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THE RISKY CAPITAL OF EMERGING MARKETS

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ABSTRACT

We build a panel of stock market returns across 37 developed and developing countries spanning five decades. We document: (1) higher and more volatile returns in poorer relative to richer countries; (2) higher returns in countries with sensitive dividends to changes in global predictable growth. We quantitatively explore whether consumption-based long- run risk can reconcile these patterns. When we estimate the parameters governing the U.S. investor's consumption growth and each market's dividend growth process, the model generates higher risk premia in emerging over developed markets, and predicts levels and volatilities of stock market returns that are in line with the data.

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1 Introduction

Since the late 1980s, following financial account liberalizations, emerging markets have been an appealing investment option for global investors. One common claim presented for investment in these markets is their potential to provide both high returns and hedging opportunities for U.S. investors due to their higher yields and lower business-cycle correlation with the U.S. market, in contrast to developed economies, whose business cycles are more closely aligned with that of the United States. Yet, capital flows to emerging markets remain systematically lower than those to developed markets—a phenomenon consistent with the "Lucas Paradox," which highlights the persistent empirical observation that required returns to capital are higher in less developed markets (Lucas, 1990).

In this paper, we propose that U.S. investors require significantly higher risk premia to invest in emerging markets, which results in lower capital intensities and capital inflows into these countries than what would otherwise have been the case. To explore this, we focus on equities, a crucial asset class that is directly comparable across countries and operates in relatively frictionless markets. Utilizing the MSCI database, we analyze USD-denominated annualized stock market returns from 22 developed markets dating back to 1970 and 15 emerging markets from 1988 to 2020.

Our analysis of 37 equity markets, which collectively represent 86% of global stock market capitalization and two-thirds of world GDP over the past five decades, reveals two key findings. First, stock market returns are higher and more volatile in emerging markets compared to developed ones. Doubling a country's income per worker is associated with a 3.1 percentage point reduction in mean stock market returns, while the correlation between return volatility and income is -0.6. Second, markets with higher stock returns exhibit stronger covariance between their equity dividend growth rate and global dividend growth, defined as the stock-market-capitalization-weighted mean of dividend growth among five major economies: U.S., U.K., France, Germany, and Japan. This relationship arises from differences in dividend growth rate volatilities across countries. Emerging markets experience substantially higher volatility in dividend growth rates, but exhibit weaker correlations with global dividend growth.

Motivated by these empirical findings, we investigate whether the risk-return trade-off predicted by asset pricing theory can explain the observed differences in risk premia and volatilities between developed and emerging markets. Specifically, we examine the role of long-run risks as defined by Bansal and Yaron (2004), who focus on the pricing of risks associated with persistent fluctuations in economic growth prospects. Our approach is guided by two key motivations. First, an expanding body of literature, initiated by Aguiar and Gopinath (2007), highlights the significance of shocks to trend growth rates in explaining business cycle dynamics in poor

and emerging markets, as well as in reconciling disparities in macroeconomic behavior between these markets and developed economies. Second, long-run risks have demonstrated profound implications for asset pricing, successfully addressing several longstanding puzzles in the literature, such as the equity premium puzzle (Bansal and Yaron 2004; Colacito and Croce 2011; Nakamura et al. 2017), the low correlation between consumption differentials and exchange rates (i.e., the Backus and Smith (1993) puzzle) and the forward-premium anomaly (Colacito and Croce, 2013), bond return predictability and violations of uncovered interest parity (Bansal and Shaliastovich, 2013), and currency risk premia (Colacito et al., 2018b). In this context, we analyze whether the heterogeneity in risks stemming from volatile and uncertain growth prospects can account for the differences in international stock market returns, particularly between wealthy and poorer nations.

We consider an international endowment economy where a key distinguishing feature is the focus on a representative U.S. investor, endowed with a consumption stream, dividend payments from risky capital investments across different countries, and access to a risk-free asset. Beyond the inherent risks of stochastic dividend payments, the investor is also exposed to exchange rate risk, as foreign equity payouts are denominated in local currencies. Initially, we simplify the global economy by assuming the existence of a single, perfectly tradable good, which eliminates exchange rate volatility. In subsequent robustness exercises, we assess the impact of incorporating exchange rate risk. This approach allows us to concentrate on the core mechanism of our model: the pricing of global long-run risks in equity markets.

We assume that economic growth rates feature a small but persistent component, which manifests itself in both consumption growth and growth in dividend payments from invested capital. This persistent process contains both a global and a country-specific element, with country-specific shocks uncorrelated across markets. Countries vary in their sensitivity to the global component. With recursive preferences as in Epstein and Zin (1989), a U.S. investor's valuation of foreign assets becomes particularly sensitive to persistent global shocks. Countries whose dividend growth is more responsive to these shocks are perceived as riskier investments by the U.S. investor and must offer higher expected returns to compensate for this added risk. Additionally, each country is subject to both common and idiosyncratic transitory shocks, which affect growth rates for only a single period. The common transitory shocks also contribute to risk premia differentials for a U.S. investor.

Under standard assumptions for preference parameters, quantifying the implications of long-run risks in our model presents three key challenges. First, we must identify global shocks. Second, we need to measure the exposure of individual countries' dividends to both global long-run growth prospects and purely transitory shocks. Third, we must estimate the parameters governing the U.S. investor's consumption growth process. Identifying global persistent shocks

is particularly difficult due to the limited availability of historical macroeconomic and financial data, which exist for a few developed economies. To address this, we utilize the MacroHistory Database described in Jordà et al. (2019) and Jordà et al. (2017), which includes data on consumption per capita and price-to-dividend ratios. Balancing the trade-off between cross-sectional and time-series coverage and data quality, we define our global variable using data from five major economies–U.S., U.K., France, Germany, and Japan–over the 1940-2020 period.

Following insights from Bansal et al. (2012) and Colacito et al. (2018b), we exploit the model's prediction that a country's logged price-to-dividend ratio is determined solely by the global persistent process. This relationship allows us to project future consumption growth onto lagged values of the price-to-dividend ratio, thereby recovering the time series of the persistent process. We implement this projection within a panel regression framework and define the persistent process as the equally-weighted mean of the predicted component of consumption growth across the five countries. The residual variation in global consumption growth, computed as the equally-weighted mean across the same five economies, is the transitory global component.

U.S. consumption growth exposures to global shocks follow from linear regressions of U.S. per-capita consumption growth series on the estimated global persistent process and the residual transitory component of global consumption growth. Further, we define a global dividend growth process, which incorporates the same global persistent and transitory shocks, in addition to an orthogonal transitory shock reflecting the higher volatility observed in financial over macroeconomic variables. Global dividend growth represents the stock-market-capitalization-weighted mean of dividend growth rates for the same five major economies over the 1975-2020 period, and the returns to this portfolio closely align with the returns on the MSCI-defined "World Index," validating our definition of a global variable.

We regress each country's dividend growth on the residual global dividend growth, excluding the persistent component, to recover exposures to transitory global shocks. With these estimates in hand, we recover exposures to the persistent global process from regression coefficients (i.e. covariances) of countries' dividend growth on total global dividend growth. These parameters directly link to excess returns in the model. Emerging markets whose dividends exhibit strong co-movement with global dividend growth have high inferred exposures to the persistent global component, prompting U.S. investors to demand higher risk premia to invest there.

Using this methodology across the 37 countries in our dataset, we demonstrate that long-run risks explain a substantial share of the observed return disparities. The model predicts a mean cross-country excess return of 9.8%, closely aligning with the observed mean of 9.3%. For the U.S., the model implies an excess return of 6.2%, consistent with the historical figure reported in Bansal and Yaron (2004), though slightly below the observed post-1970 mean of 7.6%. The model also predicts lower and less volatile excess returns in wealthier countries,

with a doubling of income per worker leading to a 1.3 percentage point decline in risk premia. Notably, the correlation between model-implied and actual mean excess returns across countries is 0.54. Finally, the average standard deviation of returns predicted by the model is 0.365, closely matching the observed value of 0.336, with a cross-sectional correlation of 0.59 between model-implied and realized standard deviations.

To gain insights behind the mechanisms at play, we set all countries' exposures to the transitory global shock to match the level estimated for the U.S., while maintaining the heterogeneous exposure parameters to the global persistent process as in our baseline specification. The mean model-implied excess returns increase slightly to 10%, and the correlation between model-implied and observed excess returns remains virtually unchanged. These results reinforce the conclusion that cross-country differences in risk premia are largely driven by the sensitivity of dividends to the global persistent process. Yet, accounting for global transitory shocks in dividend growth remains crucial. To illustrate this, we set all countries' exposures to the transitory global shock equal to the level estimated for the U.S. We then infer new exposures to the persistent global process using the same dividend growth covariance moment between a country and the world as in the baseline. This effectively loads all cross-sectional variation in the covariance moment on the single parameter governing exposure to the global persistent process. While mean risk premia decrease slightly to 9.3%, the cross-sectional variation undergoes a significant shift. The correlation between mean model-implied and observed excess returns falls to 0.2, indicating that the model struggles to capture the variation seen in the data.

The preceding analysis assumes away real exchange rate fluctuations, which can pose a risk to the U.S. investor when they covary with her stochastic discount factor. The literature offers a variety of theoretical perspectives on exchange rates, ranging from frictionless models where bilateral exchange rate movements mirror differences in consumers' stochastic discount factors, to frictional frameworks that introduce wedges and models where exchange rates are entirely decoupled from macroeconomic variables (Itskhoki, 2021). Rather than exploring various mechanisms of exchange rate determination, we perform an empirical robustness exercise to assess the potential impact of exchange rate risk on equity risk premia within our framework. When the real exchange rate deviates from unity, dividend growth rates in our analysis must be expressed in each country's local currency, as the U.S. investor prices these flows–including exchange rate fluctuations–through her no-arbitrage condition. Turning to MSCI, which provides consistent coverage of equity markets data in both USD and local currency, we re-estimate the key exposure parameters for dividend growth rates using local-currency data, while maintaining all other model parameters at their baseline values. The resulting model-implied mean risk premium declines by one percentage point to 8.2%, and the correlation between model-implied and observed risk premia across the 37 markets increases marginally to 0.56. Notably,

model-implied risk premia remain closely aligned with those from our benchmark calibration, as evidenced by a cross-sectional correlation of 0.7 between the two sets of estimates.

The exercise demonstrates the robustness of our key moment–the comovement of countries' dividend growth with global dividend growth–in quantifying long-run risks in the presence of exchange rate volatility. This result aligns with the observation that dividend growth volatility is largely invariant across local- and foreign-currency measures for most countries. Similarly, Chernov et al. (2024) report that the volatility of equity returns is nearly identical whether measured in local currency or in USD. These findings reinforce the conclusion that different dividend loading on priced long-run risk is a dominant factor in explaining the observed disparities in risk premia across countries.

The remainder of the paper is organized as follows. In Section 2, we describe data sources and measurement of financial and macroeconomic variables across rich and poor countries. In Section 3, we document facts on international stock markets. In Section 4, we lay out our quantitative analysis of a risk-based explanation of these facts. In Section 5, we conclude and discuss directions for future research. Derivations, tables and figures are in the Appendix.

Related literature. Our modeling of international long-run risks is related to Colacito and Croce (2011) and Colacito and Croce (2013), who examine macroeconomic and financial variables in the U.S. and the U.K., and Lewis and Liu (2015), who study consumption and equity correlations across the U.S., U.K. and Canada. All of these papers find a significant role for shared long-run risk across countries. Our emphasis on heterogeneous exposures to a global shock brings us closest methodologically to Colacito et al. (2018b), who examine a cross section of FX risk premia in major industrialized countries. We build on these authors' insights and rely on predictive regressions to identify a global persistent process using historical consumption growth and price-to-dividend data. A key innovation in our analysis is the dividend-based identification strategy that enables us to estimate long-run risks in emerging markets where historical consumption series are unavailable. We exploit the comovement of countries' dividend growth with global dividend growth—a moment directly observable in equity market data—to identify heterogeneous exposures to global persistent shocks. This comovement has strong predictive power for cross-country risk premia, but is absent from existing analyses.

A related strand of the literature studies cross-country differences in equity premia using long-run macroeconomic data. In particular, Nakamura et al. (2017) analyze variation in equity premia across 16 developed economies using long-run consumption data. Their framework relies on extensive historical national accounts, which limits its applicability to countries with long data availability. The authors specify a multi-country state-space model in which each country's consumption growth loads on a world persistent process with a country-specific sensitivity

parameter, and they jointly estimate the vector of exposures, persistence parameters, stochastic-volatility parameters, disaster risk and measurement-error parameters using Bayesian Markov Chain Monte Carlo methods from the time series of country-level consumption growth, treating the persistent components as latent states. Then, they compute equity risk premia for domestic investors (with country-specific stochastic discount factors) using posterior estimates of the parameters, assuming a constant dividend-leverage parameter and risk aversion parameter across countries. The empirical primitive that drives cross-country differences in equity premia in their model is the posterior estimate of the consumption exposure parameters. In contrast, our model relies on a single stochastic discount factor and differential dividend exposures to global persistent shocks to generate cross-country differences in risk premia. Each exposure, in turn, is recovered from a single moment for each country–the covariance of dividend growth with the global dividend–and the moment is systematically higher in countries with higher realized average stock returns in the data.

In the broad sample of countries that we examine, emerging markets exhibit higher and more volatile returns than developed ones. This pattern in the data is reported in Chapter 13 of Bekaert and Hodrick (2017), and was established by Bekaert and Harvey (1997) using observations from the International Finance Corporation (IFC) of the World Bank during the 1976-1992 period. Furthermore, Bekaert et al. (2007) examine equity returns in 18 emerging markets during the 1987-2003 period, derived from the S&P/IFC Global Equity Market Indices, and use empirical tools that are traditionally employed by the finance literature to document an important role of a global factor–U.S. equity return–in explaining the time series of equity returns in emerging markets. This factor is particularly powerful in accounting for returns in internationally integrated emerging markets, while local liquidity shocks play an important role in driving returns in more closed markets. The authors' findings are one important reason why we focus on emerging markets that are categorized as 'investable' for international investors by MSCI. Brusa et al. (2014) and Karolyi and Wu (2020) find that global currency factors can empirically reconcile asset returns across countries. Brusa et al. (2014) further use international equity and currency returns data to quantify an asset pricing model that features a reduced-form stochastic discount factor. These papers complement our work and provide strong support for the role of global risk factors in driving equity risk premia around the world. Unlike these papers, we use consumption and dividend data to quantitatively account for first and second moments in equity returns in the cross section of developed and emerging markets via the lens of a structural consumption-based long-run risk model.

A broader literature demonstrates the importance of global (often dominated by U.S.) shocks in driving currency returns (Lustig and Verdelhan, 2007; Lustig et al., 2011; Hassan, 2013; Andrews et al., 2024), sovereign bond returns (Longstaff et al., 2011; Borri and Verdelhan,

2015), equity (Gourio et al., 2013) as well as corporate bond returns and capital flows (Rey, 2015; Miranda-Agrippino and Rey, 2020, 2022), and returns to capital (Hassan et al., 2016). Kalemli-Özcan and Varela (2021), in turn, attribute a substantial portion of the cross-sectional and time-series variation in emerging-market survey-based UIP deviations to a local risk factor–country-specific policy uncertainty–rather than to global risk alone. More closely related literature investigates the failure of equalization of expected capital returns (Lucas (1990) Paradox) and the implied lack of capital flows from low- to high-expected-return countries (see Gourinchas and Rey (2013) for a survey of empirical and theoretical studies). This literature primarily focuses on frictions as the explanation. Most notably, Alfaro et al. (2008) demonstrate that institutional quality, particularly property rights protection and low corruption, is a key determinant limiting capital flows to poor countries. One way to view our work is as a quantification of Alfaro et al. (2008): poor institutions create or amplify fundamental risk exposures, which in turn determine the expected returns investors require when allocating capital across countries.

Finally, it is worth pointing out that long-run risk is one approach to examine the Lucas Paradox through the lens of asset pricing theory. Two other leading approaches to address asset-pricing puzzles are habits in utility (Campbell and Cochrane, 1999) and rare disasters (Barro, 2006; Gabaix, 2008). Recently, Wang (2021) links currency risk premia to capital accumulation differences across developed countries within the context of a habit persistence model. Farhi and Gabaix (2016) link international asset prices to disaster risk, and Lewis and Liu (2017) show that global and idiosyncratic disasters can reconcile equity return differentials among 20 developed countries. None of these studies examine emerging markets equity returns, which is the focus of our paper. Horvath (2020) examines two groups, one consisting of 17 advanced economies and the other of 6 emerging markets, and finds that estimated disasters are more severe and uncertain in advanced economies, but on average less persistent. Consequently, a model with heterogeneous disaster risks requires a higher risk aversion parameter in the emerging market group to generate higher equity returns there. In contrast, our long-run risk framework evaluates whether a single pricing kernel, calibrated to a representative global investor, can account for the observed cross-sectional variation in expected returns through differences in the co-movement of dividends with global growth. We show that it can, providing evidence that this mechanism reconciles first and second moments at the country level without requiring variation in preference parameters across countries.

Bringing developed and emerging markets into a unified treatment of the cross section of country required returns, our framework speaks directly to the global determinants of country risk premia. This not only resolves open puzzles in international macroeconomics and finance, but also provides a foundation for studying country risk in an era of heightened geopolitical tensions and de-globalization.

2 Data Description

In this paper, we pool real and financial data from multiple sources as we describe below.

2.1 Measuring Returns Using Financial Data

The macroeconomic literature measures returns to capital in a country via the marginal product of capital (Caselli and Feyrer, 2007). Augmented by changes in the price of capital, this object equals the return to equity, if firms do not incur adjustment costs in capital investment (Gomme et al., 2011). Financial frictions, policy and institutional barriers create a wedge between documented and realized returns for investors (Banerjee and Duflo, 2005; Bekaert et al., 2007; Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Song et al., 2011; Chari and Rhee, 2020), especially in emerging markets. While no measure of returns to capital is ideal, we study stock market returns as equity is an asset class that is more easily comparable across countries.

We obtain daily observations of the Total Return Gross Index by MSCI via Capital IQ, denominated in USD, for 37 developed and emerging markets that account for two-thirds of world GDP. We compute annualized returns, and we subtract annual total CPI inflation for the U.S., obtained from St. Louis FRED. We drop returns below -100% and above 200% to minimize measurement error. Our dataset includes stock market returns in 22 developed markets during the 1970-2020 period, and returns in 15 emerging markets dating back to 1988 until 2020.[1] To compute risk premia, we subtract the mean annual nominal interest rate on 3-month U.S. T-bills for the 1970-2020 period, obtained from St. Louis FRED, from nominal stock market returns for each country.

Table 10 in Appendix B contains descriptive statistics for equity returns in each country.[2] The 37 markets that we study account for 86% of world stock market capitalization and are considered investable by MSCI.[3] While equity is not the only way to access investment opportunities in these markets, it is a very important channel of capital inflow. Among the 37 markets, the stock market capitalization to GDP ratio amounts to a sizeable 63%, and these ratios are not systematically lower in emerging markets (see Figure 8 in Appendix A). Continental European countries exhibit some of the lowest stock market capitalization ratios as firms in these markets predominantly rely on bank debt for financing. Most emerging markets exhibit higher stock market capitalization ratios, followed by Anglo-Saxon markets such as Canada, USA and

[1] Emerging markets enter the database in the late 1980's and we include them in the analysis upon entry.

[2] We drop China as it was relatively closed to foreign investors for a substantial part of our period of analysis; and furthermore, the theoretical assumption of a small open economy is difficult to justify.

[3] International Finance Corporation (1986) documents that stock markets in developing countries are considered investable categories for international investors beginning in the late 1980's as they underwent significant financial liberalization episodes. MSCI revises the "investability" of different emerging markets for foreigners on a regular basis, and we focus on the markets that they deem investable in our study.

Great Britain. Some financial centers such as South Africa (for neighboring African economies), Taiwan, Singapore and Switzerland enjoy stock market capitalization rates of over 150%.

2.2 Country-Level Equity Dividends

Valuation theory equates a stock's price with the net present value of all future dividends, so equity dividends play a key role in our quantitative analysis. Specifically, we will derive moments on dividend growth rates to infer the key parameters of interest in the model.

To obtain dividend growth rates, we retrieve two daily series from MSCI, retaining the last date of each year: (i) Price Return Index (in USD), and (ii) Total Return Gross Index (in USD), and we apply a standard procedure in the finance literature (Jagannathan et al., 2000).[4,5] Real dividend growth rates follow by subtracting U.S. inflation rates. We drop dividend growth observations below -100% and above 200% to minimize measurement error. Table 11 in Appendix B contains descriptive statistics for dividend growth rates in each country. For robustness exercises that examine currency risk, we rely on real dividend growth rates denominated in local currency. We obtain the identical series as above from MSCI in local currency. The coverage is identical to the USD-denominated variables. To construct real local-currency variables, we use annual country-level inflation rates from the World Bank's World Development Indicators (WDI thereafter), supplemented by observations from the International Monetary Fund (IMF thereafter) for Taiwan.

2.3 Global Macroeconomic and Financial Variables

In order to quantify long-run risks priced by a U.S. investor, we need to identify global persistent and transitory shocks as well as the sensitivity of U.S. consumption growth to these shocks. To estimate the global persistent component of consumption, we will rely on methods used by Bansal et al. (2012) and Colacito et al. (2018b), which require consumption growth and equity

[4]Let R_t^p be the annual growth rate of the Price Return Index in year t, and let R_t^{tr} be the growth rate of the Total Return Gross Index in year t. To back out the dividend growth rate, notice that:

$$R_{t+1}^{tr} \equiv \frac{P_{t+1}+D_{t+1}}{P_t} = R_{t+1}^p + \frac{D_{t+1}}{P_t} \Rightarrow \Delta d_{t+1} \equiv \frac{D_{t+1}}{D_t} - 1 = \frac{\left(R_{t+1}^{tr} - R_{t+1}^p\right)}{\left(R_t^{tr} - R_t^p\right)} \frac{P_t}{P_{t-1}} - 1 = \frac{\left(R_{t+1}^{tr} - R_{t+1}^p\right)}{\left(R_t^{tr} - R_t^p\right)} R_t^p - 1$$

[5]These dividend data are implied by and derived from indices that investors actively trade, and are therefore subject to continuous market validation. Farre-Mensa et al. (2014) survey the literature on corporate payout policies and show that share repurchases have become an increasingly important component of payouts in the U.S. As noted by Braun et al. (2023), repurchases remain primarily a U.S.-centric phenomenon. Moreover, repurchase data are typically reported and, unlike dividend data, cannot be isolated or inferred from the prices of indices or other instruments actively traded by investors. As documented by Brav et al. (2005) and Graham (2022), dividends are generally funded out of permanent earnings. Measured dividend growth rates likely reflect lasting innovations to the growth rate of firms' underlying profitability, and are relevant for the long-run investor.

price-to-dividend data. Recovering global persistent shocks is particularly challenging because we need to balance time-series and cross-sectional data coverage of these variables. Ideally, we would like to use historical series for as many countries as possible in order to identify a global persistent component in consumption, but available price-to-dividend observations are limited. We obtain historical consumption, population and price-to-dividend observations from the MacroHistory Database, described in Jordà et al. (2019) and Jordà et al. (2017). To balance time-series and cross-sectional coverage against measurement error, we define 'global' or 'world' per-capita consumption growth to be the mean of the following five economies: U.S., U.K., France, Germany and Japan during the 1940-2020 period,

$$\Delta c_{Wt} = \frac{1}{5} \sum_{k=1}^{5} \Delta c_{kt}, \tag{1}$$

where k indexes each country. These countries account for 61% of stock market capitalization of the 37 countries in our sample—a significant portion of global financial market activity.[6]

Finally, in order to quantify differences in risk premia across countries, we need to identify the sensitivity of each country's dividend growth rates to global persistent and transitory shocks. To do so, we rely on dividend growth rates for each country, as described in Section 2.2 above, as well as on a 'global' dividend growth rate. We define global dividend growth to be the stock-market-capitalization weighted mean of dividend growth rates for the same five economies as above during the 1975-2020 period.

$$\Delta d_{Wt} = \sum_{k=1}^{5} \omega_{kt} \Delta d_{kt}, \tag{2}$$

where Δd_{Wt} (Δd_{kt}) denotes global or 'world' (country-level) dividend growth rate. Our definition of the 'world' equity market corresponds closely to MSCI's. Figure 10 in Appendix E plots returns to equity for our world portfolio (stock-market-capitalization weighted average of five countries), and the returns from the MSCI series labeled as 'World Index'. The two series are very closely linked, which reflects the dominance of the five countries of our choice in world

[6]GDP-weighted mean of consumption growth across the five countries yields a global process that has a correlation of 0.96 with the equally-weighted mean process. In Appendix E, we show that our measure of a 'global' persistent process is robust to including 6 other developed economies with historical data coverage, which account for an additional 7% of global stock market capitalization. As we describe in Appendix A, stock market capitalization data coverage begins in 1975. This data limitation is the reason why we cannot use stock-market-capitalization weighted mean of consumption data in our definition of a global variable. Since adding countries changes the share of stock market capitalization only marginally, and since we cannot weigh historical series by market cap, we opt to limit our definition of 'global' to the five economies with the largest contribution to global financial activity. The reported share of 61% is a lower bound for our entire study period, which dates back to 1940, when the five major economies constituted a greater share of global economic activity.

equity markets. Among these countries, the key role of the U.S. is apparent from the high correlation of U.S. equity returns with both indices. Since we aim to understand cross-country patterns of stock markets in this paper, given historical data limitations discussed above, it is reasonable to approximate 'global' variables with our set of five countries.

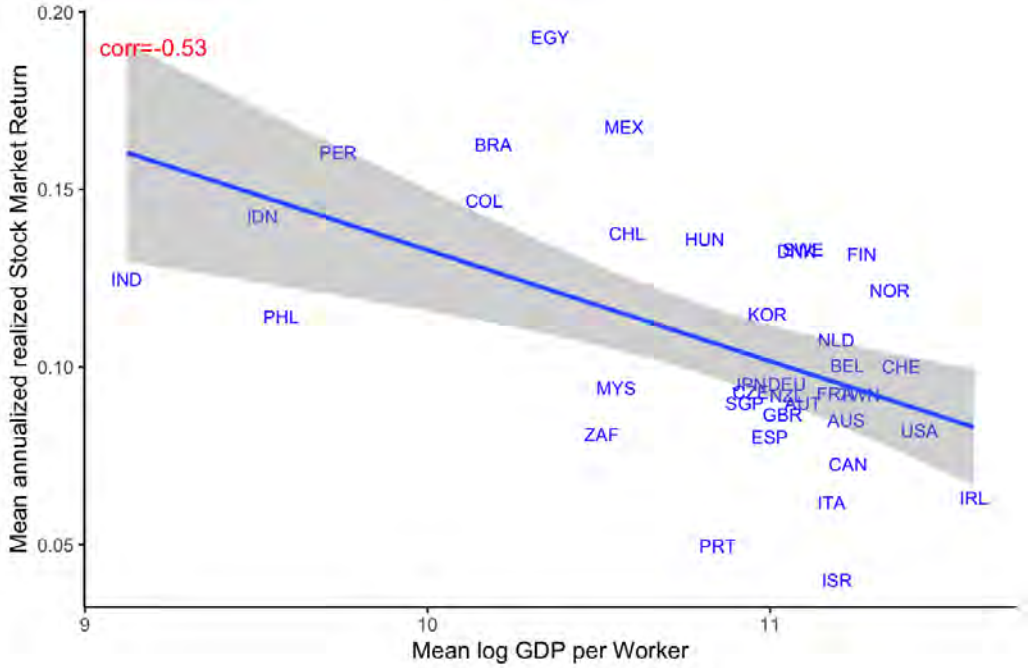
Finally, to measure the level of development of each country, we turn to Version 10.0 of the Penn World Tables (PWT thereafter) described in Feenstra et al. (2015). We use this dataset to compute income per worker from annual series of real GDP and employment for each country dating back to the year in which the country enters the MSCI dataset until 2019, which is the terminal year for the PWT dataset. We supplement with data from WDI for the year 2020.

3 Stock Markets Across Countries

In this section, we describe a number of empirical properties of the returns to equities—most notably, a systematic negative link between the level of development and the first and second moments of stock market returns across countries, as well as a positive relationship between returns and the sensitivity of dividends to global fluctuations.

3.1 Stock Market Returns

Figure 1: The Cross Section of Stock Market Returns



Notes: The figure plots mean time-series USD-denominated stock market returns against mean time-series log income per worker for 37 countries for 1970-2020. Data Sources: MSCI, PWT and WDI.

Figure 1 plots mean realized stock market returns, r_i, against the mean (log) income per worker, y_i, for each country during the entire period for which data are available via MSCI, as well as the correlation between the two variables. Equity returns are systematically higher in poorer countries—doubling a country's income per worker results in a 3.1 percentage point decline in returns. The top panel of Table 1 reports summary statistics for the (mean) realized stock market returns across countries as well as the results of a linear regression of returns on income per worker. Stock market returns amount to 10.7% on average, but there is a great deal of heterogeneity across countries. Returns are as low as 4% in Israel and as high as 19.3% in Egypt. The average U.S. return to equity is approximately 8% over this period.

Table 1: Summary Statistics for Equity Returns and Risk Premia

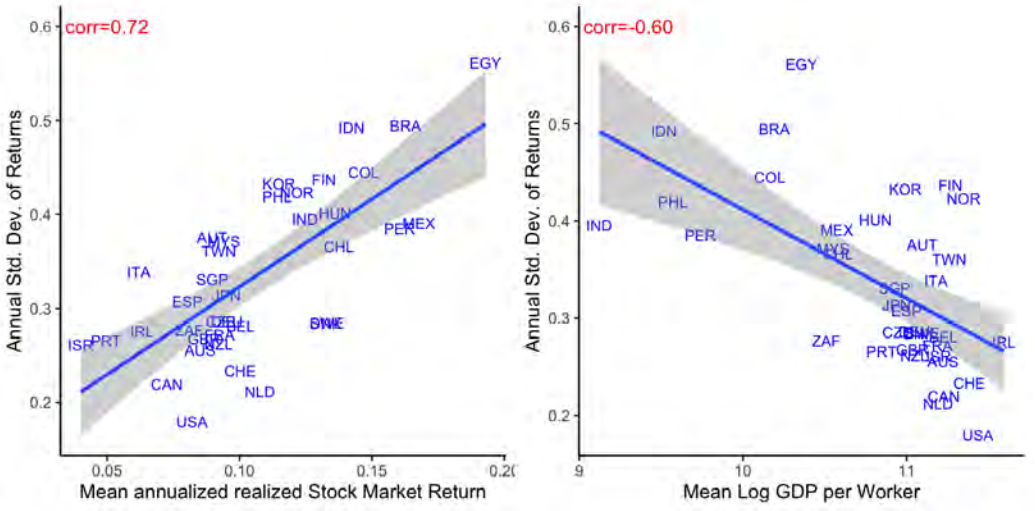
	N	Mean	Median	Std. Dev	Q_{10}	Q_{90}	Constant	y_i	R^2
r_i	37	0.107	0.095	0.034	0.069	0.152	0.446***	-0.031***	0.282
							(0.091)	(0.008)	
r_i^e	37	0.093	0.089	0.032	0.057	0.131	0.349***	-0.024***	0.180
							(0.093)	(0.009)	
σ_{r_i}	37	0.336	0.314	0.088	0.247	0.440			

Notes: Table reports summary statistics for 37 countries, in decimal points, of mean annual USD-denominated real stock market returns r_i, mean excess returns r_i^e computed as the difference between annual USD-denominated nominal stock market returns and the mean nominal interest rate on 3-month U.S. T-bill, and the results of a linear regression of (mean) r_i and r_i^e on (mean) income per worker, y_i. σ_{r_i} denotes the time-series standard deviation of USD-denominated real stock market returns from 1970-2020. Data Sources: MSCI, PWT, WDI and St. Louis Fred. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Appendix F, we demonstrate that the systematic variation in equity returns between countries of different levels of development is an empirically robust result. Specifically, we document the results of four exercises. First, we estimate a weighted least squares cross-sectional regression that accounts for heteroskedasticity in mean country-level returns. Second, we examine mean returns across countries for three sub-periods. Third, we run panel regressions that exploit both time-series and cross-sectional variation, saturated with fixed effects. Fourth, we repeat the panel analysis using lagged, rather than contemporaneous, income per worker to eliminate look ahead bias. All specifications yield a statistically significant relationship between equity returns and per-capita income.

While equities in emerging markets yield higher returns, they are also more volatile. The left panel of Figure 2 plots the standard deviation of stock market returns against the mean level of returns for the 37 countries in our sample, as well as the correlation between the two variables, which amounts to 0.72. Not surprisingly, countries that exhibit higher returns also display higher volatilities of returns. Moreover, emerging markets have more volatile returns, as can be seen from the right panel of Figure 2, which plots the standard deviation of returns

Figure 2: Volatility of Stock Market Returns



Notes: Figure plots cross-sectional standard deviation of time-series mean annualized USD-denominated stock market returns in each country against mean annualized realized USD-denominated stock market returns (left) and time-series mean log income (right) for 37 countries for 1970-2020. Data Sources: MSCI, PWT and WDI.

against countries' income levels. The bottom panel of Table 1 reports summary statistics for the standard deviation of equity returns across countries. Volatilities differ substantially across countries, with the U.S. being the least and Egypt being the most volatile market.

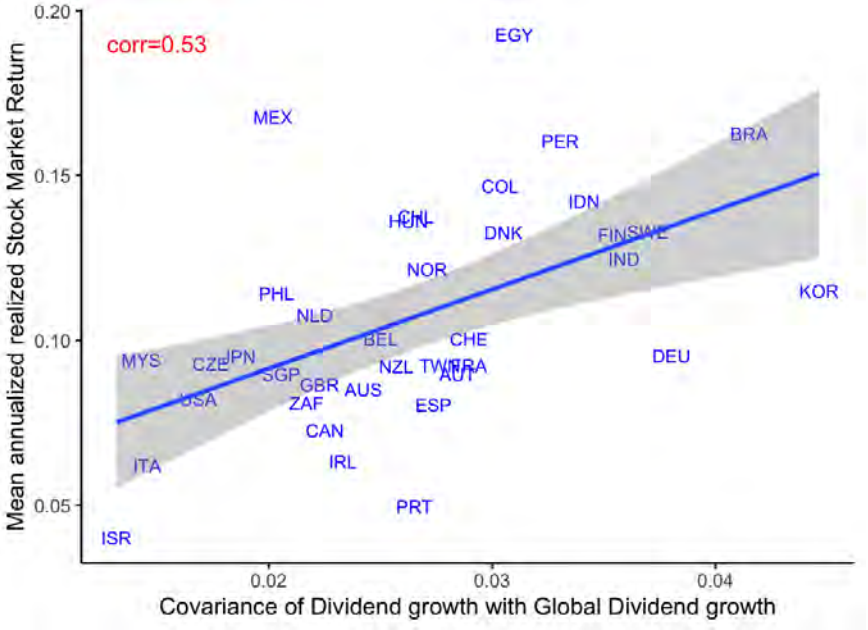
For completeness, the middle panel of Table 1 reports summary statistics for excess returns or risk premia for each country, r_i^e. The mean excess return across countries is 9.3%, and the mean for the U.S. is 7.6% over this period, which aligns with the value of 7.1% in Nakamura et al. (2017), but is higher than the historical value of 6.2% reported by Mehra and Prescott (1985). Risk premia are systematically higher in poorer countries—doubling a country's income per worker results in a 2.4 percentage point decline in risk premia. It is precisely these cross-country differences in risk premia that we will quantify via the lens of an asset pricing model.

3.2 Equity Dividend Growth Rates

The question that we want to answer is what drives the systematic relationship between returns and income. Figure 3 offers the first clue. It plots the mean stock market returns for each country for the entire period of study against $cov(\Delta d_i, \Delta d_W)$, which is the covariance of the country's dividend growth rate with the growth rate of the 'world' dividend defined in expression (2) in Section 2.3. Countries with higher stock market returns are characterized by higher co-movement of dividend growth rates with the world. In an economy where investors' consumption co-moves with global shocks, countries whose dividends co-move more strongly with the world

would be considered more risky, so an investor would demand higher returns to invest there.

Figure 3: Stock Market Returns and Dividend Comovement



Notes: Figure plots time-series mean annualized USD-denominated stock market returns against the covariance of the country-level annualized dividend growth rate with the world annualized dividend growth rate, defined as stock-market-cap weighted average of dividend growth rates in the U.S., U.K., France, Germany and Japan for 1970-2020. Data Sources: MSCI, PWT and WDI.

In order to analyze the statistical properties of dividend co-movement, recall that one can recover the covariance for each country from a linear regression of the country's dividend growth rate on the global dividend growth rate,

$$\Delta d_{it} = \gamma_i^d \Delta d_{Wt} + \epsilon_{it}. \tag{3}$$

The covariance follows from the coefficient estimate of this regression, which we denote by $\gamma_i^d \equiv \frac{cov(\Delta d_i, \Delta d_W)}{var(\Delta d_W)}$. γ_i^d has a natural interpretation: it measures the sensitivity of a country's fundamentals (i.e. dividends) to global fluctuations in dividends. In Table 2, we report the coefficient estimate for each country, followed by the standard error. The average country has a coefficient estimate of 1.24, and the cross-country standard deviation is 0.34. The coefficients are precisely estimated for almost all the countries, suggesting that this statistic is highly informative.[7] Specifically, the covariances in dividend growth rates with the world extracted

[7]Our specification assumes that dividend growth is a random walk. To evaluate this assumption, we conduct the Augmented Dickey-Fuller test of the null hypothesis that a unit root is present in each country's dividend growth rate series. We reject the null for 18 countries, and fail to reject it for 19. We re-estimate our coefficients of interest controlling for lags of Δd. The mean estimate is 1.21 with cross-country standard deviation of 0.32, and the correlation between the new estimates and the ones reported in Table 2 is 0.91.

from the estimated γ_i^d are strongly related to mean returns to equity as seen in Figure 3 above.

Table 2: Dividend Comovement and Risk Premia, by Country

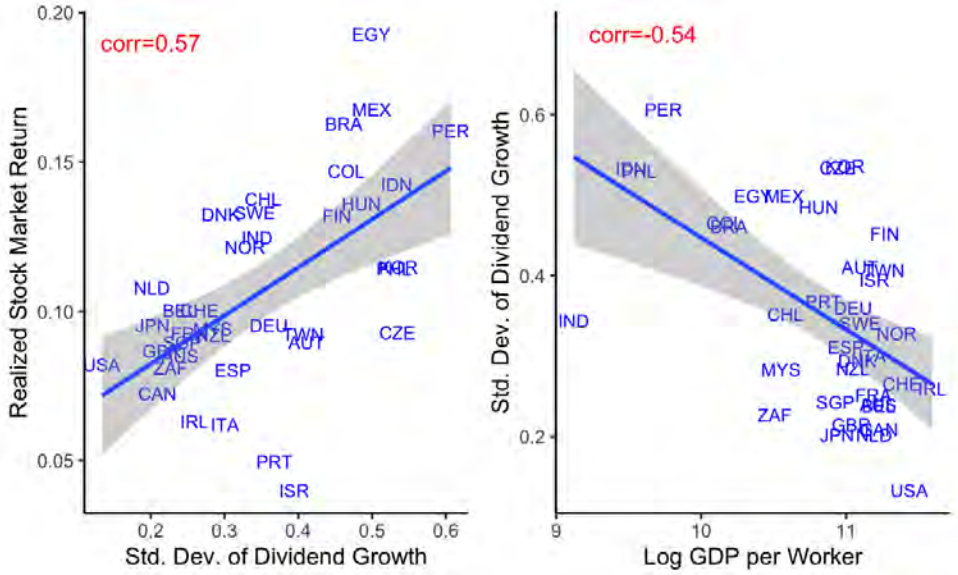
	AUS	AUT	BEL	BRA	CAN	CHE	CHL	COL	CZE	DEU	DNK	EGY	ESP
γ_i^d	1.24***	1.47***	1.28***	1.77***	1.15***	1.48***	1.19***	1.19**	0.97	1.94***	1.56***	1.13*	1.40***
s.e.(γ_i^d)	0.19	0.41	0.18	0.46	0.16	0.20	0.37	0.53	0.82	0.27	0.21	0.61	0.28

	FIN	FRA	GBR	HUN	IDN	IND	IRL	ISR	ITA	JPN	KOR	MEX	MYS
γ_i^d	1.58***	1.48***	1.14***	0.94	1.52**	1.41***	1.04***	0.76	0.74**	0.95***	1.99***	0.90	0.64*
s.e.(γ_i^d)	0.47	0.17	0.16	0.59	0.59	0.33	0.25	0.59	0.30	0.15	0.54	0.59	0.33

	NLD	NOR	NZL	PER	PHL	PRT	SGP	SWE	TWN	USA	ZAF
γ_i^d	1.13***	1.39***	1.15***	1.25*	0.89	1.18***	1.05***	1.89***	1.23***	0.86***	0.85***
s.e.(γ_i^d)	0.15	0.29	0.28	0.72	0.63	0.39	0.19	0.25	0.44	0.06	0.23

Notes: Table reports country-level estimated coefficients γ_i^d and standard errors from a regression of Δd_{it} on Δd_{Wt} from 1970-2020. Data Sources: MSCI.

Figure 4: Volatility of Dividend Growth

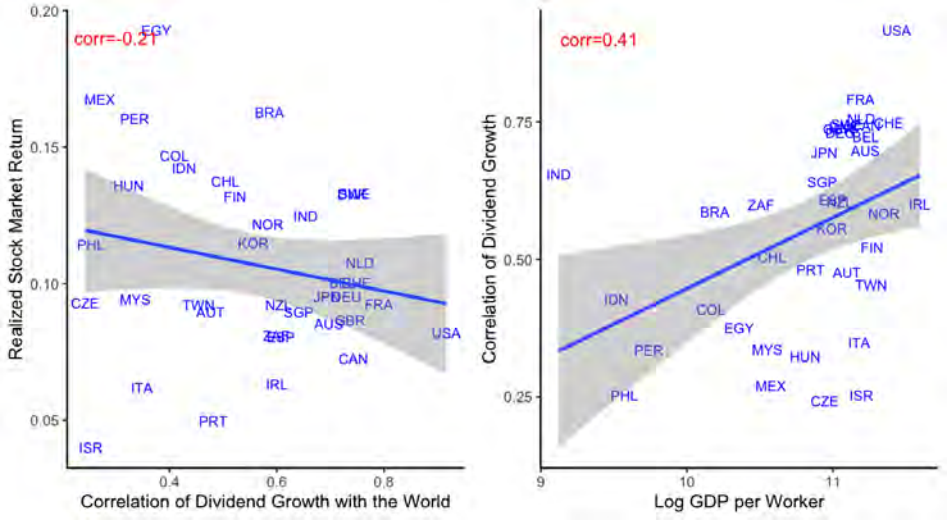


Notes: The figure plots time-series mean annualized USD-denominated stock market return against the annualized time-series standard deviation of dividend growth rates (left) and the time-series standard deviation of annualized dividend growth rates against time-series mean log income per worker (right) for 37 countries for 1970-2020. Data Sources: MSCI, PWT and WDI.

When we take a step further and decompose the covariance of dividend growth rates into each country's standard deviation of dividend growth and the correlation between the dividend growth and the global growth rate, it becomes apparent that the systematic relationship between

returns and covariances is driven by countries' volatility levels. In fact, the left panel of Figure 4 plots the country-level mean stock market returns against the standard deviation of dividend growth rates as well as the cross-country correlation between the two variables, which amounts to 0.57. Countries with higher returns are those that exhibit high underlying fundamental volatility. Moreover, the right panel of the same figure demonstrates that it is the less developed economies that experience more volatile dividend growth rates.

Figure 5: Dividend Growth Correlation



Notes: Left panel plots time-series mean annualized USD-denominated stock market return against the correlation of the time-series country-level annualized dividend growth rates with the world annualized dividend growth rates (left), defined as a stock-market-cap weighted average of the dividend growth rates of U.S., U.K., France, Germany, and Japan. Right panel plots the correlation of the country-level annualized dividend growth rates with the world annualized dividend growth rate against time-series mean log income per worker for 37 countries for 1970-2020. Data Sources: MSCI, PWT and WDI.

In contrast, countries whose dividend growth rates are more correlated with the world do not exhibit systematically different returns as is apparent in the left panel of Figure 5, where the correlation is only -0.2. Not surprisingly, it is the poorer countries that are less correlated with the world, which can be seen in the right panel of the same figure.

In Table 3, we include summary statistics for the covariance of countries' dividend growth rates with the global dividend growth rate, $cov(\Delta d_i, \Delta d_W)$, the corresponding correlation, $corr(\Delta d_i, \Delta d_W)$, and the standard deviation of each country's dividend growth rate, $s.d.(\Delta d_i)$.[8]

[8]The cross-country correlation between returns and covariances of dividend growth rates with the world reported in Figure 3 is not mechanically driven by the five major economies that constitute the 'world'. Dropping these countries from the sample yields a correlation of 0.56. Furthermore, the covariance moment is robust to the frequency of study. We compute covariances by applying a band-pass filter to isolate fluctuations in the 20-30 year periodicity range, yielding covariances of Δd_i and Δd_W at long-run frequencies. The mean covariance across countries is 0.029, with cross-country standard deviation of 0.0103. The correlation of this low-frequency moment with the contemporaneous covariance reported in Table 3 is 0.94.

Table 3: Summary Statistics for Equity Dividends

Variable	N	Mean	Median	Std. Dev	Q_{10}	Q_{90}	corr$(\cdot, r_i)$	corr$(\cdot, y_i)$
cov$(\Delta d_i, \Delta d_W)$	37	0.027	0.027	0.008	0.017	0.036	0.530	-0.266
s.d.(Δd_i)	37	0.353	0.341	0.121	0.213	0.531	0.572	-0.545
corr$(\Delta d_i, \Delta d_W)$	37	0.553	0.586	0.181	0.302	0.747	-0.212	0.414

Notes: The table displays the covariance of the time-series country-level annualized dividend growth rates with the world annualized dividend growth rate, the time-series standard deviation of country-level annualized dividend growth rates, and the correlation of the time-series country-level annualized dividend growth rates with the world annualized dividend growth rate, defined as a stock-market-cap weighted average of the dividend growth rates of the U.S., U.K., France, Germany, and Japan for 1970-2020. Data Source: MSCI.

For reference, in the last two columns of the table we report how each of these variables correlates with mean returns across countries as well as with mean income levels. Standard deviations range from as low as 0.13 for the U.S. to a three-fold value of 0.61 for an emerging market like Peru, and they are generally decreasing in countries' level of development. Meanwhile, the U.S. enjoys the highest correlation with the world of 0.92, which reflects the predominant role that the U.S. plays in world financial markets, followed by developed European markets. Some of the least correlated countries with the world include Czech Republic, Philippines and Israel, all of which are characterized by a γ_i^d that is not precisely estimated.

The strong relationship between returns and dividend-growth covariances motivates a framework in which global shocks play a central role. Nonetheless, given the large variation in stock market returns across countries and over time, it is important to account for both global and idiosyncratic shocks when modeling the behavior of macro and financial variables across countries. In the following section, we formalize both global and idiosyncratic shock processes and we derive predictions about risk premia via the lens of an asset pricing model.

4 A Long-Run Risk Explanation

In this section, we quantitatively explore a novel explanation for the observed cross-sectional variation in returns on the basis of country income levels—namely, the risk-return trade-off implied by asset pricing theory, and specifically, the role of global long-run risks due to uncertainty regarding future economic growth prospects.

4.1 The Model

We consider an endowment economy following the international long-run risk literature.[9] We view each market as a small open economy, and we focus on asset valuations from the perspective of a U.S. investor. Consumption of the investor and payments to equity in each country experience shocks to expected future growth rates. Each country is exposed to global and idiosyncratic components of these shocks. Countries differ in their exposure to the global shock process and in the characteristics of the idiosyncratic one. Heterogeneity in exposure to global shocks will play a crucial role in leading to expected return differences across countries.

Preferences. The representative U.S. investor has recursive preferences à la Epstein and Zin (1989). The investor seeks to maximize lifetime utility

$$V_t = \left[(1-\beta) C_t^{\frac{\psi-1}{\psi}} + \beta \nu_t \left(V_{t+1}\right)^{\frac{\psi-1}{\psi}} \right]^{\frac{\psi}{\psi-1}}, \quad \nu_t \left(V_{t+1}\right) = \left(\mathbb{E}_t \left[V_{t+1}^{1-\gamma} \right] \right)^{\frac{1}{1-\gamma}}$$

where ψ denotes the intertemporal elasticity of substitution, γ is risk aversion, β is the rate of time discount, and $\nu_t \left(V_{t+1}\right)$ is the certainty equivalent of period $t+1$ utility. The Euler equations for the risk-free asset, the U.S. risky asset and the foreign risky asset are:

$$\begin{aligned} 1 &= \mathbb{E}_t \left[M_{USt+1} R_{ft+1} \right] \\ 1 &= \mathbb{E}_t \left[M_{USt+1} R_{USt+1} \right] \\ 1 &= \mathbb{E}_t \left[M_{USt+1} \frac{q_{it+1}}{q_{it}} R_{it+1} \right] \ \forall \ i \neq US, \end{aligned} \tag{4}$$

where R_{ft} is the return on a risk-free bond, R_{USt} is the (gross) return to equity in the U.S., R_{it} is the (gross) return to equity in country i, denominated in local consumption units, and $q_{it} = \frac{P_{it}^c}{P_{USt}^c}$ is the real exchange rate between the U.S. and country i, where P^c denotes the price of consumption. Furthermore, M_{USt+1} is the U.S. investor's stochastic discount factor (SDF thereafter) whose log, denoted by m_{USt+1}, is given by:

$$m_{USt+1} = \theta \log \beta - \frac{\theta}{\psi} \Delta c_{USt+1} + (\theta - 1) r_{USt+1}^c, \tag{5}$$

where $\theta = \frac{1-\gamma}{1-\frac{1}{\psi}}$, and r_{USt+1}^c denotes the return on an asset that pays aggregate U.S. consumption as its dividend, or equivalently, the return to aggregate wealth.

[9] An important exception is Colacito et al. (2018a), who analyze capital flows in an international production economy featuring long-run risk.

Dynamics of Consumption and Dividends. The following system lays out the joint dynamics of consumption and dividends for any country i:

$$\begin{aligned}
\Delta c_{it+1} &= \mu_i + \phi_i x_t + x_{it} + \pi_i \eta_{t+1} + \eta_{it+1} \\
x_{t+1} &= \rho x_t + e_{t+1} \\
x_{it+1} &= \rho_i x_{it} + e_{it+1} \\
\Delta d_{it+1} &= \mu_i^d + \phi_i^d x_t + \tilde{\phi}_i^d x_{it} + \pi_i^d \eta_{t+1} + \tilde{\pi}_i^d \eta_{it+1} + \eta_{it+1}^d
\end{aligned} \tag{6}$$

In the consumption process, μ_i is the unconditional mean, and x_t and x_{it} are, respectively, the common (i.e. world) and i-specific (i.e. idiosyncratic) time-varying, small but persistent components of the growth rate, so that the conditional mean at t of consumption growth in $t+1$ is $\mu_i + x_t + x_{it}$. The world and local persistent components evolve according to AR(1) processes with persistence parameters ρ and ρ_i, and variances in the innovations σ_e^2 and σ_{ei}^2. ϕ_i governs the exposure of i's consumption to the global persistent component, while η_{t+1} and η_{it+1} are the transitory global and idiosyncratic shocks, respectively, with variances σ_η^2 and $\sigma_{\eta_i}^2$.

Dividend growth has unconditional mean μ_i^d and levered exposures to the persistent components of consumption growth, x_t and x_{it}, captured by ϕ_i^d and $\tilde{\phi}_i^d$. The transitory consumption shocks η_{t+1} and η_{it+1} influence the dividend process with exposures π_i^d and $\tilde{\pi}_i^d$. There is a residual transitory shock that governs dividends denoted by η_{it+1}^d with variance $\sigma_{\eta_i^d}^2$. We assume that all shocks are independent and normally distributed, with respective variances as defined above. We do not assume any particular pattern regarding the exposure parameters to shocks, and we recover the parameter values from macro and financial data in our quantitative exercise.

Risk Premia. To emphasize the importance of countries' heterogeneous exposures to global persistent shocks in driving equity return differences, we begin by solving the model in the absence of exchange rate risk. We assume no exchange rate volatility across countries (driven by the shocks in our model), which is a commonly employed benchmark by the macroeconomics literature consistent with the assumption of a single traded good, where the real exchange rate is unity. In Section 4.4, we relax this assumption and we demonstrate that our main quantitative results are robust in an environment where real exchange rate risk is explicitly priced.

Our objects of interest are the cross section of country risk premia, in general, and the Lucas Paradox, in particular. This is inherently a question about cross-border capital allocation, so it can only be addressed from the perspective of an investor making such an allocation choice. This implies the use of a single stochastic discount factor. We adopt the U.S. investor as the marginal investor for three reasons: (i) the U.S.'s dominant role in global financial markets, (ii) the dominance of USD-denominated capital flows, and (iii) the substantial common variation

in international asset returns.

The U.S. investor's stochastic discount factor in equation (5) depends on U.S. consumption growth, which in the model loads on global shocks (x_t, η_t) as well as on U.S.-specific shocks $(x_{US,t}, \eta_{US,t})$ defined in Equation (6). Recall that, both in general and in this model in particular, only systematic risk is priced and commands a risk premium. The country-i idiosyncratic innovations $(e_{i,t+1}, \eta_{i,t+1}, \eta^d_{i,t+1})$ are, by definition, uncorrelated with the global shocks. They are therefore orthogonal to the U.S. SDF and command no risk premium. In Section 4.3, we quantify the contribution of global and idiosyncratic shocks to countries' dividend growth rates and we discuss the roles that these shocks play in driving equity returns and their volatilities.

To derive risk premia, we solve the model using a log-linear approximation around the balanced growth path as described in detail in Appendix C. Under the assumption of log-normality, the log-linear approximations to the Euler equations in expression (4) yield the following risk premia (or excess returns, $\mathbb{E}[\hat{r}^e_i]$) for a risky asset from country i:

$$\begin{aligned}\mathbb{E}\left[\widehat{r^e_i}\right] &\equiv \log \mathbb{E}\left[R_i\right] - \log \mathbb{E}\left[R_f\right] + \mathbb{E}\left[\Delta q_i\right] \\ &= -\operatorname{cov}\left(m_{US}, r_i\right) - \frac{1}{2}\operatorname{var}\left(r_i\right), \end{aligned} \tag{7}$$

where r_i is the logged real return to the risky asset from country i and $\mathbb{E}[\Delta q_i] = 0$ by assumption. Under the assumption that returns reflect only global shocks and following the methodology outlined in Appendix C, the risk premia can be written as:

$$\begin{aligned}\mathbb{E}\left[\widehat{r^e_i}\right] =& \gamma \pi_{US} \pi^d_i \sigma^2_\eta + (1-\theta)\kappa^2 \left(\frac{\phi_{US} - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)\left(\frac{\phi^d_i - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)\sigma^2_e \\ &- \frac{1}{2}\left[\kappa^2 \left(\frac{\phi^d_i - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)^2 \sigma^2_e + \left(\pi^d_i\right)^2 \sigma^2_\eta\right], \end{aligned} \tag{8}$$

where κ is a constant defined in Appendix C that is a function of the mean growth rate of consumption, μ_{US}. The risk premium features a fundamental trade-off between the covariance of the SDF and returns (first line of expression (8)), and the variance of returns (second line), and it reflects the variance in both temporary and persistent global shocks, σ_η and σ_e, respectively, as well as the exposures of the countries' dividend growth to these shocks, π^d_i and ϕ^d_i. The U.S.-specific consumption exposure parameters, π_{US} and ϕ_{US}, reflect the assumption that the U.S. agent is pricing the assets. With preference parameter values commonly employed in the literature, risk premia are rising in countries' exposures to growth shocks, π^d_i and ϕ^d_i, and differences in these parameters drive cross-country return differentials.

4.2 Identification of Parameters

To derive the model's risk premia implications and to assess its ability to account for the cross section of stock market returns in the data, we must assign values to the parameters governing the preferences as well as the consumption and dividend processes laid out in expression (6). From expression (8), note that risk premia only reflect parameters that govern the global shocks and countries' exposures to these shocks. Additionally, observe that country-specific exposures of consumption growth to global shocks (ϕ_i and π_i) for foreign countries (vis-à-vis the U.S.) do not drive risk premia since the U.S. investor is pricing the assets in our model.

We use standard preference parameters from the literature (Colacito and Croce, 2011). Furthermore, we implement techniques used by Bansal and Yaron (2004), Bansal et al. (2012), and Colacito et al. (2018b) to estimate the parameters that govern the global persistent process and global transitory shocks using consumption growth and price-to-dividend ratio data for five major economies (U.S., U.K., France, Germany and Japan) during the 1940-2020 period provided by Jordà et al. (2019) and Jordà et al. (2017). U.S. consumption growth exposures to global shocks follow from linear regressions of U.S. consumption growth series on the estimated global persistent process and the residual transitory component of global consumption growth. Since these procedures are standard in the literature, we relegate the details to Appendix D, and we focus on the new moments on dividends that we introduce to the literature, which ultimately drive cross-country return differentials.

Global dividend growth parameters. To identify parameters pertaining to dividend growth rates, we specify a global dividend growth process (measured by expression (2) in the data):

$$\Delta d_{Wt+1} = \mu_W^d + \phi_W^d x_t + \pi_W^d \eta_{t+1} + \eta_{Wt+1}^d, \tag{9}$$

where $\eta_W^d \sim N(0, \sigma^2_{\eta_W^d})$ is independent of all country-specific and global shocks defined above, and idiosyncratic components have been averaged out. As was the case for each individual country, the global dividend growth process features an additional transitory shock, η_W^d, which reflects the possibility of sources of variation in equity dividends that are not related to sources of variation in real variables such as consumption.

As we describe in Section 2.3, we define the 'world' portfolio to be the stock-market-capitalization weighted mean of five major economies during the 1975-2020 period. Due to the relatively short time coverage on dividend growth data in MSCI, compared to consumption growth data, we are not able to identify π_W^d and, especially, ϕ_W^d from linear regressions as in the case for consumption.[10] In order to relate our results to the existing literature, we set the

[10]Missing historical stock market capitalization data, used to weigh countries, prevents us from defining global

leverage parameter to the global persistent process, ϕ_W^d, to 3, which is the value that Nakamura et al. (2017) use for 12 developed economies. We set π_W^d to 4.9, which implies that the transitory and persistent global shocks that the U.S. agent prices in our model account for 89% of the observed variation in global dividend growth in MSCI data, with the residual shock, η_W^d, accounting for only 11% of variation. Furthermore, as we show in column (i) of Table 5 below, our choice of a value of 4.9 implies that the leverage parameter of U.S. dividend growth on the global persistent process is 3.5, which compares favorably to the value for this parameter of 3 used by Bansal and Yaron (2004) and Colacito and Croce (2011) for the U.S.[11]

We summarize the values for the parameters that govern preferences, global processes and the U.S. consumption growth process in Table 4, alongside the moments. As is clear from this table, the variance of the global persistent shock is lower than the variance of the global transitory shock, and the residual variance of the shock that governs global dividends is rather high, which reflects the fact that dividend growth is several orders of magnitude more volatile than consumption growth.

Table 4: Moments and Parameters for Preferences, Global Processes, and U.S. Consumption

Parameter	Value	Moment
γ	4	Literature (Colacito and Croce, 2011)
ψ	1.5	Literature (Colacito and Croce, 2011)
β	0.99	Literature (Colacito and Croce, 2011)
ρ	0.758	AR1 reg. coeff. est. in eq. (6) for x_t estimated in eq. (10), 5 countries
σ_e	0.017	Autoreg. coeff. est. in eq. (19) for Δc_W defined in eq. (1), 5 countries
σ_η	0.021	Variance of Δc_W (net of x_t) defined in eq. (1), 5 countries
μ_{US}	0.021	Mean of Δc_{US}, USA
ϕ_{US}	2.133	Reg. coeff. est. in eq. (20) for Δc_{US}, USA
π_{US}	0.425	Reg. coeff. est. in eq. (21) for Δc_{US}, USA
ϕ_W^d	3.000	Literature (Bansal and Yaron, 2004; Nakamura et al., 2017)
π_W^d	4.900	$\phi_W^d \sigma_x^2 + \pi_W^d \sigma_\eta^2 = 89\%$ of var(Δd_W) defined in eq. (2), 5 countries
$\sigma_{\eta_W^d}$	0.047	11% of var(Δd_W) defined in eq. (2), 5 countries

Notes: Table reports parameter values and moments used in benchmark calibration.

dividend growth prior to 1975 and estimating π_W^d and ϕ_W^d following the standard procedure used to estimate the U.S. consumption growth parameters outlined in Appendix D. While consumption series across countries are relatively smooth and cross-country means are robust to different weighting schemes (see footnote 8), the same is not true for financial series, so country weights affect the results, and the unweighted mean is quite different from the 'world' equity portfolio as defined by MSCI.

[11] In Figure 10 in Appendix E, we show that the 'world' portfolio returns are driven predominantly by U.S. returns, so it is reasonable that the U.S. and the global dividend growth processes in the model have similar leverage parameters to the persistent process.

Idiosyncratic dividend growth parameters. We rely on the same MSCI data to assign values to the idiosyncratic parameters that govern the process in the fourth line of expression (6) for all countries. To recover π_i^d, we run the following regression for each country:

$$\Delta d_{it+1} = \pi_i^d(\Delta d_{Wt+1} - \phi_W^d x_t)/\pi_W^d + \epsilon_{it+1}, \tag{10}$$

which identifies the parameter of interest under the independence assumption among all idiosyncratic and global shocks. The resulting regression coefficient estimates for each country are reported in Table 5. For the majority of countries, the parameters are precisely estimated; the mean centers at 5.97 and the parameter value for the U.S. is 4.21.[12] These parameters do not display any systematic pattern across rich and poor countries.

Finally, given all other parameters, to recover the key dividend exposure parameters to the persistent global process, ϕ_i^d, we rely on the covariance of a country's dividend growth rate with the world, which is given by $\text{cov}(\Delta d_{it+1}, \Delta d_{Wt+1}) = \phi_i^d \phi_W^d \sigma_x^2 + \pi_i^d \pi_W^d \sigma_\eta^2$. We recover the covariance from the coefficient estimates of country-level regressions of dividend growth rates on the global dividend growth, γ_i^d, as reported in Table 2 in Section 3.2. Recall that this moment is very informative about stock market returns in the data (see Figure 3 in Section 3.2), and it is the most important moment in the identification procedure as it directly dictates the risk premia differentials that we document below. Crucially, notice that we identify all country-specific parameters using dividend growth data only—we do not rely on cross-country equity prices in our identification procedure.

We report the resulting parameter values for ϕ_i^d for each country in Table 5, along with the correlation of this variable with income per worker. The mean value for the leverage parameter across countries amounts to 6.21 and the value for the U.S. is 3.5.[13] As is evident from Table 5, emerging markets display higher exposures to the persistent global process than developed ones–the correlation between income per worker and ϕ_i^d is -0.45–and are characterized by higher model-implied excess returns, as we demonstrate in the next section.

Given the importance of these parameters in the quantitative analysis, in Appendix E, we re-estimate them using four different definitions of the 'global' portfolio that range from the G-10 countries to the entire set of 37 countries in our study. The correlation of the newly-estimated parameters and our benchmark estimates is nearly 1 in all the specifications, even though the mean levels of the parameters change somewhat depending on the specification. These findings imply that approximating the world with our five countries of choice is a reasonable assumption.

[12] Standard errors omitted due to space constraints and available in Replication Package.

[13] It is clear from the regressions used to identify π_i^d and ϕ_i^d that π_W^d scales all country-specific dividend growth leverage parameters. This is why we use the estimate of π_{US}^d of 3.5 to cross check our choice of 4.9 for π_W^d.

Table 5: Dividend Growth Exposure Parameters and Resulting Risk Premia, by Country

	AUS	AUT	BEL	BRA	CAN	CHE	CHL	COL	CZE	DEU	DNK	EGY	ESP
ϕ_i^d	5.06	5.99	5.24	10.59	4.72	6.06	6.45	8.22	3.49	7.99	6.44	8.85	5.80
π_i^d	6.02	7.02	6.20	8.51	5.58	7.19	5.76	5.78	4.46	9.40	7.51	5.47	6.72
$\widehat{r_i^e}$	9.30	10.47	9.55	10.61	8.75	10.52	11.27	12.34	6.18	11.31	10.87	12.39	10.30
r_i^e	7.90	8.40	9.40	14.20	6.60	9.40	11.70	12.40	6.90	8.90	12.60	16.90	7.40

	FIN	FRA	GBR	HUN	IDN	IND	IRL	ISR	ITA	JPN	KOR	MEX	MYS
ϕ_i^d	8.71	6.10	4.61	7.61	8.29	9.70	5.69	2.43	3.07	3.89	10.95	4.94	3.50
π_i^d	7.54	7.14	5.57	4.52	7.39	6.86	5.03	3.58	3.59	4.64	9.56	4.33	3.07
$\widehat{r_i^e}$	11.95	10.57	8.54	12.35	11.98	11.79	10.46	3.32	5.18	7.14	9.85	9.35	6.34
r_i^e	11.20	8.60	8.00	11.20	12.20	10.10	4.30	1.70	5.60	8.90	9.40	14.70	7.40

	NLD	NOR	NZL	PER	PHL	PRT	SGP	SWE	TWN	USA	ZAF	corr$(\cdot, y_i)$
ϕ_i^d	4.61	5.65	6.23	9.22	5.09	6.44	4.27	7.81	6.76	3.49	5.89	-0.45
π_i^d	5.47	6.74	5.58	6.04	4.27	5.74	5.13	9.10	5.95	4.21	4.11	0.01
$\widehat{r_i^e}$	8.56	10.08	11.07	12.19	9.61	11.27	7.91	11.35	11.54	6.23	10.86	-0.34
r_i^e	10.20	11.60	7.20	13.70	9.40	2.90	8.40	12.70	7.20	7.60	5.80	-0.42

Notes: Table reports the country-level parameters ϕ_i^d, π_i^d, the model-predicted risk premia $\widehat{r_i^e}$ and the risk premia from the data r_i^e. Data Sources: MSCI.

4.3 Results

Equity Risk Premia. We begin by evaluating the ability of the model to reconcile observed risk premia in the data, under the assumption that real exchange rates equal unity–i.e., in the absence of real exchange rate risk. We compute risk premia for each country by plugging the parameter values reported in Tables 4 and 5 into expression (8).

Table 6: Summary Statistics for Model-Predicted Variables

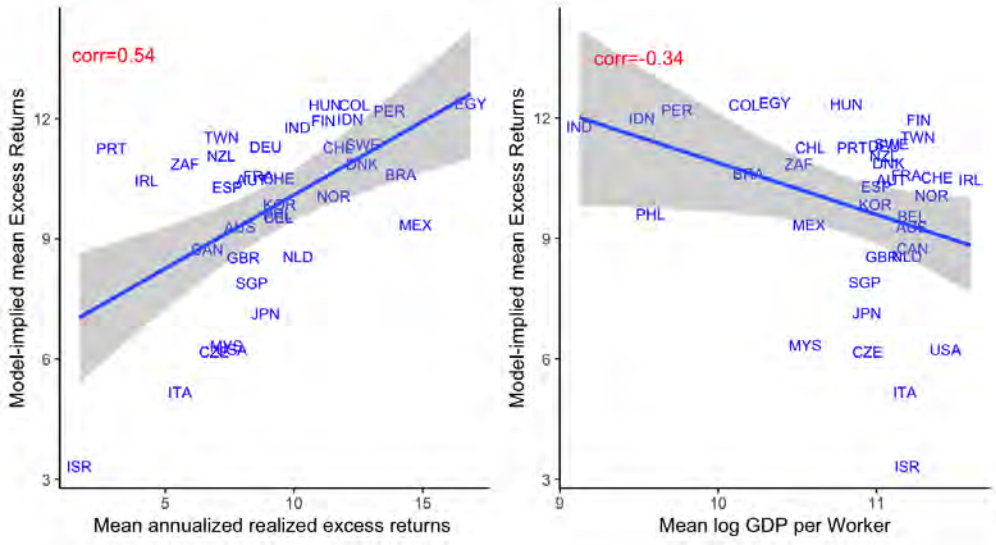
Returns							*Dependent variable:* $\widehat{r_i^e}$	
	N	Mean	Median	Std. Dev	Q_{10}	Q_{90}	Constant	y_i
$\widehat{r_i^e}$	37	0.098	0.105	0.022	0.063	0.121	0.238***	-0.013**
							(0.065)	(0.006)
$\sigma_{\widehat{r_i}}$	37	0.365	0.357	0.150	0.174	0.552		
Dividends								

$\frac{\text{Var}(\Delta d_{\text{Long-Run}})}{\text{Var}(\Delta d_{\text{Data}})}$	$\frac{\text{Var}(\Delta d_{\text{Short-Run}})}{\text{Var}(\Delta d_{\text{Data}})}$
0.217	0.126

Notes: The upper panel reports summary statistics of the predicted risk premia from the parameterized model ($\widehat{r_i^e}$) for 37 countries, and the results of a linear regression of $\widehat{r_i^e}$ on the time-series mean log income per worker, y_i. $\sigma_{\widehat{r_i}}$ is the model-implied standard deviation of returns. Regression standard errors are in parentheses. The lower panel reports the cross-country mean fraction of dividend growth variance accounted for by the long-run and short-run components of the calibrated model. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

In Table 6, we report the summary statistics of risk premia that we compute from our model.

Figure 6: Model-Implied Excess Returns



Notes: The above figure plots the predicted risk premia from the parameterized model $\widehat{r^e}$ against the realized risk premia from the data r^e (left) and the predicted risk premia from the parameterized model $\widehat{r^e}$ against income per worker (right) and for 37 countries for 1970-2020. Data Sources: MSCI, PWT, WDI and St. Louis Fred.

The mean risk premium in the model is 9.8%, which is nearly identical to the mean reported in MSCI data of 9.3% in Table 1 above. Turning to the cross section of countries, in Table 5, we report excess returns implied by the calibrated model, $\widehat{r_i^e}$, and their data counterparts, r_i^e. The model-predicted excess return ranges from 3.32% in Israel to 12.39% in Egypt, and the U.S. value amounts to 6.23%. More interestingly, the model is able to reconcile the cross section of risk premia in the data. The left panel of Figure 6 plots model-implied against realized excess returns at the country level and the accompanying correlation between the two series, which amounts to 0.54.

In the model, risk premia differentials across countries are driven by two parameters, ϕ_i^d and π_i^d, which capture the sensitivity of each country's dividend growth rate to persistent and transitory shocks. To evaluate the role of each parameter in delivering the results, we perform two robustness exercises. First, we set all country-specific π_i^d's to that of the U.S., and we keep the values of ϕ_i^d as in Table 5. The first row of Table 19 in Appendix F shows the summary statistics from this exercise. Mean risk premia, denoted by $\hat{r}_r^e$ (for robustness), increase to 10%, and the correlation between the model-implied and realized excess returns is effectively unchanged. Similarly, the correlation between the benchmark model-implied excess returns and the counterfactual one is effectively 1, which suggests that risk premia in the model did not change in the cross section, only slightly in levels. This finding demonstrates that the values of ϕ_i^d generate the majority of risk premia differentials across countries.

In the second exercise, we set all country-specific π_i^d's to that of the U.S., and we re-estimate the resulting ϕ_i^d's so as to match the covariance of each country's dividend growth rate with the world. Thus, we are effectively assigning all the cross-sectional variation of the key moment of interest—the covariance of a country's dividend growth rate with the global dividend—on the parameter ϕ_i^d. The second row of Table 19 in Appendix F shows the summary statistics from this exercise. While risk premia levels, denoted by $\hat{r}_r^e$, decrease slightly to 9.3% on average, there is a notable change in the cross-sectional variation. The correlation between the model-implied and realized excess returns drops to a mere 0.2, while the correlation between the baseline and the counterfactual risk premia is only 0.58. This finding implies that it is important to separately identify persistent from transitory shocks when estimating the global dividend process, even though the latter do not play an important role in governing the levels of risk premia.

Discussion of key mechanism. The robustness analysis sheds light on the role that the parameters ϕ_i^d play in generating cross-sectional risk premia differences. In theory, these parameters govern the exposure of each country's dividend growth to global persistent shocks. The estimated parameter values are systematically higher in poorer economies; Table 5 shows a correlation between these estimates and income per worker of -0.45. Consequently, the model generates equity risk premia that are lower in richer countries. Specifically, Table 6 reports that doubling a country's income per worker results in a 1.3 percentage point decline in model-implied risk premia. Similarly, the right panel of Figure 6 plots mean model-implied excess returns against mean logged income per worker as well as the correlation between the two variables, which is -0.34.

In the model, high values of ϕ_i^d generate more volatile dividend growth rates in a country. As we demonstrate in Section 3, less developed economies exhibit higher volatilities in dividend growth. Higher dividend volatilities in these economies, in turn, translate into higher estimates of ϕ_i^d. A natural question therefore relates to the underlying mechanism that generates higher dividend volatilities in emerging markets.

The premise that emerging-market dividend processes inherit greater fundamental volatility than developed-market processes is well grounded in the macro and corporate-finance literature, and the gradient appears at every level of aggregation. At the aggregate level, Aguiar and Gopinath (2007) document that emerging-market business cycles are roughly twice as volatile as those of developed small open economies, and attribute the differential to a larger role for trend-growth shocks tied to policy-regime instability.

At the sectoral level, Koren and Tenreyro (2007) decompose the cross-country variance of GDP growth and find that roughly half of the emerging-developed market gap is attributable to sectoral composition—poor countries specialize in more volatile sectors—while the remaining

half reflects higher country-specific aggregate volatility, where within-sector volatility is itself higher in less developed economies. The theoretical foundation for this pattern is provided by Acemoglu and Zilibotti (1997), who show that limited diversification opportunities in countries with higher required yields on capital imply higher equilibrium volatility of returns to capital.

At the firm level, John et al. (2008) construct an industry- and country-year-adjusted measure of the volatility of EBITDA, relative to assets, for a panel of 4,000 firms across 40 countries and document that this object varies systematically with the quality of investor protection, which is itself strongly correlated with development. Acharya et al. (2011) report a parallel result, showing that firm-level cash-flow volatility is systematically lower in countries with stronger creditor rights. Taken together, these findings establish that the cross-country gradient of dividend growth volatilities that we identify is not an artifact of the dividend series—it has a clear counterpart in fundamentals at the aggregate, sectoral, and firm levels.

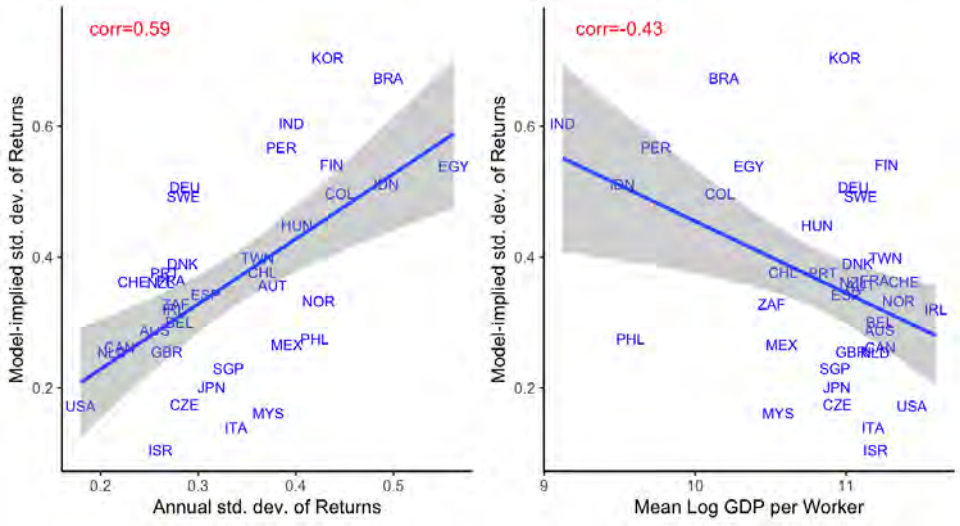
Volatility of Returns to Equity. We proceed to evaluate whether the model can account for the cross-sectional volatility of equity returns reported in Section 3.1. By construction, the model matches the variance of each country's dividend growth rate, which is driven by three objects: long-run global component, along with the country's leverage parameter, $(\phi_i^d x_t)$, short-run global component $(\pi_i^d \eta_{t+1})$, and residual component $(\tilde{\phi}_i^d x_{it} + \tilde{\pi}_i^d \eta_{it+1} + \eta_{it+1}^d)$. The bottom panel of Table 6 reports the average standard deviation of dividend growth among the 37 markets in our dataset, as well as the percent of variance that is explained by the long-run and short-run global components. The long-run global component accounts for nearly double the variation than does the short-run global component—22% versus 13%. Not surprisingly, the largest part of the variation is explained by the residual idiosyncratic component.

The second row of the top panel of Table 6 reports summary statistics of the volatility of equity returns implied by the model. The model generates a standard deviation of returns to equity of 0.365 for the average country, which is nearly identical to (and somewhat exceeds) the mean of 0.336 reported in MSCI data in Table 1 in Section 3.1.

To evaluate the fit of the model to the volatility data, in the left panel of Figure 7, we plot the model-implied standard deviation of returns against the standard deviation observed for the 37 countries in MSCI data. The correlation between the two variables is remarkably high—0.59. With this statistics at hand, we conclude that our parsimonious model, which excludes currency risk and relies on a single moment on dividend growth comovement with the world, can reconcile at least 50% of the variation in levels and volatilities of stock market returns across rich and poor countries.

To understand the driver behind this result, note that higher dividend growth volatility translates into higher return volatility via the key parameters ϕ_i^d. Since these parameter esti-

Figure 7: Model-Implied Standard Deviation of Equity Returns



Notes: The above figure plots the predicted standard deviation of risk premia against the time-series standard deviation of risk premia from the data (left) and the time-series mean log income (right) for 37 countries from 1970-2020. Data Sources: MSCI, PWT and WDI.

mates are higher in poorer countries, the model generates more volatile returns in less developed economies. The right panel of Figure 7 plots the model-implied standard deviation of equity returns against the logged income per worker for the 37 countries in our sample, as well as the correlation between the two variables, which amounts to 0.43. Since return volatility contributes negatively to model-predicted excess returns in expression (7), it follows that the negative relationship between model-predicted returns and per-capita income is driven by the covariances of returns with the U.S. agent's SDF.

A few observations are in order. As discussed, our object of interest is cross-border capital allocation and the cross section of risk premia, which requires a single stochastic discount factor pricing all assets. With this question defining the model, the U.S. investor prices all assets. Shocks to country-i dividends are at the core of the risk premium the U.S. investor demands to hold the asset. The investor prices the systematic, global portion of dividend variation, which covaries with her SDF. This portion is heterogeneous across countries, and it is what generates cross-country differences in equity premia.

Country-i-specific, idiosyncratic shocks $(e_{it}, \eta_{it}, \eta_{it}^d)$ are by construction orthogonal to the representative investor's SDF and earn zero risk premium. A single U.S. SDF, pricing all assets, places foreign idiosyncratic risk outside the priced factor structure. The result that idiosyncratic shocks are unpriced is therefore not a claim about the U.S. investor's indifference to country-i dividend shocks, but a statement about which portion of those shocks is priced

and commands a risk premium. The ability of the parsimonious model to generate levels and variation in first and second moments of equity returns, in the absence of stochastic volatility shocks, is a testament to the importance of these global shocks in international asset pricing.

4.4 Real Exchange Rate Risk

In the model, we assume that the U.S. agent is pricing all assets—domestic and foreign. Therefore, she faces real exchange rate risk from dividend income incurred from abroad. If the volatility of real exchange rate change, Δq_i, is non-zero, the U.S. agent would be pricing it, which would result in the following risk-premium expression for equity from country i:

$$\mathbb{E}\left[\widehat{r_i^{e,rer}}\right] = -\operatorname{cov}\left(m_{US}, r_i\right) - \frac{1}{2}\operatorname{var}\left(r_i\right) - \operatorname{cov}\left(m_{US}, \Delta q_i\right) - \frac{1}{2}\operatorname{var}\left(\Delta q_i\right) - \operatorname{cov}\left(r_i, \Delta q_i\right). \quad (11)$$

Relative to the risk premium equation (7) that we quantify, currency risk adds the last three terms in equation (11). The last term, which is referred to as the "cross term" is roughly 0 in the data (see Chernov et al. (2024)). Furthermore, $\frac{1}{2}\text{var}(\Delta q_i)$ is a small number (less than 0.1% for a typical country—see Table 2 in Colacito and Croce (2011) for U.S.-U.K. for example). Hence, if currency risk premia were to be incorporated in the model, model-implied risk premia would change by the amount corresponding to the third term, $\text{cov}(m_{US}, \Delta q_i)$.

There are a number of theories of the real exchange rate in the existing literature (see Itskhoki, 2021, for summary). In frictionless environments, the change in the exchange rate is

$$\Delta q_{it+1} = m_{it+1} - m_{USt+1}, \quad (12)$$

which obtains directly from the Euler equations for domestic and foreign agents who price a given asset using their respective SDF. If agents' SDFs reflect consumption growth, as in our model, then the third covariance term in expression (11) would be non-zero (see ex. Colacito and Croce (2011), Colacito and Croce (2013), and Colacito et al. (2018b) within the context of long-run risk models of the real exchange rate in developed markets, Verdelhan (2010) for a model that builds on consumption habits or the seminal work by Lustig and Verdelhan (2007) that emphasizes the role of U.S. consumption growth).[14] Any market friction would decouple variability in real and financial variables (see ex. Itskhoki and Mukhin (2021), Itskhoki (2021) and Lustig and Verdelhan (2019) among others for discussion on the "exchange rate disconnect puzzle"). Furthermore, exchange rate regimes, which are notably different between emerging and developed markets (as documented by Ilzetzki et al. (2019)), could introduce further sources

[14]Recently, Hassan et al. (2024) re-examine long-run risk and habit models and their implications for the cross section of currency risk premia.

of exchange rate risk premia for a U.S. agent. Finally, a segment of the finance literature aims to explain the behavior of currency risk premia using reduced-form SDFs that are entirely orthogonal to macroeconomic variables (ex. Verdelhan (2018) and related work).

Given the vast literature, it is outside of the scope of this paper to incorporate the various mechanisms of exchange rate determination. Instead, we conduct a robustness exercise to quantify how large the contribution of exchange rate risk could be within the context of our model. Observe that, if the real exchange rate is not unity, we would need to denominate dividend growth rates in our quantitative exercise in each country's local currency. This follows directly from the third line in the Euler equation for foreign equity in expression (4), where R_{it+1} is denominated in local currency by definition and it reflects local-currency denominated dividends, which becomes more apparent from the approximation methods detailed in Appendix C. Therefore, to evaluate the role of currency risk, we re-calibrate the model's parameters related to dividend growth using dividend series denominated in local currency, as described in Section 2.2. Recall that, MSCI data coverage is identical in local currency and USD, which implies that our robustness exercise focuses on the exact same time period for each country as our benchmark calibration above.

Table 7: Parameters and Resulting Risk Premia, in local currency

	(i)	(ii)	(iii)
	$\phi_i^{d,lc}$	$\pi_i^{d,lc}$	$\widehat{r^{e,lc}}$
mean	4.88	5.23	8.20
std. dev	1.89	1.57	2.62
corr(.,ϕ_i^d)	0.80	-	-
corr(.,π_i^d)	-	0.72	-
corr(.,r^e)	-	-	0.56
corr(.,$\widehat{r^e}$)	-	-	0.70
corr(.,y_i)	-0.35	0.01	-0.32

Notes: Table reports estimated dividend growth parameters using local currency data and corresponding model-predicted risk premia $\widehat{r^{e,lc}}$, as well as correlations with income, parameters and risk premia from the benchmark calibration, and risk premia in the data. Data Sources: MSCI.

Specifically, we keep the values of all global and U.S. parameters as outlined in Table 4, and we re-estimate all the country-specific parameters related to dividend growth, ϕ_i^d and π_i^d, using dividend growth series denominated in local currency. We report summary statistics for the estimated country-level parameters and the model-implied risk premia in Table 7. Notice that the mean value for the key parameter ϕ_i^d across countries drops to 4.88, compared to the mean of 6.21 for the values reported in Table 5. The implication for model-implied risk premia is a fall in the mean to 8.2% from the benchmark prediction of 9.8%. Hence, risk premia fall on average

by roughly 1 percentage point. More importantly, risk premia do not change considerably in the cross section of countries. In particular, the correlation between model-implied and actual risk premia is nearly unchanged–0.56–which is due to the high correlation between model-predicted risk premia under the two specifications. Indeed, notice that the correlation between the resulting parameter values for ϕ_i^d between the two specifications is remarkably high—0.8.

The findings from the robustness exercise suggest that exchange rate risk premia do not have a first-order effect on equity risk premia in this model, when the key model parameters are recovered from countries' dividend growth comovement with the world.[15] In other words, this moment is robust to the currency of denomination. This finding is not surprising in light of the fact that this moment is predominantly driven by the volatility of dividend growth rates, which is very similar whether denominated in local or foreign currency for a typical country. Similarly, Chernov et al. (2024) document that the volaitlity of equity returns is near identical when denominated in local currency and in USD for most countries.

5 Conclusion

In this paper, we compile a comprehensive panel of international stock market returns and we document: (1) higher and more volatile stock market returns in poorer relative to richer countries, and (2) higher stock market returns in countries with higher co-movement of dividends with the world. We find that long-run risk, i.e., risk due to persistent fluctuations in economic growth rates, is a promising channel to reconcile these facts. Key to our results is that emerging markets not only feature large fluctuations in growth rates, but also that the shocks are systemically related across countries, i.e., these markets are highly exposed to global growth-rate shocks.

In our quantitative analysis, one parameter is critical in generating risk premia differentials across countries—the exposure of a country's dividend growth to global persistent shocks. This parameter is governed by one moment in the data—the co-movement of a country's dividend growth rate with the world, after accounting for transitory sources of dividend growth volatility.

Specifically, excess observed dividend growth volatilities in less developed economies directly identify higher dividend growth exposure parameters in these countries. The excess fundamental volatility in emerging markets is studied extensively by the existing literature and is attributed to differences in institutions and sectoral diversification. Our study emphasizes the important quantitative role that these mechanisms play in resolving a long-standing puzzle in international

[15] Colacito et al. (2018b) show that currency risk premia account for a significant portion of equity risk premia for 10 developed economies during the 1987-2013 period. We reach a different conclusion using a sample of 37 developed and emerging markets during the 1970-2020 period.

economics–the Lucas Paradox–via the lens of a parsimonious asset pricing model.

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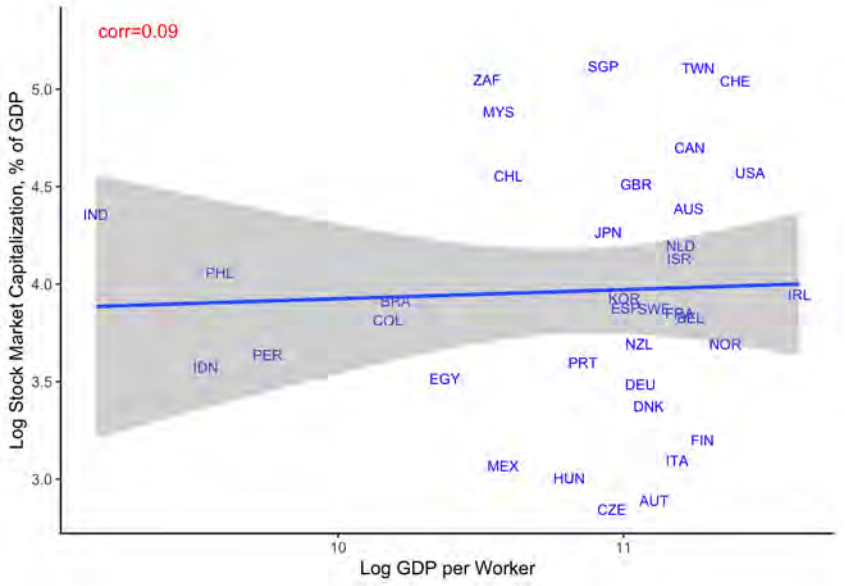
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Appendix

A Stock Market Capitalization

We obtain stock market capitalization to GDP ratios from World Development Indicators (WDI) during the 1975-2020 period. Stock market capitalization for the U.K. during 2012-2020, France during 2019-2020, and Taiwan during 1983-2020 are from CEIC. We compute the ratio relative to GDP using nominal GDP series in USD from IMF for Taiwan. For France and the U.K., we use nominal GDP per capita in USD and population from St. Louis Fred to arrive at total nominal GDP. Figure 8 plots the log of the stock market capitalization to GDP ratio against a country's level of development.

Figure 8: Log Stock Market Capitalization (% of GDP)



Notes: Figure plots (log) stock market capitalization (% of GDP) against time-series mean log income per worker for 37 countries from 1975-2020. Data Sources: WDI, CEIC, PWT and WDI.

B Supplemental Empirical Analysis of Equity Returns

B.1 Equity Returns and Income Differences

In this section, we examine the relationship between equity returns and income per worker in more detail.

First, we address concerns regarding sampling uncertainty and statistical inference. We estimate a weighted least squares (WLS) cross-sectional regression that accounts for heteroskedasticity in estimated mean returns by weighing each country by the inverse of the variance of its returns. This procedure puts lower weight on countries with shorter samples or more volatile returns. Table 8 reports the results. The coefficient on per-capita income is nearly unchanged compared to the OLS specification in the main text and remains highly statistically significant.

Table 8: Cross-country Relationship Between Returns and Income (WLS)

$\overline{\ln(y_i)}$	Constant	Observations	R^2	Estimator
-0.0302^{***} (0.0091)	0.4286^{***} (0.1001)	37	0.239	WLS

Second, we analyze the time series of the country-level returns. We use the specification:

$$r_{it} = \alpha + \beta \ln(y_{it}) + \varepsilon_{it}, \tag{13}$$

as well as versions including year- and country-fixed effects.

Table 9: Realized Stock Market Returns Regression

	Dependent variable: r_{it}					
	Contemporaneous Income			Lagged Income		
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(y_{it})$	-0.043^{***}	-0.040^{***}	-0.108^{*}			
	(0.015)	(0.009)	(0.064)			
$\ln(y_{it-1})$				-0.036^{**}	-0.036^{***}	-0.156^{*}
				(0.015)	(0.009)	(0.077)
Constant	0.576^{***}			0.490^{***}		
	(0.159)			(0.161)		
Observations	1,432	1,432	1,432	1,396	1,396	1,396
R^2	0.006	0.474	0.481	0.004	0.478	0.486
Within R^2		0.009	0.003		0.007	0.007
Country fixed effects	N	N	Y	N	N	Y
Year fixed effects	N	Y	Y	N	Y	Y

Notes: Table reports the results of linear regressions of equity returns r_{it} on contemporaneous and lagged income per worker. Data Sources: MSCI, PWT and WDI. Standard errors clustered at the country level in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

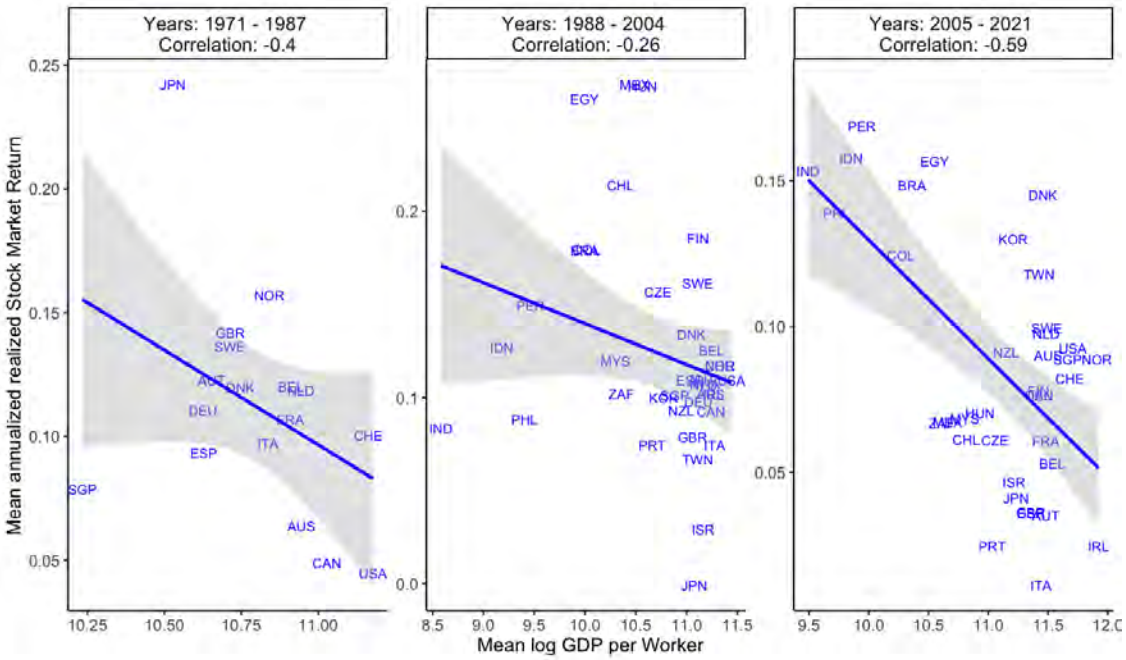
Column (1) in Table 9 reports the results of a pooled regression without fixed effects, which uses both cross-sectional and time-series variation. Column (2) includes year-fixed effects, which absorb global shocks common to all countries and identify the relationship using cross-

sectional variation within each year. Column (3) includes both year- and country-fixed effects that closely capture very persistent characteristics such as institutional quality levels, which are tied to cross-country capital flow differentials (Alfaro et al., 2008). This specification exploits within-country variation over time after removing both time-invariant country characteristics and global shocks and provides the most stringent test by comparing whether a country earns higher returns in periods when its income is low relative to its own historical average. In order to eliminate look ahead bias, we repeat the analysis with lagged income per worker in the last three columns of the table.

Across all specifications, the estimated relationship between returns and income per worker is negative and economically meaningful. While the panel regressions do not directly identify expected returns, they consistently recover a negative cross-sectional relationship between returns and income, supporting the baseline findings.

Finally, in Figure 9, we plot the cross section of mean equity returns against income per worker for three sub-periods of equal duration. The first spans 1971-1987 when only developed markets are in the MSCI sample, while the second two span 1988-2004 and 2005-2021. It is clear from these figures that returns vary significantly over the entire period of study, and that there is no convergence in returns across rich and poor countries. In fact, the most recent sub-period shows some of the largest return differentials between developed and emerging markets.

Figure 9: Stock Market Returns and Income Per Worker Over Time



Notes: Figures plot mean annualized USD-denominated stock market returns against time-series mean log income per worker for 37 countries for three sub-periods of equal duration. Earlier decades exclude emerging markets due to data unavailability. Data Sources: MSCI, PWT and WDI.

B.2 Summary Statistics

Table 10: Summary Statistics for Equity Returns, by Country

	(i)	(ii)	(iii)	(iv)	(v)	
Country	N	Mean	Median	Std. dev	Q_{10}	Q_{90}
AUS	50	0.085	0.086	0.256	-0.186	0.411
AUT	49	0.090	0.019	0.376	-0.268	0.472
BEL	50	0.100	0.076	0.281	-0.202	0.431
BRA	30	0.163	0.138	0.495	-0.412	0.750
CAN	50	0.073	0.090	0.219	-0.192	0.300
CHE	50	0.100	0.114	0.233	-0.159	0.325
CHL	32	0.138	0.109	0.366	-0.227	0.576
COL	27	0.147	0.121	0.445	-0.341	0.727
CZE	24	0.093	-0.014	0.286	-0.145	0.427
DEU	50	0.095	0.111	0.286	-0.241	0.334
DNK	50	0.133	0.116	0.284	-0.175	0.436
EGY	23	0.193	0.108	0.562	-0.465	0.889
ESP	50	0.080	0.026	0.308	-0.229	0.456
FIN	32	0.132	0.095	0.437	-0.339	0.496
FRA	50	0.092	0.086	0.272	-0.227	0.363
GBR	50	0.087	0.087	0.268	-0.170	0.327
HUN	24	0.136	0.145	0.401	-0.298	0.659
IDN	32	0.142	0.071	0.492	-0.472	0.770
IND	27	0.125	0.073	0.395	-0.286	0.726
IRL	32	0.063	0.115	0.275	-0.241	0.402
ISR	26	0.040	0.057	0.261	-0.327	0.308
ITA	50	0.062	0.020	0.339	-0.252	0.369
JPN	50	0.095	0.081	0.314	-0.264	0.404
KOR	32	0.115	0.090	0.432	-0.402	0.537
MEX	32	0.168	0.149	0.391	-0.238	0.572
MYS	32	0.094	0.018	0.372	-0.225	0.513
NLD	50	0.108	0.109	0.212	-0.159	0.338
NOR	50	0.122	0.051	0.423	-0.299	0.533
NZL	32	0.092	0.094	0.262	-0.223	0.368
PER	26	0.160	0.169	0.385	-0.315	0.659
PHL	31	0.114	0.092	0.419	-0.484	0.602
PRT	32	0.050	0.031	0.266	-0.250	0.416
SGP	49	0.090	0.041	0.331	-0.311	0.503
SWE	50	0.133	0.133	0.285	-0.254	0.478
TWN	32	0.092	0.084	0.361	-0.316	0.496
USA	50	0.082	0.118	0.179	-0.150	0.292
ZAF	27	0.081	0.153	0.277	-0.259	0.428

Notes: Table reports summary statistics for annual equity returns (in decimal form). Annual returns are computed by the authors using daily observations of each country's Total Return Gross Index from MSCI. The sample period begins in the year the country enters the dataset and ends in 2020.

Table 11: Summary Statistics for Dividend Growth, by Country

	(i)	(ii)	(iii)	(iv)	(v)	
Country	N	Mean	Median	Std. dev	Q_{10}	Q_{90}
AUS	50	0.041	0.025	0.240	-0.248	0.266
AUT	49	0.043	0.047	0.411	-0.365	0.438
BEL	50	0.022	-0.014	0.239	-0.177	0.225
BRA	30	0.146	0.084	0.462	-0.443	0.704
CAN	50	0.035	-0.018	0.209	-0.177	0.254
CHE	50	0.084	0.046	0.266	-0.155	0.252
CHL	32	0.065	-0.005	0.352	-0.267	0.481
COL	27	0.155	0.077	0.465	-0.328	0.860
CZE	24	0.090	-0.020	0.534	-0.377	0.815
DEU	50	0.075	-0.006	0.360	-0.245	0.416
DNK	50	0.075	0.044	0.295	-0.302	0.423
EGY	23	0.036	-0.049	0.499	-0.464	0.769
ESP	50	0.018	-0.009	0.311	-0.271	0.270
FIN	32	0.123	0.005	0.453	-0.358	0.907
FRA	50	0.041	0.021	0.252	-0.246	0.337
GBR	50	0.027	0.027	0.215	-0.211	0.312
HUN	24	0.057	0.070	0.486	-0.472	0.489
IDN	32	0.100	0.094	0.533	-0.547	0.791
IND	27	0.104	0.101	0.344	-0.305	0.420
IRL	32	0.020	-0.003	0.259	-0.228	0.274
ISR	26	-0.002	0.091	0.394	-0.516	0.504
ITA	50	0.021	-0.007	0.301	-0.382	0.401
JPN	50	0.044	0.033	0.203	-0.165	0.288
KOR	32	0.145	0.041	0.536	-0.371	0.771
MEX	32	0.192	0.272	0.500	-0.364	0.851
MYS	32	0.051	-0.004	0.284	-0.258	0.464
NLD	50	0.037	0.010	0.202	-0.191	0.300
NOR	50	0.072	0.077	0.328	-0.325	0.426
NZL	32	0.007	-0.022	0.285	-0.278	0.382
PER	26	0.241	0.152	0.607	-0.421	1.011
PHL	31	0.082	0.014	0.530	-0.423	0.721
PRT	32	0.067	0.035	0.368	-0.385	0.306
SGP	49	0.056	0.047	0.243	-0.224	0.366
SWE	50	0.085	0.014	0.341	-0.253	0.435
TWN	32	0.118	0.079	0.407	-0.406	0.721
USA	50	0.027	0.026	0.134	-0.141	0.188
ZAF	27	0.035	-0.007	0.227	-0.261	0.300

Notes: Table reports summary statistics of dividend growth. Data Sources: MSCI.

Table 12: Summary Statistics for Consumption Growth, by Country

	(i)	(ii)	(iii)	(iv)	(v)	
Country	N	Mean	Median	Std. dev	Q_{10}	Q_{90}
DEU	81	0.022	0.020	0.046	-0.009	0.068
FRA	81	0.021	0.021	0.072	-0.000	0.053
GBR	81	0.017	0.020	0.028	-0.009	0.045
JPN	81	0.031	0.027	0.081	-0.007	0.091
USA	81	0.021	0.019	0.022	-0.002	0.046

Notes: Table reports summary statistics of annual consumption growth. Data are for 1940-2020 period from MacroHistory Database provided by Jordà et al. (2019) and Jordà et al. (2017).

Table 13: Summary Statistics for Price-Dividend Ratios, by Country

	(i)	(ii)	(iii)	(iv)	(v)	
Country	N	Mean	Median	Std. dev	Q_{10}	Q_{90}
DEU	79	3.71	3.61	0.65	3.22	4.16
FRA	81	3.56	3.46	0.53	3.04	4.20
GBR	81	3.16	3.15	0.28	2.85	3.48
JPN	81	3.90	3.95	0.78	2.80	4.86
USA	81	3.45	3.42	0.46	2.88	4.04

Notes: Table reports summary statistics of pd ratios. Data are for 1940-2020 period from MacroHistory Database provided by Jordà et al. (2019) and Jordà et al. (2017).

C Model Solution

Processes in our environment:

$$\begin{aligned}
\Delta c_{it+1} &= \mu_i + \phi_i x_t + x_{it} + \pi_i \eta_{t+1} + \eta_{it+1} \\
x_{t+1} &= \rho x_t + e_{t+1} \\
x_{it+1} &= \rho_i x_{it} + e_{it+1} \\
\Delta d_{it+1} &= \mu_i^d + \phi_i^d x_t + \tilde{\phi}_i^d x_{it} + \pi_i^d \eta_{t+1} + \tilde{\pi}_i^d \eta_{it+1} + \eta_{it+1}^d
\end{aligned} \tag{14}$$

For a consumption paying domestic asset the Euler equation is:

$$1 = E_t \left[M_{it+1} R_{ict+1} \right]$$

with the stochastic discount factor in country i:

$$m_{it+1} := \log M_{it+1} = \theta \log \delta - \frac{\theta}{\psi} \log \left(\frac{C_{it+1}}{C_{it}} \right) + (\theta - 1) \log R_{ict+1}$$

equivalently:

$$m_{it+1} = \theta \log \delta - \frac{\theta}{\psi} \Delta c_{it+1} + (\theta - 1) \, r_{ict+1}$$

where ψ is IES, γ risk aversion and $\theta = \frac{1-\gamma}{1-\frac{1}{\psi}}$.

The return to the domestic dividend paying asset, R_{idt+1} assumes a similar Euler equation. Following Bansal and Yaron (2004), we approximate returns as:

$$r_{ict+1} = k_{i0} + k_{i1} z_{it+1} - z_{1t} + \Delta c_{it+1}$$

$$r_{idt+1} = k_{i0} + k_{i1} z_{it+1}^d - z_{1t}^d + \Delta d_{it+1}$$

where

$$\begin{aligned}
z_{it+1} &= A_{i0} + A_{i1} x_{t+1} \\
z_{it} &= A_{i0} + A_{i1} x_t
\end{aligned}$$

$$\begin{aligned}
z_{it+1}^d &= A_{i0} + A_{i1}^d x_{t+1} \\
z_{it}^d &= A_{i0} + A_{i1}^d x_t
\end{aligned} \tag{15}$$

and $z^d = pd = \log(\frac{P}{D})$. The standard asset pricing condition is:

$$E_t \left[M_{USt+1} R_{i,t+1} \right] = 1$$

since

$$m_{USt+1} + r_{it+1} = \theta \log \delta - \frac{\theta}{\psi} \Delta c_{USt+1} + (\theta - 1) r_{USct+1} + r_{it+1}$$

the Euler Equation is equivalent to:

$$E_t \left[\exp \left(\theta \log \delta - \frac{\theta}{\psi} \Delta c_{USt+1} + (\theta - 1) r_{USct+1} + r_{it+1} \right) \right] = 1$$

for any asset from country i. We focus on the asset from the US. For any realization of the state variable, the following equation must be constant:

$$\theta \log \delta - \frac{\theta}{\psi} \Delta c_{USt+1} + (\theta - 1) r_{USct+1} + r_{USct+1}$$

Thus if you plug in the expressions for Δc_{USct+1}, r_{USct+1}:

$$\begin{aligned} &= \theta \log \delta - \frac{\theta}{\psi} \left(\mu_{US} + \phi_{US} x_t + x_{USt} + \pi_{US} \eta_{t+1} + \eta_{USt+1} \right) \\ &+ (\theta) \left(\kappa_{i0} + \kappa_{i1} \left(A_{i0} + A_{i1} x_{t+1} \right) - \left(A_{i0} + A_{i1} x_t \right) \right) \\ &+ (\theta) \left(\mu_{US} + \phi_{US} x_t + x_{USt} + \pi_{US} \eta_{t+1} + \eta_{USt+1} \right) \end{aligned}$$

solving for A_1:

$$A_{i1} = \frac{\phi_{US} - \frac{\phi_{US}}{\psi}}{1 - \kappa_{i1} \rho}$$

similarly:

$$m_{it+1} + r_{idt+1} = \theta \log \delta - \frac{\theta}{\psi} \Delta c_{it+1} + (\theta - 1) r_{ict+1} + r_{idt+1}$$

equivalently

$$m_{USt+1} + r_{idt+1} = \theta \log \delta - \frac{\theta}{\psi} \Delta c_{USt+1} + (\theta - 1) r_{USct+1} + r_{idt+1}$$

this is equivalent to:

$$\begin{aligned} m_{USt+1} + r_{idt+1} &= \theta \log \delta - \frac{\theta}{\psi} \Delta c_{USt+1} \\ &\quad +(\theta - 1)(k_{US0} + k_{US1} z_{USt+1} - z_{USt} + \Delta c_{USt+1}) \\ &\quad +k_{i0} + k_{i1} z^d_{it+1} - z^d_{it} + \Delta d_{it+1} \\ &= \theta \log \delta - \frac{\theta}{\psi}(\mu_{US} + \phi_{US} x_t + x_{USt} + \pi_{US} \eta_{t+1} + \eta_{USt+1})) \\ &\quad +(\theta - 1)(k_{US0} + k_{US1}(A_{US0} + A_{US1} x_{t+1}) - (A_{US0} + A_{US1} x_t) \\ &\quad +(\mu_{US} + \phi_{US} x_t + x_{USt} + \pi_{US} \eta_{t+1} + \eta_{USt+1})) \\ &\quad +k_{i0} + k_{i1}(A_{i0} + A^d_{i1} x_{t+1}) - (A_{i0} + A^d_{i1} x_t) \\ &\quad +(\mu^d_i + \phi^d_i x_t + \tilde{\phi}^d_i x_{it} + \pi^d_i \eta_{t+1} + \tilde{\pi}^d_i \eta_{it+1} + \eta^d_{it+1}) \end{aligned}$$

This yields:

$$A^d_1 = \frac{\phi^d_i - \frac{\phi_{US}}{\psi}}{1 - \kappa_{i1} \rho}$$

The demeaned stochastic discount factor in country i:

$$m_{it+1} - \mathbb{E}_t[m_{it+1}] = (-\frac{\theta}{\psi} + (\theta - 1))(\pi_i \eta_{t+1} + \eta_{it+1}) + (\theta - 1)(\kappa A_1 e_{t+1} + \kappa e_{it+1})$$

The demeaned return on consumption in country i:

$$r_{ict+1} - \mathbb{E}_t[r_{ict+1}] = \pi_i \eta_{t+1} + \kappa A_1 e_{t+1}$$

The demeaned return to dividends in country i:

$$r^d_{it+1} - \mathbb{E}_t[r^d_{it+1}] = \pi^d_i \eta_{t+1} + \kappa A^d_1 e_{t+1}$$

We assume m, e and r are jointly log-normal.

$$\begin{aligned} 0 &= \log(\mathbb{E}_t[\exp(r^d_{it+1} + \Delta e + m_{USt+1})]) \\ &= \mathbb{E}_t[r^d_{it+1}] + \mathbb{E}_t[\Delta e] + \mathbb{E}_t[m_{USt+1}] \\ &\quad +\frac{1}{2} \operatorname{var}(r^d_{it+1}) + \frac{1}{2} \operatorname{var}(\Delta e) + \frac{1}{2} \operatorname{var}(m_{USt+1}) \\ &\quad + \operatorname{cov}(r^d_{it+1}, \Delta e) + \operatorname{cov}(r^d_{it+1}, m_{USt+1}) + \operatorname{cov}(\Delta e, m_{USt+1}) \end{aligned}$$

Combining these terms gives the risk premium.
Total US return:

$$\mathbb{E}\left(r_{US} - r_{f_{us}}\right) = -\operatorname{cov}\left(m_{US}, r_{US}\right) - \frac{1}{2}\operatorname{var}\left(r_{US}\right)$$

Total foreign return:

$$\mathbb{E}\left[\hat{r}_i^e\right] \equiv \log \mathbb{E}\left[R_i\right] + \mathbb{E}\left[\Delta q_i\right] - \log \mathbb{E}\left[R_f\right] = -\operatorname{cov}\left(m_{US}, r_i\right) - \frac{1}{2}\operatorname{var}\left(r_i\right) - \frac{1}{2}\operatorname{var}\left(\Delta q_i\right),$$

where

$$\operatorname{cov}\left(m_{US}, r_i\right) = \left(-\frac{\theta}{\psi} + \theta - 1\right)\pi_{us}\pi_i^d\sigma_\eta^2 + (\theta-1)\kappa^2\left(\frac{\phi_{US} - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)\left(\frac{\phi_i^d - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)\sigma_e^2$$

$$\operatorname{var}(m_{US}) = \left(-\frac{\theta}{\psi} + \theta - 1\right)^2\pi_{US}^2\sigma_\eta^2 + (\theta-1)^2\kappa^2\left(\frac{\phi_{US} - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)^2\sigma_e^2$$

$$\operatorname{var}(m_i) = \left(-\frac{\theta}{\psi} + \theta - 1\right)^2\pi_i^2\sigma_\eta^2 + (\theta-1)^2\kappa^2\left(\frac{\phi_i - \frac{\phi_i}{\psi}}{1-\kappa\rho}\right)^2\sigma_e^2$$

$$\operatorname{var}\left(r_i\right) = \kappa^2\left(\frac{\phi_i^d - \frac{\phi_{US}}{\psi}}{1-\kappa\rho}\right)^2\sigma_e^2 + \left(\pi_i^d\right)^2\sigma_\eta^2$$

C.1 Kappas

We estimate κ using a symmetric balanced growth path, so that the terms are constant across countries. On a balanced growth path,

$$\begin{aligned}\bar{z} = A_0 &= \frac{\log\beta + \left(1 - \frac{1}{\psi}\right)\mu_{US} + \kappa_0}{1-\kappa_1} \\ &= \frac{\log\beta + \left(1 - \frac{1}{\psi}\right)\mu_{US} + \log\left(1+e^{\bar{z}}\right) - \frac{e^{\bar{z}}}{1+e^{\bar{z}}\bar{z}}}{1 - \frac{e^{\bar{z}}}{1+e^{\bar{z}}}}\end{aligned}$$

Similarly,

$$\begin{aligned}\bar{z}_m = A_{0m} &= \frac{\log\beta + \left(1 - \frac{1}{\psi}\right)\mu_{US} + \kappa_{0m}}{1-\kappa_{1m}} \\ &= \frac{\log\beta + \left(1 - \frac{1}{\psi}\right)\mu_{US} + \log\left(1+e^{\bar{z}_m}\right) - \frac{e^{\bar{z}m}}{1+e^{\bar{z}}m}\bar{z}_m}{1 - \frac{e^{\bar{z}}m}{1+e^{\bar{z}}m}}\end{aligned}$$

$$\kappa = \frac{e^{A_0}}{1+e^{A_0}} = \frac{e^{A_{0m}}}{1+e^{A_{0m}}}$$

Given $\mu_{US} = 0.021$, $\kappa = 0.9975$, which is consistent with the estimate of Bansal and Yaron (2004), who report $\kappa = 0.997$.

C.2 Risk-Free Rate

To derive the U.S. risk-free rate

$$\mathbb{E}_t\left[\theta \log\delta - \frac{\theta}{\psi}\Delta c_{USt+1} + (\theta-1)r_{USct+1} + r_{ft+1}\right] = 0$$

which yields:

$$r_{f,t} = -\theta\log(\delta) + \frac{\theta}{\psi}\mathbb{E}_t\left[\Delta c_{USt+1}\right] + (1-\theta)\mathbb{E}_t\left[r_{USct+1}\right] - \frac{1}{2}\,\mathrm{var}_t\left[\frac{\theta}{\psi}\Delta c_{USt+1} + (1-\theta)r_{USct+1}\right],$$

following the approach Bansal and Yaron (2004), subtract $(1-\theta)r_{f,t}$ from both sides and divide by θ:

$$r_{f,t} = -\log(\delta) + \frac{1}{\psi}\mathbb{E}_t\left[\Delta c_{USt+1}\right] + \frac{(1-\theta)}{\theta}\mathbb{E}_t\left[r_{USct+1} - r_{f,t}\right] - \frac{1}{2\theta}\,\mathrm{var}_t\left[\frac{\theta}{\psi}\Delta c_{USt+1} + (1-\theta)r_{USct+1}\right]$$

D Estimation of Consumption Growth Processes

Global consumption growth parameters. In our model, there are both global and idiosyncratic sources of risk, but only the former are priced by the U.S. agent. We model global consumption growth, measured by expression (1) in the data, as:

$$\Delta c_{Wt+1} = \mu_W + x_t + \eta_{t+1}, \tag{16}$$

where x_t is the global persistent component defined in expression (6) and idiosyncratic components have been averaged out.[16] The global process closely mimics the consumption growth process for the U.S. in Bansal and Yaron (2004). We will rely on second moments from the global consumption process in our identification strategy, so we need not specify a value for the mean growth rate, μ_W.

To identify the global persistent component, x_t, we follow the methodology in Colacito et al. (2018b) and we proceed in two steps. First, based on insights in Bansal et al. (2012), we exploit

[16] One can view this process as a special case of the following process: $\Delta c_{Wt+1} = \mu_W + \phi_W x_t + \pi_W \eta_{t+1}$, where the exposure parameters ϕ_W and π_W are normalized to unity.

the model's prediction that a country's logged price-to-dividend ratio is a function of the global persistent process only (see expression (15) in Appendix C). This implies that a projection of future consumption (or dividend) growth on lagged values of the (logged) price-to-dividend ratio is able to recover the time series of the persistent process. The challenge with this strategy is to estimate parameters pertaining to the "world" over a long period of time as we want to capture global long-run risks. As we describe in Section 2.3, we define the world to consist of five major economies, each denoted by k below: U.S., U.K., France, Germany and Japan, due to reliable data coverage during the 1940-2020 period. Tables 12 and 13 in Appendix B report summary statistics for consumption growth and price-dividend ratios for each country.

Specifically, we estimate the parameter α from the following pooled regression using data on all five countries during the 1940-2020 period:

$$\Delta c_{it+1} = \alpha \cdot pd_{it} + \epsilon_{it+1} \qquad \forall t, i, \tag{17}$$

where pd_{it} is the logged price-dividend ratio in country i in year t. In the second step, we define the global persistent component as:

$$x_{t+1} \equiv \frac{1}{5} \sum_k \Delta \hat{c}_{kt+1} = \frac{1}{5} \sum_k \hat{\alpha} \cdot pd_{kt}, \tag{18}$$

where $\Delta \hat{c}_{kt+1}$ is a fitted value for country k of the pooled linear regression in expression (17).

Table 14: Global Persistent Component

	Dependent variable:		
	Δc_{t+1}		x_t
pd_t	0.006^{***}	x_{t-1}	0.758^{***}
	(0.001)		(0.073)
		Constant	0.005^{***}
			(0.002)
Observations	395		79
R^2	0.149		0.584

Notes: Table reports (left) a pooled linear regression of country k's per-worker consumption growth on the log price-to-dividend ratio, pd_{kt}, and the estimated coefficient $\hat{\alpha}$, where k = U.S., U.K., France, Japan, Germany, and $K = 5$. On the right, the table reports the autoregression results of the global persistent process, x_t. $x_{t+1} \equiv \frac{1}{5}\sum_k \Delta \hat{c}_{kt+1} = \frac{1}{5}\sum_k \hat{\alpha} \cdot pd_{kt}$. Data are for 1940-2020 period from MacroHistory Database. Standard errors in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

We report the estimate of α in the left panel of Table 14. Our estimate of 0.006 compares

Table 15: Summary Statistics for World (5 countries) Consumption Growth

	N	Mean	Median	Std. Dev	Q_{10}	Q_{90}	Constant	Δc_{Wt}	R^2
Δc_{Wt+1}	81	0.022	0.022	0.034	0.000	0.049	0.013**	0.459***	0.217
							(0.004)	(0.100)	

Notes: Table reports summary statistics of world consumption growth Δc_{Wt+1} and results of linear regression of Δc_{Wt+1} on its lag, Δc_{Wt}, where the world is computed as the average consumption of U.S., U.K., France, Germany and Japan. Data are for the 1940-2020 period from MacroHistory Database. Standard errors in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

favorably to the estimate of 0.005 in Colacito et al. (2018b), and similarly to the authors, we find that country-specific estimates of the parameter are not statistically different from each other, which supports the choice in favor of a pooled regression.[17] Having obtained a series for the global persistent component, x_t, we estimate ρ from an AR(1) regression corresponding to the second line in expression (6), and we report the results in the right panel of Table 14. The estimate amounts to a sizeable 0.76, which compares favorably to estimates reported by the existing literature (see for ex. Table 4 in Colacito and Croce (2011) for U.S. and U.K.).

We recover the variance of the persistent global shock, σ_e^2, from an autoregression of the global consumption growth process. Specifically, taking the time-series variance of Δc_W in expression (16) yields $\sigma_e^2 = \frac{(1-\rho^2)\beta_W^c \text{var}(\Delta c_W)}{\rho}$, where $\beta_W^C \equiv \frac{\text{cov}(\Delta c_{Wt+1}, \Delta c_{Wt})}{\text{var}(\Delta c_W)}$ is the coefficient estimate of the following regression:

$$\Delta c_{Wt+1} = \beta_W^C \Delta c_{Wt} + \epsilon_{t+1}, \tag{19}$$

and it is reported in the right panel of Table 15, along with summary statistics of the series in the left panel. The resulting value for σ_e is 0.017, which coincides with the estimate in Nakamura et al. (2017). The variance of the persistent component, σ_x^2, is a direct function of the variance of the innovations to the persistent component, $\sigma_x^2 = \sigma_e^2/(1-\rho^2)$. Finally, the residual variance of the transitory shock follows from the global consumption growth series, after accounting for the persistent component, $\sigma_\eta^2 = \text{var}(\Delta c_W) - \sigma_x^2$. This approach to recovering the persistent and transitory innovations to global consumption growth parallels Bansal and Yaron (2004), who aim to account for observed variations in consumption growth (in the U.S.) over a long horizon.

In Appendix E, we re-estimate the key autoregressive parameter of the global persistent process, ρ, using historical data from the MacroHistory Database for six additional economies: Australia, Switzerland, Spain, Italy, Netherlands and Sweden. The resulting parameter estimate

[17] Colacito and Croce (2011) identify the persistent process from a projection of consumption growth on the price-dividend ratio and the risk-free rate of a country. For our sample of countries and period of study, the coefficient estimates of the risk-free rate are not statistically different from zero, so we exclude risk-free rates from the analysis as they do not seem to contain additional information.

of 0.81 compares favorably to our benchmark and to estimates in the existing literature.

Idiosyncratic consumption growth parameters for the U.S. To identify the parameters that govern the U.S. consumption growth process in the first line of expression (6), we use the series described in Section 2.3 for the 1940-2020 period. Under the assumption that innovations are independent, we recover the consumption growth exposure parameter to the global persistent process for the U.S. from a linear regression of U.S. consumption growth on the global persistent process, x_t,

$$\Delta c_{USt+1} = \phi_{US} x_t + \epsilon_{t+1}. \tag{20}$$

Given the specifications for U.S. and global consumption growth in expressions (6) and (16), the exposure parameter to the global temporary shock follows from a regression of U.S. consumption growth on the residual component of global consumption growth,

$$\Delta c_{USt+1} = \pi_{US}(\Delta c_{Wt+1} - x_t) + \epsilon_{t+1}. \tag{21}$$

The results from these regressions are displayed in Table 16. The mean U.S. consumption growth rate is 2.1% as reported in Table 12 in Appendix B and corresponds to parameter μ_{US} in the consumption process. The leverage parameters to the temporary and persistent global shocks are precisely estimated and correspond to 2.13 and 0.42, respectively.

Table 16: U.S. consumption growth

	Dependent variable: Δc_{USt+1}	
	(1)	(2)
x_t	2.133*	
	(1.195)	
$\Delta c_{Wt+1} - x_t$		0.425***
		(0.059)
Constant	-0.027	0.020***
	(0.027)	(0.002)
Observations	79	79
R^2	0.04	0.401

Notes: Table reports results of linear regression of U.S. consumption Δc_{USt+1} on persistent process x_t, and on $\Delta c_{Wt+1} - x_t$ to estimate ϕ_{US} and π_{US}, respectively. Data are for the 1940-2020 period from MacroHistory Database. Standard errors in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

E Global Variables: Robustness

As described in the main text, we define a 'global' variable to be the mean of five economies: U.S., U.K., France, Germany and Japan. In Table 17, we show that adding observations for Australia, Switzerland, Spain, Italy, Netherlands and Sweden yields estimates for the parameters that govern the global persistent shocks that are very similar to our benchmark estimates.[18]

Table 17: Global Persistent Component, Robustness

	Dependent variable:		
	Δc_{t+1}		x_t
pd_t	0.006^{***}	x_{t-1}	0.810^{***}
	(0.000)		(0.068)
		Constant	0.004^{***}
			(0.001)
Observations	845		79
R^2	0.166		0.648

Notes: Table reports (left) a pooled linear regression of country k's per-worker consumption growth on the log price-to-dividend ratio, pd_{kt}, and the estimated coefficient $\hat{\alpha}$, where k = Australia, Switzerland, Germany, Spain, France, U.K., Italy, Japan, Netherlands, Sweden and U.S. and $K = 11$. On the right, the table reports the autoregression results of the global persistent process, x_t. $x_{t+1} \equiv \frac{1}{11}\sum_k \Delta\hat{c}_{kt+1} = \frac{1}{11}\sum_k \hat{\alpha} \cdot pd_{kt}$. Data are for 1940-2020 period from MacroHistory Database provided by Jordà et al. (2019) and Jordà et al. (2017). Standard errors in parentheses. *p< 0.1; **p< 0.05; ***p< 0.01.

Furthermore, we show that estimates of country-level exposures to global persistent shocks are robust to different definitions of global dividend growth. First, recall that, as we describe in Appendix A, stock market capitalization data coverage begins in 1975, while dividend growth data begins in 1970 for developed economies. Hence, the key moment of interest that identifies dividend growth exposure to global persistent shocks–namely, the covariance of a country's dividend growth with the global dividend growth rate—is computed beginning in 1975, even though returns and dividend growth rates date back to 1970 for developed economies. We believe that it is important to weigh stock-market moments by stock market capitalization as it is standard practice when constructing an index; for ex. MSCI indices, that combine groups

[18]The MacroHistory Database also includes consumption data for Portugal, Canada, and Ireland, but price-dividend data are missing for these countries. Price-dividend observations for Belgium are not reliable during the post-war period as the variance is several orders of magnitude higher than what we observe for other countries. Data are available for Finland, Denmark and Norway, but these countries accounted for a negligible share of world economic activity historically. Furthermore, the financial variables from Norway are pooled from a variety of data sources and the coverage of stocks changes multiple times over the period of study, which makes the data difficult to interpret.

of countries, weigh countries' equity indices by stock market capitalization.[19] This weighting scheme aims to capture the importance of each country in driving global economic activity. Second, recall that our definition of global dividend growth reflects five countries: U.S., U.K., France, Germany and Japan.

In Table 18, we explore several different definitions of global dividend growth. Keeping all other parameters of the model fixed as in Table 4 the main text, we re-estimate π_i^d using expression (10) and ϕ_i^d from the covariance implied by expression (3) for each country, where Δd_W is derived under an alternative definition. In column (i), we let global dividend growth be the stock-market-capitalization weighted mean of all 37 countries in our sample. In column (ii), we focus on the countries that make up MSCI's World Index, which are the following developed economies: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, U.K. and U.S. In column (iii), we include the 11 countries from the robustness exercise that re-estimated the global persistent process in Table 17, and in column (iv), we include the G-10 countries (which add up to 11 including Switzerland): Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, U.K., and U.S.

The mean level of ϕ_i^d increases as we increase the sample of countries that constitute the world. Compared to the mean in our benchmark specification in Table 5 of 6.21, the most significant increase occurs when we include all 37 countries in the definition of the 'world', which mechanically reflects the increased correlation of each country with the 'world'. But more importantly, in the cross section of countries, the correlation of estimated ϕ_i^d's under the alternative specifications with our benchmark estimates is almost unity. This finding implies that different definitions of the 'world' do not affect the cross-sectional predictions of our model, and only affect the levels of risk premia.

Finally, in Figure 10, we plot equity returns during the 1975-2020 period for: (i) the U.S., (ii) the definition of World Index provided by the MSCI, and (iii) our definition of a global variable, which constitutes the stock-market-weighted mean of returns for U.S., U.K., France, Germany, and Japan. It is apparent that the three series comove very closely, which reassures our definition of a global variable.

F Supporting Tables

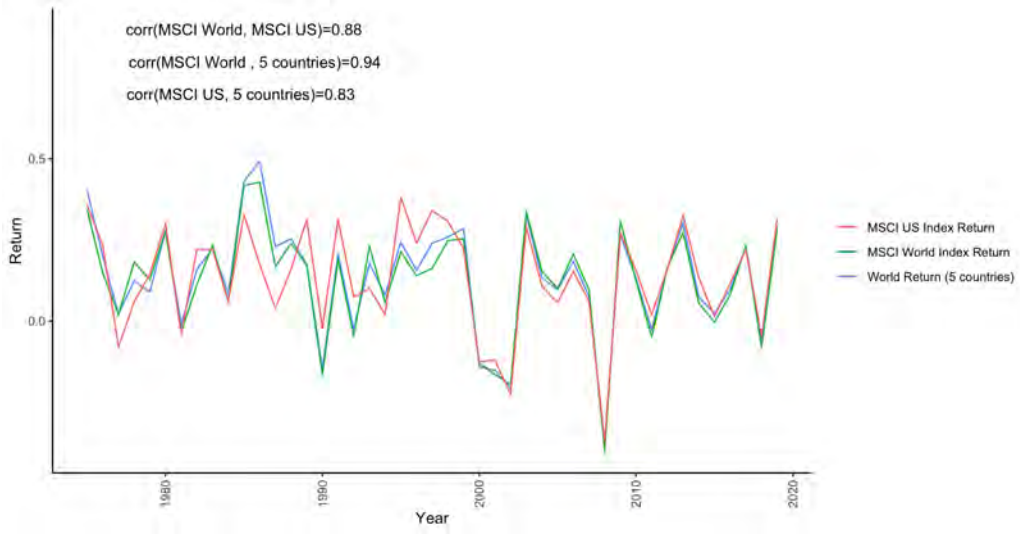
[19] An individual country's index weighs firm observations by their respective stock market capitalization.

Table 18: Estimated ϕ_i^d Under Different Global Dividend Processes

	(i)	(ii)	(iii)	(iv)
Country	$\phi^d_{AllCountries}$	$\phi^d_{MSCIWorld}$	ϕ^d_{C-11}	ϕ^d_{G-10}
AUS	7.14	6.39	5.96	5.60
AUT	9.00	7.97	7.32	6.77
BEL	6.64	6.18	5.97	5.64
BRA	15.22	13.06	12.19	11.40
CAN	6.77	5.99	5.47	5.36
CHE	8.13	7.41	7.13	6.73
CHL	10.12	8.45	7.73	7.37
COL	11.25	10.00	9.24	8.78
CZE	5.75	4.93	4.15	3.68
DEU	10.69	9.74	9.29	8.81
DNK	8.24	7.63	7.33	7.01
EGY	13.43	11.19	9.96	10.03
ESP	8.27	7.49	7.04	6.46
FIN	12.16	10.87	9.98	9.79
FRA	8.12	7.47	7.12	6.69
GBR	5.93	5.55	5.32	4.97
HUN	10.17	9.32	8.32	8.06
IDN	13.40	11.25	10.20	9.64
IND	14.20	12.01	10.99	10.81
IRL	6.81	6.66	6.46	6.12
ISR	3.74	3.16	2.62	2.63
ITA	3.84	3.83	3.76	3.38
JPN	4.75	4.39	4.34	4.10
KOR	15.50	12.90	12.08	11.78
MEX	7.95	6.42	5.63	5.47
MYS	5.87	4.68	4.07	4.13
NLD	5.92	5.57	5.37	5.02
NOR	8.36	7.29	6.69	6.44
NZL	8.31	7.61	7.12	6.81
PER	12.71	11.38	10.68	10.33
PHL	7.66	6.68	5.98	5.84
PRT	9.04	8.25	7.60	7.26
SGP	6.06	5.28	4.93	4.65
SWE	10.08	9.37	8.95	8.49
TWN	9.41	7.91	7.47	7.18
USA	4.37	4.09	3.91	3.79
ZAF	8.20	7.12	6.58	6.35
mean	8.74	7.72	7.16	6.85
median	8.24	7.47	7.12	6.69
std. dev	3.11	2.59	2.40	2.34
corr(.,y_i)	-0.55	-0.51	-0.47	-0.48
corr(., ϕ_i^d)	0.98	0.99	1.00	1.00

Notes: Table reports country-level estimated parameters ϕ_i^d using different definitions of the Δd_W process. All countries refers to a stock-market weighted Δd_W using all countries in our sample. C-11 refers to a stock-market weighted Δd_W process using the 11 countries used for the robustness exercise in Table 17. G-10 refers to a stock-market weighted Δd_W process using G-10 countries. MSCI World refers to a stock-market weighted Δd_W process using countries that are in the MSCI World database. Data Sources: MSCI.

Figure 10: Time Series of Stock Market Returns



Notes: Figure plots various return series over time. Data Sources: MSCI.

Table 19: Robustness Results

Condition	Statistic	N	Mean	Median	St. Dev.	Q_{10}	Q_{90}	$\text{corr}(\cdot, r_i^e)$	$\text{corr}(\cdot, \widehat{r_i^e})$
$\pi_i^d = \pi_{i,US}^d$ & $\phi_i^d = \phi_i^d$	$\widehat{r_{ri}^e}$	37	10.050	10.840	2.486	6.231	12.533	0.558	0.993
$\pi_i^d = \pi_{i,US}^d$ & $\phi_i^d = \phi_i^d(\pi_{US}^d)$	$\widehat{r_{ri}^e}$	37	9.299	10.761	4.084	2.865	12.568	0.201	0.581

Notes: Table reports summary statistics of predicted risk premia ($\widehat{r_{ri}^e}$) from the parameterized model under two alternative parameter estimates. The first specification sets $\pi_i^d = \pi_{US}^d$ and keeps ϕ_i^d as in the baseline. The second specification sets $\pi_i^d = \pi_{US}^d$ and re-estimates ϕ_i^d from the same moment conditions as in the baseline.