The International Commonality of Idiosyncratic Variances

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Abstract

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JEL Classification: F39, G12, G15

Keywords: return idiosyncratic variance, cash flow idiosyncratic variance, global commonality, countercyclical, state variables.

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Abstract

We establish several facts about the aggregate idiosyncratic variances of equity markets in 23 countries. First, we document strong global commonality in aggregate idiosyncratic variances of returns and cash flows across countries. Second, the global and country level common factors of the idiosyncratic return and cash flow variances are mostly but not always countercyclical. Third, the time series variation of these common factors in idiosyncratic variances of returns and cash flows are highly correlated. Global aggregate idiosyncratic return variances are also significantly related to variables capturing aggregate discount rate variation, and growth opportunities. These stylized facts are mostly inconsistent with extant theories regarding the time variation in idiosyncratic return variances.

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1. Introduction

Idiosyncratic return variances represent the uncertainty in returns that cannot be explained by systematic risk factors. Traditional asset pricing theories normally ignore idiosyncratic return variances, under the assumption that idiosyncratic risk should not affect asset prices. However, recently there has been a resurgence of interest in the dynamics and economic effects of idiosyncratic variances in both economics and finance. For instance, Campbell, Lettau, Malkiel, and Xu (2001) document an upward trend in idiosyncratic variances, generating a voluminous literature on potential explanations for the trend (see e.g. Irvine and Pontiff (2009) and Wei and Zhang (2006)), but additional empirical work cast doubt on these findings (see e.g. Brandt, Brav, Graham, and Kumar (2010) and Bekaert, Hodrick, and Zhang (2012)). Duarte, Kamara, Siegel, and Sun (2014) and Herskovic, Kelly, Lustig, and Van Nieuwerbugh (2016) identify a common factor in the idiosyncratic volatility of individual firms, showing it to be priced in the cross section. Ang, Hodrick, Xing, and Zhang (2006, 2009) find that firms with higher idiosyncratic variances have lower returns, in the U.S. and in all developed countries, with Bali and Cakici (2008) questioning the robustness of the U.S. results. Bali, Cakici, Yan, and Zhang (2005) show that idiosyncratic volatility, contrary to previous claims, does not robustly predict aggregate stock returns.

Idiosyncratic variances have also become important in economics more generally. For example, Bartram, Brown, and Stulz (2012) and Brown and Kapadia (2007) link idiosyncratic volatility to financial development over time and across countries. Comin and Mulani (2009) link the dynamics of idiosyncratic volatility to macroeconomic volatility. Finally, there is a rapidly growing macroeconomic literature on the effect of uncertainty shocks on real economic activity and business cycles (see e.g. Bloom (2009) and Christiano, Motto, and Rostagno (2014)).[1] Changes in aggregate uncertainty are now considered one of the driving forces of business cycles.

At this point, little is known about idiosyncratic variances in global capital markets. In this article, we study the dynamics, determinants, and commonality of idiosyncratic variances in 23 developed markets using individual stock return and cash flow data. Our analysis goes significantly beyond extant work on the G7 countries in Guo and Savickas (2008) and Bekaert, Hodrick, and Zhang (2012).

We start by establishing several stylized facts. First, we extend the analysis of Duarte et al. (2014) and Herskovic et al. (2016) to an international setting. Not only do we find an important common component in idiosyncratic return variances across individual firms in 23 countries, we also find that adding the global idiosyncratic variance to its country specific counterpart doubles the explanatory power for firm's idiosyncratic variances.

The second stylized fact is therefore not a surprise: we document strong commonality in aggregate idiosyncratic return variances across countries. Given that idiosyncratic variances by definition reflect "non-systematic" variation, the strength of the relationship is surprising however. For the G7 countries, for example, the average correlation of country level aggregate idiosyncratic return variances is 60.7%, while the average correlation of country level market returns for the same set of countries is 60.4%. One simplistic explanation is that the existing factor models used to remove systematic components from returns are missing an internationally correlated risk factor which features conditional heteroskedasticity. However, the results are robust to alternative models

[1] While the economic models seem to call for a measure of idiosyncratic volatility, macroeconomists take various short-cuts in its measurement, using aggregate uncertainty measures or measures of cross-sectional dispersion.

to remove systematic risk, and the residual returns themselves do not appear correlated across countries.

It is, however, conceivable that cash flow fundamentals may constitute an explanation. Cao, Simin, and Zhao (2008) propose a simple model in which idiosyncratic volatility is related to the growth options available to managers. They argue that aggregate idiosyncratic volatility is related to the level and variance of growth options. Alternatively, Pastor and Veronesi (2003, 2006) formulate asset pricing models with learning in which uncertainty about a firm's profitability increases idiosyncratic uncertainty and risk. To the extent that growth options and profitability uncertainty are correlated across countries, these variables could help account for the correlation patterns observed in the data.

Our third stylized fact establishes that there is indeed an important global common component in aggregate idiosyncratic cash flow variances. This part of the paper introduces a new methodology to compute idiosyncratic cash flow variability which we proxy with the variability in the return on equity. Additionally, we show that the time series variation of aggregate idiosyncratic return variances is significantly related to variation in idiosyncratic cash flow variability.

Our fourth stylized fact regards cyclicality: the idiosyncratic return and cash flow variances and their global common components are predominantly but not always countercyclical. The countercyclicality makes it more difficult for the models of Cao, Simin, and Zhao (2008) and Pastor and Veronesi (2003, 2006) to explain the data. Cao, Simin, and Zhao (2008) link growth options to a price variable (more specifically, the market to book value of assets), whereas Pastor and Veronesi point out that, under certain assumptions, the market to book ratio of a firm is increasing in idiosyncratic uncertainty, because of the convex relation between future payoffs and variability. That is, in both theories, idiosyncratic volatility would be high in good times, inconsistent with our overall countercyclical pattern. A distinct possibility to explain a countercyclical pattern is that in recessions, aggregate uncertainty and risk aversion increase, leading to increased global discount rates, and increased overall volatility.[2] While increased aggregate uncertainty first and foremost feeds into the volatilities of systematic risk factors, as long as simple factor models do not fully capture potential non-linear pricing effects, idiosyncratic volatility likely increases as well. Increases in aggregate uncertainty are likely correlated with differences of opinion about the idiosyncratic profitability of firms, providing another channel to increase idiosyncratic variability in bad times.

To interpret the puzzling empirical dynamics of idiosyncratic volatilities, we develop a simple pricing model with stochastic discount rates, stochastic expected earnings growth and growth options, and time-varying uncertainty. It suggests that the dynamics of a firm's return variability are affected by five key state variables: the aggregate discount rate, the aggregate conditional market variance, which we decompose into discount rate and aggregate earnings uncertainty, expected earnings growth, and idiosyncratic earnings variability. Because the global aggregate component is so important, we estimate the model at the aggregate level. We find that the state variables explain a substantial part of the time series variation of aggregate idiosyncratic variances, with a linear model delivering R^2s of over 60%. The most important state variable is indeed aggregate idiosyncratic variability in the return on equity (ROE), but the discount rate and growth opportunity variables also explain a non-trivial fraction of the aggregate idiosyncratic return variances. We therefore confirm the Cao, Simin, and Zhao (2008) results, but our growth opportunity measure is constructed differently and is verified to indeed predict future earnings

[2] That stock market volatility is countercyclical is well documented beginning for example with Schwert (1989).

growth. As Bekaert, Hodrick, and Zhang (2012) and Bartram, Brown, and Stulz (2017) do, we also find a positive relation between the conditional market return variance (market risk) and idiosyncratic return variability, but the relation is weak.

The paper is organized as follows. Section 2 describes the data we use. In Section 3, we establish the commonality and dynamics of idiosyncratic variances of returns. In Section 4, we establish the commonality and dynamics of idiosyncratic variances of cash flows. We examine the link between idiosyncratic return and cash flow variances in Section 5. We describe and estimate a simple pricing model to investigate the determinants of the global aggregate idiosyncratic return variance. Section 6 concludes.

2. Data

Our sample covers 23 MSCI developed countries, and the sample period is January 1980 to December 2015. For U.S. firms, we obtain return data from CRSP and accounting data from Compustat. For non-U.S. firms, we obtain returns and market values in USD from Datastream and accounting data from Worldscope. We apply the following filters to the data: 1) We remove firm-quarters with market capitalization below USD1 million at the quarter end; 2) We remove firm-quarters with negative total asset at the quarter end; 3) We remove firm-months when monthly returns are less than -100% or larger than 1000%; 4) Because accounting data have many outliers, we winsorize firm-month book-to-market ratios and firm-quarter ROEs at the 1% and 99% levels.

We use ROE as our cash flow variable as in Vuolteenaho (2002). The ROE is defined as earnings divided by last period's book equity**.** For the U.S. sample, we obtain quarterly "Net Income" (NIQ) and the "Book Value of Common Equity" (CEQQ) from the Compustat quarterly file. To mitigate potential seasonality in the ROE data, each quarter, we compute an annualized

ROE as the trailing 4-quarter net income divided by common equity at the beginning of the period. Thus, for firm *i* at quarter *q*, annualized ROE is computed as follows:

$$ROE_{iq} = \frac{\sum_{t=q-3}^{q} Net\ Income_{i,t}}{Common\ Equity_{i,q-4}}. \quad (1)$$

For firms outside of the U.S., we compute ROE by dividing annual "Net Income" (WC01751) by the "Book Value of Common Equity" (WC03501). Notice that DataStream's coverage of non-U.S. firms' accounting data, from Worldscope, can be sporadic at the beginning of the sample. For instance, at the beginning of the sample period, only annual data on the accounting variables are available from Worldscope. Because our data only covers 35 years, we choose to use overlapping quarterly data to have a reasonable number of observations in the time series. When the quarterly data are available, we compute ROE for non-U.S. firms as in equation (1). When only annual data are available, we transform the annual data to quarterly data by computing ROE for firm i at quarter q in year y as follows:

$$ROE_{iq} = \frac{\frac{q}{4} NetIncome_{i,y} + (1-\frac{q}{4}) NetIncome_{i,y-1}}{CommonEquity_{i,y-1}}. \quad (2)$$

That is, we approximate quarterly observations of net income, using annual net income, as a weighted average of the annual net income from the previous year, y-1, and the current year y.[3] Following Vuolteenaho (2002), we treat ROE as missing if common equity is non-positive or ROE is below -100%.

Summary statistics for our sample firms are reported in Table 1. For each country in our sample, we present the time-series average of the cross-sectional median for the following data

[3] For robustness, we also compute all ROE measures using only annual data. In addition, we consider an alternative transformation by computing quarterly observations of annual ROE as weighted average of the annual ROE from the current and previous years: $ROE_{i,q} = q/4 * ROE_{i,y-1} + (4-q)/4 * ROE_{i,y-1}$. The results are generally similar to what we report in the main text.

from the firm-quarter panel: the number of firms, their market capitalization, their stock market return, and their ROE. The U.S., Japan, and the U.K. have the largest number of firms, with each having over 1,000 publicly listed firms, whereas 6 countries including Ireland, Portugal, Austria, New Zealand, Belgium and Finland have fewer than 100 public firms. The average median firm market capitalizations range between $80 million (Denmark) and $481 million (Spain). The average median annual returns are between 3.84% (Portugal) and 19.03% (Ireland). The average median annual ROE is the highest in the Netherlands at 12.28%, and the lowest in Australia at 4.09%.

3. Commonality in Idiosyncratic Return Variances

3.1 Defining Idiosyncratic Return Variances

To compute firm level idiosyncratic variances, we need to remove systematic risks from stock returns. Bekaert, Hodrick, and Zhang (2009) examine different specifications of asset pricing models, and find that the best performing model for describing the comovement among international assets is the world-local Fama-French (1996) factor model, which includes market, size, and value factors from the global and local capital markets. Therefore, we estimate the following specification using daily excess returns for each firm i within each quarter q:

$$\begin{aligned} exret_{it} = \alpha &+ \beta_{iq}^{WMKT} WMKT_t + \beta_{iq}^{WSMB} WSMB_t + \beta_{iq}^{WHML} WHML_t \\ &+ \beta_{iq}^{MKT} MKT_t + \beta_{iq}^{SMB} SMB_t + \beta_{iq}^{HML} HML_t + u_{it}, \quad t \in q. \end{aligned} \tag{3}$$

The variables MKT, SMB, and HML are the country level market, size, and value factors, respectively; the variables WMKT, WSMB, and WHML are the global market, size, and value factors, respectively, computed as the value-weighted average of the country level factors. The details for constructing these pricing factors are discussed in Internet Appendix.

After the betas are estimated for each firm and each quarter, we obtain the time-series of firm-specific residuals, $u_{i,t}$. For robustness, we calculate the idiosyncratic return variances in two ways. We first compute a standard "spot" variance estimate as the sample variance of $u_{i,t}$ in each quarter *q*:

$$IVRET_{iq}^{SPOT} = \frac{1}{T-1} \sum_{t \in q} u_{it}^2, \tag{4}$$

where T is the number of days in the quarter. The spot variance quickly reflects the fluctuation in the idiosyncratic return variances in real time. Our second estimate of idiosyncratic variance uses a kernel weighted average of $IVRET_{iq}^{SPOT}$:

$$IVRET_{iq}^{KERNEL} = \sum_{k=-10}^{10} w_k IVRET_{i,q+k}^{SPOT}, \tag{5}$$

where the kernel is Gaussian with a bandwidth of 4 quarters:

$$w_k = \frac{w_k^*}{\sum_{k=-10}^{10} w_k^*}, and\ w_k^* = \frac{1}{4 \times \sqrt{2\pi}} e^{-\frac{\left(\frac{k}{4}\right)^2}{2}}. \tag{6}$$

That is, the kernel estimate for quarter *q* puts the most weight on quarter *q*'s spot variance (the weight is 0.101), but also uses "nearby" spot variances up to 10 quarters before and after the current quarter, with the lowest weight being 0.004. We compute the kernel variances for two reasons. First, in contrast to the spot variance, we also want to examine the dynamics of a smoothed version of the idiosyncratic variance. Second, in later sections, we compute the variances of quarterly cash flow variables, which would cover a period of 20 quarters. The kernel estimation should be more comparable to these cash flow variances. All return variance measures are annualized by multiplying by 250.

We report the time series average of the cross-sectional median spot and kernel estimations of IVRET for each country in Table 2, Panel A. The average median spot idiosyncratic return variance is the highest for Australia at 0.189, and lowest for Austria at 0.053 while the U.S. level is at 0.160. For the kernel idiosyncratic return variance, they range between 0.068(Switzerland) and 0.257 (Australia), showing similar patterns as the spot variance. The global averages for the spot and kernel variances are 0.112 and 0.135, respectively. The correlation between the spot and kernel variances is 77%.

3.2 Commonality in Firm Level Idiosyncratic Return Variances

While most of the idiosyncratic variance literature has focused on the time series dynamics of aggregate idiosyncratic variances, Duarte et al. (2014) and Herskovic et al. (2016) have identified the importance of a common factor in firm specific idiosyncratic variances in the U.S. In this section, we first extend their results to 23 countries and then examine the relative importance of local and global factors in explaining firm's idiosyncratic variances. The results are reported in Table 2, Panel B. For each country in each non-overlapping period (1982-1995, 1996-2005, and 2006-2015, respectively) we conduct a principal component analysis using all firm level IVRETs, and we calculate the percentage of variance explained by the first principal component (PC henceforth).

In column 1 of Table 2, Panel B, we present the time-series median of the variance explained by the first PC by country. For the U.S., the first principal component explains 61% of the variation across firm-specific IVRETs. This number varies between 42.3% for Germany and 67.6% for Ireland, and the average across countries is 54.8%. It is clear that there is substantial comovement among firm level idiosyncratic variances within each of the developed countries.

Next, we examine how firm-specific idiosyncratic variances are related to country and global level aggregate idiosyncratic variances to gauge whether the commonality is related to the aggregate measures. We first define the country aggregate idiosyncratic variance measure, $IVRET_q^c$, for country c in quarter q, as the value weighted average of the firm level $IVRET_{iq}$ within the country. Similarly, we compute the global aggregate idiosyncratic variance measure, $IVRET_q^g$, as the value-weighted average of country level $IVRET_q^c$. The time-series means and standard deviations for the country and global aggregate idiosyncratic variance measures are reported in the second and third columns of the Table 2, Panel B. The country aggregate idiosyncratic variances range between 0.033 (Switzerland) and 0.081 (Japan), and they generally are less volatile than the firm level idiosyncratic variances. The global aggregate idiosyncratic variance has an average of 0.072 with a standard deviation of 0.028.

We use the country and global aggregate idiosyncratic variance to explain firm level idiosyncratic variance $IVRET_{iq}$. In the fourth column of Table 2, Panel B, we report the median R^2 of regressing firm level idiosyncratic variance on country aggregate idiosyncratic variance only. The median R^2 ranges between 0.213 (Portugal) and 0.531 (Japan), and the U.S. median R^2 is 0.392.[4] These results show that the country aggregate idiosyncratic variance is an important driver of firm level idiosyncratic variances.

We then regress the firm-level idiosyncratic variances on both country and global level aggregate idiosyncratic variances. The fifth column of Table 2, Panel B reports the median R^2 for these regressions. The R^2s almost double when the global aggregate idiosyncratic variance is added to the regression, and they now range between 0.490 (Spain) and 0.711 (Finland), with the U.S. at 0.644. Clearly, the commonality of idiosyncratic variances at the firm level could be driven by both country-level and global aggregate idiosyncratic variances, with both factors contributing about equally to the explanatory power. In fact, the ratio of the median R^2 in the domestic factor

[4] The U.S. results in Duarte et al. (2014) and Herskovic et al. (2016) are comparable despite using a slightly different methodology. Duarte et al. (2014) use the log of monthly idiosyncratic volatility and find that a principal component explains a third of the variation. Herskovic et al. (2016) use annual idiosyncratic volatility and regress on the equally weighted average, finding an R^2 of 0.35.

regression relative to median R^2 in the regression also featuring the global factor, varies between 40.7% for Hong Kong and 85.5% for Japan. Using the R^2s averaged over countries, the ratio is 59.1%. Alternatively, we estimate a pooled regression of firm-specific idiosyncratic variances on the global idiosyncratic variance and the corresponding country-specific variances, and we find:

$$IVRET_{it}^{c} = \alpha_c + \underset{(3.18)}{1.712}\, IVRET_t^{g} + \underset{(6.00)}{3.240}\, IVRET_t^{c} + \varepsilon_{it}, \tag{7}$$

where α_c represents a country fixed effect, and t-statistics are in parentheses. For this exercise, we orthogonalize the country-specific variances with respect to the global idiosyncratic variance and cluster standard errors by country. Clearly, both the global and country-specific effects are highly statistically significant. The R^2 is 0.106.

3.3 Commonality in Country Aggregate Idiosyncratic Variances

The previous section shows that firm level idiosyncratic variances have common factors, and that both country and global level idiosyncratic variances explain a large part of the firm level idiosyncratic variances. The importance of the global component in our regressions suggests that there is commonality in country aggregate idiosyncratic variances. This fact would naturally steer us towards global pricing models to explain these stylized facts.

To measure the commonality among country idiosyncratic variances, we first compute the pairwise correlation between the countries for each country, and we report the mean and the interquartile range in Table 3, Panel A. For comparison, we also compute the average pairwise correlations for the market portfolio quarterly returns. In the case of the U.S., the average correlation with other country's aggregate idiosyncratic variances is 0.633, and the interquartile range is 0.448 to 0.851, while the average correlation with other country's market portfolio returns is 0.609, and the interquartile range is 0.548 to 0.686. That is to say, comovement among country aggregate idiosyncratic variances is of the same order of magnitude as return comovements. Given that the return residuals themselves are uncorrelated, it is surprising to see such high cross-country correlations in their second movements. Averaging over all countries, the average correlation of idiosyncratic variances is actually 0.555, slightly lower than the average correlation of returns at 0.599. The pattern holds for most but not all countries. For example, the return correlations for Finland and Portugal are much higher than the idiosyncratic variance correlations. Yet, idiosyncratic variance correlations are on average higher (lower) than return correlations in 11 (12) countries.

Can this surprising comovement in country aggregate idiosyncratic variances across countries be captured by the global aggregate idiosyncratic variance? To address this issue, we regress the country aggregate idiosyncratic variances on the global counterpart, and we report the results in the remaining columns of Table 3. All country level aggregate idiosyncratic variances load positively on the global measure, with coefficients mostly between 0.3 and 1.3. The average coefficient is 0.596. The t-statistics are highly significant, except for Finland and Portugal and the R^2s are on average 0.521. Clearly, the global aggregate idiosyncratic variance explains a large part of the commonality in country aggregate idiosyncratic variances. In the Online Appendix Table OA1, we show that the global component is instrumental in driving the high cross-country correlations in idiosyncratic variances, by examining the cross-country correlations of the residuals in the above regression. The average correlation of the residuals invariably drops for all countries, with the interquartile range straddling zero for all but three countries. The average correlation across all countries of our sample falls to 0.154, and for the G7 countries, it is 0.012.

It is conceivable that the relation between global and country aggregate idiosyncratic variances is affected by the country's financial integration status. We used data on de jure financial integration from Bekaert, Harvey, Kiguel, and Wang (2016) to verify this conjecture, but did not find statistically significant results, possibly because the degree of integration is already very high for most of the 23 developed countries during most of our sample period. These results are included in Table 3, Panel B.

3.4 Cyclicality of Idiosyncratic Variances

The modeling approaches of Cao, Simin and Zhao (2008) and Pastor and Veronesi (2003, 2006) both suggest that the idiosyncratic variances are pro-cyclical, meaning they are high in good economic times, but low during recessions. We now examine the cyclical time-series properties of the aggregate idiosyncratic variances in our global sample.

To measure business cycles, we focus on GDP growth, as in Campbell, Lettau, Malkiel, and Xu (2001) and others. We obtain seasonally adjusted nominal GDP and GDP deflator data from Datastream for each country. We first compute real GDP by deflating nominal GDP using the GDP deflator. Next, we calculate the annualized growth rate of real GDP for country *c* in quarter *q* as follows:

$$\Delta GDP_q^c = \frac{\sum_{k=0}^{3} GDP_{q-k}^c}{\sum_{k=4}^{7} GDP_{q-k}^c} - 1. \tag{8}$$

We compute global GDP growth similarly, using OECD total GDP and the corresponding GDP deflator. All GDP growth rates are transformed using kernel method.

To identify whether country aggregate idiosyncratic return variances are pro-cyclical or counter-cyclical, we regress aggregate idiosyncratic variances on various measures of GDP growth. To separate the influences of global GDP growth and country GDP growth, we estimate country-specific GDP growth as the orthogonal component when we regress country GDP growth on global GDP growth. Thus, country-specific GDP growth captures information that is not contained in global GDP growth. In Table 4, Panel A, we report the results of bivariate regressions, regressing the country specific idiosyncratic variances on both the global and country-specific cycle. We observe a clear pattern of counter-cyclicality: out of the 23 countries, 17 have negative coefficients on global GDP growth, and 14 of these coefficients are statistically significant. In two cases where global GDP growth receives a positive coefficient, country-specific GDP receives a negative and significant coefficient. There are 4 countries (France, Italy, Spain and the U.S.) where the coefficients on global and country-specific GDP growth are positive, indicating pro-cyclical idiosyncratic variances, which is consistent with the models of Cao et al. (2008) and Pastor and Veronesi (2003, 2006).[5] Overall, the R^2's range between essentially zero for Norway and 0.491 for New Zealand, indicating that the country aggregate idiosyncratic variances are quite correlated with GDP growth measures.

To provide a parsimonious description of the relation between GDP growth and idiosyncratic return variances, we estimate several panel regressions that constrain the parameters to be the same across countries. We report the panel regression results in Table 4, Panel B. In the first specification, we only include the contemporaneous GDP growths from the local and global markets. This regression includes country fixed effects, and the standard errors are clustered by country. We find that IVRET exhibits counter-cyclicality, especially with respect to global GDP growth. The coefficient on contemporaneous global GDP growth is negative and significant, with a coefficient of -0.544 and a t-statistic of -2.70.

One business cycle normally lasts several years, and the economy's fundamentals vary between troughs and peaks. Meanwhile, both country and global GDP growth and country and

[5] When using equally weighted idiosyncratic variances (see the Online Appendix Table OA2), the countercyclicality is even more pronounced; global GDP growth has a negative coefficient for 21 out of 23 countries, being statistically significant in 18. When we only consider one GDP growth measure, it turns out that global GDP growth has stronger explanatory power for country aggregate idiosyncratic variances than does country GDP growth. The coefficients are overwhelmingly negative.

global idiosyncratic variances show substantial autocorrelation. It is important to understand the dynamics of the relation between the GDP growth and idiosyncratic variances. In the second specification, to allow previous year GDP growth to affect next year idiosyncratic variance, we only include the GDP growth from previous year. We do not find any strong relationships between IVRET and previous year GDP growth. The coefficient on global (country-specific) GDP growth rate is positive (negative), but these coefficients are not statistically significant.

In the third regression, we consider the feedback effect of current idiosyncratic variance on future GDP growth one year ahead. We find that IVRET is negatively related to the one-year future GDP growth rate, especially the growth rate at the global level.

In the last specification, we include GDP growth from 3 different times, the previous year, the current year, and the next year. The global aggregate IVRET is negatively related with contemporaneous global GDP growth, with a coefficient of -1.352 and t-statistic of -7.18. The negative relationship also exists for one-year future GDP growth rate at both the global and country level, but the magnitudes of the coefficients are smaller. Among the significant effects, it is striking that idiosyncratic variances are negatively correlated with both future country-specific and global GDP growth. Several recent macro papers (see Bloom, 2009; Christiano, Motto, and Rostagno, 2014) have suggested that "uncertainty" is negatively linked to future economic activity. While these articles do not consider idiosyncratic variances to measure economic uncertainty, this variable may be closer to the theoretical concept these articles have in mind, than, for example, the VIX (used in Bloom's article), which is an aggregate implied volatility index affected by aggregate non-diversifiable risk and risk aversion (see Bekaert, Hoerova, and Lo Duca, 2013). While the contemporaneous global effect is statistically significant and negative, there is also a positive significant association between past global GDP growth and current idiosyncratic variances.

We conclude that idiosyncratic variances are mostly countercyclical, especially with respect to the world business cycle. However, given the relatively low R^2 at the country level and in the panel regressions, business cycle variation might not be the dominant force behind the high correlations across idiosyncratic variances.

4. Commonality in Idiosyncratic Variances of Firm Cash Flows

4.1 Defining Idiosyncratic Variances of Cash Flows

One possible fundamental source of comovement across idiosyncratic variances is the comovement of idiosyncratic cash flow variances; a channel we make precise in the pricing model of Section 5. While there has been some research linking the time variation of U.S. aggregate idiosyncratic return variances to cash flow variances (see Wei and Zhang (2006), Bekaert, Hodrick, and Zhang (2012), Herskovic et al. (2016), and Bartram, Brown, and Stulz, (2017)), there has been virtually no research on this link in an international context.[6] Moreover, thus far, the literature has only employed very crude measures to compute idiosyncratic variances of cash flow variables. Irvine and Pontiff (2009) use a pooled AR(3) model for firms' earnings per share to create earnings innovations, and then use the cross-sectional variance of these innovations as a fundamental idiosyncratic risk variable. Zhang (2010) and Bekaert, Hodrick, and Zhang (2012) use the value-weighted firm level time series variance of return on equity computed using the last 12 quarters of data, and the cross-sectional variance of return on equity. Bartram et al. (2017) use the square of the change in cash flows (various measures) for firm *i* minus the value weighted cash flow change across all firms. These approaches make obvious strong implicit assumptions, such as unit betas with respect to simple aggregate benchmarks, to compute idiosyncratic variances.

[6] Bekaert, Hodrick, and Zhang (2012)'s last section provides some preliminary analysis for the G7 countries.

In this section, we develop a new model to compute idiosyncratic variances of cash flow variables. A first step in this endeavor is to determine idiosyncratic cash flow shocks, without the strong assumptions implicit in the existing methodologies. We do so using a linear factor model that mimics the approach taken in Bekaert, Hodrick, and Zhang (2009) to explain comovements of international stock returns. The model combines local and global Fama and French (1993) factors, that is factors capturing the market, size, and value dimensions, not of reruns but of firm level ROEs.

Parallel to the asset pricing literature on returns, we first construct the country market factor of the ROE as the value-weighted ROE of all firms in the country. For the size and value ROE factors, we first sort all stocks within the country into 3 groups based on their capitalizations and the book-to-market (B/M) ratio, separately, for each country at the end of each June. The size ROE factor is the difference between value-weighted ROE of firms in the smallest 1/3 of firms and largest 1/3 of firms. The value ROE factor is the difference between the value-weighted ROE of firms in the highest and lowest 1/3 of firms ranked by B/M. Global ROE factors are value-weighted country-level ROE factors.

Table 5 reports time series summary statistics for the country and global ROE factors. The ROE market factors are on average positive for all countries, ranging between 7.17% (Japan) to 19.35% (U.K.). Interestingly, the country size factors are all negative, ranging between -3.77% (Japan) and -22.38% (U.S.), indicating small firms have lower ROE than large firms. The value factors are also all negative ranging between -23.34% (U.K.) and -4.81% (Japan), suggesting value firms have lower ROEs than growth firms. Thus, the usual observed small cap and value risk premiums seem to be accompanied by small cap and value firms earning lower ROEs. One possibility is that such firms move together because of distress risk, reflected in their low ROEs, and therefore require a risk premium (see Chan and Chen, 1991 for the size premium, and Fama and French, 1996; Vassalou and Xing, 2004 for the value premium). The standard deviations of the size and B/M ROE factors are slightly higher than the volatility of the market ROE factor.[7]

We use these ROE factors to estimate a factor model for firm-specific ROE's using both the country-specific and global factors. Given the low frequency nature of the accounting data, rather than estimating the model firm by firm with rolling windows, we estimate the following panel model for each country:

$$ROE_{iq} = \left(\alpha_{0,i} + a_1 size_{i,q-1} + a_2 BM_{i,q-1}\right) + \left(b_0 + b_1 size_{i,q-1} + b_2 BM_{i,q-1}\right) WMKT_q^{ROE} + \left(c_0 + c_1 size_{i,q-1} + c_2 BM_{i,q-1}\right) WSMB_q^{ROE} + \left(d_0 + d_1 size_{i,q-1} + d_2 BM_{i,q-1}\right) WHML_q^{ROE} + \left(e_0 + e_1 size_{i,q-1} + e_2 BM_{i,q-1}\right) MKT_{c,q}^{ROE} + \left(f_0 + f_1 size_{i,q-1} + f_2 BM_{i,q-1}\right) SMB_{c,q}^{ROE} + \left(g_0 + g_1 size_{i,q-1} + g_2 BM_{i,q-1}\right) HML_{c,q}^{ROE} + u_{iq}^{ROE}, \quad (9)$$

where $size_{i,q-1}$ and $BM_{i,q-1}$ are the log size and the book-to-market ratio for firm i from the previous quarter q-1. With only quarterly observations on ROE, the panel specification substantially increases statistical power. Meanwhile, we make the model flexible in 3 aspects. First, we allow the firm ROEs to be related to country and global ROE factors, constructed on multiple dimension of risks. Second, the factor loadings are linear functions of the firm's own size and book-to-market ratio, which allows for time and cross firm variation in the factor loadings. Third, we also include firm fixed effects to take into account firm level differences in ROE.

Table 6 reports the parameter estimates for the panel regression. We first report the interquartile range and median for the estimates across countries for an overall perspective, and

[7] In the Internet Appendix Table OA3, we investigate the cyclicality of the ROE factors, by projecting them on country and global GDP growth rates. The country level market, size and value ROE factors are mostly pro-cyclical. There is strong and significant procyclicality for the global market, SMB and HML ROE factors.

then report specific parameters for the case of U.S. Across all countries, the coefficients display four patterns. First, in terms of firm characteristics, size has a significantly positive coefficient, indicating that larger firms tend to have higher ROEs while the BM ratio does not have a significant effect on ROEs. Second, the global and country market, size, and value ROE factors mostly have positive loadings, and the majority of them are significant, especially for the market and size ROE factors. This implies that the global and local ROE factors do have significant influences on firm level ROEs. Third, the interaction effects between size and BM and the factors, are mostly not significant. The only exceptions are the coefficients on the interaction between country size factors and firm size, which are mostly significantly negative, suggesting the largest firms load more negatively on the country size ROE factors. Finally, the above model captures the variation in firm level ROE quite well, with the overall R^2's 25th percentile being 0.402, and the 75th percentile being 0.492. The resulting idiosyncratic variances of firm level ROE are insensitive to alternative specifications in which various subsets of parameters are constrained to equal zero. We therefore retain the most general model. The patterns for the U.S. are quite similar to the other countries.

The key deliverable of the model is the idiosyncratic cash flow, u_{it}^{ROE}. With this residual in hand, we first define the "spot" idiosyncratic variance measure for ROE at the firm level:

$$IVROE_{iq}^{SPOT} = {u_{it}^{ROE}}^2 \tag{10}$$

For each quarter, we only have one observation rather than multiple observations as is true for return residuals. Therefore, to obtain a genuine variance estimate that is still quarter specific, we use the kernel estimate introduced above:

$$IVROE_{iq}^{KERNEL} = \sum_{k=-10}^{10} w_k IVROE_{i,q+k}^{SPOT}, \tag{11}$$

where the weights are defined in equation (6).

Summary statistics for firm level ROE idiosyncratic variances are reported in Table 7, which is analogous to Table 2. In Panel A, for each country, we report the time series average of the cross-sectional median of firm-specific IVROE, for both the kernel and spot variances. The median spot (kernel) IVROE is the highest for Norway at 0.009 (0.018), and lowest for Japan at 0.001 (0.002). For the U.S., the median spot (kernel) IVROE is 0.005 (0.010). The correlation between the spot and kernel variances is 78%.

4.2 Commonality in Firm Level Idiosyncratic ROE Variances

Similar to the principal component analysis of idiosyncratic return variances, we conduct a principal component analysis on the cross-section of firm level idiosyncratic ROE variances. For each country in three non-overlapping windows (see above), we calculate the percentage of variation in all firm level IVROE's explained by the first principal component.

Table 7, Panel B (first column) presents the time-series median of the first PC's explanatory power in each country. The first principal component on average explains between 34.5% (Canada) and 47.2% (Finland) of the cross-sectional variation in idiosyncratic ROE variances, with the average across the 23 countries being 41.2%. For the U.S., the first principal component explains 38.0% of the total cross-sectional variation; and globally, it is 39.3%. It is clear that there is substantial comovement among firm-level idiosyncratic ROE variances, but the first PC's explanatory power is somewhat weaker than that of the firm level idiosyncratic return variances.

To understand whether country and global aggregate idiosyncratic variances contribute to the commonality in firm level idiosyncratic ROE variances, we regress the firm level measures on the aggregate measures. The country level aggregate idiosyncratic ROE variance measure, $IVROE_q^c$ for country c in quarter q, is the value weighted average of the firm level $IVROE_{iq}$ within the country. Similarly, the global aggregate idiosyncratic variance measure, $IVROE_q^g$, is the value-weighted average of country level IVROE. The time-series means and standard deviations for both aggregate idiosyncratic cash flow variance measures are reported in the second and third column of Table 7, Panel B. Compared to firm level idiosyncratic ROE variances, the average aggregate measures are lower, ranging between 0.007 (Japan) and 0.026 (Norway).

Next, we regress the firm level $IVROE_{iq}$'s on the global and local aggregate idiosyncratic ROE variances, $IVROE_q^c$ and $IVROE_q^g$. In the fourth column of Table 7, Panel B, when we include only the country aggregate $IVROE_q^c$, the median R^2 ranges between 0.081 (Ireland) and 0.242 (U.S.), and the average is 0.162. In the fifth column of Table 7, Panel B, when we include both local and global aggregate idiosyncratic ROE variances, the median R^2s more than double, and they range between 0.266 (Japan) and 0.582 (Australia), with the U.S. producing a 0.573 median R^2. The average across countries now becomes 0.430. These results indicate that country and global aggregate idiosyncratic variances contribute significantly to the commonality in firm level idiosyncratic ROE variances. The dominance of the global aggregate idiosyncratic variance over the country counterparts for cash flow variances is even stronger than for return variances, with the addition of the global aggregate idiosyncratic ROE variance often leading to a three-fold increase in R^2.

4.3 Commonality in Country Aggregate Idiosyncratic ROE Variances

The importance of the global component in explaining firm-specific idiosyncratic cash flow variances also suggests commonality at the country level. To measure the commonality among country measures, we first compute pairwise correlation coefficients for each country's aggregate idiosyncratic ROE variance measures, and we report the mean and the interquartile range in Table 8, Panel A. In the U.S. case, the average correlation with other country's aggregate idiosyncratic ROE variances is 0.239, and the interquartile range is 0.095 to 0.421. The cross-country average of pairwise correlations of idiosyncratic ROE variances is 0.136, with an interquartile range of -0.052 to 0.339; the average over the G7 countries is even slightly higher. There are three countries for which the average correlation is slightly negative. Thus, while the correlations of idiosyncratic ROE variances are positive overall, they are substantially lower than those associated with idiosyncratic return variances.

The remaining columns of Table 8 present an alternative view of commonality, showing slope coefficients from a projection of country aggregate idiosyncratic ROE variances on the global aggregate idiosyncratic ROE variance. The loadings on the global aggregate idiosyncratic ROE variance are positive in 18 out of 23 countries. The coefficient for the U.S. is indistinguishable from 1; the average coefficient across countries is 0.470. The coefficients are statistically significant in most cases, and the R^2 is on average 0.226. The global component in ROE variances is important, but there appears to be much more country-specific variation in ROE variances than in idiosyncratic return variances (compare with Table 3). Given the very high R^2's recorded in Table 7 Panel B, for firm-specific IVROE, the lower R^2's for some countries in Table 8 are in fact surprising. After all, a country's IVROE is a value-weighted average of individual firm IVROE's, and one would expect the R^2 in an individual firm's IVROE regression to be lower because of firm specific variation in IVAR. However, it turns out that there is a negative correlation between the beta's in the firm specific regressions and firm size.

In addition, we examine whether the comovement with the global aggregate idiosyncratic ROE variances has increased over time as a function of de jure integration, and we find mostly significant and positive results. These results are included in Table 8, Panel B.

4.4 Cyclicality of Idiosyncratic ROE Variances

How do idiosyncratic ROE variances fluctuate over the business cycle? Table 9 provides the answer. There we report results of a bivariate regression on country-specific GDP growth and global GDP growth. Panel A presents the results of bivariate regression by country. The coefficients on the global cycle are negative in 14 out of the 23 countries, with 11 coefficients being significant. Positive or insignificantly negative coefficients often go hand in hand with significantly negative domestic cycle coefficients. This is the case for Hong Kong, Japan, Norway, Singapore, and the three Scandinavian countries, which experienced a banking crisis in the early 1990s. While the dominant pattern is that of countercyclicality, there is no countercyclicality or even pro-cyclicality in Austria, Canada, France, Italy, New Zealand, and the UK.[8] The adjusted R^2's range between practically zero for Canada and Italy to 0.724 for Switzerland, and the average adjusted R^2 is 0.226. We also examine the cyclicality of the idiosyncratic ROE variance at the global level. The global aggregate idiosyncratic ROE variance also loads negatively and significantly on global GDP growth.

Similar to the tests for IVRET, we also run panel regressions with country fixed effects and in which we use one year lagged, a contemporaneous year, and one year led of country specific and global GDP growth as independent variables (see Table 9, Panel B). In the first two specifications, we include only the contemporaneous and one year lagged GDP growth rates, respectively. The coefficients are generally not statistically significant. In the third specification, we include one year led GDP growth rates. We find a negative relationship between IVROE and global GDP growth rate, while the coefficient on country-specific GDP growth rate is also negative

[8] When using equally weighted idiosyncratic variances (see the Online Appendix Table OA4), the countercyclicality is even more pronounced: global GDP growth has a negative coefficient for 20 out of 23 countries, being statistically significant in 18. When we only consider one GDP growth measure, it turns out that global GDP growth has a stronger explanatory power for country aggregate idiosyncratic variances than country GDP growth does. The coefficients are overwhelmingly negative.

but not statistically significant. In the last specification, we include all the variables. While the overall R^2 is relatively high at 0.300, there is only one statistically significant coefficient, namely that high idiosyncratic ROE variances are associated with lower future GDP growth, as suggested in the macroeconomics literature.

While this approach matches well with macroeconomic theory, we are not aware of anyone in the macroeconomic literature measuring uncertainty shocks using a cash flow concept such as ROE. The “risk shock” in Christiano, Motto, and Rostagno (2014) presumably measures uncertainty about productivity of an entrepreneur’s capital investment, which would appear to be more closely related with the ROE concept than, with say, return variances or the VIX.

We conclude that idiosyncratic ROE variances are mostly countercyclical, especially with respect to the world business cycle. However, given the low R^2, business cycle variables may not be the dominant force behind the high correlation in idiosyncratic variances.

In Herskovic et al. (2016) the time series variation in idiosyncratic return variances in the U.S. is shown to be relatively highly correlated to the dispersion of individual income growth and the cross-sectional dispersion of sectoral employment growth. This motivates an incomplete market’s model in which idiosyncratic cash flow risk is directly linked to the dispersion in individual consumption growth. Our evidence confirms that both cash flow and return idiosyncratic variances are countercyclical, which is also the case for the income variables explored by Herskovic et al. (2016). Unfortunately, it seems somewhat difficult to reconcile the international evidence we uncover with their model. For this to work, an international component of the idiosyncratic uninsurable consumption risk of households must be a main driver of the global component in idiosyncratic return and cash flow variances, while one of the most enduring puzzles in international economics is that the correlation of consumption growth across countries is quite low and difficult to explain (see e.g. Backus and Smith (1993)).

5. What Drives the Commonality in Idiosyncratic Variances?

So far, we have separately documented strong commonalities across countries in the idiosyncratic variances of returns and cash flows. Given that both variances share similar countercyclical patterns, it is possible that the international commonality of idiosyncratic return variances can be traced back to the comovement among idiosyncratic cash flow variances. Therefore, in Section 5.1, we first investigate whether the return and ROE idiosyncratic variances are indeed connected. Section 5.2 introduces a simple dynamic pricing model that suggests a number of alternative fundamental factors that may affect the commonality in idiosyncratic return variances. We bring the model to the data and compute the state variables of the model in Section 5.3. In Section 5.4, we examine whether our model can explain time variation in the global component of idiosyncratic return variances, which is the dominant source of the international commonality of idiosyncratic returns variances (see Table 3). A full estimation of an international version of the model is beyond the scope of the paper.

5.1 The link between Return and ROE Idiosyncratic Variances

In any rational asset pricing model, idiosyncratic cash flow variability should be one of the determinants of idiosyncratic return variability. There have been several studies that have linked idiosyncratic return variances to cash flow variances, including Wei and Zhang (2006) who employ value-weighted time-series and cross-sectional ROE variances and Irvine and Pontiff (2009) who use the cross-sectional variance of time series earnings innovations from a pooled AR(3) model at the firm level. Bekaert, Hodrick, and Zhang (2012) run a horse race of these variables to explain the aggregate idiosyncratic return variance in the U.S., also including the times series and cross-sectional variance of the value-weighted firm-level market value of assets over the book value of assets (MABA), inspired by the work of Cao, Simin, and Zhao (2008). Bekaert, Hodrick, and Zhang (2012) find that a number of these variables are indeed important determinants of the aggregate idiosyncratic variability in the U.S. None of these papers compute idiosyncratic ROE variances as we do in this paper, using a model that removes systematic variation in ROE with a factor model.

In Table 10, we first correlate the idiosyncratic return and ROE variances country by country for our 23 countries. The correlation is 0.609 for the U.S., which is highly significant with a p-value of 0.00. Across countries, the interquartile range is 0.213 to 0.540, with a median of 0.457, with all correlations highly significant. The maximum (minimum) correlation is observed in Belgium (Spain). For the global IVRET and IVROE, the correlation is 0.646. Clearly, return and ROE idiosyncratic variances are closely related.

In addition, we have shown before that there are important global components in the idiosyncratic variances of returns and ROE. We now investigate the explanatory power of global and country level IVROE's for IVRET. The results are presented in the remaining columns of Table 10. The coefficient on global ROE variances is positive and highly significant for 21 out of 23 countries. The interquartile range for the coefficients, reported at the bottom of the table, is 1.812 to 4.338. We also include the country-specific ROE variances in the regression, which is orthogonal to the global ROE variances. These coefficients in 19 out of 23 cases are positive and the interquartile range is 0.305 and 2.228. Therefore, we find that global IVROE is a much more significant explanatory variable for country level IVRET than is the country-specific IVROE. In terms of explanatory power overall, the interquartile range of the R^2 is between 0.260 and 0.604, and it is 0.452 for the U.S. That is to say, the global and country IVROEs explain a substantial part of the variations in the individual country IVRETs.

We also estimate a pooled panel model with country fixed effects for all country level IVRETs. The results are reported at the bottom of the table and are labelled “global”. The pooled coefficient on the global IVROE is 3.391, and the coefficient on country specific IVROE is 0.828. Both coefficients are highly statistically significant, and the overall R^2 is 0.403. We conclude that the idiosyncratic ROE variances have strong explanatory power for idiosyncratic return variances worldwide, and the explanatory power of the global ROE variance dominates that of the country-specific variance. In robustness checks, we verify that the results are even stronger for equally weighted variances.

5.2 A Simple Dynamic Pricing Model

So far, we have considered only one fundamental determinant of aggregate idiosyncratic return variances. In this section, we sketch a simple dynamic pricing model, with aggregate and firm-specific variability of earnings growth, time-varying expected earnings growth, and time-varying discount rates. This model is a partial equilibrium model, and we design it to be simple and tractable. Our intention is to provide intuition for explaining commonality in idiosyncratic return variances.

The model is formulated at the “global” level. We assume that each firm operates in an integrated world economy. Our results before suggest that while globalization may have affected the impact of global factors on idiosyncratic variances, the degree of integration did not affect global betas in a statistically significant fashion. While a hybrid model with both local and global factors may be preferred, the global factor tends to be dominant and the global idiosyncratic return variance explains a large portion of aggregate idiosyncratic return variances in all 23 countries. We therefore focus our attention on explaining variation in this global idiosyncratic return variance.

5.2.1 The Aggregate Environment

The global economy features an aggregate discount rate (δ_t), an aggregate earnings process, and aggregate uncertainty about earnings shocks measured by their volatility (V_t). Firms differ from one another because they have different sensitivities to these aggregate factors, and they also face idiosyncratic uncertainty (with volatility V_{it}) about their cash flows. Here, we verbally describe the intuition behind the various aggregate state variables. More details about the model are discussed in the Appendix.

The core state variable is aggregate cash flow uncertainty which follows a square root process, so that the variance of uncertainty is proportional to its level. The process is autoregressive, but an aggregate version of the Cao, Simin, and Zhao (2008) growth opportunity mechanism is implicit here as well. They rely on the standard intuition that a firm's equity is a call option on the firm's assets, giving a firm's manager an incentive to increase the variance of the firm. The manager can do so by selecting investments from an opportunity set with the most non-systematic risk. That is, while assets in place generate a particular conditional variance of future cash flows, the arrival of a growth option adds to the uncertainty of the future cash flows, thus increasing the conditional variability of the firm's future cash flows. Therefore, the conditional mean of aggregate uncertainty also depends on a growth opportunity state variable, GO_t.

Of course, growth options should also, by definition, increase earnings growth in the future when they are realized, and thus, growth options should affect expected earnings growth. We model the conditional mean of aggregate earnings growth as driven by GO_t and the past return on equity, ROE_{t-1}. The latter variable can be thought of as capturing the profitability of assets in place.

Aggregate uncertainty spans time-variation in earnings growth variability. So far, we have introduced three aggregate state variables: aggregate cash flow uncertainty, aggregate growth opportunities, and the aggregate return on equity. To close the model, we must specify the dynamics of ROE_t. We let its conditional mean depend on past ROE, the aggregate discount rate and the growth opportunity variable. Moreover, its conditional variance depends on discount rate specific volatility.

The two remaining state variables follow from the specification of an aggregate discount rate process. The conditional mean of the discount rate δ_t features an autoregressive term but also depends on aggregate cash flow uncertainty. Moreover, its conditional variability not only depends on aggregate cash flow uncertainty but also on discount rate specific volatility, DV_t, perhaps attributable to changes in sentiment, or economically motivated changes in aggregate risk aversion (see Bekaert, Engstrom, and Xu (2018) for more discussion)). Therefore, there are five state variables in total that we collect into the state vector $X_t = [\delta_t, V_t, GO_t, ROE_t, DV_t]'$.

5.2.2 Modelling Firms

Given the aggregate pricing environment, a firm is characterized by three main "systematic" exposures: its discount rate exposure, β, its cash flow exposure, γ, and its volatility exposure, η.[9] In addition, it faces idiosyncratic cash flow shocks with time-varying volatility V_{it}. In our model, an increase in idiosyncratic cash flow variability increase prices, as in Pastor and Veronesi (2005, 2006), but an increase in aggregate uncertainty may also affect discount rates and therefore decrease prices. The latter effect is essential to fully explain the stylized facts documented above.

[9] Several modeling choices are possible: the cash flow exposure could be split up into go_t and roe_t exposure (instead of earnings growth exposure), and we could define discount rate volatility exposure too. The three exposures mentioned above seem most salient to differentiate different types of firms. We can further simplify the model, by only defining discount rate and earnings growth exposure (which is what we do in the Appendix).

If an aggregate uncertainty effect would not exist, (idiosyncratic) volatility would tend to rise in good times as idiosyncratic earnings variability and positive growth options are all linked with relatively high stock market prices. These latter effects can explain high levels of idiosyncratic variability and high prices in, for example, the Tech boom of the 1990s, but they cannot explain the elevated levels of systematic and idiosyncratic variability in the 2008 financial crisis, or more generally the countercyclicality of idiosyncratic return variances that we document.

In the Appendix, we show that, given normally distributed shocks, it is straightforward to determine a firm's price earnings ratio in closed form as the infinite sum of exponentiated affine functions of the state variables. Return expressions then follow straightforwardly (see also Bekaert and Harvey (2000), for example).

Consider the price earnings ratio for a portfolio with unit exposure to the three main state variables and no idiosyncratic cash flow shocks. This portfolio consequently contains only systematic risk and can be viewed as a benchmark global "market" portfolio. Because of the non-linearities in the model, this portfolio's return and all its moments are a function of all five state variables. If we were to linearize the model, we could approximate the gross return, R_{t+1}, for this portfolio as:

$$R_{t+1} = a'X_{t+1} + b'X_t, \tag{12}$$

where a and b contain the linearization constants.

Conditional on this linearization, the conditional volatility of this market portfolio is a function of any state variable that has a time-varying conditional variance. In this model, aggregate cash flow and discount rate uncertainty are therefore the only variables that matter. We use this fact to motivate using the conditional market variance together with the conditional variance of the ROE as empirical proxies spanning these two types of uncertainty in the model. For an individual firm, the variability of firm-specific earnings growth is an additional variable driving its return variability, conditional on a similar linearization.

Given the dynamic nature of the model, it is rather obvious that standard models to compute idiosyncratic variability are unlikely to correctly adjust for all systematic sources of returns. Even in a linearized version of the model, one would need to use portfolios that span aggregate uncertainty, aggregate discount rate, and aggregate expected cash flow effects. The current models using the market return and the Fama-French size and book-to-market portfolios are unlikely to accomplish this task. This implies that total volatility and idiosyncratic volatility may depend on all the state variables introduced here. Moreover, the true solution to the model would also imply that X_t matters for the conditional variance of returns, as it would involve the conditional variance of an infinite sum of exponentials of a linear function of the state variables.[10] The model also implies that individual stock returns and their variability are affected by individual stock specific uncertainty.

5.3 Measuring the State Variables

We briefly outline the actual measurement of the various state variables, which are at the quarterly frequency. All the data are obtained from DataStream.

We begin with the conditional variance of global market returns. In the model, this variance is spanned by discount rate and cash flow uncertainty so that we can equivalently employ this aggregate market return uncertainty and cash flow uncertainty as the two state variables. Bekaert, Hodrick, and Zhang (2012) find an estimate of aggregate return uncertainty to be significantly

[10] Veronesi (1999) and Pastor and Veronesi (2006) suggest that in a learning story, the dependence of endogenous variables on state variables may be different in good times and bad times. Such a channel to generate business cycle dependence is missing in our model.

linked to aggregate idiosyncratic uncertainty in the U.S., a result recently confirmed by Bartram, Brown, and Stulz (2017). Define the quarterly realized variance as:

$$RV_q = \frac{1}{T}\sum_{i \in q} r_i^2 \quad , \tag{13}$$

where r_i is the daily global market return on day *i* in quarter q and T is the total number of days in the quarter. We then annualize the variance measure by multiplying by 250.

Suppose week *w* is the last week in quarter q, and month *m* is the last month in quarter q. Then our benchmark model for the conditional variance is specified as:

$$RV_q = a + bVIX_{q-1}^2 + cRV_{q-1} + dRV_{m-1} + eRV_{w-1} + v_q, \tag{14}$$

The quarterly realized variance, RV_q, is projected on the previous weekly, monthly and quarterly realized variances of daily returns and the squared VIX index. For example, the past weekly realized variance sums the last 5 squared returns of the previous quarter. Such a model is inspired by Corsi (2009), who shows that a model containing 1-day, 5-day, and 22-day realized variances, provides a good approximation for the dynamics of monthly realized market variances. Bekaert, Hoerova, and Lo Duca (2013) show that including the squared VIX improves the model fit considerably. The conditional market variance, CV_q, is the fitted value of this equation.

The second state variable is the global discount rate δ_t, which is the conditional expected global market gross return. Therefore, we compute δ_t as the fitted value from the following specification:

$$\ln(1 + RET_q) = a + bCV_{q-4} + cDY_{q-4} + d\left(VIX_{q-4}^2 - CV_{q-4}\right) + u_q, \tag{15}$$

with the independent variables: the conditional market variance CV_{q-4}, the market dividend yield DY_{q-4}, and the variance premium measured by the difference between the squared VIX index and the conditional market variance CV_{q-4}. The dividend yield is a standard predictor of equity returns;

the variance premium was first shown to predict equity returns in Bollerslev, Tauchen, and Zhou (2009). Bekaert and Hoerova (2014) introduce both the variance premium and the conditional variance as predictors for equity returns. Note that we predict annual returns to be consistent with our annual model for cash flow growth.

The three remaining state variables characterize cash flow growth dynamics. In the model, cash flow variability can be measured as the conditional variability of aggregate earnings growth or ROE. Given our focus on ROE as the cash flow concept, we focus on world-wide ROE, also a state variable in its own right, to measure the conditional variance of cash flow growth. Global ROE is computed as net income (NI) divided by lagged book value (BV) of the Datastream World Market Index.

Our fourth state variable is the conditional aggregate variance of the cash flows. To obtain the time series of this conditional variance, we estimate the following GARCH-in-Mean system:

$$\ln(1+ROE_q) = a + b\ln(1+ROE_{q-4}) + cEY_{q-4} + dCV_{q-4} + e\delta_{q-4} + fV_{q-4} + u_q, \qquad (16)$$

$$V_{q-4} = E_{q-4}[u_q^2] = \exp\left(\alpha + \beta ln(u_{q-4}^2) + \gamma EY_{q-4} + \rho CV_{q-4} + \varphi\delta_{q-4}\right), \qquad (17)$$

with EY_q representing the earnings yield. The parameters are estimated with maximum likelihood and are presented in the Appendix. The fitted value of V_q is the conditional variance of cash flows.

In the model, the cash flow equation for earnings growth and ROE features the last, unobserved state variable, GO_t. However, under the null of the model, the earnings yield is an exact function of all the state variables, including ln ($1+ROE_t$), δ_t and the conditional variance variables. By including these state variables and the earnings yield, we therefore “span” the growth opportunity state variable. Growth options should by definition increase expected earnings growth, but they should also increase the variability of the firm’s future cash flows. Using the model’s implication for the earnings yield, we then obtain GO_t using the following regression:

$$EY_q = a + b\ln(1 + ROE_q) + cCV_q + d\delta_q + eV_q - GO_q. \quad (18)$$

As defined above, the growth opportunity is the negative of the residual of the projection of market earnings yield on the 4 state variables. That is, the growth opportunity variable represents the part of the earnings yield that is unrelated to discount rates, cash flows and their variances.

For GO_t to be a valid growth opportunity variable, it should predict earnings growth. In each quarter, we calculate EBIT growth for the DataStream Total Market Index as the growth rate of trailing 4-quarter EBIT over the same quarter of the previous year. A projection of this annual earnings growth rate at t+k on GO_t yields statistically significant coefficients on GO_t (at the 10% level) for k = 4 through 6. The predictive power is strongest for earnings growth one year ahead (k = 4) with a coefficient of 7.020 and an adjusted R^2 of 0.151. We report the regression results in the Online Appendix Table OA5.[11]

5.4 Explaining the Global Idiosyncratic Variance Factor

Table 11 Panel A reports the means and standard deviations for the 5 state variables and the global aggregate IVRET and IVROE. Not surprisingly, IVRET has a higher mean, corresponding to 27.03% volatility, than IVROE, which has a volatility half this level (12.74%). Return variances are also considerably more variable than cash flow variances. Similarly, the aggregate conditional return variance is multiple times higher and more variable than the conditional cash flow variances. The discount rate is on average 7.85% but its variability (a 6.16% volatility) is quite high. Note that the mean of the growth opportunity variable is zero (as it represents a residual from a regression).

Panel B of Table 11 provides the correlation matrix. The IVRET variable is significantly correlated with the discount rate and with growth opportunities, while IVROE is only significantly

[11] The standard errors use 10 Newey-West (1987) lags.

correlated with the discount rate. The correlation is surprisingly negative, indicating high idiosyncratic variances when discount rates are low. This is surprising because it is typically surmised that discount rates are countercyclical (see e.g. Campbell and Cochrane, 1999), which is true in our sample as well[12]. Among the state variables, the correlations are quite low, mostly below 0.2, and the growth opportunity variable is orthogonal to all other state variables by construction.

To further investigate what explains the global component in idiosyncratic return variances, IVRET, we project it on the 5 state variables and report the results in Panel A of Table 12**.** Consistent with the correlation results above, two out of the five state variables are significant. High discount rates are associated with lower IVRET. The coefficient is -0.235, with a t-statistic of -5.69. Meanwhile, better growth opportunities are also associated with high IVRET, with a coefficient of 1.040 (t=4.07), and an R^2 of 0.090. This result is consistent with the finding in Cao, Simin, and Zhao (2008) and Bekaert, Hodrick, and Zhang (2012) that the market to book ratio is significantly correlated with the aggregate idiosyncratic return variance, which they interpret as a growth opportunity effect. Our result is stronger in that we use a price variable cleansed of discount rate effects and shown to predict future earnings growth. When the five state variables are put together, the ROE variable becomes marginally significant with a negative sign, while both the discount rate and growth opportunity variables retain their significance. The R^2 is 0.349, indicating that the 5 state variables are quite relevant to explain IVRET.

Our earlier results show that the IVRET is closely related to IVROE. This is also an implication of the model as the idiosyncratic cash flow variability is a priced state variable for each

[12] A regression of the discount rate on the quarterly GDP growth rate yields a coefficient of -2.846 with a t-statistic of -9.61. It is conceivable that the negative correlation is mostly driven by the extreme low discount rate period occurring during the Tech Boom, which coincided with very elevated idiosyncratic variances.

firm. In Panel B of Table 12, we include IVROE in all the regressions. In the first column, IVROE is always positive and highly significant, and by itself has an adjusted R^2 of 0.492. Both the discount rate and growth opportunity state variables maintain their signs and statistical significance in the presence of IVROE. When all the 5 state variables are included, in addition to IVROE, the adjusted R^2 increases from 0.492 to 0.656.

In the last line, we report a covariance decomposition, which reports for each state variable, $X_{t,i}$, the estimate of $cov(\widehat{X_t}, \beta_i X_{t,i})/var(\widehat{X_t})$ with $\widehat{X_t}$, the fitted value of the regression and β_i the regression coefficient for state variable i. This decomposition adds to 100% across the different explanatory variables. It reveals that only three state variables contribute meaningfully to variation in idiosyncratic variances, global IVROE (accounting for 60.11% of the explained variation); the discount rate (accounting for 22.52%) and the growth opportunity variable (accounting for 11.23%). While the R^2 is high, it does not fully reflect the explanatory power of these state variables. Because of the non-linearity in the pricing model, higher order functions of the state variables are likely to matter as well. When we partially accommodate these non-linearities, by running a regression of IVAR on IVROE and levels, squares and cross-products of the state variables, the adjusted R^2 increases to 0.857**.** Hence, our state variables almost perfectly fit the time series variation in global idiosyncratic variances.

6. Conclusion

This article characterizes several properties of idiosyncratic return and ROE variances. First, we show that there is a large common component in firm-specific idiosyncratic return variances, with their variation driven more by a global than a country specific aggregate idiosyncratic return factor. We find that aggregate idiosyncratic return variances at the country level are highly correlated, often as highly correlated as are the actual returns. A global idiosyncratic return variance thus explains a substantial fraction of country level idiosyncratic return variances. Second, we document similar properties for idiosyncratic ROE variances, where the idiosyncratic cash flow variance is calculated in a novel way using the residuals from a factor model with time-varying factor loadings. The cross-country correlations of idiosyncratic ROE variances remain mostly positive but are somewhat weaker than what we find for return variances. Third, both idiosyncratic returns and cash flow variances are countercyclical in most countries with the link to the global business cycle stronger than to the local business cycle. Fourth, there is a very strong link between idiosyncratic return and ROE variances. Importantly, country specific idiosyncratic return variances again load more strongly on the global ROE idiosyncratic variance than on country specific ones.

Our results may prove important input for a rapidly growing macroeconomics literature linking economic and financial uncertainty (shocks) to economic activity (see Bloom (2009); Christiano, Motto, and Rostagno (2014); and Jurado, Ludvigson, and Ng (2015)). While most of the literature has resorted to return uncertainty variables, the economic concepts are more appropriately linked to cash flow uncertainty or ROE uncertainty (a productivity measure). We show that these concepts are highly but not perfectly correlated. ROE volatility may also be a proxy for the volatility of investment shocks, which Justiniano and Primiceri (2008) argue played an important role in the Great Moderation and reflect shocks to the return on capital or the marginal efficiency of the investment technology in a DSGE model.

Perhaps the most surprising finding is the importance of the global component in idiosyncratic return and ROE variances. Extant international pricing and risk models are not likely to be consistent with this set of stylized facts. However, to embark on an initial understanding of the empirical dynamics of idiosyncratic variances, we develop a simple pricing model with stochastic discount rates, stochastic expected earnings growth and growth options, and time-varying cash flow variability. In the model volatility dynamics are affected by five key state variables: the aggregate discount rate, the aggregate conditional market variance (which we decompose into aggregate cash flow variability and pure discount rate variability), expected cash flow growth, idiosyncratic earnings variability, and a growth opportunity variable that we extract from the aggregate earnings yield. Importantly, this latter variable is shown to predict earnings growth and thus its positive link with idiosyncratic return variances is consistent with the mechanism described in Cao, Simin, and Zhao (2008). While we could in principle price each firm in the world, we use the model to shed light on the global component in idiosyncratic return variances linking its time series variation to the global state variables and the global idiosyncratic ROE variance. With only linear terms, the model explains more than 60% of the variation in idiosyncratic return variances. We confirm that the idiosyncratic and conditional market variances are positively linked but this result is weak. The three most important state variables to explain variation in idiosyncratic return variances are the global IVROE, global discount rates, and growth opportunities.

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Appendix

This appendix describes the setup of our model and the estimation results for the state variables.

1. Model Setup

The model is formulated at the "global" level.

The aggregate cash flow uncertainty (V_t) follows a square root process:

$$V_t = \mu_V + \rho_V V_{t-1} + \phi_{go} GO_{t-1} + \sigma_V \sqrt{V_{t-1}} \varepsilon_{V,t}$$

The conditional mean of aggregate uncertainty V_t has an autoregressive component, and also depends on a growth opportunity state variable, GO_t, as suggested by Cao, Simin, and Zhao (2008).

The conditional mean of the aggregate discount rate (δ_t) features an autoregressive term but also loads on aggregate cash flow uncertainty, both in the conditional mean and the conditional variance:

$$\delta_t = \mu_\delta + \rho_\delta \delta_{t-1} + \phi_{\delta,V} V_{t-1} + \sigma_\delta \sqrt{DV_{t-1}} \varepsilon_{\delta,t} + C_{\delta,V} \sqrt{V_{t-1}} \varepsilon_{V,t}$$

Discount rate specific uncertainty (DV_t) follows a simple autoregressive process:

$$DV_t = \mu_{DV} + \rho_{DV} DV_{t-1} + \sigma_{DV} \sqrt{DV_{t-1}} \varepsilon_{\delta,t}$$

Aggregate earnings growth (eg_t) is defined as follows:

$eg_t = ln \frac{EA(t)}{EA(t-1)}$, where EA is total earnings.

We model the conditional mean of aggregate earnings growth as driven by GO_t and the past return on equity, roe_{t-1}:

$$eg_t = \mu_{eg} + \phi_{eg,roe} roe_{t-1} + go_{t-1} + \sigma_{eg}\, \varepsilon_{eg,t} + C_{eg,V} \sqrt{V_{t-1}} \varepsilon_{V,t}\ ,$$

where the growth opportunity variable (GO_t) is modeled in a simple way:

$$go_t = \rho_{go} go_{t-1} + \sigma_{go} \varepsilon_{go,t}$$

Lastly, aggregate ROE (roe_t) follows:

$$roe_t = \mu_{roe} + \rho_{roe} roe_{t-1} + \phi_{roe,\delta} \delta_{t-1} + \phi_{roe,GO} GO_t + \sigma_{roe} \varepsilon_{roe,t} + C_{roe,V} \sqrt{V_{t-1}} \varepsilon_{V,t}$$

While the fundamental cash flow variable is at first glance earnings growth, the time variation in its conditional mean is spanned by roe_t (to reflect the growth in earnings of assets in place) and the unobserved growth opportunity variable. The ROE process depends on the GO_t variable as well, and then we let it also depend on both past roe and the discount rate. It is natural to expect firms with high ROE's relative to their costs of capital to grow and expand future earnings. However, ROE may also be expected to be mean reverting for a variety of reasons (abnormal values being caused by temporary factors; high ROEs should invite competition etc.), see Freeman, Ohlson and Penman (1982) for some evidence. This could lead to negative $\phi_{eg,roe}$ coefficients. Importantly, the time variation in the volatility of both earnings growth and ROE is spanned by aggregate uncertainty, V_t, which is the sole variable representing aggregate cash flow variability.

This global pricing model is fully characterized by the state variable vector $X_t = [V_t, \delta_t, DV_t, roe_t, GO_t]'$. All shocks, $\varepsilon_{V,t}, \varepsilon_{\delta,t}, \varepsilon_{eg,t}, \varepsilon_{roe,t}, \varepsilon_{go,t}$, are assumed N (0, 1).

In general, we assume that earnings are positive and are all paid out. Imagine the "global market" claim to all earnings; $EA_{t+j}, j = 0, 1, \dots, \infty$.

By definition of the discount rate:

$$P_t = E_t[\exp(-\delta_t)(P_{t+1} + EA_{t+1})]$$

Or, to allow for a stationarity representation,

$$PE_t = \frac{P_t}{EA_t} = E_t\{\exp(-\delta_t)[\exp(eg_{t+1}) + \exp(eg_{t+1})PE_{t+1}]\}$$

So,

$$PE_t = E_t\{\sum_{j=1}^{\infty} \exp[\sum_{i=1}^{j} (-\delta_{t+i-1} + eg_{t+i})]\}$$

Thus, the PE solution is of the following form:

$$PE_t = \sum_{j=1}^{\infty} q_{t,j},$$

where

$$q_{t,j} = E_t\{\exp[\sum_{i=1}^{j} (-\delta_{t+i-1} + eg_{t+i})]\}$$

First note:

$$q_{t,1} = \exp(\delta_t + \mu_{eg} + \phi_{eg,roe} roe_t + 0.5\sigma_{eg}^2 + GO_t + 0.5C_{eg,V}^2 V_t)$$

The general form of the solution will be:

$$q_{t,j} = \exp(A_j + B_j\delta_t + C_j GO_t + D_j V_t + F_j roe_t + G_j DV_t)$$

The expressions for the various coefficients are easily found by induction, and follow difference equations, which can easily be filled in recursively.

Using $q_{t,n+1} = E_t[\exp(-\delta_t + eg_{t+1})\ q_{t+1,n}]$ and properties of the log-normal distribution, we find:

$$A_{n+1} = \mu_{eg} + \frac{1}{2}\sigma_{eg}^2 + A_n + B_n\,\mu_\delta + D_n\,\mu_V + F_n\,\mu_{roe} + G_n\,\mu_{DV}$$

$$B_{n+1} = -1 + B_n\,\rho_\delta + F_n\,\phi_{roe,\delta}$$

$$C_{n+1} = 1 + C_n\,\rho_{go} + C_n^2\,\frac{\sigma_{eg}^2}{2} + D_n\,\phi_{go} + F_n\,\phi_{roe,go}$$

$$\begin{aligned} D_{n+1} = {} & \frac{C_{eg,V}^2}{2} + B_n\left(\phi_{\delta,V} + C_{eg,V}\,C_{\delta,V}\right) + B_n^2\,\frac{C_{\delta,V}^2}{2} + D_n\left(\rho_V + \sigma_V\,C_{eg,V}\right) + D_n^2\,\frac{\sigma_V^2}{2} \\ & + F_n C_{roe,V}\,C_{eg,V} + F_n^2\,\frac{C_{roe,V}^2}{2} + B_n\,D_n\,C_{\delta,V}\,\sigma_V + B_n\,F_n\,C_{\delta,V}\,C_{roe,V} \\ & + D_n\,F_n\,\sigma_V\,C_{roe,V} \end{aligned}$$

$$F_{n+1} = \phi_{eg,roe} + F_n\,\rho_{roe} + F_n^2\,\frac{\sigma_{roe}^2}{2}$$

$$G_{n+1} = \frac{1}{2}B_n^2\sigma_\delta^2 + \frac{1}{2}G_n^2\sigma_{DV}^2 + B_n G_n \sigma_\delta \sigma_{DV} = \frac{1}{2}(B_n\sigma_\delta + G_n\sigma_{DV})^2$$

Here, $Z_0 = 0$, for Z=A, B, C, D, F, G. The main intuition is mostly quite clear. For example, the B_n coefficients measure discount rate effects and are clearly negative with the persistence of the discount rate playing a large role in determining the total pricing effect. Note that the discount rate volatility effect on prices is positive, which is a pure Jensen's inequality effect. Analogously, the effect of GO_t on prices should be positive. There are potentially countervailing effects if D_n and F_n are negative. The sign of F_j depends on how ROE affects earnings (which may have negative effects).

The coefficient of D_n is difficult to sign.

First, $D_1 = \frac{C_{eg,V}^2}{2} > 0$. This may be counter-intuitive: uncertainty increases prices, but it is similar to the uncertainty term stressed by Pastor-Veronesi (PV). However, our model is more complex here.

First, because the C-coefficients and σ are positive, there are several additional "Jensen's inequality terms" that strengthen the "PV" effect. It is not clear that $C_{eg,V}$ and $C_{\delta,V}$ will be "small", so these terms may be important. They will be counteracted by the positive effect of volatility and discount rate, which unambiguously cause uncertainty to decrease prices, as $B_j < 0, \phi_{\delta,V} > 0, and\ C_j > 0$. They are difficult to sign as they depend on the sign of D_j and F_j and how they interact.

We conclude that if our prior is that uncertainty decreases prices, cash flow uncertainty should substantially increase discount rates ($\phi_{\delta,V}$ positive and large).

Modeling Firms

It is straightforward to use the model to explore pricing at the firm level, although we do not explore this in this article. For example, we could specify a simple firm specific discount rate and earnings growth rate process:

In particular, for firm *i*, the firm discount rate follows:

$$\delta_{i,t} = (1 - \beta_i) r_f + \beta_i \delta_t$$

This is a version of the conditional CAPM, assuming a constant interest rate. The firm-specific earnings growth rate follows:

$$eg_{i,t} = \gamma_i eg_t + \sqrt{V_{i,t-1}} \varepsilon_{eg,i,t}$$

with earnings volatility given by

$$V_{i,t} = (1 - \rho_i)\mu_i + \rho_i V_{i,t-1} + \sigma_i \sqrt{V_{i,t-1}} \varepsilon_{V,i,t}$$

Therefore, a firm is characterized by just two "systematic" exposures: discount rate exposure, β, and cash flow exposure, γ. We also allow for firm-specific cash flow uncertainty that is varying through time, and thus affects PE's and firm-specific return volatility. It would be trivial to allow additional exposures, but this simple model suffices to generate meaningful dynamics for aggregate idiosyncratic earnings variability. For this model, only one additional state variable would be priced for each firm, namely firm-specific earnings volatility. The aggregate market portfolio and its return and return volatility are thus exposed to aggregate frim-specific earnings variability.

2. Estimation of State Variables

We estimate five state variables: the conditional market variance (CV), the aggregate discount rate (δ), the aggregate ROE (roe), the conditional aggregate variance of the cash flows

(V), and the growth opportunity variable (GO). The sample period is from 1986 to 2015 and the regressions are estimated at the quarterly frequency.

2.1 Conditional Market Variance (CV)

We first define the quarterly realized variance, RV_q, as the average of squared daily returns of the World Market Index from Datastream in quarter q. Suppose week *w* is the last week in quarter q, and month *m* is the last month in quarter q. Then our benchmark model for the quarterly conditional variance is specified as follows:

$$RV_q = a + bVIX_{q-1}^2 + cRV_{q-1} + dRV_{m-1} + eRV_{w-1} + v_q$$

The quarterly realized variance, RV_q, is projected on the previous weekly, monthly and quarterly realized variances of daily returns, and the square of CBOE S&P 500 Volatility Index (we use the square of CBOE S&P 100 Volatility Index before 1990, and we scaled the index level by 100). All return variances are annualized by multiplying by 250.

The regression results are as follows, with the first row presenting the coefficients and the second row the t-statistics.

a	b	c	d	e	Adj. R^2
0.011	-0.084	0.266	-0.113	0.438	0.607
4.07	-1.05	2.81	-0.58	7.28	

We use the fitted value of the regression as our measure of CV. The insignificant coefficient on the VIX is surprising from the perspective of models that use monthly realized variances (see e.g. Bekaert and Hoerova, 2014). However, there is strong correlation between some of the dependent variables and a regression with only the past VIX and past quarterly realized variance does yield a positive and significant coefficient on the VIX.

2.2 Aggregate Discount Rate (δ)

We compute δ_t as the fitted value from the following predictive regression for annual returns:

$$\ln(1 + RET_q) = a + bCV_{q-4} + cDY_{q-4} + d\left(VIX_{q-4}^2 - CV_{q-4}\right) + u_q$$

where RET_q is the return on the Datastream World Market Index over quarters (q-3, q), CV is the conditional market variance, and DY is the dividend yield of the Datastream World Market Index.

The regression results are as follows, with the first row presenting the coefficients and the second row the t-statistics.

a	**b**	**c**	**d**	**Adj. R^2**
-0.202	0.362	12.083	0.254	0.090
-2.44	0.42	2.99	0.53	

The dividend yield appears to be the most important predictor at this frequency. We construct δ as the fitted value of the regression above.

2.3 Aggregate ROE (roe)

We focus on global ROE, which is computed as net income (NI) divided by the lagged book value (BV) of the World Market Index from Datastream. roe is the natural logarithm of 1+ROE.

2.4 Conditional Aggregate Variance of Cash Flows (V)

To obtain the time-series of this conditional variance, we estimate the following GARCH-in-Mean system using Maximum Likelihood:

$$roe_q = a + b roe_{q-4} + cEY_{q-4} + dCV_{q-4} + e\delta_{q-4} + fV_{q-4} + u_q,$$

where $u_q \sim N\left(0, V_{q-4}\right), V_{q-4} = E_{q-4}\left[u_q^2\right] = \exp[\alpha + \beta ln(u_{q-4}^2) + \gamma EY_{q-4} + \rho CV_{q-4} + \varphi\delta_{q-4}]$ with EY_q representing the earnings yield on the World Market Index. The parameters are estimated using the Maximum Likelihood method. The fitted value of V_q is the conditional variance of cash flows.

To obtain parameter starting values for the Maximum Likelihood routine, we proceed as follows:

1) Estimate $roe_q = a + b roe_{q-4} + cEY_{q-4} + dCV_{q-4} + e\delta_{q-4} + fV_{q-4} + u_q$;

2) Obtain the residual u from the OLS regression above and then regress $\ln\left(u_q^2\right) = \alpha + \beta ln\left(u_{q-4}^2\right) + \gamma EY_{q-4} + \rho CV_{q-4} + \varphi\delta_{q-4} + \varepsilon_q$ to obtain the starting values for α, β, γ, ρ, φ;

3) use the starting values obtained in 2) and calculate $\widehat{V_{q-4}} = \exp[\alpha + \beta ln(u_{q-4}^2) + \gamma EY_{q-4} + \rho CV_{q-4} + \varphi\delta_{q-4}]$, then run $roe_q = a + b roe_{q-4} + cEY_{q-4} + dCV_{q-4} + e\delta_{q-4} + f\widehat{V_{q-4}} + u_q$ to obtain the starting value of a, b, c, d, e, f.

The estimation results are as follows, with the first row presenting the coefficients and the second row t-statistics.

a	**b**	**c**	**d**	**e**	**f**	**α**	**β**	**γ**	**ρ**	**φ**	**log likelihood**
0.040	0.463	-0.224	0.124	0.115	77.624	-7.196	0.148	16.249	-15.940	-6.429	371.544
44.63	55.40	-14.56	5.48	16.45	12.53	-116.94	22.45	14.64	-6.60	-10.41	

2.5 Growth Opportunity (GO)

We obtain GO_t using the following regression:

$$EY_q = a + broe_q + cCV_q + d\delta_q + eV_q - GO_q$$

As defined above, the growth opportunity is the negative of the residual of the projection of global earnings yield on the four state variables. That is, the growth opportunity variable represents the part of the earnings yield that is unrelated to discount rates, cash flows and their variances, and we define it such that it is negatively correlated with the earnings yield.

The regression results are as follows, with the first row presenting the coefficients and the second row the t-statistics.

a	**b**	**c**	**d**	**e**	**Adj. R^2**
0.031	0.122	0.279	0.066	1.578	0.387
6.35	3.19	6.74	4.55	0.19	

Both the conditional market variance and the discount rate yield highly significant positive coefficients; higher expected returns decrease earnings yields. The ROE effect can be explained by mean reversion in ROE, which may imply it negatively affects earnings growth.

Table 1. Summary Statistics

This table presents the average number of firms, the median market value (MV) in US$ millions and the median of quarterly returns and ROE. To obtain the average number of firms, we calculate the number of firms in each quarter and then take the time-series average over the sample period. To obtain the median MV, we calculate the cross-sectional median of MV for each country in each quarter and then take the time-series average over the sample period. For each firm in each quarter t, we calculate the annual return as the return in USD over quarters (t-3, t), and compute ROE as the trailing 4-quarter net income divided by common equity at the beginning of the period. To obtain the median of annual return and ROE, we calculate the cross-sectional median for each country in each quarter and then take the time series average.

Country	# of Firms	MV (in $millions)	Annual Return (%)	ROE (%)
Australia	719	119	7.49	4.09
Austria	68	219	8.11	8.16
Belgium	91	168	12.91	9.85
Canada	500	158	9.87	6.42
Denmark	137	80	11.91	8.87
Finland	99	163	8.59	9.86
France	508	147	12.42	10.10
Germany	422	192	8.26	7.90
Hong Kong	546	152	9.76	9.78
Ireland	36	236	19.03	11.73
Israel	205	142	9.92	7.80
Italy	185	260	6.79	6.82
Japan	2,006	333	7.24	5.35
Netherlands	114	325	14.99	12.28
New Zealand	78	89	11.33	9.46
Norway	128	119	10.42	8.44
Portugal	54	152	3.84	7.97
Singapore	275	152	9.73	7.68
Spain	125	481	6.69	10.02
Sweden	209	117	12.20	11.23
Switzerland	174	282	11.24	8.82
UK	1,130	94	10.36	10.22
US	4,586	235	7.25	9.19

Table 2. Commonality in Firm Idiosyncratic Return Variances

This table presents evidence of commonality in firm-level idiosyncratic return variance (IVRET). Panel A presents the time-series average of cross-sectional median of firm-level IVRET. The row "Global" shows the time-series average of cross-sectional median of spot and kernel variances using data of all countries. Panel B presents the firm-level principal component analysis, summary statistics of country IVRET and regression results. IVRET is transformed using the kernel method. The row "Global" presents the results using data of all countries. The row "Average" shows the average of the values across all countries. Column I presents the time-series median of the % of variation explained by the 1st principal component of firm-level IVRET in each country over 1982-1995, 1996-2005, and 2006-2015. Columns II and III present the summary statistics for aggregate IVRET using value-weighted firm IVRET in each country. Column IV presents the median R^2 in a firm-level regression of IVRET on country value-weighted IVRET. Column V presents the median R^2 in a firm-level regression of IVRET on both global and country-specific value-weighted IVRET, where country-specific IVRET is country IVRET orthogonalized with respect to global IVRET.

Panel A. Summary Statistics of Firm Level IVRET

Country	Spot Variance	Kernel Variance
Australia	0.189	0.257
Austria	0.053	0.071
Belgium	0.055	0.065
Canada	0.142	0.175
Denmark	0.065	0.083
Finland	0.096	0.109
France	0.090	0.111
Germany	0.094	0.114
Hong Kong	0.137	0.178
Ireland	0.095	0.115
Israel	0.073	0.090
Italy	0.070	0.081
Japan	0.102	0.116
Netherlands	0.061	0.073
New Zealand	0.064	0.077
Norway	0.118	0.151
Portugal	0.068	0.094
Singapore	0.112	0.139
Spain	0.057	0.071
Sweden	0.112	0.130
Switzerland	0.057	0.068
UK	0.067	0.090
US	0.160	0.192
Global	0.112	0.135

Panel B. Commonality in Firm Level IVRET

Country	I Variation Explained by 1st PC	II Aggregate IVRET Mean	III Aggregate IVRET Std	IV Median R^2 (Country)	V Median R^2 (Global and Country)
Australia	51.2%	0.062	0.023	0.341	0.660
Austria	47.7%	0.053	0.025	0.453	0.666
Belgium	57.6%	0.043	0.027	0.316	0.572
Canada	63.7%	0.068	0.024	0.426	0.703
Denmark	49.0%	0.058	0.024	0.229	0.532
Finland	55.4%	0.069	0.035	0.410	0.711
France	52.0%	0.061	0.022	0.431	0.613
Germany	42.3%	0.053	0.033	0.381	0.606
Hong Kong	60.2%	0.071	0.032	0.257	0.632
Ireland	67.6%	0.078	0.059	0.265	0.629
Israel	65.1%	0.060	0.016	0.444	0.667
Italy	43.8%	0.054	0.017	0.332	0.616
Japan	58.2%	0.081	0.027	0.531	0.621
Netherlands	61.1%	0.039	0.020	0.372	0.555
New Zealand	59.6%	0.046	0.012	0.315	0.590
Norway	47.9%	0.080	0.028	0.312	0.512
Portugal	49.4%	0.062	0.026	0.213	0.507
Singapore	58.8%	0.068	0.035	0.411	0.599
Spain	45.8%	0.039	0.013	0.224	0.490
Sweden	64.2%	0.060	0.023	0.498	0.667
Switzerland	52.3%	0.033	0.014	0.419	0.605
UK	46.2%	0.055	0.024	0.299	0.606
US	61.1%	0.078	0.037	0.392	0.644
Global	56.5%	0.072	0.028	0.391	0.633
Average	54.8%	0.060	0.026	0.360	0.609

Table 3. Commonality in Country Aggregate Idiosyncratic Variances

This table presents evidence of commonality in country-level value-weighted idiosyncratic return variances (IVRET). IVRET is transformed using the kernel method. Panel A presents correlations of country-level value-weighted IVRET and market returns. Market return is the market return in USD over each quarter. For each country, we obtain the correlations of IVRET or market return with all other countries. Column I presents the average correlation of IVRET with the IVRET of other countries. Column II (III) presents the 25th (75th) percentile of the IVRET correlations with other countries. Column IV presents the average correlation of a country's market return with the market returns from other countries. Column V (VI) presents the 25th (75th) percentile of the market return correlations with other countries. Column VII-IX show the regression results of country's VW IVRET on global VW IVRET. The t-statistics are adjusted for serial correlation using Newey and West (1987) standard errors with four lags. The row Overall (G7) Average presents the equally-weighted average of the statistics in each column across all countries (the G7 countries). Panel B presents a panel regression of country IVRET on global IVRET, including an interaction term with a financial integration measure (FI). The regression includes country fixed effects. The first row presents coefficients, and the second row presents t-stats. Standard errors are clustered by country.

Panel A. Commonality in Country IVRET

	IVRET Correlation			Market Return Correlation			Regression on Global VW IVRET		
	I	II	III	IV	V	VI	VII	VIII	IX
Country	Average	P25	P75	Average	P25	P75	Coeff.	t-stat	Adj. R^2
Australia	0.489	0.310	0.690	0.603	0.557	0.649	0.343	2.55	0.165
Austria	0.580	0.451	0.775	0.556	0.513	0.643	0.446	3.40	0.278
Belgium	0.555	0.407	0.745	0.628	0.499	0.722	0.481	2.90	0.260
Canada	0.683	0.669	0.851	0.626	0.580	0.703	0.740	13.20	0.758
Denmark	0.660	0.599	0.836	0.596	0.557	0.667	0.693	7.62	0.687
Finland	0.143	-0.106	0.384	0.571	0.506	0.639	0.199	1.82	0.022
France	0.538	0.244	0.707	0.672	0.586	0.782	0.725	14.06	0.840
Germany	0.677	0.650	0.845	0.648	0.580	0.712	0.987	11.52	0.719
Hong Kong	0.439	0.263	0.694	0.480	0.423	0.524	0.550	3.69	0.220
Ireland	0.512	0.298	0.707	0.585	0.480	0.648	0.873	2.54	0.170
Israel	0.708	0.662	0.775	0.589	0.513	0.657	0.364	7.31	0.649
Italy	0.408	0.107	0.638	0.583	0.484	0.681	0.368	6.03	0.385
Japan	0.596	0.379	0.777	0.413	0.381	0.453	0.887	17.39	0.878
Netherlands	0.672	0.597	0.853	0.684	0.592	0.762	0.611	12.58	0.753
New Zealand	0.510	0.379	0.639	0.543	0.512	0.584	0.150	2.56	0.153
Norway	0.692	0.569	0.838	0.593	0.537	0.670	0.844	11.41	0.782
Portugal	0.132	-0.033	0.322	0.626	0.538	0.734	0.104	1.30	0.007
Singapore	0.622	0.594	0.769	0.516	0.457	0.569	0.955	7.50	0.598
Spain	0.631	0.473	0.805	0.643	0.534	0.743	0.359	10.54	0.731
Sweden	0.577	0.409	0.713	0.682	0.645	0.749	0.591	7.38	0.544
Switzerland	0.654	0.661	0.792	0.630	0.540	0.708	0.384	5.16	0.579
UK	0.715	0.685	0.868	0.673	0.609	0.741	0.772	12.47	0.826
US	0.633	0.448	0.851	0.609	0.548	0.686	1.292	34.78	0.973
Overall	0.558	0.422	0.734	0.598	0.529	0.671	0.596	8.68	0.521
G7 Average	0.607	0.455	0.791	0.604	0.538	0.680	0.824	15.64	0.768

Panel B. The Effect of Financial Integration

	Country VW IVRET	
	Overall Integration	Equity Integration
FI	-0.005	0.004
	(-0.12)	(0.13)
Global IVRET	0.717	0.708
	(1.07)	(1.40)
Global IVRET*FI	-0.122	-0.114
	(-0.18)	(-0.23)
Overall R^2	0.497	0.496

Table 4. Cyclicality of Aggregate Idiosyncratic Return Variances

This table presents the regression results of aggregate value-weighted idiosyncratic return variances (IVRET) on GDP growth rates. GDP growth is the growth rate of trailing 4-quarter real GDP compared to the same quarter of previous year (seasonally adjusted). We obtain nominal GDP and GDP deflator data for each country and the OECD total from Datastream. Both IVRET and the GDP growth rate are transformed using the kernel method. Panel A presents the regression results by country. For each country, we regress country IVRET on contemporaneous global and country-specific GDP growth rates, where country-specific GDP growth rate is obtained by orthogonalizing the country's GDP growth rate with respect to the global GDP growth rate. The row "Average" presents the average of coefficients and t-stats across 23 countries. The row "Global" presents the result of regressing global IVROE on global GDP growth rate. Panel B presents the panel regression result. We regress country IVRET on the contemporaneous and one-year lag/lead global and country GDP growth rates. The regression includes country fixed effects and the standard errors are clustered by country. The first row presents coefficient estimates and the t-stats are in parentheses.

Panel A. By Country

	Global GDP Growth		Country-Specific GDP Growth		
	I	II	III	IV	V
Country	Coeff.	t-stat	Coeff.	t-stat	Adj.R^2
Australia	-1.022	-5.89	1.004	3.99	0.268
Austria	-1.287	-7.02	1.428	4.88	0.378
Belgium	-1.217	-6.75	2.291	6.66	0.406
Canada	-0.565	-3.14	1.257	6.03	0.250
Denmark	-0.756	-3.80	-0.260	-0.85	0.093
Finland	0.344	1.27	-1.417	-9.52	0.462
France	0.747	4.83	2.090	7.30	0.359
Germany	-0.891	-3.27	-0.522	-1.66	0.079
Hong Kong	-1.315	-5.91	-0.763	-6.96	0.380
Ireland	-3.751	-9.81	-0.544	-4.00	0.461
Israel	-0.170	-0.96	0.557	3.29	0.121
Italy	0.271	2.00	0.928	3.93	0.116
Japan	0.708	3.49	-0.849	-5.46	0.231
Netherlands	-0.466	-3.34	1.229	7.78	0.344
New Zealand	-0.691	-7.83	-0.433	-6.48	0.491
Norway	-0.288	-1.20	-0.415	-1.88	0.023
Portugal	-0.102	-0.44	0.992	6.46	0.276
Singapore	-0.700	-2.60	-0.637	-5.31	0.198
Spain	0.195	1.73	0.480	5.60	0.229
Sweden	-0.504	-2.54	-0.276	-1.42	0.049
Switzerland	-0.355	-3.00	0.465	3.22	0.119
UK	-0.492	-2.40	0.131	0.43	0.029
US	0.372	1.17	0.867	1.39	0.010
Average	-0.519	-2.41	0.331	0.76	0.234
Global	0.254	1.04	––	––	0.001

Panel B. Panel Regression

		Global GDP Growth			Country-Specific GDP Growth			
		GDP Growth$_{g,t}$	GDP Growth$_{g,t-4}$	GDP Growth$_{g,t+4}$	GDP Growth$_{c,t}$	GDP Growth$_{c,t-4}$	GDP Growth$_{c,t+4}$	Overall R^2
I	Coeff	-0.544			-0.284			0.231
	t-stat	(-2.70)			(-1.74)			
II	Coeff		0.163			-0.197		0.197
	t-stat		(1.09)			(-1.19)		
III	Coeff			-0.967			-0.319	0.298
	t-stat			(-4.42)			(-2.38)	
IV	Coeff	-1.352	1.545	-0.587	0.154	-0.207	-0.393	0.366
	t-stat	(-7.18)	(9.46)	(-2.50)	(0.68)	(-0.92)	(-2.59)	

Table 5. Summary Statistics of ROE Factors

This table presents the summary statistics of ROE factors. For each country at the end of each June, sort stocks into 3 portfolios based on size or B/M ratio (one-way sort), i.e. Size1, Size2, Size3, B/M1, B/M2, B/M3. The size used to form portfolios in June of year t is market value at the end of June of t. The B/M ratio used to form portfolios in June of year t is book equity for the fiscal year ending in calendar year t-1, divided by market equity at the end of December of t-1. MKT_ROE is the value-weighted ROE of all firms in the sample. SMB_ROE is the difference between value-weighted ROE of firms in Size1 (smallest) and value-weighted ROE of firms in Size3 (largest). HML_ROE is the difference between value-weighted ROE of firms in B/M3 (highest) and value-weighted ROE of firms in B/M1 (lowest). Global ROE factors are value-weighted country-level ROE factors (including countries when they have data available). All statistics are in percent.

	MKT_ROE		SMB_ROE		HML_ROE	
Country	Mean (%)	Std Dev (%)	Mean (%)	Std Dev (%)	Mean (%)	Std Dev (%)
Australia	14.12	4.12	-20.11	18.00	-12.32	8.83
Austria	10.16	4.11	-5.42	7.14	-6.33	5.41
Belgium	14.43	4.50	-8.57	7.75	-10.11	7.91
Canada	12.07	3.49	-14.08	9.58	-9.14	6.99
Denmark	16.85	8.24	-12.42	12.29	-16.24	13.42
Finland	16.16	11.16	-10.50	11.55	-17.11	10.59
France	12.87	3.66	-7.68	3.41	-9.65	4.20
Germany	11.18	2.75	-8.52	6.72	-6.92	5.40
Hong Kong	17.68	3.25	-14.59	7.23	-16.06	4.00
Ireland	15.39	7.27	-10.61	11.17	-12.90	11.48
Israel	13.73	4.97	-11.46	8.18	-11.14	6.47
Italy	10.94	4.67	-10.13	6.06	-11.04	6.83
Japan	7.17	3.25	-3.77	2.54	-4.81	3.66
Netherlands	17.61	4.96	-10.09	6.30	-19.74	8.86
New Zealand	17.57	10.31	-16.30	11.10	-19.50	16.75
Norway	14.39	7.60	-14.51	9.48	-8.44	12.89
Portugal	14.59	3.94	-11.81	6.80	-14.34	8.17
Singapore	13.33	4.27	-10.08	4.90	-11.97	4.30
Spain	15.92	4.86	-12.27	9.11	-12.73	7.47
Sweden	17.14	5.36	-14.87	11.79	-8.51	12.33
Switzerland	14.71	4.52	-10.35	6.27	-10.69	6.89
UK	19.35	3.35	-16.84	10.88	-23.34	7.53
US	18.72	3.19	-22.38	4.24	-17.10	5.35
Global	15.37	2.82	-15.88	4.81	-13.69	4.39

Table 6. Estimating IVROE

This table presents the coefficients and t-statistics from the following regression run country by country: $ROE_{i,t} = a_1*\ln(size)_{i,t-1} + a_2*B/M_{i,t-1} + [b_0 + b_1*\ln(size)_{i,t-1} + b_2*B/M_{i,t-1}]*WMKT\_ROE_t + [c_0 + c_1*\ln(size)_{i,t-1} + c_2*B/M_{i,t-1}]*WSMB\_ROE_t + [d_0 + d_1*\ln(size)_{i,t-1} + d_2*B/M_{i,t-1}]*WHML\_ROE_t + [e_0 + e_1*\ln(size)_{i,t-1} + e_2*B/M_{i,t-1}]*MKT\_ROE_t + [f_0 + f_1*\ln(size)_{i,t-1} + f_2*B/M_{i,t-1}]*SMB\_ROE_t + [g_0 + g_1*\ln(size)_{i,t-1} + g_2*B/M_{i,t-1}] *HML\_ROE_t + \text{firm dummies} + u_{i,t}$ where MKT_ROE, SMB_ROE and HML_ROE are orthogonalized to the global factors. Standard errors are clustered by both firm and quarter. The columns P25, Median and P75 shows the 25th percentile, median and 75th percentile of the statistics across all countries.

	P25		Median		P75		U.S.	
Variable	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Size	0.022	1.45	0.042	2.73	0.054	4.11	0.066	15.72
BM	-0.047	-1.13	-0.011	-0.16	0.053	1.39	-0.052	-4.47
WMKT	0.431	0.82	0.970	2.13	1.649	2.80	0.365	2.00
Size*WMKT	-0.075	-1.17	-0.030	-0.38	0.029	0.56	0.044	2.11
BM*WMKT	-0.339	-1.38	-0.101	-0.66	0.024	0.11	0.213	2.91
WSMB	0.503	0.84	0.926	2.44	1.802	3.67	0.501	2.44
Size*WSMB	-0.093	-1.30	-0.024	-0.70	0.025	0.27	0.038	1.33
BM*WSMB	-0.335	-1.90	-0.092	-0.41	0.086	0.43	0.081	0.81
WHML	-0.129	-0.48	0.372	0.82	0.599	1.51	0.586	2.86
Size*WHML	-0.070	-1.50	-0.046	-0.51	0.023	0.79	0.020	0.69
BM*WHML	-0.098	-0.58	-0.010	-0.05	0.114	0.69	-0.055	-0.56
MKT	0.216	0.63	0.601	1.68	1.363	3.17	-0.329	-1.07
Size*MKT	-0.053	-1.06	-0.007	-0.17	0.082	1.45	-0.038	-0.93
BM*MKT	-0.229	-1.43	-0.167	-1.07	-0.021	-0.13	0.010	0.07
SMB	0.687	2.79	1.015	4.13	1.348	4.81	0.417	2.23
Size*SMB	-0.146	-4.27	-0.086	-3.17	-0.062	-2.04	-0.091	-4.23
BM*SMB	-0.264	-2.59	-0.173	-1.92	-0.122	-1.46	0.129	1.71
HML	-0.261	-1.39	-0.065	-0.39	-0.009	-0.06	-0.196	-0.95
Size*HML	0.001	0.01	0.019	0.81	0.034	1.53	-0.043	-1.52
BM*HML	0.032	0.47	0.086	1.14	0.176	1.81	-0.105	-1.10
Overall R^2	0.402		0.444		0.492		0.475	

Table 7. Commonality in Firm Idiosyncratic ROE Variances

This table presents evidence of commonality in firm-level idiosyncratic ROE variances (IVROE). Panel A presents the time-series average of cross-sectional median of firm-level IVROE for each country. The row "Global" shows the time-series average of cross-sectional median of spot and kernel variances using data of all countries. Panel B presents the firm-level principal component analysis and regression results. IVROE is transformed using the kernel method. The row "Global" presents the results using data of all countries. The row "Average" shows the average of the values across all countries. Column I presents the time-series median of the % of variation explained by the 1st principal component of firm-level IVRET in each country over 1982-1995, 1996-2005, and 2006-2015. Columns II and III present the time-series mean and standard deviation for aggregate IVROE using the value-weighted firm IVROE in each country. Column IV presents the median R^2 in a firm-level regression of IVROE on country value-weighted IVROE. Column V presents the median R^2 in a firm-level regression of IVROE on both global and country-specific value-weighted IVROE, where country-specific IVROE is country IVROE orthogonalized with respect to global IVROE.

Panel A. Summary Statistics of Firm Level IVROE

Country	Spot Variance	Kernel Variance
Australia	0.006	0.013
Austria	0.003	0.005
Belgium	0.003	0.007
Canada	0.005	0.009
Denmark	0.004	0.007
Finland	0.004	0.007
France	0.004	0.006
Germany	0.004	0.008
Hong Kong	0.005	0.008
Ireland	0.005	0.008
Israel	0.006	0.010
Italy	0.003	0.005
Japan	0.001	0.002
Netherlands	0.004	0.007
New Zealand	0.003	0.005
Norway	0.009	0.018
Portugal	0.004	0.006
Singapore	0.003	0.005
Spain	0.003	0.005
Sweden	0.007	0.014
Switzerland	0.002	0.003
UK	0.005	0.010
US	0.005	0.010
Global	0.004	0.007

Panel B. Firm Level Commonality

	I	II	III	IV	V
Country	Variation Explained by 1st PC	Aggregate IVROE Mean	Aggregate IVROE Std	Median R^2 (Country)	Median R^2 (Global and Country)
Australia	38.1%	0.012	0.004	0.237	0.582
Austria	40.9%	0.007	0.003	0.137	0.434
Belgium	44.8%	0.010	0.006	0.100	0.374
Canada	34.5%	0.012	0.002	0.098	0.386
Denmark	38.5%	0.019	0.015	0.116	0.379
Finland	47.2%	0.014	0.007	0.188	0.445
France	40.8%	0.012	0.006	0.233	0.539
Germany	40.2%	0.011	0.004	0.189	0.484
Hong Kong	40.4%	0.011	0.004	0.105	0.388
Ireland	42.2%	0.015	0.017	0.081	0.332
Israel	46.5%	0.022	0.007	0.203	0.483
Italy	40.2%	0.010	0.004	0.153	0.348
Japan	38.8%	0.007	0.002	0.100	0.266
Netherlands	40.4%	0.014	0.006	0.139	0.340
New Zealand	46.3%	0.013	0.008	0.200	0.488
Norway	40.9%	0.026	0.016	0.240	0.541
Portugal	47.0%	0.013	0.007	0.141	0.412
Singapore	41.6%	0.009	0.004	0.201	0.472
Spain	40.6%	0.011	0.005	0.109	0.364
Sweden	39.8%	0.016	0.008	0.170	0.501
Switzerland	42.1%	0.012	0.008	0.159	0.352
UK	37.8%	0.019	0.009	0.193	0.404
US	38.0%	0.021	0.005	0.242	0.573
Global	39.3%	0.014	0.009	0.180	0.474
Average	41.2%	0.014	0.007	0.162	0.430

Table 8. The Commonality in Country Aggregate Idiosyncratic ROE Variances

This table presents evidence of commonality in country-level value-weighted (VW) idiosyncratic ROE variances (IVROE). IVROE is transformed using the kernel method. Panel A presents correlations of country-level value-weighted IVROE. Columns I-III show the correlations of country-level value-weighted IVROE. For each country, we obtain the correlations of IVROE with all other countries. Column I presents the average correlation of IVROE with other countries. Column II (III) presents the 25th (75th) percentile of the IVROE correlations with other countries. Columns IV-VI show the results of regressing country's VW IVROE on global VW IVROE. The t-statistics are adjusted for serial correlation using Newey and West (1987) standard errors with four lags. The row Overall (G7) Average presents the equally-weighted average of the statistics in each column across all countries (the G7 countries). Panel B presents a panel regression of country IVROE on global IVRET, including an interaction term with a financial integration measure (FI). The regression includes country fixed effects. The first row presents coefficients, and the second row presents t-stats. Standard errors are clustered by country.

Panel A. Commonality in Country IVROE

	IVROE Correlation			Regression on Global VW IVROE		
	I	II	III	IV	V	VI
Country	Average	P25	P75	Coefficient	t-stat	Adj. R^2
Australia	0.187	-0.021	0.447	0.371	2.51	0.121
Austria	0.033	-0.172	0.224	-0.024	-0.17	-0.007
Belgium	0.186	0.037	0.279	0.284	1.41	0.023
Canada	0.238	0.104	0.415	0.259	2.53	0.238
Denmark	0.075	-0.085	0.198	2.063	3.97	0.278
Finland	-0.208	-0.384	-0.061	-0.726	-2.04	0.119
France	0.033	-0.185	0.199	-0.168	-0.58	0.006
Germany	0.209	-0.079	0.463	0.581	4.43	0.344
Hong Kong	0.195	0.062	0.374	0.531	2.30	0.233
Ireland	-0.015	-0.131	0.062	0.484	2.27	0.005
Israel	0.244	0.047	0.452	0.581	1.95	0.077
Italy	0.096	-0.067	0.244	0.425	2.68	0.217
Japan	0.170	0.019	0.444	0.332	4.77	0.379
Netherlands	0.245	0.071	0.432	1.156	6.21	0.525
New Zealand	0.265	0.064	0.514	1.272	3.93	0.336
Norway	-0.014	-0.284	0.319	-1.697	-1.79	0.170
Portugal	0.285	0.211	0.439	0.911	3.65	0.203
Singapore	0.183	-0.029	0.431	0.380	2.87	0.133
Spain	0.140	-0.113	0.430	0.428	1.43	0.082
Sweden	0.010	-0.204	0.241	-0.310	-0.81	0.014
Switzerland	0.080	-0.212	0.324	0.623	2.02	0.075
UK	0.251	0.063	0.512	1.985	12.80	0.855
US	0.239	0.095	0.421	1.062	11.42	0.764
Overall Average	0.136	-0.052	0.339	0.470	2.95	0.226
G7 Average	0.177	-0.007	0.385	0.639	5.43	0.401

Panel B. The Effect of Financial Integration

	Country VW IVROE	
	Overall Integration	Equity Integration
FI	-0.048	-0.023
	(-1.99)	(-2.04)
Global IVROE	-1.744	-0.535
	(-1.46)	(-0.94)
Global IVROE*FI	2.516	1.151
	(1.97)	(1.83)
R^2	0.340	0.330

Table 9. Cyclicality of Aggregate Idiosyncratic ROE Variances

This table presents the regression results of aggregate idiosyncratic ROE variances (IVROE) on quarterly GDP growth rates. GDP growth is the growth rate of trailing 4-quarter real GDP compared to the same quarter of previous year (seasonally adjusted). We obtain nominal GDP and GDP deflator data for each country and the OECD total from Datastream. Both IVROE and the GDP growth rate are transformed using the kernel method. Panel A presents the regression results by country. For each country, we regress aggregate IVROE on contemporaneous global and country-specific GDP growth rates, where country-specific GDP growth rate is obtained by orthogonalizing the country's GDP growth rate with respect to global GDP growth rate. The row "Average" presents the average of coefficients and t-stats across 23 countries. The row "Global" presents result of regression global IVROE on global GDP growth rate. Panel B presents the panel regression result. We regress country IVROE on contemporaneous and one-year lag/lead global and country GDP growth. The regression includes country fixed effects and the standard errors are clustered by country. The first row presents coefficient estimates and the t-stats are in parentheses.

Panel A. By Country

	Global GDP Growth		Country-Specific GDP Growth		
	I	II	III	IV	V
Country	Coeff.	t-stat	Coeff.	t-stat	Adj.R^2
Australia	-0.187	-6.41	0.218	5.13	0.330
Austria	0.041	1.70	0.063	1.62	0.029
Belgium	-0.183	-3.98	0.602	6.84	0.320
Canada	-0.002	-0.11	0.008	0.36	-0.014
Denmark	-0.341	-2.62	0.119	0.59	0.039
Finland	0.091	1.46	-0.246	-7.22	0.332
France	0.218	4.76	0.100	1.18	0.142
Germany	-0.019	-0.62	-0.170	-4.68	0.132
Hong Kong	0.135	4.02	-0.072	-4.36	0.200
Ireland	-0.342	-2.37	-0.081	-1.57	0.045
Israel	-0.416	-7.69	0.050	0.97	0.443
Italy	0.010	0.31	0.008	0.15	-0.014
Japan	0.010	0.67	-0.098	-8.56	0.350
Netherlands	-0.141	-2.78	0.231	4.01	0.141
New Zealand	0.416	5.86	-0.007	-0.12	0.236
Norway	0.864	8.55	-0.573	-6.18	0.466
Portugal	-0.410	-7.23	0.188	4.94	0.416
Singapore	-0.095	-2.80	-0.029	-1.89	0.066
Spain	-0.236	-5.43	0.146	4.42	0.301
Sweden	0.023	0.43	-0.520	-9.85	0.433
Switzerland	-0.646	-16.50	0.392	8.21	0.724
UK	-0.079	-1.08	0.211	1.94	0.022
US	-0.128	-3.15	0.039	0.49	0.058
Average	-0.062	-1.52	0.025	-0.16	0.226
Global	-0.097	-2.90	––	––	0.053

Panel B. Panel Regression

		Global GDP Growth			Country-Specific GDP Growth			
		GDP $Growth_{g,t}$	GDP $Growth_{g,t-4}$	GDP $Growth_{g,t+4}$	GDP $Growth_{c,t}$	GDP $Growth_{c,t-4}$	GDP $Growth_{c,t+4}$	Overall R^2
I	Coeff	-0.060			-0.051			0.276
	t-stat	(-0.94)			(-1.49)			
II	Coeff		0.015			-0.032		0.270
	t-stat		(0.24)			(-0.83)		
III	Coeff			-0.126			-0.047	0.289
	t-stat			(-2.04)			(-1.47)	
IV	Coeff	0.036	0.076	-0.193	-0.085	0.028	0.006	0.300
	t-stat	(0.39)	(0.88)	(-2.29)	(-0.58)	(0.33)	(0.06)	

Table 10. The Relationship between Idiosyncratic Return and ROE Variances

This table presents the relationship between country-level idiosyncratic return variances (IVRET) and idiosyncratic ROE variance (IVROE). Both IVRET and IVROE are transformed using the kernel method. Column I and II shows the correlation between country-level IVRET and IVROE. Column I shows the correlation and II shows p-value. The row "Global" shows the correlation between global IVRET and global IVROE. Column III-VII present results from a regression of country-level IVRET on global and country-specific IVROE. Global IVROE is the value-weighted average of country-level value-weighted IVROE. Country-specific IVROE is country-level IVROE orthogonalized with respect to global-level IVROE. The row "Global" shows the regression results from a pooled regression for all countries with country dummies. Standard errors are clustered by country and we report overall R^2 instead. The last 3 rows report percentiles (25^{th}, median and 75^{th}) of the cross-country distribution of the various statistics.

	Correlation		Global IVROE		Country-Specific IVROE		
	I	II	III	IV	V	VI	VII
Country	Coeff.	p-value	Coeff.	t-stat	Coeff.	t-stat	Adj.R^2
Australia	0.784	0.00	1.724	5.41	4.417	13.41	0.609
Austria	0.233	0.01	2.629	4.90	2.336	3.00	0.210
Belgium	0.820	0.00	2.581	8.19	3.249	16.57	0.725
Canada	0.501	0.00	4.350	12.34	2.190	2.83	0.543
Denmark	0.088	0.32	4.327	13.03	-0.637	-6.29	0.616
Finland	0.776	0.00	-2.197	-3.59	3.891	12.07	0.599
France	0.310	0.00	2.430	6.02	1.429	5.05	0.310
Germany	0.450	0.00	6.246	13.29	0.036	0.06	0.568
Hong Kong	0.523	0.00	5.500	10.88	1.931	3.62	0.493
Ireland	0.278	0.00	5.122	4.18	0.858	3.00	0.159
Israel	0.457	0.00	2.662	6.92	0.737	3.59	0.409
Italy	0.306	0.00	0.981	2.84	1.163	2.67	0.090
Japan	0.512	0.00	3.800	8.12	3.275	2.95	0.353
Netherlands	0.692	0.00	4.201	18.35	0.526	2.51	0.719
New Zealand	0.139	0.16	0.834	2.64	-0.019	-0.11	0.045
Norway	0.095	0.29	4.309	9.71	0.748	6.17	0.510
Portugal	0.150	0.13	-1.082	-1.59	1.006	2.61	0.065
Singapore	0.518	0.00	6.790	15.37	2.266	4.84	0.660
Spain	-0.227	0.02	1.346	4.66	-0.929	-4.36	0.262
Sweden	0.482	0.00	3.539	11.80	1.656	11.41	0.681
Switzerland	0.194	0.03	1.899	6.81	0.084	0.62	0.258
UK	0.557	0.00	4.069	10.84	-1.341	-2.90	0.482
US	0.609	0.00	6.285	10.55	0.541	0.53	0.452
Global	0.646	0.00	3.391	7.75	0.828	2.94	0.403
P25	0.213	0.00	1.812	4.78	0.305	0.58	0.260
Median	0.457	0.00	3.539	8.12	1.006	2.95	0.482
P75	0.540	0.01	4.338	11.34	2.228	4.94	0.604

Table 11. Summary Statistics for Global Idiosyncratic Variances and State Variables

This table shows the summary statistics and correlation matrix of global value-weighted idiosyncratic variances and state variables. State variables are estimated using data on the Datastream World Market Index. CV is the conditional variance of global returns. δ represents the global discount rate. We calculate ROE as the net income divided by lagged book value and roe is the natural logarithm of 1+ROE. V is the conditional aggregate variance of the cash flows; GO is the growth opportunity measure. Panel A presents means and standard deviations. Panel B presents the correlation matrix, and bold denotes significance at the 5% level.

Panel A. Summary Statistics

	Global IVRET	Global IVROE	CV	δ	roe	V	GO
Mean	0.073	0.016	0.020	0.078	0.113	0.000	0.000
Std	0.030	0.004	0.022	0.062	0.023	0.000	0.009

Panel B. Correlation Matrix

	Global IVRET	Global IVROE	CV	δ	roe	V	GO
Global IVRET	1.000	**0.669**	0.095	**-0.477**	-0.104	0.173	**0.313**
Global IVROE	**0.669**	1.000	0.029	**-0.276**	-0.113	0.001	0.123
CV	0.095	0.029	1.000	0.042	**-0.186**	**0.201**	0.000
δ	**-0.477**	**-0.276**	0.042	1.000	-0.111	-0.103	0.000
roe	-0.104	-0.113	**-0.186**	-0.111	1.000	0.168	0.000
V	0.173	0.001	**0.201**	-0.103	0.168	1.000	0.000
GO	**0.313**	0.123	0.000	0.000	0.000	0.000	1.000

Table 12. Explaining the Global Component in Idiosyncratic Returns Variances

This table presents the regression results of global value-weighted IVRET on global IVROE and state variables. State variables are estimated using data on Datastream World Market Index. CV is the conditional variance of global returns. δ represents the global discount rate. We calculate ROE as the net income divided by lagged book value and roe is the natural logarithm of 1+ROE. V is the conditional aggregate variance of the cash flows; GO is the growth opportunity. The estimation of the state variables is described in text. Panel A presents the results using only state variables as explanatory variables. Panel B presents results using both global IVROE and state variables. T-stats are in parentheses.

Panel A. Only State Variables

	CV	δ	roe	V	GO	Adj. R2
Coeff.	0.134					0.001
t-stat	(1.04)					
Coeff.		-0.235				0.222
t-stat		(-5.69)				
Coeff.			-0.127			0.001
t-stat			(-1.06)			
Coeff.				45.861		0.021
t-stat				(1.83)		
Coeff.					1.040	0.090
t-stat					(3.44)	
Coeff.	0.085	-0.240	-0.214	36.745	1.040	0.349
t-stat	(0.78)	(-6.26)	(-2.12)	(1.71)	(4.07)	

Panel B. Global IVROE and State Variables

	Global IVROE	CV	δ	roe	V	GO	Adj. R^2
Coeff.	5.832						0.492
t-stat	(10.36)						
Coeff.	5.806	0.088					0.491
t-stat	(10.30)	(0.96)					
Coeff.	5.126		-0.150				0.575
t-stat	(9.56)		(-4.72)				
Coeff.	5.802			-0.063			0.489
t-stat	(10.26)			(-0.74)			
Coeff.	5.831				45.726		0.517
t-stat	(10.63)				(2.60)		
Coeff.	5.599					0.764	0.540
t-stat	(10.38)					(3.53)	
Coeff.	4.767	0.046	-0.156	-0.146	40.394	0.805	0.656
t-stat	(9.73)	(0.58)	(-5.36)	(-1.98)	(2.59)	(4.29)	
	60.11%	0.50%	22.52%	1.74%	3.89%	11.23%	100.00%

Online Appendix

Table OA1. Commonality in Country-Specific Idiosyncratic Return Variances

This table presents the summary statistics of cross-country correlations of country-specific idiosyncratic return variances (IVRET). IVRET is transformed using the kernel method and is value-weighted. To obtain country-specific IVRET, we regress the country aggregate IVRET on the global IVRET and obtain the residuals. Column I presents the average correlation of country-specific IVRET with the other countries. Column II (III) presents the 25th (75th) percentile of the country-specific IVRET correlations with the other countries.

	Country-Specific IVRET Correlation		
	I	II	III
Country	Average	P25	P75
Australia	0.303	-0.170	0.752
Austria	0.337	-0.058	0.747
Belgium	0.322	-0.114	0.704
Canada	0.266	-0.352	0.747
Denmark	0.250	-0.033	0.496
Finland	-0.022	-0.326	0.137
France	-0.298	-0.548	0.002
Germany	0.275	-0.188	0.704
Hong Kong	0.190	-0.314	0.595
Ireland	0.335	-0.094	0.766
Israel	0.200	-0.029	0.522
Italy	-0.061	-0.364	0.233
Japan	-0.177	-0.314	-0.039
Netherlands	0.242	-0.213	0.584
New Zealand	0.331	0.169	0.686
Norway	0.261	0.152	0.502
Portugal	0.014	-0.334	0.290
Singapore	0.212	-0.164	0.559
Spain	0.067	-0.328	0.259
Sweden	0.137	-0.115	0.390
Switzerland	0.285	0.034	0.570
UK	0.320	-0.183	0.756
US	-0.240	-0.435	-0.056
Overall Average	0.154	-0.188	0.474
G7 Average	0.012	-0.341	0.335

Table OA2. Cyclicality of Aggregate Idiosyncratic Return Variances (Equal-Weighted)

This table presents the regression results of aggregate equal-weighted idiosyncratic return variances (IVRET) on GDP growth rates. GDP growth is the growth rate of trailing 4-quarter real GDP compared to the same quarter of previous year (seasonally adjusted). We obtain nominal GDP and GDP deflator data for each country and the OECD total from Datastream. Both IVRET and the GDP growth rate are transformed using the kernel method. For each country, we regress country IVRET on contemporaneous global and country-specific GDP growth rates, where country-specific GDP growth rate is obtained by orthogonalizing the country's GDP growth rate with respect to the global GDP growth rate.

	Global GDP Growth		Country-Specific GDP Growth		
	I	II	III	IV	V
Country	Coeff.	t-stat	Coeff.	t-stat	Adj.R^2
Australia	-20.627	-11.48	9.471	3.63	0.518
Austria	-3.918	-9.59	0.842	1.29	0.439
Belgium	-4.353	-13.81	3.712	6.18	0.638
Canada	-8.389	-7.51	9.215	7.12	0.441
Denmark	-6.635	-25.21	-2.706	-6.68	0.840
Finland	0.536	1.21	-0.290	-1.19	0.008
France	-3.764	-6.87	4.544	4.49	0.329
Germany	-5.324	-6.37	-2.904	-3.02	0.264
Hong Kong	-6.810	-6.01	-2.898	-5.19	0.315
Ireland	-9.937	-11.95	0.476	1.61	0.526
Israel	-3.016	-11.37	0.903	3.56	0.663
Italy	-0.477	-1.68	2.111	4.28	0.126
Japan	-0.650	-1.92	-2.940	-11.34	0.495
Netherlands	-1.697	-5.11	0.774	2.05	0.175
New Zealand	-5.293	-16.74	-1.745	-7.30	0.759
Norway	-5.541	-11.85	-2.158	-5.03	0.567
Portugal	-1.423	-1.25	-1.863	-2.45	0.050
Singapore	-11.130	-11.85	-3.056	-7.31	0.591
Spain	-1.253	-8.16	-0.413	-3.53	0.414
Sweden	-9.192	-15.38	3.261	5.58	0.680
Switzerland	-1.659	-5.48	0.601	1.63	0.192
UK	-5.613	-12.32	1.962	2.90	0.543
US	1.260	1.06	1.428	0.61	-0.004

Table OA3. Cyclicality of Country Level ROE Factors

This table presents the regression result of country level ROE factors on GDP growth. For each country at the end of each June, sort stocks into 3 portfolios based on size or B/M ratio (one-way sort), i.e. Size1, Size2, Size3, B/M1, B/M2, B/M3. The size used to form portfolios in June of year t is market value at the end of June of t. The B/M ratio used to form portfolios in June of year t is book equity for the fiscal year ending in calendar year t-1, divided by market equity at the end of December of t-1. MKT_ROE is the value-weighted ROE of all firms in the sample. SMB_ROE is the difference between value-weighted ROE of firms in Size1 (smallest) and value-weighted ROE of firms in Size3 (largest). HML_ROE is the difference between value-weighted ROE of firms in B/M3 (highest) and value-weighted ROE of firms in B/M1 (lowest). GDP growth is the growth rate of trailing 4-quarter real GDP compared to the same quarter of the previous year (seasonally adjusted). We obtain nominal GDP and GDP deflator data for each country and the OECD total from Datastream. The GDP growth rate is transformed using the kernel method. T-statistics are shown in parentheses.

	MKT_ROE		SMB_ROE		HML_ROE	
Country	GDP Growth	Adj. R^2	GDP Growth	Adj. R^2	GDP Growth	Adj. R^2
Australia	0.668	0.062	1.245	0.005	0.625	0.006
	(3.12)		(1.29)		(1.32)	
Austria	1.268	0.219	0.469	0.002	0.970	0.068
	(5.82)		(1.10)		(3.10)	
Belgium	1.322	0.164	0.745	0.011	2.054	0.126
	(5.12)		(1.54)		(4.43)	
Canada	0.794	0.207	0.554	0.006	0.114	-0.006
	(5.98)		(1.36)		(0.38)	
Denmark	-0.354	-0.002	2.992	0.194	3.198	0.186
	(-0.90)		(5.67)		(5.52)	
Finland	2.150	0.430	-1.090	0.096	-1.121	0.123
	(8.95)		(-3.49)		(-3.97)	
France	1.455	0.307	0.987	0.160	1.059	0.119
	(7.74)		(5.13)		(4.36)	
Germany	0.419	0.078	1.568	0.191	1.234	0.183
	(3.49)		(5.69)		(5.55)	
Hong Kong	0.437	0.260	0.689	0.127	0.162	0.017
	(6.92)		(4.51)		(1.81)	
Ireland	0.779	0.225	0.331	0.010	0.004	-0.008
	(6.20)		(1.52)		(0.02)	
Israel	0.346	0.008	1.130	0.078	1.324	0.165
	(1.27)		(2.72)		(4.01)	
Italy	0.786	0.101	1.659	0.279	1.303	0.132
	(3.99)		(7.25)		(4.60)	
Japan	0.699	0.250	0.441	0.162	0.506	0.099
	(6.74)		(5.16)		(3.95)	
Netherlands	1.345	0.250	1.682	0.241	-0.541	0.005
	(6.72)		(6.58)		(-1.31)	

Country	MKT_ROE		SMB_ROE		HML_ROE	
	GDP Growth	Adj. R2	GDP Growth	Adj. R2	GDP Growth	Adj. R2
New Zealand	2.010	0.136	-1.676	0.078	-1.308	0.014
	(4.18)		(-3.14)		(-1.57)	
Norway	-0.090	-0.008	1.527	0.076	3.478	0.228
	(-0.24)		(3.36)		(6.16)	
Portugal	0.246	0.015	0.532	0.030	0.781	0.049
	(1.62)		(2.05)		(2.53)	
Singapore	0.323	0.085	0.336	0.068	0.222	0.035
	(3.65)		(3.27)		(2.42)	
Spain	0.162	-0.003	2.622	0.472	1.880	0.358
	(0.84)		(9.93)		(7.87)	
Sweden	0.925	0.141	0.488	0.001	-0.116	-0.008
	(4.64)		(1.03)		(-0.23)	
Switzerland	0.351	0.007	1.030	0.059	1.280	0.078
	(1.39)		(3.02)		(3.45)	
UK	0.452	0.055	2.051	0.114	0.885	0.040
	(2.95)		(4.26)		(2.55)	
US	0.436	0.059	0.369	0.019	1.255	0.190
	(3.06)		(1.91)		(5.67)	

Table OA4. Cyclicality of Aggregate Idiosyncratic ROE Variances (Equal-Weighted)

This table presents the regression results of aggregate equal-weighted idiosyncratic ROE variances (IVROE) on GDP growth rates. GDP growth is the growth rate of trailing 4-quarter real GDP compared to the same quarter of previous year (seasonally adjusted). We obtain nominal GDP and GDP deflator data for each country and the OECD total from Datastream. Both IVROE and the GDP growth rate are transformed using the kernel method. For each country, we regress country IVROE on contemporaneous global and country-specific GDP growth rates, where country-specific GDP growth rate is obtained by orthogonalizing the country's GDP growth rate with respect to the global GDP growth rate.

	Global GDP Growth		Country-Specific GDP Growth		
	I	II	III	IV	V
Country	Coeff.	t-stat	Coeff.	t-stat	Adj. R^2
Australia	-0.761	-6.96	0.527	3.33	0.302
Austria	-0.303	-6.96	0.136	1.96	0.300
Belgium	0.024	0.50	0.451	5.01	0.153
Canada	-0.396	-8.31	0.244	4.41	0.394
Denmark	-0.641	-12.50	0.009	0.11	0.545
Finland	-0.167	-4.68	-0.080	-4.09	0.259
France	-0.076	-1.66	0.302	3.54	0.091
Germany	-0.370	-3.93	-0.388	-3.58	0.165
Hong Kong	-0.227	-2.51	-0.131	-2.95	0.089
Ireland	-0.007	-0.10	0.127	5.41	0.174
Israel	-0.459	-6.34	0.272	3.94	0.438
Italy	-0.319	-10.19	-0.385	-7.08	0.533
Japan	-0.022	-1.64	-0.129	-12.37	0.536
Netherlands	-0.352	-4.39	0.176	1.94	0.137
New Zealand	-0.232	-4.07	0.016	0.38	0.123
Norway	0.356	4.01	-0.226	-2.78	0.148
Portugal	-0.388	-6.30	-0.214	-5.19	0.381
Singapore	-0.353	-6.68	-0.150	-6.37	0.385
Spain	-0.448	-11.62	-0.313	-10.65	0.693
Sweden	-0.526	-8.12	0.334	5.27	0.423
Switzerland	-0.308	-6.41	0.192	3.28	0.279
UK	-0.441	-5.27	0.325	2.61	0.197
US	0.073	2.05	-0.190	-2.75	0.068

Table OA5. Validity of Growth Opportunity Variable (GO)

This table presents the regression result of future EBIT growth on growth opportunity variable (GO). In each quarter, we calculate EBIT of the DataStream Total Market Index as the trailing 4-quarter EBIT. EBIT growth is the growth rate of EBIT over the same quarter of the previous year. GO is the growth opportunity variable extracted from aggregate earnings yield. The t-statistics are adjusted for serial correlation using Newey and West (1987) standard errors with 10 lags and are shown in parentheses.

	EBIT Growth_{t+4}	EBIT Growth_{t+5}	EBIT Growth_{t+6}	EBIT Growth_{t+7}	EBIT Growth_{t+8}
Coefficient	7.020	6.783	4.919	2.684	-0.034
t-stat	(2.47)	(2.31)	(1.96)	(1.26)	(-0.02)
Adj.R^2	0.151	0.140	0.069	0.014	-0.010