market openness, and monetary sovereignty. The classic, open-economy trilemma constrains a country's choices among these arrangements. (For example, with open capital markets, monetary actions spill over into exchange rate markets. So, a country with open capital markets and an exchange rate peg cannot use its monetary policy to manage inflation.) To capture the stability – or instability – of these arrangements, we use the trilemma stability indicator of Popper, Mandilaras, and Bird (2013). The trilemma indicator gauges the stability of *policy*, not of the underlying variables. For example, the measure accurately captures the relative stability of U.S. trilemma policies since the mid-

[23]Specifically, we create a summary variable for banking, currency, default, inflation, or stock market crises as defined by Reinhart and Rogoff (2011), and that equals zero in the absence of any of these crises.

seventies: the United States has largely maintained open financial markets, a dollar float, and monetary sovereignty. This policy stability contrasts with the fluctuations in the underlying variables, such as the foreign exchange value of the U.S. dollar. That is, a constant policy of floating exchange rates means that the value of the exchange rate fluctuates; and a constant policy of monetary sovereignty allows for periods of monetary tightening and monetary ease. The policy can be constant while the affected variables are allowed to fluctuate.

Because differences in comovement might arise as an artifact of size or of industry structure, we also include the IMF's standard measures of market capitalization and the the country's share of world output; and we include UNCTAD's concentration index.

Separately, we also include an alternative set of institutional variables. These include the World Bank's governance indicators developed by Kaufmann et al. (2010), World Bank data on the extent of business disclosure and the strength of legal rights, and an indicator of press freedom provided by Freedom House. We use these variables both to explore the robustness of our results and to provide a more detailed and disaggregated alternative to the ICRG composite.

We transform several of the variables to make linear regression more appropriate and to make the coefficient estimates easier to interpret. Specifically, we use a logistic transformation of the covariance share, $ln(\frac{\frac{c^2}{s^2}}{1-\frac{c^2}{s^2}})$;[24] we standardize the subjective indices; and we take logs of countries' per capita GDP, share of world output, market capitalization, and turnover.

[24]The transformation follows Morck, Yeung, and Yu (2000), and it is necessary because the covariance share, $\frac{c^2}{s^2}$, is bounded between zero and one.

Table 1: Comovement panel regression with time and country fixed effects

The dependent variable is the logistic transformation of *Covariance share*, $\frac{c^2}{s^2}$, defined as the average equity return covariance scaled by the average equity return variance. Data for the thirty-three countries and nineteen years (1995-2013) are included in the analysis. The explanatory variables are: *Country risk*, defined as the (standardized) composite country risk indicator produced by PRS Group; the *Corruption* perceptions risk indicator from transparency international; the (standardized) corrected *Antidirector rights* indicator from Spamann (2010); the (standardized) *Anti-self-dealing* indicator taken from Djankov, et al (2008); a (standardized) measure of trade product *Concentration* taken from the United Nations Conference on Trade and Development statistical system; countries' (logged) *Output share* of world GDP, (logged) PPP-based *per capita Real GDP*, and *Demeaned GDP* growth expressed as a deviation from its 1995-2013 country mean, all taken from the World Economic Outlook Database, October 2014; a measure of macroeconomic policy stability (*Trilemma stability*) taken from Popper, Mandilaras, and Bird (2013); Market capitalization *Market cap* and *Turnover* taken from the World Development Indicators; a *Crisis* indicator taken from Reinhart and Rogoff (2011); and *Inflation*, taken from the World Economic Outlook Database, October 2014. Robust standard errors are reported in parentheses and are clustered at the country level, and asterisks indicate statistical significance at the one (***), five (**) and ten percent (*) levels. The table also reports tests of the hypotheses: (1) country risk and corruption coefficients jointly equal zero, and (2) both corporate governance indicators (antidirector rights and anti-self-dealing) jointly equal zero.

Covariance share	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country risk	-0.1950**							-0.1924
	(0.084)							(0.149)
Corruption		0.0039						-0.0245
		(0.050)						(0.055)
Antidirector rights			-0.3496***					-2.6650
			(0.000)					(2.933)
Anti-self-dealing				-1.8520***				5.6993
				(0.000)				(6.620)
Concentration					0.0040			0.0529
					(0.097)			(0.125)
ln(Output share)						-0.3831		-1.1284
						(0.383)		(1.490)
ln(per capita RGDP)							-0.1958	0.0917
							(0.378)	(1.619)
Demeaned growth								0.0158
								(0.015)
Trilemma stability								-0.0551**
								(0.021)
ln(Market cap)								0.1487
								(0.127)
ln(Turnover)								0.1380**
								(0.060)
Crisis								0.0688
								(0.053)
Inflation								-0.0080*
								(0.005)
Ho: Country Risk = Corruption = 0								1.81
probability $> \chi^2$								0.4054
Ho: Antidirector Rights = Anti-self-dealing = 0								3.16
probability $> \chi^2$								0.2064
Observations	626	626	569	626	626	626	626	417
Number of countries	33	33	30	33	33	33	33	26
R^2	0.564	0.557	0.543	0.557	0.557	0.560	0.558	0.611
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes

4.2.2 Regression Results

Tables 1, 2, and 3 provide the details of the baseline panel regressions. The regressions in the three tables differ only in their treatment of fixed effects. The first table provides the estimates of regressions that include both country fixed effects and time fixed effects. The second table provides the estimates from regressions that include fixed country effects, but no time fixed effects. By leaving out the time fixed effects, we can unpack the role of variables that change over time. Finally, the third table provides estimates from the regressions that include time fixed effects, but no country fixed effects. This allows us to explore the cross-country variation that is hidden in – subsumed by – the country fixed effects of the regressions in the first two tables. That is, table 3 allows us to focus on the variables that change little over time, but vary across countries. Each of the three tables first lists the estimates from regressions on individual variables; then, each table lists the estimates from the full, multivariate regression.

As shown in the first table, the coefficients on both measures of property rights – the antidirector rights index and the anti-self-dealing index – along with the coefficient on the country risk measure are statistically significant at the five-percent or one-percent confidence levels when included individually. However, none of them remains statistically significant in the full regression. Nor is the coefficient on the corruption perceptions index sizable or statistically significant either in the univariate regression or in the full regression. We also see that the coefficient on per capita GDP is statistically insignificant both individually and in the full regression (where it changes sign).

Because multicollinearity could potentially mask the significance of some of these variables in the full regression, we also provide two sets of joint hypotheses. The test statistics are given at the bottom of the table. The first one tests whether the coefficients on both country risk and corruption perceptions equal zero; and the second one tests whether the coefficients on both the antidirector-rights index and the anti-self-dealing index equal zero. Neither hypothesis can be rejected at standard confidence levels.

Instead, some of the shorter-term conditions appear to be important. The coefficients on trilemma stability, turnover, and inflation are all statistically significant, and the coefficients on trilemma stability and turnover are large enough to be economically meaningful.[25] A few examples may give some insight into their quantitative relevance.

The Asian crisis of the nineties provides a telling trilemma example. At the time of the crisis, Indonesia's international macroeconomic policies changed considerably, then they stabilized. The policy instability is captured by a trilemma measure of about -0.6. which is a large magnitude relative to the rest of the sample. As the crisis began to abate, Indonesia's policies steadied, and the trilemma measure shrank to about -0.2. The estimated trilemma coefficient of -0.06 given in table 1 implies that Indonesia's return to stability corresponds to a decline in the return comovement of about 0.03.[26] While smaller than the actual decline of about 0.05 at the time, it is

[25]While the coefficient on inflation is very small, its sign is puzzling and will be seen to persist in all of the regressions.

[26]To assess the implied quantitative impact, we divide the estimated coefficient by the logistic transformation's derivative, which equals $\frac{1}{\frac{c^2}{s^2}(1-\frac{c^2}{s^2})}$ and varies with the covariance share. Here, we evaluate the derivative at the value of $\frac{c^2}{s^2}$ equal to Indonesia's actual covariance share, 0.18. We

Table 2: Comovement panel regression with country fixed effects

As in Table 1, the dependent variable is the logistic transformation of *Covariance share*, $\frac{c^2}{s^2}$, defined as the average equity return covariance scaled by the average equity return variance. Data for the thirty-three countries and nineteen years (1995-2013) are included in the analysis. The explanatory variables are: *Country risk*, defined as the (standardized) composite country risk indicator produced by PRS Group; the *Corruption* perceptions risk indicator from transparency international; the (standardized) corrected *Antidirector rights* indicator from Spamann (2010); the (standardized) *Anti-self-dealing* indicator taken from Djankov, et al (2008); a (standardized) measure of trade product *Concentration* taken from the United Nations Conference on Trade and Development statistical system; countries' (logged) *Output share* of world GDP, (logged) PPP-based *per capita Real GDP*, and *Demeaned GDP* growth expressed as a deviation from its 1995-2013 country mean, all taken from the World Economic Outlook Database, October 2014; a measure of macroeconomic policy stability (*Trilemma stability*) taken from Popper, Mandilaras, and Bird (2013); Market capitalization *Market cap* and *Turnover* taken from the World Development Indicators; a *Crisis* indicator taken from Reinhart and Rogoff (2011); and *Inflation*, taken from the World Economic Outlook Database, October 2014. Robust standard errors are reported in parentheses and are clustered at the country level, and asterisks indicate statistical significance at the one (***), five (**) and ten percent (*) levels. The table also reports tests of the hypotheses: (1) country risk and corruption coefficients jointly equal zero, and (2) both corporate governance indicators (antidirector rights and anti-self-dealing) jointly equal zero.

Covariance share	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country risk	-0.1591**							-0.0340
	(0.080)							(0.122)
Corruption		0.0149						0.0091
		(0.063)						(0.060)
Antidirector rights			-0.3496***					-1.3571
			(0.000)					(1.348)
Anti-self-dealing				-1.8520***				2.7988
				(0.000)				(2.855)
Concentration					-0.0847			-0.0327
					(0.103)			(0.125)
ln(Output share)						-0.1559		-0.4245
						(0.312)		(0.669)
ln(per capita RGDP)							-0.3472**	-0.1610
							(0.148)	(0.340)
Demeaned growth								-0.0305**
								(0.014)
Trilemma stability								-0.0599
								(0.037)
ln(Market cap)								-0.0886
								(0.124)
ln(Turnover)								0.1217*
								(0.068)
Crisis								0.1439***
								(0.045)
Inflation								-0.0064*
								(0.004)
Ho: Country Risk = Corruption = 0								0.01
probability > χ^2								0.9524
Ho: Antidirector Rights = Anti-self-dealing = 0								2.01
probability > χ^2								0.3662
Observations	626	626	569	626	626	626	626	417
Countries	33	33	30	33	33	33	33	26
R^2	0.406	0.401	0.361	0.401	0.402	0.401	0.415	0.475
country dummies	yes	yes	yes	yes	yes	yes	yes	yes
time dummies	no	no	no	no	no	no	no	no

nevertheless substantial.[27]

The quantitative relevance of turnover can be seen from a U.S. example. Turnover changes of as much as fifty to one hundred percent are large, but not infrequent. The United States experienced such a change between 2007 and 2008, when U.S. stock market turnover doubled at the time of the global financial crisis. As shown in table 1, the coefficient on the natural log of turnover is about 0.13. The implied change in U.S. comovement would be about 0.01, which is about 20 percent of the actual U.S. comovement change of about 0.05. Like the coefficient on trilemma policy stability, the coefficient on turnover is both statistically significant and of an economically meaningful magnitude.

The next table gives the results from regressions that include country fixed effects, but no time fixed effects. Again, we find that the coefficients on country risk, the antidirector rights index, and the anti-self-dealing index are statistically significant in the individual regressions. We now also find that the coefficient on per capita GDP is statistically significant in the individual regression. However, as before, none of these variables remains significant in the full regression.

The bottom of the table gives the test statistic for the joint hypothesis that the coefficients on political risk and corruption perceptions are zero, and the test statistic for the joint hypothesis that the coefficients on the antidirector rights and anti-self-dealing indices are zero. As before, neither hypothesis can be rejected at any standard confidence level. The full regression provides no support for the idea that property rights drive comovement.

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also account for the standardization of the trilemma measure.

[27]Indonesia's average comovement is 0.11.

As in the first table, the estimated coefficients on several of the shorter-term variables are statistically significant. The estimated coefficients on turnover and inflation remain statistically significant. (The trilemma coefficient point estimate is little changed, but its larger standard error renders it statistically indistinguishable from zero.) In addition, this table allows us to see the significance of variables whose important variation occurs in the time dimension. By providing the results from the regressions that include country fixed effects, but no time fixed effects, table 2 highlights the role of GDP growth and crises. Specifically, the estimated coefficients on detrended GDP growth and crises are now statistically significant. They are also economically meaningful. At the average covariance share of .11, a one standard deviation change in GDP implies about a nine percent change in the covariance; and a crisis implies a change of about seven percent. Without the time dummies, we now can see that higher growth is accompanied by lower comovement; and crisis periods are accompanied by higher comovement.

The next table provides results from regressions that include time fixed effects, but no country fixed effects. Most of the main results of the first table are also evident here. The estimated coefficients on the anti-self-dealing and antidirector rights indexes are again statistically significant at standard confidence levels in the bilateral regressions, but they are insignificant in the full regression, both individually and together. Likewise, the country risk and corruption coefficients are again statistically significant in the bilateral regressions but individually statistically insignificant in the multilateral regressions. Here, the joint insignificance of corruption and country risk (the amalgam of 22 variables) is rejected at the five percent significance level; how-

Table 3: Comovement panel regression with time fixed effects

As in Tables 1 and 2, the dependent variable is the logistic transformation of *Covariance share*, $\frac{c^2}{s^2}$, defined as the average equity return covariance scaled by the average equity return variance. Data for the thirty-three countries and nineteen years (1995-2013) are included in the analysis. The explanatory variables are: *Country risk*, defined as the (standardized) composite country risk indicator produced by PRS Group; the *Corruption* perceptions risk indicator from transparency international; the (standardized) corrected *Antidirector rights* indicator from Spamann (2010); the (standardized) *Anti-self-dealing* indicator taken from Djankov, et al (2008); a (standardized) measure of trade product *Concentration* taken from the United Nations Conference on Trade and Development statistical system; countries' (logged) *Output share* of world GDP, (logged) PPP-based *per capita Real GDP*, and *Demeaned GDP* growth expressed as a deviation from its 1995-2013 country mean, all taken from the World Economic Outlook Database, October 2014; a measure of macroeconomic policy stability (*Trilemma stability*) taken from Popper, Mandilaras, and Bird (2013); Market capitalization *Market cap* and *Turnover* taken from the World Development Indicators; a *Crisis* indicator taken from Reinhart and Rogoff (2011); and *Inflation*, taken from the World Economic Outlook Database, October 2014. Robust standard errors are reported in parentheses and are clustered at the country level, and asterisks indicate statistical significance at the one (***), five (**) and ten percent (*) levels. The table also reports tests of the hypotheses: (1) country risk and corruption coefficients jointly equal zero, and (2) both corporate governance indicators (antidirector rights and anti-self-dealing) jointly equal zero.

Covariance share	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country risk	-0.1741***							-0.2190
	(0.056)							(0.148)
Corruption		-0.0632**						-0.0636
		(0.029)						(0.044)
Antidirector rights			-0.0208					-0.0806
			(0.060)					(0.061)
Anti-self-dealing				-0.0491				-0.0660
				(0.078)				(0.066)
Concentration					0.0201			0.0655
					(0.065)			(0.069)
ln(Output share)						-0.0667		-0.2308***
						(0.084)		(0.080)
ln(per capita RGDP)							-0.1848**	0.0880
							(0.074)	(0.115)
Demeaned growth								0.0117
								(0.013)
Trilemma stability								-0.0568**
								(0.022)
ln(Market cap)								0.1035
								(0.120)
ln(Turnover)								0.2057***
								(0.066)
Crisis								0.0814
								(0.051)
Inflation								-0.0086*
								(0.005)
Ho: Country Risk = Corruption = 0								6.19**
probability > χ^2								0.0454
Ho: Antidirector Rights = Anti-self-dealing = 0								4.05
probability > χ^2								0.1322
Observations	626	626	569	626	626	626	626	417
Countries	33	33	30	33	33	33	33	26
R2	0.189	0.226	0.180	0.158	0.157	0.153	0.195	0.355
country dummies	no	no	no	no	no	no	no	no
time dummies	yes	yes	yes	yes	yes	yes	yes	yes

ever, that significance disappears when time dummies are also omitted. As in tables 1 and 2, some of the other variables again appear to be important. The coefficients on trilemma stability, turnover, and inflation are again all statistically significant, and the coefficients on trilemma stability and turnover remain large enough to be economically meaningful.

The final table provides similar regressions, but ones that capture the idea of property rights using alternative indicators. These are the World Bank's indicators described above: the business index of the extent of disclosure of ownership and financial information; the index of strength of legal rights, which gauges protections in lending; and the Kaufmann, Kraal, and Mastruzzi measures of government effectiveness, regulatory quality, political stability, press freedom, voice and accountability, and rule of law.

Here we show only the full multivariate regressions, but as before many of the individual variables are significant in individual regressions. The table's first column gives the results from the regression that includes both time and country fixed effects, as in Table 1. The middle column gives the results from the regression that includes only country fixed effects, but no time fixed effects, as in Table 2. The final column gives the results from including only time fixed effects, but not country fixed effects, as in Table 3.

As before, the estimated coefficients on trilemma policy stability and turnover are again statistically significant, and their point estimates are of similar magnitude to their earlier values. Likewise, removing the time fixed effects again reveals the coefficients on demeaned GDP growth and crises to be statistically significant; that

Table 4: Comovement panel regression with alternate indicators

The dependent variable is again the logistic transformation of *Covariance share*, $\frac{c^2}{s^2}$, which equals the average equity return covariance scaled by the average equity return variance. Data for the thirty-three countries and nineteen years (1995-2013) are included. The explanatory variables are: *Government effectiveness*, *Regulatory quality*, *Political stability*, *Voice and accountability*, and *Rule of law*, all taken from the Worldwide Governance Indicators, 2014 update; the extent of *Business disclosure* and the *Strength of legal rights* taken from the World Bank; *Press freedom* taken from Freedom House; and additional variables (*Concentration*, *Output share*, *per capita Real GDP*, *Demeaned growth Trilemma stability*, *Market capitalization*, *Turnover*, *Crisis*, and *Inflation*), which are defined in Tables 1 through 3. Robust standard errors are clustered at the country level and reported in parentheses; and asterisks indicate statistical significance at the one (***), five (**) and ten percent (*) levels. The table also reports tests of two hypotheses, H_{01}: the coefficients on the first six variables jointly equal zero; and H_{02}: the coefficients on the extent of *Business disclosure* and the *Strength of legal rights* jointly equal zero.

Covariance share	(1)	(2)	(3)
Government effectiveness	-0.2757	-0.2588	-0.2677
	(0.218)	(0.245)	(0.236)
Regulatory quality	0.2529	0.2595	0.2468
	(0.213)	(0.259)	(0.188)
Political stability	-0.1135	0.0151	-0.0285
	(0.101)	(0.097)	(0.093)
Press freedom	-0.0063	-0.0045	0.0054
	(0.007)	(0.008)	(0.005)
Voice and accountability	0.0700	-0.0750	-0.0421
	(0.185)	(0.246)	(0.186)
Rule of law	-0.2269	-0.2902	-0.1872
	(0.353)	(0.371)	(0.335)
Business disclosure	0.4414	0.0089	-0.0179
	(0.896)	(0.280)	(0.025)
Strength of legal rights	-30.0592	-3.1698	-0.0242
	(51.288)	(17.962)	(0.037)
Concentration	0.0629	-0.0058	0.0169
	(0.125)	(0.129)	(0.067)
ln(Output share)	-0.7274	0.1371	-0.1482*
	(1.570)	(0.529)	(0.080)
ln(per capita Real GDP)	0.3915	0.0145	0.0549
	(1.597)	(0.265)	(0.104)
Demeaned growth	0.0062	-0.0296***	0.0066
	(0.011)	(0.010)	(0.009)
Trilemma stability	-0.0559***	-0.0611*	-0.0451**
	(0.019)	(0.034)	(0.019)
ln(Market capitalization)	0.0964	-0.1125	0.0413
	(0.118)	(0.106)	(0.099)
ln(Turnover)	0.1282**	0.1001*	0.1831***
	(0.063)	(0.059)	(0.059)
Crisis	0.0771	0.1463***	0.0935*
	(0.054)	(0.039)	(0.051)
Inflation	-0.0065*	-0.0077**	-0.0091***
	(0.004)	(0.004)	(0.003)
H_{01}	7.57	3.49	8.70
$P > \chi^2$	0.2713	0.7455	0.1912
H_{02}	2.38	0.76	1.10
$P > \chi^2$	0.3035	0.6854	0.5757
Observations	449	449	449
Countries	28	28	28
R^2	0.625	0.509	0.380
country dummies	yes	yes	no
time dummies	yes	no	yes

is, comovement again appears to be high when GDP growth is low and in periods of crisis. Additionally, as was the case in the original full regressions, none of the variables that might be considered indicative of property rights or country risk are significant in any of these full regressions. Finally, neither of the joint hypotheses given at the bottom of the table can be rejected. None of these multivariate regressions provide support for the idea that property rights and country risk are important in explaining variation in comovement; instead trilemma policy stability, crises, and turnover are important.

5 Conclusions

In this paper, we use a simple gauge of return comovement that relies only on a variance decomposition of the market return, and not on any particular model of returns to explore the behavior of stock return comovement.

Applying the simple gauge to a recent international panel, we observe that return comovement is not, as had once been thought, tied to whether a country is rich or poor. Nor is it tightly tied to typical measures of investor protection and country risk. Instead, it is more closely related to shorter-term variables, including international macroeconomic policy stability. These variables help to explain the dramatic changes in the relative rankings of countries' return comovement over the last several decades.

We also challenge findings that attribute the long-term downward trend in U.S. comovement to compositional factors. We find that the trend appears even in a sample that has a nearly constant composition. Finally, we attribute much of the recent U.S. comovement uptick to cyclical factors, rather than to a reversal in the long trend observed over much of the twentieth century.

Many existing cross-country comparisons of return comovement highlight differences in the quality of the markets' financial institutions – differences that correspond to variation in informational efficiency. Our findings suggest that institutional quality and its link to informational efficiency should be considered in a broad context, one that includes the stability of macroeconomic institutions as well as financial ones. Future firm-level research linking return comovement to other variables, such as analyst following, foreign ownership, corporate structure, and corporate culture, would benefit from also considering interactions with broader and more transitory economic conditions, such as international macroeconomic policy instability.

References

Allen, L. and T. G. Bali (2007). Cyclicality in catastrophic and operational risk measurements. *Journal of Banking and Finance 31*(4), 1191–1235.

Alves, P., K. Peasnell, and P. Taylor (2010). The use of the R^2 as a measure of firm-specific information: A cross-country critique. *Journal of Business Finance and Accounting 37*(1-2), 1–26.

Barberis, N. and A. Shleifer (2003, May). Style investing. *Journal of Financial Economics 68*(2), 161–199.

Barberis, N., A. Shleifer, and J. Wurgler (2005). Comovement. *Journal of Financial Economics 75*(2), 283–317.

Baum, C. F. (2006). *An Introduction to Modern Econometrics Using Stata.* Stata press.

Bekaert, G., R. J. Hodrick, and X. Zhang (2012). Aggregate idiosyncratic volatility. *Journal of Financial and Quantitative Analysis 47*(06), 1155–1185.

Brandt, M., A. Brav, J. R. Graham, and A. Kumar (2010). The idiosyncratic volatility puzzle: Time trend or speculative episodes? *Review of Financial Studies 23*, 863–899.

Brockman, P., I. Liebenberg, and M. Schutte (2010). Comovement, information production, and the business cycle. *Journal of Financial Economics 97*(1), 107–129.

Brown, G. and N. Kapadia (2007). Firm-specific risk and equity market development. *Journal of Financial Economics 84*(2), 358–388.

Butterworth, S. (1930). On the theory of filter amplifiers. *Wireless Engineer 7*(6), 536–541.

Carhart, M. (1997). On persistence in mutual fund performance. *Journal of Finance 52*, 57–82.

Chan, K. and A. Hameed (2006, 4). Stock price synchronicity and analyst coverage in emerging markets. *Journal of Financial Economics 80*(1), 115–147.

Chan, K., A. Hameed, and W. Kang (2013). Stock price synchronicity and liquidity. *Journal of Financial Markets 16*(3), 414 – 438.

Chen, H., V. Singal, and R. F. Whitelaw (2016). Comovement revisited. *Journal of Financial Economics*, forthcoming.

Claessens, S. and Y. Yafeh (2013). Comovement of Newly Added Stocks with National Market Indices: Evidence from Around the World. *Review of Finance 17*(1), 203–227.

Dasgupta, S., J. Gan, and N. Gao (2010). Transparency, price informativeness, and stock return synchronicity: Theory and evidence. *Journal of Financial and Quantitative Analysis 45*(5), 1189–1220.

De Long, J. B., A. Shleifer, L. H. Summers, and R. J. Waldmann (1990). Noise Trader Risk in Financial Markets. *Journal of Political Economy 98*(4), 703–38.

Djankov, S., R. La Porta, F. L. de Silanes, and A. Shleifer (2008). The law and economics of self-dealing. *Journal of Financial Economics 88*(3), 430 – 465. Darden - Conference Volume: Capital Raising in Emerging Economies.

Fama, E. and K. French (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics 33*, 3–56.

Garcia, R., D. Mantilla-Garcia, and L. Martellini (2013). A model-free measure of aggregate idiosyncratic volatility and the prediction of market returns. *CIRANO - Scientific Publication* (2013s-01).

Gassen, J., R. LaFond, H. A. Skaife, and D. Veenman (2015). Illiquidity and R^2.

Goetzmann, W. N., L. Li, and K. G. Rouwenhorst (2005, January). Long-Term Global Market Correlations. *The Journal of Business 78*(1), 1–38.

Goyal, A. and P. Santa-Clara (2003). Idiosyncratic risk matters! *The Journal of Finance 58*(3), 975–1008.

Hameed, A., R. Morck, J. Shen, and B. Yeung (2015). Information, analysts, and stock return comovement. *Review of Financial Studies 28*(11), 3153–3187.

Hodrick, R. J. and E. C. Prescott (1997). Postwar us business cycles: an empirical investigation. *Journal of Money, Credit, and Banking*, 1–16.

Jin, L. and S. C. Myers (2006). R^2 around the world: New theory and new tests. *Journal of Financial Economics 79*(2), 257 – 292.

Karolyi, G. A., K.-H. Lee, and M. A. Van Dijk (2012). Understanding commonality in liquidity around the world. *Journal of Financial Economics 105*(1), 82–112.

Kaufmann, D., A. Kraay, and M. Mastruzzi (2010, September). The worldwide governance indicators: Methodology and analytical issues. *World Bank Policy Research Working Paper* (5430).

Kumar, A. and C. Lee (2006). Retail investor sentiment and return comovements. *Journal of Finance 61*(5), 2451–2486.

Kumar, A., J. K. Page, and O. G. Spalt (2016). Gambling and comovement. *Journal of Financial and Quantitative Analysis 51*(01), 85–111.

Mele, A. (2007). Asymmetric stock market volatility and the cyclical behavior of expected returns. *Journal of Financial Economics 86*(2), 446–478.

Morck, R., B. Yeung, and W. Yu (2000). The information content of stock markets: why do emerging markets have synchronous stock price movements? *Journal of Financial Economics 58*(1), 215–260.

Morck, R., B. Yeung, and W. Yu (2013). R-squared and the economy. Technical report, National Bureau of Economic Research.

Popper, H., A. Mandilaras, and G. Bird (2013). Trilemma stability and international macroeconomic archetypes. *European Economic Review 64*, 181 – 193.

Reinhart, C. M. and K. S. Rogoff (2011, August). From financial crash to debt crisis. *American Economic Review 101*(5), 1676–1706.

Roll, R. (1988). R^2. *The Journal of Finance 43*(3), 541–566.

Russell, T. and R. H. Thaler (1987). The Relevance of Quasi Rationality in Competitive Markets: Reply. *American Economic Review 77*(3), 499–501.

Spamann, H. (2010). The antidirector rights index revisited. *Review of Financial Studies 23*, 467–486.

StataCorp. (2013). *Stata Statistical Software: Release 13.* College Station, TX.

Veldkamp, L. L. (2005). Slow boom, sudden crash. *Journal of Economic Theory 124*(2), 230–257.

Veldkamp, L. L. (2006). Information markets and the comovement of asset prices. *The Review of Economic Studies 73*(3), 823–845.

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