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Abstract

Using global data on aggregate stock market prices, this paper finds that the standard capital asset pricing model (CAPM) fares much better than suggested in the literature. At shorter time horizons, our results also show that the positive risk-reward relation can collapse during times of high volatility. Compared to advanced and emerging markets, we retrieve evidence of lower systematic risks across frontier stock market portfolios. We find that countries characterized by higher levels of financial and trade openness, exchange rate volatility, and larger economic size are exposed to higher systematic covariances with the world stock market. Conversely, we obtain evidence of an inverse link between international reserves and systematic risks in national equity.

Keywords: portfolios, stock market, cross-country, systematic risk, capital asset pricing model, macroeconomic covariates

JEL: F30, F31, F41, G15

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1 Introduction

The capital asset pricing model (CAPM) is often presented as one of the cornerstones of financial economics (Lo, 2017; Campbell, 2018), and highlighted to be of particular relevance to those interested in the long run (Jagannathan and McGrattan, 1995). From the pool of asset pricing models in the literature, Berk and van Binsbergen (2016) find that the CAPM is closest to the model that investors use in making capital allocation decisions. Despite providing an intuitive and elegant explanation of asset returns, the theory has enjoyed scant success in empirical assessments (Black *et al.*, 1972; Stambaugh, 1982; Campbell and Vuolteenaho, 2004; Fama and French, 1992, 1993, 2004, 2006, 2015, 2016; Bai *et al.*, 2018). According to such tests, the popularity of the CAPM is rather puzzling. In contrast, our paper provides more favorable global evidence using national-level data. A further novelty of our work is that we probe into the macroeconomic covariates of systematic risks (betas) in national equity markets.

While most studies focus on the performance of the CAPM intranationally, our paper offers evidence at the international level. Instead of designating individual firm-level stocks, we concentrate on entire national stock markets across a large sample of developed, emerging and frontier economies, employing them as our micro-level assets. We find overall that the CAPM performs much better than suggested in the literature. Our results indicate that the systematic risks of national stock markets adequately explain corresponding excess portfolio returns in many samples. We in turn find that a number of macroeconomic factors, such as openness and exchange rate stability, play crucial roles in the variation of national stock market betas.

Our paper presents the first truly global study of the CAPM and systematic risk drivers in the context of national stock market portfolios. It comprises over eighty countries and time horizons of up to five decades. Much of the literature asserts that the market portfolio of stocks has strong explanatory power for the comovement in stock returns. However, the associated betas, lacking dispersion in many cases, fail to account for the cross-sectional variation in individual expected returns (Fama and MacBeth, 1973; Reinganum, 1981; Lakonishok and Shapiro, 1986; Roll and Ross, 1994; Fama and French, 1992, 2004, 2015). We endeavour to rectify this issue by appealing to a large group of more diverse assets in the form of an eclectic mix of national stock market portfolios. Given a global portfolio at the macro level and suitable risk-free rate, the security market line (SML) that emerges from the CAPM in our study ultimately relates country-level stock market portfolio returns to country-level stock market systematic risks.[1] In many instances, our SML regressions reveal an estimated reward per unit of systematic risk that is consistent with the risk premium on the world portfolio, as predicted by the theory. Such congruency between slope estimates and the data is non-existent in past studies.

Scrutinizing the data at shorter time horizons, we retrieve evidence indicating that the usual risk-reward relation can collapse, as suggested by the adaptive markets hypothesis. This typically arises in periods of crisis when significant equity volatility causes investors to sharply reduce their holdings through a fight-or-flight response. Assessing cross-country discrepancies in betas, we find that frontier markets tend to be characterized by lower levels of systematic risk. According to general performance indicators, frontier markets have also on average performed better than emerging and developed markets, while the relation between alphas and betas in the full panel of countries is flat.[2]

We next turn to identifying the main drivers of national stock market betas. Our results highlight that trade openness, international finacial integration, economic size, and exchange rate volatility covary positively with the systematic risks of national stock markets. Conversely, due to their insulation properties, we obtain evidence that international reserves correlate negatively with national equity betas. Notably, our findings imply that deepening international trade ties diminish the incentives of cross-border portfolio diversification.

The remainder of the paper is structured as follows. Section 2 outlines the theoretical framework of our study. Specifically, subsection 2.1 lays out the basic capital asset pricing model, while subsection 2.2 documents the potential macroeconomic covariates of national stock market betas. In section 3 we describe the empirical framework adopted, with section 4 providing data details. Empirical findings are discussed in section 5. The first subsection on results, 5.1, assesses CAPM regression estimates for long and short time horizons. Next, subsection 5.2 analyzes if discrepancies in national equity betas are present across developed, emerging and frontier markets. Subsection 5.3 examines national stock market performance across countries. Finally, subsection 5.4 studies the relation between systematic risks in national stock markets and a number of macroeconomic covariates using cross-section gross correlations and panel regressions. Section 6 concludes.

[1]We confine our analysis to the traditional CAPM alone, as multi-factor models (i.e. augmented CAPMs) are known to diminish the dispersion in market portfolio betas, pushing them toward unity (Ahn *et al.*, 2013; Fama and French, 1992, 1996, 2015).

[2]Alpha is the return above that predicted by the CAPM.

2 Theoretical Framework

2.1 Asset Pricing

In this section, similar to the approaches of Cochrane (2005) and Coeurdacier and Guibaud (2011), we derive the CAPM equation from a simple one-period model of portfolio asset holdings. As we only aim to provide a basic guide for the empirical analysis that follows, we ignore the role of possible frictions, such as transaction or information costs, and the exchange rate.

The preferences of the international investor over consumption C are given by the negative exponential utility function

$$\mathbb{E}_t\Big[U(C_{t+1})\Big] = -\mathbb{E}_t\Big[e^{-\gamma C_{t+1}}\Big] \tag{1}$$

where $\gamma > 0$ is the coefficient of absolute risk aversion. The investor has initial wealth, W_t, which is allocated across a global risk-free asset with rate of return r_f and N risky assets with respective rates of return r_n. The budget constraint that the investor faces is thus

$$C_{t+1} = W_{t+1} = A_{f,t}R_{f,t+1} + \boldsymbol{A}'_{\boldsymbol{n},t}\boldsymbol{R}_{\boldsymbol{n},t+1} = W_t + A_{f,t}r_{f,t+1} + \boldsymbol{A}'_{\boldsymbol{n},t}\boldsymbol{r}_{\boldsymbol{n},t+1} \tag{2}$$

where $R = 1 + r$, $\boldsymbol{r_n} = [r_1\ r_2 \ldots r_N]'$, A_f is the absolute amount of wealth allocated to the risk-free asset, and $\boldsymbol{A_n} = [A_1\ A_2 \ldots A_N]'$ is the vector of absolute wealth quantities allocated to the N risky assets.

The objective is to select the dollar amounts to be invested in each security, $\boldsymbol{A} = [A_1\ A_2 \ldots A_N\ A_f]'$, such that (1) is maximized subject to (2). Asset returns are assumed to be multivariate normal where $\bar{\boldsymbol{r}}_{\boldsymbol{n}} = \mathbb{E}[\boldsymbol{r_n}]$ is the vector of expected returns on the N risky assets and $\boldsymbol{\Sigma}$ is the corresponding non-singular $N \times N$ variance-covariance matrix of returns. The expected dollar amount return on the portfolio and corresponding return variance can therefore be written as $\overline{AR}_p = \mathbb{E}[W_{t+1} - W_t] = A_f r_f + \boldsymbol{A}'_{\boldsymbol{n}}\bar{\boldsymbol{r}}_{\boldsymbol{n}}$ and $\sigma_p^2 = \boldsymbol{A}'_{\boldsymbol{n}}\boldsymbol{\Sigma}\boldsymbol{A_n}$ respectively. With $AR_p = W_{t+1} - W_t$ being normally distributed, $U(C)$ is lognormally distributed. The expected value of $U(C)$ is then given by

$$\mathbb{E}\Big[U(C)\Big] = -\eta e^{-\gamma(A_f r_f + \boldsymbol{A}'_{\boldsymbol{n}}\bar{\boldsymbol{r}}_{\boldsymbol{n}}) + \frac{1}{2}\gamma^2 \boldsymbol{A}'_{\boldsymbol{n}}\boldsymbol{\Sigma}\boldsymbol{A_n}} \tag{3}$$

where $\eta = e^{-\gamma_r}$ and $\gamma_r \equiv \gamma W_t$ is the coefficient of relative risk aversion at initial wealth. Noting that the expected utility function is monotonic in its exponent, we can write the maximization problem as

$$\max_{\boldsymbol{A}} E\big[U(C)\big] = A_f r_f + \boldsymbol{A_n'}\bar{\boldsymbol{r}}_{\boldsymbol{n}} - \frac{1}{2}\gamma \boldsymbol{A_n'}\boldsymbol{\Sigma}\boldsymbol{A_n}. \tag{4}$$

The maximand is now linear in the expected portfolio return and variance. The corresponding N-vector of first-order conditions for risky assets is

$$\nabla_{\boldsymbol{A_n}} f = -r_f.\boldsymbol{\iota} + \bar{\boldsymbol{r}}_{\boldsymbol{n}} - \underbrace{\gamma \boldsymbol{\Sigma}\boldsymbol{A_n}}_{\textit{risk premia}} = \boldsymbol{0}. \tag{5}$$

Solving for $\boldsymbol{A_n}$ gives the optimal dollar amounts invested in risky assets

$$\boldsymbol{A_n^*} = \boldsymbol{\Sigma}^{-1}\frac{\bar{\boldsymbol{r}}_{\boldsymbol{n}} - r_f.\boldsymbol{\iota}}{\gamma}. \tag{6}$$

The optimal dollar demand for the risk-free asset is therefore given by $A_f^* = W_t - \boldsymbol{A_n^{*\prime}}.\boldsymbol{\iota}$.

Equation (6) indicates that the investor allocates more funds to risky assets that, ceteris paribus, have higher expected returns, with elements of the covariance matrix determining the relative weights. Meanwhile, ceteris paribus, riskier assets command lower investment. Finally, holding all other factors constant, the solution indicates that the investor will invest less in risky assets if his coefficient of risk aversion is higher.

Rearranging equation (6), if all investors are the same, we obtain

$$\bar{\boldsymbol{r}}_{\boldsymbol{n}} - r_f.\boldsymbol{\iota} = \gamma \boldsymbol{\Sigma}\boldsymbol{A_n} = \gamma \operatorname{cov}[\boldsymbol{r_n}, r_m]. \tag{7}$$

The total risky portfolio of the investor is described by $\boldsymbol{A_n'}\boldsymbol{r_n}$. Thus, $\boldsymbol{\Sigma}\boldsymbol{A_n}$ provides the covariance of each return with $\boldsymbol{A_n'}\boldsymbol{r_n}$ and the overall portfolio return $AR_p = A_f r_f + \boldsymbol{A_n'}\boldsymbol{r_n}$. In the case of homogeneous investors, the portfolio of the individual investor is the same as the market portfolio. Put differently, all investors hold risky assets in the same proportions as their relative values in the market. This implies that $\boldsymbol{\Sigma}\boldsymbol{A_n}$ also gives the correlation of each risky asset return with the market portfolio return $AR_m = A_f r_f + \boldsymbol{A_n'}\boldsymbol{r_n}$. With differences in risk aversion across investors, the same result can be obtained, but with an aggregate risk aversion coefficient. Applying equation (7) to the market portfolio, we retrieve

$$\mathbb{E}[r_m] - r_f = \gamma \sigma_m^2 \tag{8}$$

where σ_m^2 is the variance of the market portfolio return. Equation (8) ties the coefficient of risk aversion, γ, to the market price of risk, $\frac{\mathbb{E}[r_m]-r_f}{\sigma_m^2}$ i.e. the slope of the capital market line (CML) multiplied by σ_m^{-1}. Combining equation (8) with equation (7) for any risky asset n, we obtain the standard CAPM equation

$$\mathbb{E}[r_n] - r_f = \beta_n(\mathbb{E}[r_m] - r_f) \tag{9}$$

where $\beta_n = \frac{\text{cov}[r_n, r_m]}{\text{var}[r_m]}$ is the systematic risk of asset n.[3]

In our setup, the individual micro-level risky assets $n = \{1, 2, \ldots N\}$ are country-level total stock market portfolios, such as the FTSE 100. Meanwhile, the macro-level market portfolio is the world stock market portfolio, such as the MSCI All Country World Index. This contrasts with the standard approach of employing firm-level stocks and narrower country-level market portfolios. Hence, through the portfolio betas, our approach allows us to identify the systematic risk of each country's overall stock market. Denoting the country-specific aggregate stock market portfolio return by r_c, and the world stock market portfolio return by r_w, we rewrite equation (9) as

$$\mathbb{E}[r_c] - r_f = \beta_c \underbrace{(\mathbb{E}[r_w] - r_f)}_{\text{SML slope}}. \tag{10}$$

2.2 Macroeconomic Covariates of Beta

The macro finance literature suggests a number of potential reasons for comovements between national and world stock markets. Positive correlations may emanate from, for example, global disturbances, such as world interest rate shocks, or common institutional characteristics. Comovements can also arise from the international transmission of country-specific disturbances via cross-border financial asset holdings and trade in goods and services. Specifically, the degree of international trade and financial integration influences the extent to which cross-country business cycles are synchronized, and thus in turn stock market correlations (Frankel and Rose, 1998; Kalemli-Ozcan *et al.*, 2001; Bordo and Helbling, 2003; Kose *et al.*, 2003; Chinn and Forbes, 2004; Imbs, 2004, 2006; Calderon *et al.*, 2007; Bruno and Shin, 2015; Obstfeld, 2015). Overall, theory is equivocal about the net effects of cross-border linkages on

[3] A perfect negative correlation between the market portfolio return and the marginal utility of consumption implies that the CCAPM and CAPM are parallel representations. The negative exponential utility function allows such a link. See Cochrane (2005) for other utility formulations that achieve the same result.

stock market comovements, with the matter left to empirical assessment. We next discuss in greater detail some of the factors affecting stock market covariances.

2.2.1 Financial Openness

From a theoretical perspective, the implications of heightened international financial integration for cross-country business and financial cycle comovements are ambiguous. To illustrate, if the equities of a particular country feature significantly in foreign investor portfolios, then fluctuations in that national stock market will impart wealth effects in the rest of the world. Such domestic developments consequently affect foreign consumer demand, thereby inducing greater cross-border business cycle and stock market synchronization. Conversely, increased financial openness with the rest of the world can also reduce cross-border comovements by enabling consumption smoothing through internationally diversified portfolios, without the need for diversified production. Put differently, stronger international financial linkages may imply greater output specialization, and therefore an attenuation of business cycle correlations across countries.

2.2.2 Trade Openness

Although it is often associated with enhanced business cycle synchronization, the net effect of higher international trade in goods and services is in fact ambiguous at the theoretical level. From the lens of the demand side, a fraction, that depends partly on trade openness, of aggregate expenditure in a country will be allocated toward imports. An increase in the aggregate demand of the country will therefore raise demand for foreign goods and in turn foreign income levels, thereby engendering output, and thus stock market, comovements across nations.

On the other hand, from the lens of the supply side, the predictions are more mixed. International trade integration may lead to production specialization in countries based on comparative advantage. Hence, in the case of inter-industry trade, comovements across economies weaken. In the context of intra-industry trade, however, trade specialization is suppressed as home and foreign varieties of a particular good are imperfect substitutes. Models of trade within industries typically highlight similar production structures and factor endowments across countries. If intra-industry trade is the dominant form of trade, expansions in some industries will lead to stronger comovements in cross-country output levels.

More generally, the net contribution of greater trade openness will depend on the extent to which intra-industry trade dynamics subdue inter-industry trade dynamics.

2.2.3 Economic Size

National market size is predicted to covary positively with the degree to which the stocks of a country feature in global investment portfolios. According to "gravity" models, countries of larger economic size also tend to have stronger economic ties. As a result, higher business cycle and stock market correlations may be more likely amongst such countries. Many supply-side models indicate that equity returns have their roots in the productivity of the underlying real economy, with gains following the path of economic growth. Similar-growth countries can thus observe higher equity market correlations. Under the "financing" hypothesis based on Tobin's q theory for example, countries characterised by larger or more developed financial markets, as proxied by higher market capitalisation, can exhibit a more pronounced link between growth and stock returns. On the other hand, technology improvements contributing to rising output levels may not imply higher profits, and thus equity gains, if firm competition results in proceeds being distributed to consumers and workers. Finally, in the presence of more domestic multinationals in the country, national stock market performance can rely more heavily on trends in global income and equity growth.

2.2.4 Exchange Rate Volatility

Theory offers two different views on the link between exchange rate stability and international correlations of stock markets. The first line of argument is based on the fundamental approach to asset pricing and indicates that a credibly fixed exchange rate, associated with lower volatility, augments cross-country correlations. Under a peg or currency union for example, lower exchange rate volatility implies that cross-border investments carry lower transaction costs. Moreover, fixed regimes can lead to a convergence in inflation and real risk-free rates across relevant countries. Overall, such cross-country symmetry in monetary policies, which may be more likely amongst nations geographically closer to one another, can eliminate disruptive exchange rate shocks to the tradable sector and induce strong business cycle, and in turn stock market, correlations across economies.

Conversely, flexible exchange rates tend to diminish the effects arising from the transmission of country-specific real shocks, thus reducing international comovements. While floating exchange rates are thought to shield domestic interest rates from foreign interest rates (Obstfeld *et al.*, 2004, 2005), it is not entirely clear that this insulation extends to risk appetite and risk premia more broadly (Rey, 2013). Non-credible pegs, yielding greater exchange rate volatility, can also induce lower asset return correlations transnationally as regular changes in the likelihood of realignment imply a high variance of interest rate differentials.

The second line of reasoning is based on the contagion explanation of asset price fluctuations (King and Wadhwani, 1990). This strand of the literature, in contrast, points to an increase in global correlations when currency markets are more volatile. In particular, contagion effects are highest in volatile markets as a result of herd behavior or noise trading, when significant discrepancies in expectations about fundamentals cause investors to turn to asset prices abroad as an indicator of probable trends in the home market. However, contagion effects are less likely and international correlations fall in the presence of credibly fixed exchange rates that decrease uncertainty about fundamentals. Pegs lacking credibility would culminate in the opposite scenario, with volatility spillovers across economies.

2.2.5 International Reserves

Countries holding larger stocks of foreign exchange reserves are more likely to be able to insulate their economies from global shocks, safely riding out periods of international financial stress. As the literature has documented, however, the build-up of reserves may work against the intended purpose of the accumulation by encouraging greater private-sector risk-taking. Such developments could induce volatility and contagion in the region, with enhanced comovements among stock markets.

Using model simulations, Chutasripanich and Yetman (2015) demonstrate how intervention designed to restrict exchange rate volatility can heighten speculative activity amongst risk-averse speculators, and, hence, may be counterproductive. Caballero and Krishnamurthy (2004) contend that policies of foreign exchange intervention constrain the growth of domestic financial markets and so contribute to the underinsurance of foreign currency risks. Burnside *et al.* (2004) show how implicit guarantees to foreign creditors of banks can be the underlying cause of self-fulfilling twin banking-currency crises, with banks encouraged to take unhedged foreign currency exposures. Meanwhile, Cook and Yetman (2012) provide empirical evidence that higher foreign exchange reserves offer banks insurance against exchange rate shocks, such that their equity prices become less sensitive to movements in the exchange rate. Lastly, reserve accumulation could depress foreign interest rates, stimulating higher risk-taking abroad too and globally transmitted financial crises (Gerlach-Kristen *et al.*, 2016).

3 Empirical Framework

According to the security market line (SML) embodied in the CAPM, discrepancies in average returns in a cross-section of country stock market portfolios will be linearly related to discrepancies in portfolio betas. Our preliminary CAPM analysis in the context of country stock market portfolios entails two phases.

First, employing real returns and assuming that the country portfolio betas, β_c, are constant over the sample period, we estimate the time series regression

$$(r_c - r_f)_t = \alpha_c + \beta_c(r_w - r_f)_t + \epsilon_{c,t} \tag{11}$$

for each country portfolio c. The equation is also estimated for non-overlapping five-year periods in order to examine changes in systematic risk. We note that working with portfolios, as opposed to individual securities, improves the precision of estimated betas (Blume and Friend, 1970, 1973; Fama and French, 2004).

Second, using the estimates of β_c across country portfolios, we estimate the cross-section regression

$$\bar{r}_c = \psi_0 + \psi_1\hat{\beta}_c + \varepsilon_i \tag{12}$$

for the entire sample period and the five-year sample periods, where $\bar{r}_c$ is the average monthly return for country portfolio c. Noting that a bar indicates the monthly average, we expect $\hat{\psi}_0 \approx \bar{r}_f$ and $\hat{\psi}_1 \approx \bar{r}_w - \bar{r}_f > 0$ (i.e. average risk premium on world portfolio) which is the slope of the security market line.[4]

Concluding our analysis, we examine the potential covariates of systematic risk in national stock markets by estimating the basic reduced-form panel regression

$$\beta_{c,t} = \alpha_c + \delta_t + \mathbf{\Phi}'\mathbf{X}_{c,t} + u_{c,t} \tag{13}$$

where five-year data are used, α_c and δ_t are country and time fixed effects repsectively, and

[4]Following Fama and MacBeth (1973), we also estimate month-by-month and year-by-year cross-section regressions, obtaining time series means of the intercepts and slopes for testing. This approach yielded similar results.

X is a vector of controls in log form. The inclusion of time dummies allows for the relation between beta and covariate x_i for country c at time t to be captured relative to worldwide common patterns in beta and x_i at time t. Additionally, this core regression is supplemented with pooled panel estimation. While the fixed effects estimator focuses on within-country data variation, the pooled estimator exploits the full cross-sectional variation in the data.

4 Data

4.1 Stock and Bond Market Variables

We are able to obtain national equity data for 82 countries, comprising 23 developed, 36 emerging and 23 frontier markets. In addition, we gather Morgan Stanley Capital International (MSCI) aggregate indexes covering the three aforementioned groups as well as the euro area. Table 1 provides the list of countries and corresponding stock market indexes (country portfolios) employed. We choose country stock market indexes that represent the largest firms by market capitalization. We use the MSCI All Country World Index (ACWI MXWD) as the global stock market index (world portfolio). "Adjusted" stock market prices are adopted, which are total return indexes that assume dividends are reinvested in the index.[5] The 10-year government bond yields of 34 countries are also included in our analysis. The global risk-free rate employed is the 3-month U.S. Treasury Bill return. For the purposes of calculating real returns from the perspective of a U.S. investor, we also retrieve U.S. consumer price index (CPI) and cross-country nominal exchange rate data. All data are collected at the monthly frequency over the period 1968:1-2017:12. Stock market data are gathered from the Bloomberg repository, while CPI and exchange rate data are retrieved from both Bloomberg and IMF's International Financial Statistics (IFS).

The real return on a given foreign stock market portfolio to a U.S. investor is defined as

$$R_{p,t+1} = 1 + r_{p,t+1} = \frac{\frac{S^*_{t+1}}{S^*_0}\frac{E_{t+1}}{E_0}}{\frac{P^{US}_{t+1}}{P^{US}_0}} \frac{\frac{P^{US}_t}{P^{US}_0}}{\frac{S^*_t}{S^*_0}\frac{E_t}{E_0}} = \left(1 + r^{nom}_{p,t+1}\right)\left(1 + \frac{\Delta E_{t+1}}{E_t}\right)\left(\frac{1}{1 + \pi^{US}_{t+1}}\right)$$

$$\Rightarrow r_{p,t+1} \approx r^{nom}_{p,t+1} + \frac{\Delta E_{t+1}}{E_t} - \pi^{US}_{t+1} \approx r^{nom}_{p,t+1} + \Delta e_{t+1} - \pi^{US}_{t+1} \tag{14}$$

where S^*_t is the foreign "adjusted" stock market price index in local currency terms, E_t is

[5] See MSCI methodology for construction details.

the nominal exchange rate quoted in U.S. dollar per unit of foreign currency terms, P_t^{US} is the U.S. consumer price index in national currency terms, π_t^{US} is the U.S. inflation rate, $e_t = \ln E_t$ and $t = 0$ is the common base year across indexes. That is, the real return to a U.S. resident is the nominal local currency return adjusted for exchange rate appreciation and U.S. inflation. Real returns on the U.S. Treasury Bill, long-term government bonds, and world stock market portfolio are calculated similarly. We note that the real return on the foreign investment to the U.S. resident is equal to the real local currency return, $r_p^{nom} - \pi^*$, if relative purchasing power parity (PPP) holds i.e. $\pi^{US} - \pi^* = \Delta e$.

4.2 Systematic Risk Drivers

Following our discussion in sub-section 2.2, we accordingly collect data on some of the potential macroeconomic covariates of beta. Exports and imports of goods and services, market capitalization, international reserves minus gold, ease of doing business indicators, GDP and GDP per capita are retrieved from the World Bank's World Development Indicators. Data on stocks of external assets and liabilities are gathered from the updated External Wealth of Nations II repository of Lane and Milesi-Ferretti (2007). Finally, a measure of geographical proximity to the U.S. is obtained from the CEPII Distances database.

We adopt the volume-based measure of international financial integration, reflecting the sum of total external assets and liabilities for each country, from Lane and Milesi-Ferretti (2007). Meanwhile, the sum of import and export flows is employed to define international trade integration in goods and services. Lastly, real and nominal exchange rate volatility are each calculated as the standard deviation of the annual growth rate of the exchange rate over the period of concern.

5 Empirical Results

5.1 CAPM Regressions

5.1.1 Long Time Horizons

For the period 1988-2017, Figure 1 plots the cross-section of average excess returns on national stock market indexes and 10-year government bonds against the corresponding betas obtained from equation (11). The betas in this figure are estimated using the MSCI All Country World Index as the global portfolio. Figure 2 repeats the exercise for the extended time interval 1968-

2017 by employing the MSCI Developed Markets Index as a proxy for the global portfolio. Over the common time period, the MSCI world and developed market indexes are highly correlated.

Figures 1 and 2 both indicate a strong positive association between the excess returns and systematic risks of assets in world, developed, emerging and frontier market samples. This salient feature of the graphs stands in stark contrast to the typical evidence proffered by the literature, namely, that CAPM betas bear at best a weak postive relation with excess returns. The graphs highlight that there is significant dispersion in country betas, with values ranging from approximately -0.40 to 2. Moreover, beta estimates across the two figures prove to be quite similar. As expected, long-term government bonds typically carry the lowest betas, where the former are given by green squares while equities are denoted by red circles. The removal of these assets however does not adversely affect the rank correlation coefficients of world, developed, and emerging country cohorts, which lie around 0.60, 0.80, and 0.60 respectively.[6] Overall, the preliminary graphical evidence of pronounced positive correlations suggests that market betas should have significant explanatory power in cross-section regressions.

Table 2 displays the results of the cross-section CAPM regressions (equation (12)) for the four aforementioned country cohorts and four different regional portfolios approximating the global portfolio. For each global portfolio proxy, the average excess return observed in the data is reported under the regression results, along with the average risk-free rate for the period.

Panel A of the table uses the MSCI All Country World Index (mxwd) as the global portfolio, and thus is based on the period 1988-2017. The panel shows that market betas have notable explanatory power in most country samples, with the R-squared value reaching as high as 0.63 for developed markets. Regression standard errors are relatively low too. The estimate of the slope coefficient on beta in the case of world and developed samples falls exactly in line with the average monthly excess global portfolio return of 0.004 (or 0.4 percent) over the period, as predicted by the CAPM.[7] Such congruency with the slope of the theoretical security market line is practically non-existent in the literature.

At 0.005, the slope estimate for emerging markets marginally overshoots the average global portfolio risk premium, in contrast to the regular findings of significant undershooting

[6]Parametric Pearson correlations (unreported) are also similar.
[7]The annualized rate is approximately 5 percent.

in the literature. We note, however, that an estimate of 0.004 is obtained for this group when government bonds are omitted from the regression. Meanwhile, in the relatively small cohort of frontier markets, the slope estimate of 0.003 marginally undershoots the target, although it narrowly falls short of statistical significance. Despite the latter, at conventional significance levels, additional statistical tests (unreported) in each sample still stress that one cannot reject the null hypothesis of a slope coefficient equal to 0.004.

Intercept estimates are generally larger than the average T-Bill rate in the data (0.001) and these differences tend to be statistically significant, as indicated by excess return regressions. Nevertheless, we highlight that the intercept estimate for developed markets (0.002) is relatively close to our average risk-free rate. Furthermore, the intercept estimate in this sample turns out to be consistent with the average risk-free rate when bonds are excluded from the analysis, while the slope coefficient estimate is unaffected. That is, a regression of excess returns on betas yields a statistically insignificant constant term. Thus, a perfect fit is retrieved in the case of equities alone in the developed markets sample. Figure 3 shows the corresponding security market line.

Panel B of Table 2 employs the MSCI Developed Markets Index (mxwo) as the global portfolio and covers the extended period 1968-2017. The results yielded in this panel are virtually identical to those found in panel A, reflecting the high degree of correlation between the aggregate world and developed market portfolios. Panel B deviates from Panel A only with respect to the average excess global portfolio return in the data, which now stands at 0.003, making the theoretical security market line slightly flatter than before.

In panel C of the table, the MSCI Emerging Markets Index (mxef) proxies for the global portfolio and results pertain to the interval 1988-2017 as in panel A. The coefficient estimates on beta for world, developed and emerging market samples stand typically around 0.007, or an annualized rate of approximately 8.7 percent. These point estimates are almost equal to the historical average excess return of 0.008 on the global portfolio proxy. On the other hand, the frontier market sample estimate of 0.004 is marginally statistically insignificant, although one cannot reject the null hypothesis of a 0.008 value. In relation to the intercept term, estimates across the four columns remain relatively similar to those in previous panels. Overall, three of the four samples observe a higher R-squared under the emerging markets global portfolio proxy. Most notably, market betas now explain 42 percent of the variation in emerging market average excess returns (column (3)).

Finally, panel D in Table 2 adopts the MSCI Frontier Markets Index (mxfm) as the global portfolio and spans the period 2002-2017. As in panel C, the slope coefficient estimates lie around 0.007 for world, developed and emerging market groups. In addition now, the frontier markets sample generates a statistically significant slope coefficient of 0.007. As can be seen from the panel, these estimates on beta across the four samples tend to be in symmetry with the mean monthly excess return on the global portfolio proxy, namely 0.7 percent. Intercept terms still generally suggest overshooting of the average risk-free rate, which is approximately zero during the period. However, this parameter now reaches its peak at 0.003 across columns, with emerging and frontier market samples observing declines in the estimate. In particular, the frontier market intercept estimate is borderline statistically significant at the 10 percent level, arguably equating the empirical security market line of the sample with the theoretical one. Relative to previous panels, the R-squared value in the frontier markets sample is higher.

5.1.2 Short Time Horizons

Given that the systematic risks of national stock markets can fluctuate over time, we also execute our time series and cross-section CAPM regressions for shorter time horizons. Long-term averages can conceal many pertinent features of the financial landscape. This is especially true when the time horizon is so long that it includes substantial changes in the underlying finanical infrastructure, such as institutional and regulatory framework developments.

Taking a closer look at the data, Figure 4 plots cross-country average excess returns against corresponding market betas for non-overlapping five-year periods. The graphs convey the message that the risk-reward relation is not broadly consistent over the entire sample period. For instance, in the five-year period 2003-2007 immediately prior to the global financial crisis and great recession, we observe a strong positive relation (rank correlation of 0.60) between average excess returns on passive “buy and hold” national stock market indexes and systematic risk. However, this relation turns significantly negative during the recessionary, crisis period of 2008-2012 (rank correlation of -0.27), before reverting to significantly positive in the recovery phase of 2013-2017 (rank correlation of 0.34). Other unconventional cases of distinct negative correlations in the graphs include the period 1998-2002 when the dot com bubble burst and 1973-1977 when the first major oil crisis of the decade hit.

Using Figure 5 we can discern that these episodes of pronounced negative correlations coincide heavily with episodes of large return volatility in the world stock market index. For example, the 2008-2012 interval is characterized by an annualized return volatility level of approximately 21.5 percent, compared to the average level of roughly 14 percent over the full interval 1968-2017. According to the adaptive markets hypothesis, the standard risk-reward nexus can break down during phases of heightened equity volatility. Specifically, large abrupt increases in stock market volatility cause a non-negligible fraction of investors to swiftly lower their holdings through a fight-or-flight response, or, “freaking out”. Panic selling during crises places downward pressure on equity prices and upward pressure on the prices of safer assets, as investors reconfigure their portfolios to hold more of the latter. Such dynamics engender a temporary violation of the positive risk-reward relation. Once overreactions subside, the wisdom of the crowds prevails and the standard investment paradigm spawned by the efficient markets hypothesis is restored. Thus, financial markets can be bipolar, featuring excessive downward price spirals at times, but exhibiting normal behavior on most occasions (Lo, 2017).

Another potential explanation for the ostensibly backward relation between risk and reward is the so-called “leverage effect”. Deteriorating stock markets inflict negative returns on investors. This produces higher volatility as firms featuring debt in their capital structure are now more highly leveraged. In turn, this can also increase national covariances with the global market. Overall, periodic slumps may not have a significant impact over long time horizons. Although we observe a general upward trend in equities over the very long run (e.g. 50 years), most investors do not adopt such holding positions. Examining shorter five-year horizons can therefore be more informative.

Tables 3-5 shows the results of cross-section regressions of average returns on market betas for different five-year periods. The MSCI world index (mxwd) is used as the global portfolio over the interval 1988-2017, while the MSCI developed markets index (mxwo) is used as the global portfolio over the interval 1968-1987. Panel C of Table 3 indicates that slope coefficient estimates on beta over the 2003-2007 period were largely consistent with the corresponding excess global portfolio return of 0.013. Indeed, the null hypothesis that 0.013 is the true value cannot be rejected at conventional significance levels across samples. However, with the exception of the developed markets sample, intercept estimates significantly overshoot the average real risk-free rate of roughly zero. All country cohorts observe relatively high R-squareds, with the developed group attaining the highest value of 0.82.

During the period 2008-2012, panel B suggests that riskier assets received a lower return. Deviating significantly from the excess world portfolio return of 0.001, point slope estimates are -0.004 for world and developed groups, -0.002 for emerging markets, although statistically insignificant, and -0.009 for frontier markets. Intercept estimates overshoot once again. Overall, R-squared values indicate much lower explanatory power compared to the previous period.

However, in the recovery phase of 2013-2017 following the great recession, the positive return-beta link is restored as shown in panel A. Standing at 0.004 and 0.005 respectively, coefficient estimates on market beta for world and developed groups fall short of the excess global portfolio return of 0.008. Meanwhile, the frontier markets sample attains a point estimate of 0.007 which cannot be statistically differentiated from the excess world return. Conversely, we find a statistically insignificant estimate on beta of 0.001 for emerging markets. According to relatively recent Geneva reports on the world economy (e.g. Buttiglione *et al.* (2014)), global debt accumulation post financial crisis (2010 in particular) has continued under the stimulus of emerging markets, with notable increases in corporate debt. This may consequently have dampened the standard return-beta nexus for emerging markets in 2013-2017. Intercept estimates lie around zero and are closer to the observed real risk-free rate of -0.001. Moreover, R-squared values are higher for world and developed samples.

Panel D reveals that a negative relation between return and systematic risk generally prevailed over the period 1998-2002, except in the case of frontier markets. In particular, column (2) indicates that the slope and intercept point estimates for developed markets are perfectly aligned with the average excess global portfolio return of -0.004 and average risk-free rate of 0.002. For the entire world sample, the slope estimate is -0.002, while the intercept estimate is 0.002 again.

Panels E, G and H of Table 4 show that the relation between beta and return is typically positive across country samples for the periods 1993-1997, 1983-1987 and 1978-1982. In panel E, while the point estimate on beta is 0.005 for the world sample, the corresponding estimate for developed markets falls in line with the mean excess return on the global portfolio of 0.008. Meanwhile, intercept estimates tend to overshoot, although not by as much in the case of world and developed samples, and R-squareds are relatively high. In panel G, slope estimates tend to be consistent with the excess global portfolio return of 0.010, while intercept estimates are quite close to the risk-free rate of 0.004. In fact, at standard significance levels across samples, normally one cannot reject the null hypotheses that slope and intercept parameters are 0.010 and 0.004 respectively. Panel H predominantly displays statistically insignificant coefficient estimates. At the 5 percent level across all columns, one is unable to reject the null hypothesis of a slope coefficient equal to the average world portfolio excess return of -0.002

over the period 1978-1982. Furthermore, at all conventional significance levels, intercept estimates are statistically indistinguishable from the average risk-free rate of 0.001 during the interval.

Finally, Table 5 gives results for the periods 1973-1977 and 1968-1972. For the first of these intervals, Panel I reveals that there is a negative link between systematic risk and return across country samples, with slope estimates lying around the average excess global portfolio return of -0.007. Indeed, in all cases, one cannot reject the null hypothesis that the slope parameter is -0.007. Intercept estimates, nevertheless, overshoot the average risk-free rate. For the second time interval, panel J highlights a positive risk-reward relation, with slope estimates equalling approximately 0.002. These estimates fall below the excess world portfolio return of 0.004. In contrast, the intercept estimates of around 0.002 lie above the average risk-free rate of 0.001.

5.2 Systematic Risk in National Stock Markets

Table 6 shows the discrepancies in equity systematic risks across developed, emerging and frontier markets over full time intervals. Regardless of the global portfolio used, panels A-D indicate that frontier markets exhibit the lowest betas. Employing the world and developed market indexes respectively as proxies for the global portfolio, panels A and B report median (mean) betas of around 1.09 (1.08) for developed markets, 0.94 (0.92) for emerging markets, and 0.38 (0.54) for frontier markets. As column (5) of the table shows, these differences are statistically significant. With the emerging markets global potfolio proxy, panel C also displays statistically significant differences. However, median and mean betas across samples are now lower, with frontier markets characterized by a median beta of 0.25 compared to the high of 0.75 for emerging markets. Using the frontier markets index as the global portfolio, panel D indicates that group differences are not statistically significant. Based on estimates alone, nevertheless, frontier markets have a lower median beta (roughly 0.60) than developed and emerging markets (roughly 0.70 for both).

Providing an intertemporal decomposition, Table 7 examines country group betas over shorter time horizons of five years. World and developed market indexes are used as the global portfolio, with panels A-F using the former and panels G-J using the latter. We find that frontier stock markets display the lowest levels of systematic risk in each period, while developed stock markets are typically at the other end of the spectrum. Differences across country cohorts in each period tend to be statistically significant.

Frontier markets observe the lowest level of systematic risk during 1993-1997, with a median beta of approximately -0.01. Conversely, they are exposed to the highest level of systematic risk during 2008-2012, with a median beta of approximately 0.72. Similarly, the median beta for developed markets is also highest, at 1.30, in 2008-2012. The lowest beta, on the other hand, for this group is found during 1973-1977. The relatively stronger betas of advanced economies, particularly in more recent times, can partly be attributed to the harmonization of national risk appetites, arising from the transmission effects induced by monetary policy in global financial centres (Jordà *et al.*, 2018). Meanwhile, emerging market median betas range from 0.36 over the period 1968-1972 to 1.19 over 2003-2007. Tests of mean and median equality over time for each country group, including the full world sample, point to statistically significant intertemporal differences in betas.

Lastly, assessing the means and medians of pooled five-year estimates over 1968-2017, the bottom of Table 7 shows results consistent with panels A and B of Table 6. Developed markets carry the highest equity betas, followed by emerging, and then frontier markets. The corresponding pooled median (mean) betas are 1.01 (1.02), 0.86 (0.86) and 0.30 (0.36) respectively. These figures are marginally smaller than those in Table 6.

5.3 Performance

Figure 6 summarizes general stock market performance for each country over the sample period by plotting average and median five-year Sharpe ratios and Morningstar risk-adjusted returns. The Sharpe ratio is the reward-to-variability ratio, defined as $(\bar{r}_p - \bar{r}_f)/\sigma_p$. The Morningstar rating on the other hand can be interpreted as the risk-free equivalent excess return for an investor with a level of risk aversion γ. Specifically, with annualized values, it is defined as $\left[T^{-1}\sum_{t=1}^{T}[(1+r_{p,t})(1+r_{f,t})^{-1}]^{-\gamma}\right]^{-12/\gamma} - 1$. In line with the literature, we set $\gamma = 2$.

The graphs indicate that the two general performance indicators are highly correlated, with parametric and non-parametric correlations in excess of 0.50. Notably, the graphs suggest that frontier stock markets are typically among the better performers in our sample.[8] We find pooled median 5-year Sharpe ratios of 0.29, 0.27 and 0.47 for developed, emerging and frontier markets over the full period, where the data are annualized. Looking at pooled median 5-year Morningstar returns over the same time horizon, we obtain corresponding values

[8] Quite similar patterns are found over the shorter interval 1988-2017 too.

of 0.004, -0.053 and 0.036 respectively. These group differences are statistically significant.

However, Jensen's alpha, which is defined as the average return on the national stock market index over and above that predicted by the CAPM, does not suggest that frontier markets are systematically better performers.[9] Figure 7 shows that 5-year alphas across countries and over time tend to be clustered around zero. Figure 8 in turn plots 5-year alphas against 5-year betas across countries over the entire sample period. In contrast to previous studies, the graph suggests that countries with higher levels of non-diversifiable stock market risk are not systematically associated with negative alphas. In particular, we find that the median beta across countries with positive alphas is 0.84, while it is 0.94 across countries with negative alphas, with this discrepancy being statisitically insignificant at the 10 percent level. As the graph illustrates, there does not appear to be an unequivocally strong inverse relation between alpha and beta.

5.4 Betas and Covariates

5.4.1 Cross-Section Correlations

Figure 9 provides cross-section plots of systematic risks in national stock markets against a number of potential macroeconomic covariates over the full sample period of the world portfolio index, where time-averages of the latter variables are employed.[10] The initial graphical evidence suggests strong links between country betas and corresponding macro variables. Almost all of the supporting non-parametric gross correlation coefficients are statistically significant at the 1 percent level.

Plots 9(a) and 9(b) show that financial and trade openness, measured by volumes of respective stocks and flows, are positively associated with systematic risk in national equity markets. This suggests that enhanced cross-border financial and trade linkages induce higher comovements across countries. Economies in which it is easier to conduct business, as a result of greater political stability or less rigid regulation for example, are expected to have more pronounced global ties through higher levels of international portfolio investment, foreign direct investment etc. Importantly, better business environments are more conducive to successes among domestic firms, that, building on their foundations, can go on to compete robustly on the world stage with their exports. As Figure 9(c) illustrates, there is a positive

[9]That is, Jensen's alpha can be obtained as the intercept from time series regression (11).

[10]The graphs do not change significantly by using median values of macro variables or the sample period of the developed markets portfolio index.

relation between market betas and ease-of-doing business rankings.

Figures 9(d)-9(f) show that economic size and development factors, such as market capitalization and real GDP, are positively correlated with systematic risks in national equity. Bigger economic players can impart far-reaching effects more regularly. For instance, larger developed markets, especially global financial centres, are likely to covary more with world markets through national monetary policy spillovers or familiarity bias in the international portfolios of foreign investors. Conversely, local events in developing markets are less likely to have the ubiquitous effects that induce such comovements.

The next three figures, 9(g)-9(i), depict a positive link between exchange rate volatility (nominal or real) and beta, while a negative one between geographical distance from the U.S. and beta. The former correlation is consistent with Bordo and Helbling (2003) who find that fixing the exchange rate does not enhance output synchronization across countries. Moreover, recent research finds that, post 1945, the transmission effects of financial centre monetary policy are sizable under floats, leading to an increased synchronization of national risk appetites that bind equity markets together (Jordà *et al.*, 2018). The latter correlation on the other hand may indicate that countries further away from the main actor on the world stage are less exposed to contagion effects from the region. This may be related to weaker financial and trade linkages with the U.S. as a result of larger information asymmetries or transportation costs. The final plot, Figure 9(j), suggests that international reserve holdings correlate positively with systematic risk in equity markets.

5.4.2 Five-Year Panel Regressions

Examining the macroeconomic covariates of national equity betas in a more refined longitudinal setup, Table 8 provides the results of fixed effects and pooled OLS panel regressions using five-year data. Betas in columns (1)-(3) are based on the all-country world portfolio (acwi mxwd), with regressions corresponding to the interval 1988-2017. Betas in columns (4)-(6) meanwhile are based on the developed markets world portfolio proxy, with regressions corresponding to the 1968-2017 interval. Panel A of the table employs nominal exchange rate volatility in the specifications, while panel B uses real exchange rate volatility instead. Financial openness, trade openness, market capitalization, and international reserves are employed as fractions of national GDP.

Consistent with the preliminary cross-section analysis of gross correlations, the core fixed effects panel regressions of Table 8 (columns (1) and (4)) show that financial and trade openness have relatively strong positive links with national stock market betas. The parameter estimates are all statistically significant at one or more of the conventional levels. In panel A of the table, the estimated coefficients on financial openness stand around 0.21 and are statistically significant at the 1 percent level. This implies that a 10 percent increase in financial openness (i.e. percentage change in variable) is associated with a 0.021 increase in beta. In panel B, the comparable average estimate is 0.39. Trade openness coefficient estimates are quite sizable in fixed effects regressions, ranging from 0.56 in panel B to 0.88 in panel A. The average estimate across the four specifications suggests that a 10 percent increase in trade openness is related to a 0.075 increase in beta, which is over twice as much as the typical effect of a similar increase in international financial integration. Although they are smaller, trade openness coefficients remain positive and mostly statistically significant in pooled regressions.

Reflecting financial or economic size and development, market capitalization and relative-to-world GDP are statistically significant covariates across all specifications in both panels of the table. Unequivocally, all estimates point to a positive association between each of these variables and beta. Pooled regressions, however, yield slope estimates that are less economically significant. In particular, market capitalization coefficients across fixed effects regressions lie around 0.16, while in pooled regressions the typical value is around 0.09. There is a more pronounced positive relation between relative GDP and beta. Slope estimates in this instance range from about 0.14 in pooled regressions to values of approximately 0.56 and 0.85 in fixed effects specifications.

In contrast to indications along the cross section, panel estimates suggest an inverse link between international reserves and systematic risk in national stock markets. In panel A, within-regression estimates for reserves of around -1.25 are much larger in absolute terms than corresponding pooled estimates, although the latter are statistically insignificant. In panel B, on the other hand, all slope coefficients on reserves are relatively similar in size. They average around -0.49, but only pooled estimates are statistically significant. Overall, our results suggest that international reserves assist in insulating national markets against foreign shocks, thereby decoupling domestic and foreign output and equity movements.

In almost all specifications, higher exchange rate volatility is associated with a higher equity beta. In panel B of the table, coefficients on real effective exchange rate volatility across columns are all positive and statistically significant at the 5 percent level. The estimates are similar in magnitude with a typical value of 0.13, implying that a 10 percent increase in real exchange rate volatility contributes to a 0.013 increase in beta. For bilateral nominal exchange rate volatility in panel A, pooled estimates are clustered around 0.05 and are statistically significant at the 1 percent level. Conversely, corresponding estimates in fixed effects regressions are indifferent from zero.

The primary reason for the discrepancy between pooled and within estimates of volatility coefficients in panel A is that the nominal exchange rate exhibits much greater variation across countries than over time for individual countries. For example, certain peggers in the Middle East observe virtually zero nominal exchange rate volatility over the sample period. Put differently, given that pooled regressions focus on between-country variation, while fixed effects regressions focus on within-country variation, the former are better suited to capturing the role of nominal exchange rate volatility. In summary, our estimates are consistent with the notion that lower nominal exchange rate volatility raises consensus among domestic investors about the likely direction of home fundamentals, thereby attenuating the need to look abroad for guidance, and thus cross-border comovements.

6 Conclusions

Employing national stock market prices across the globe, this paper finds that the basic CAPM performs much better than documented in the literature. At shorter time horizons we also obtain evidence indicating that the positive risk-reward relation can break down during times of high volatility, as suggested by the adaptive markets hypothesis. Relative to advanced and emerging markets, our results point to lower systematic risk in frontier equity markets. Moreover, general return indicators reveal that frontier stock markets have on average fared better than more developed ones, while the relation between alphas and betas across countries is quite flat. Examining government bond markets across nations, we find that they are weakly related to the world portfolio, bearing very low absolute betas in comparison to typical equities.

We next investigate the macroeconomic covariates of national stock market betas. Our results show that countries characterized by higher levels of financial and trade openness, exchange rate volatility, and larger economic size feature greater systematic risk in their equity markets. On the other hand, by protecting the economy from external pressures, international reserves are found to attenuate the systematic link between national and world stock markets. Importantly, our results suggest that with increasing trade globalization, the transmitted effects of country-specific developments are likely to be more profoundly felt in foreign markets. In addition, such integration into the world economy implies a reduction in the benefits of portfolio diversification across countries.

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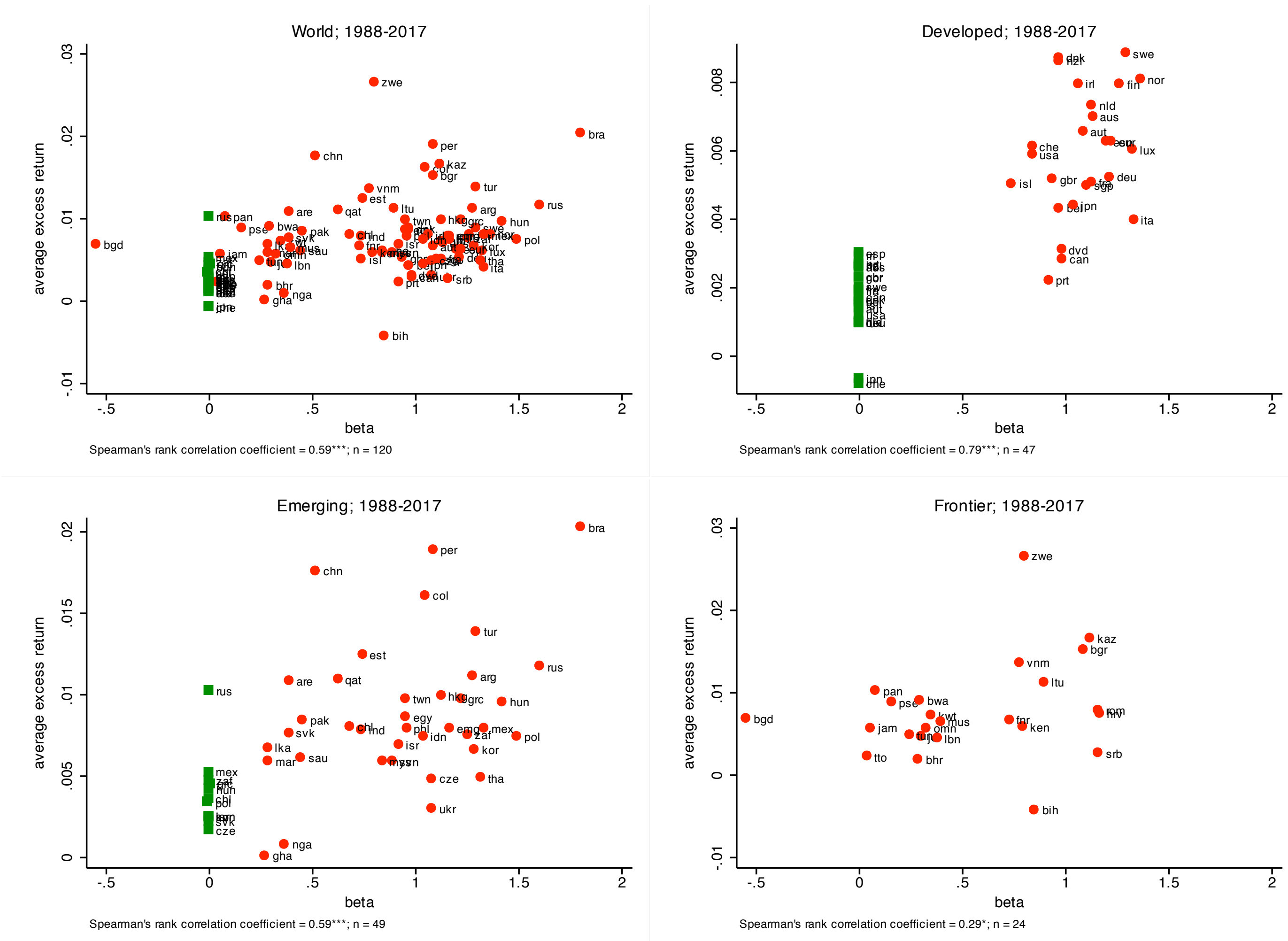
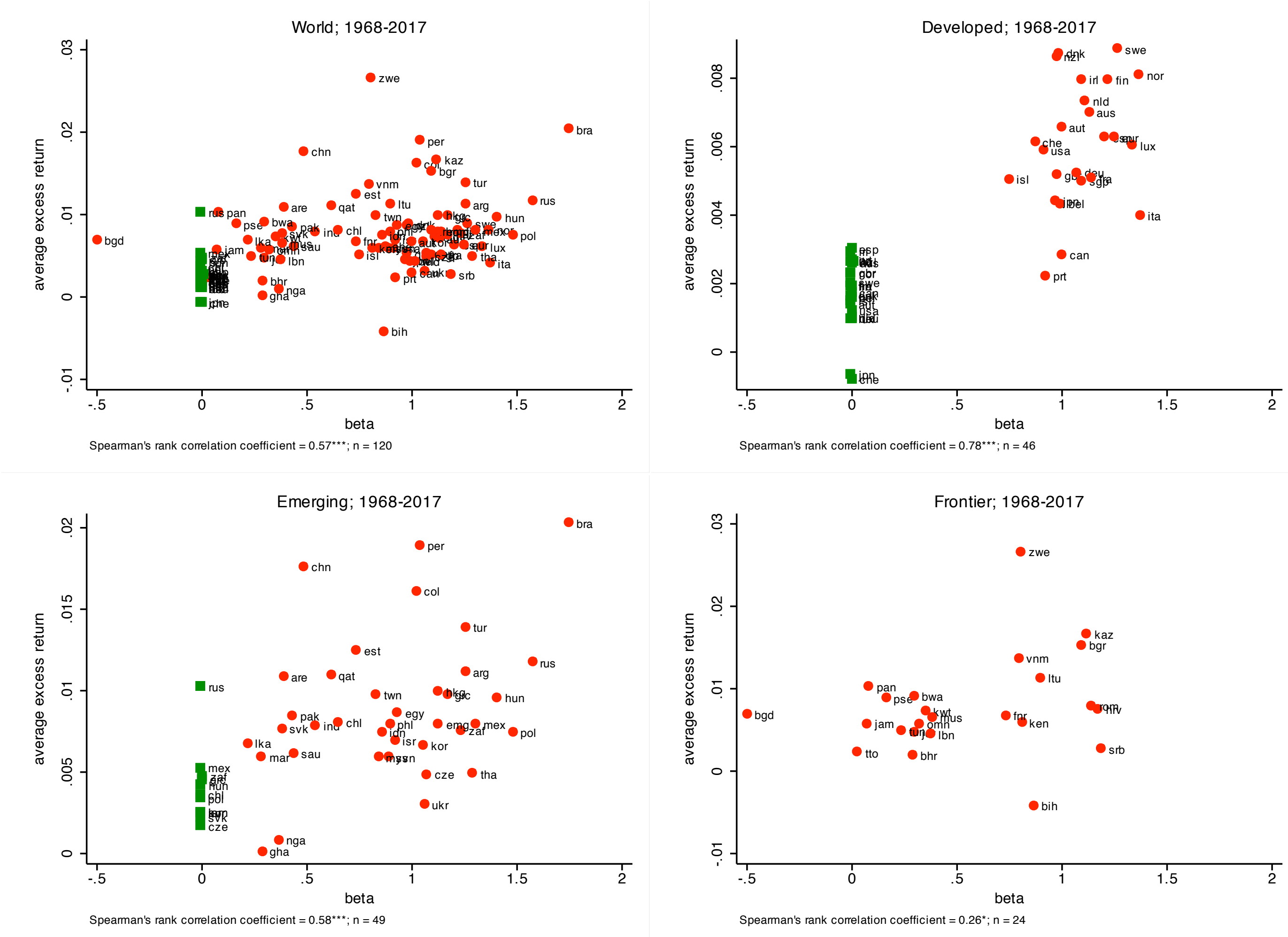
Figure 1: Average Excess Returns and Systematic Risks, Cross-Sections I



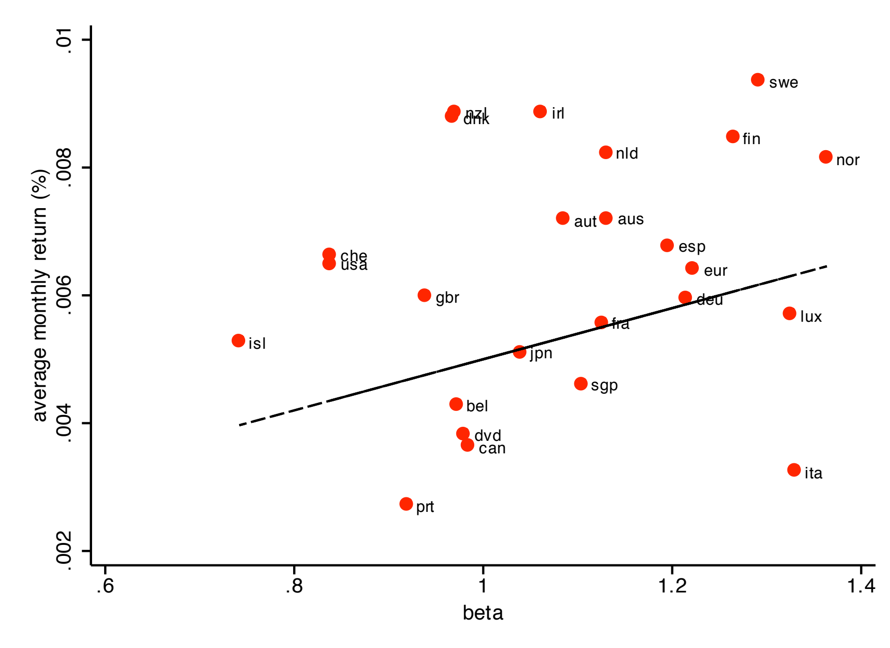
Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. MXWD (MSCI ACWI) is used as the world stock market portfolio. Red circles represent equity while green squares represent long-term government debt.

Figure 2: Average Excess Returns and Systematic Risks, Cross-Sections II



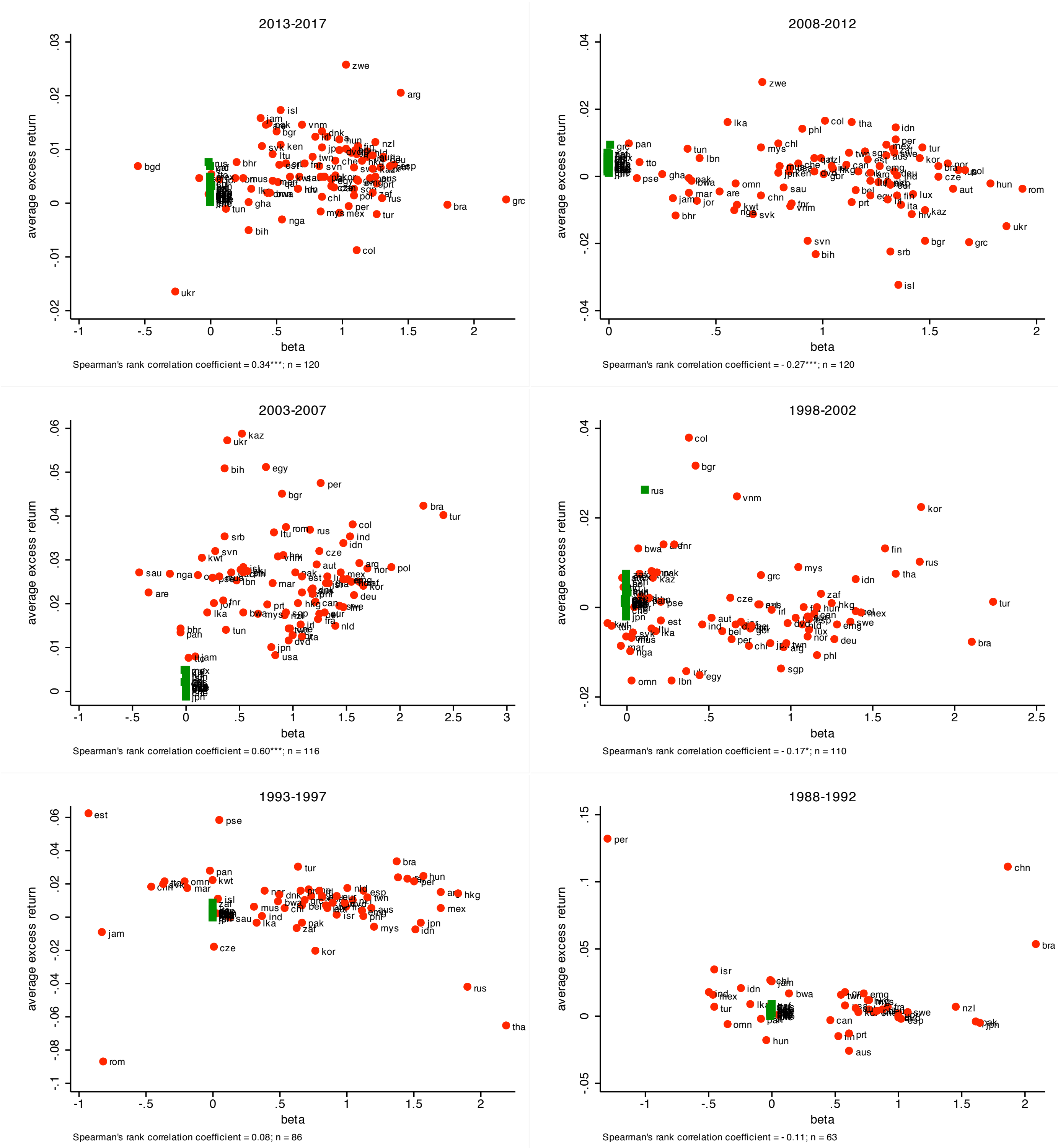
Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. MXWO is used as the world stock market portfolio. Red circles represent equity while green squares represent long-term government debt.

Figure 3: Empirical Security Market Line, 1988-2017



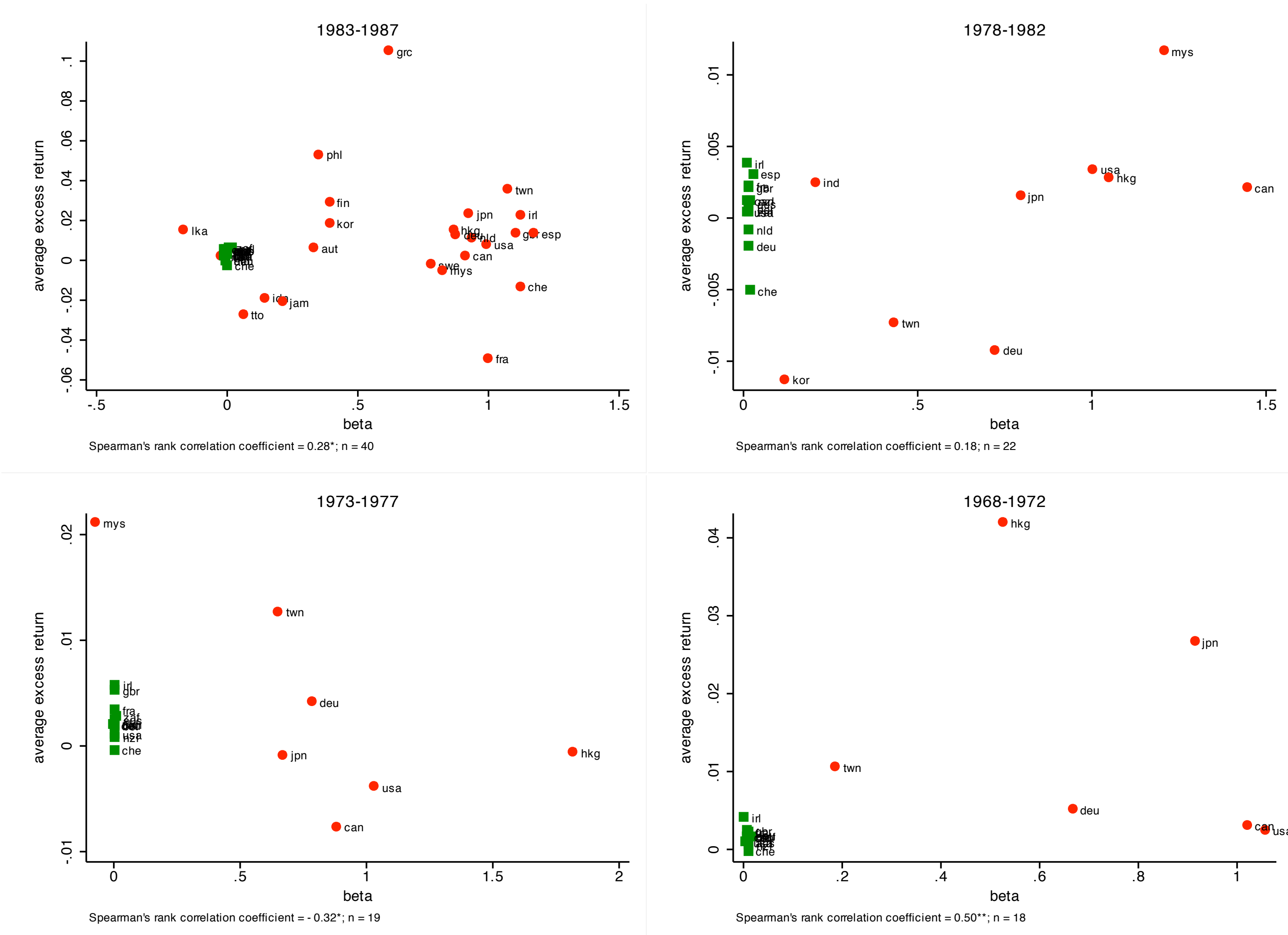
Notes: Sample consists of developed national stock markets. Global portfolio employed is the MSCI All Country World Index (MXWD). Security market line (SML) plotted is both the empirical and theoretical one. SML has a slope of 0.004, consistent with the average monthly excess return on the world portfolio over the period. When national stock market beta is equal to 0, SML shows an average monthly return equal to 0.001, consistent with the average risk-free rate over the period.

Figure 4: Average Excess Returns and Systematic Risks, World Cross-Sections for 5-year periods



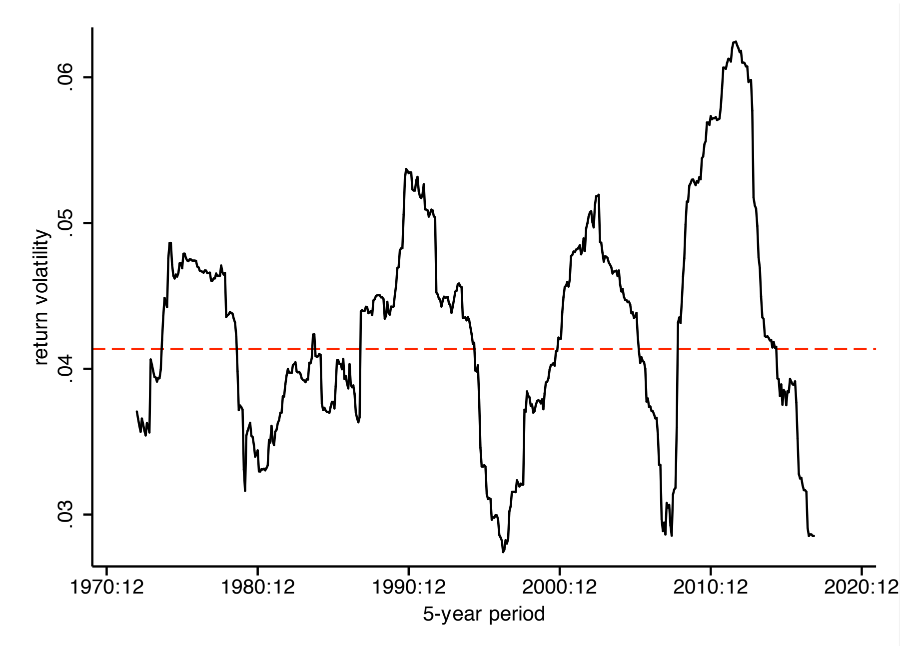
Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. MXWD (MSCI ACWI) is used as the world stock market portfolio for the period 1988-2017. MXWO proxies for the world stock market over the period 1968-1987. Red circles represent equity while green squares represent long-term government debt.

Figure 4 (continued): Average Excess Returns and Systematic Risks, World Cross-Sections for 5-year periods



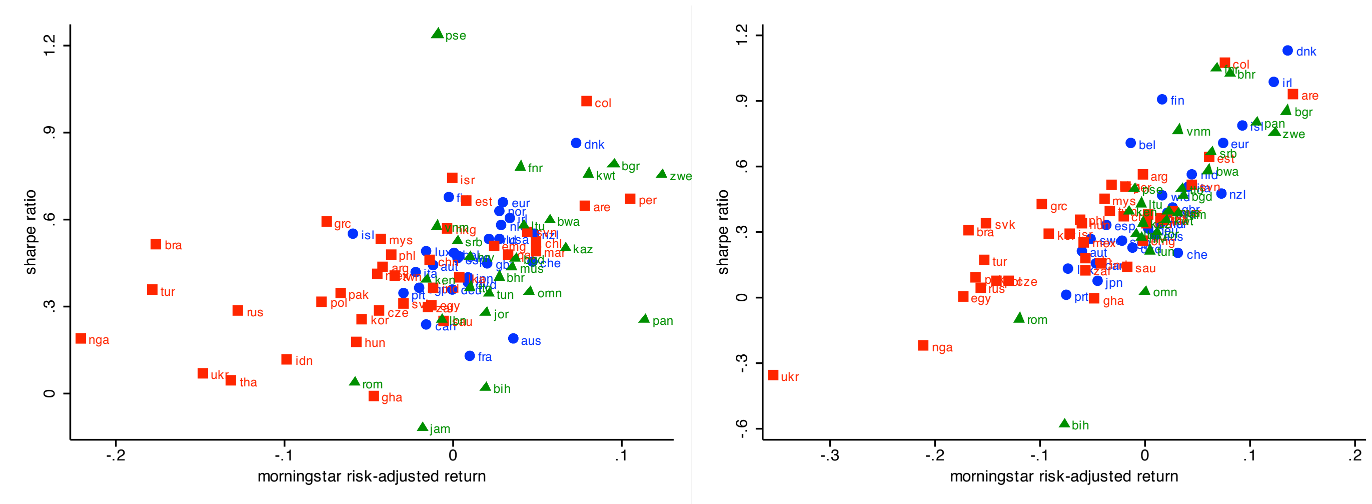
Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. MXWD (MSCI ACWI) is used as the world stock market portfolio for the period 1988-2017. MXWO proxies for the world stock market over the period 1968-1987. Red circles represent equity while green squares represent long-term government debt.

Figure 5: World Stock Market Index, Rolling 5-year Return Volatility



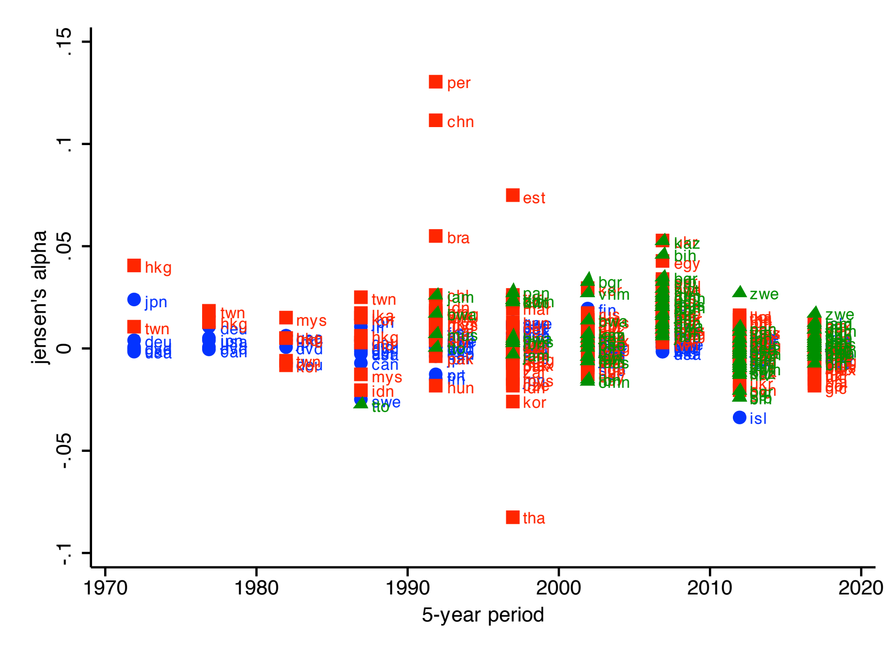
Notes: The horizontal axis marks the end of each 5-year period. The red dashed line marks the average return volatility over the entire sample period.

Figure 6: Average (left) and Median (right) 5-Year Performance Indicators, 1968-2017



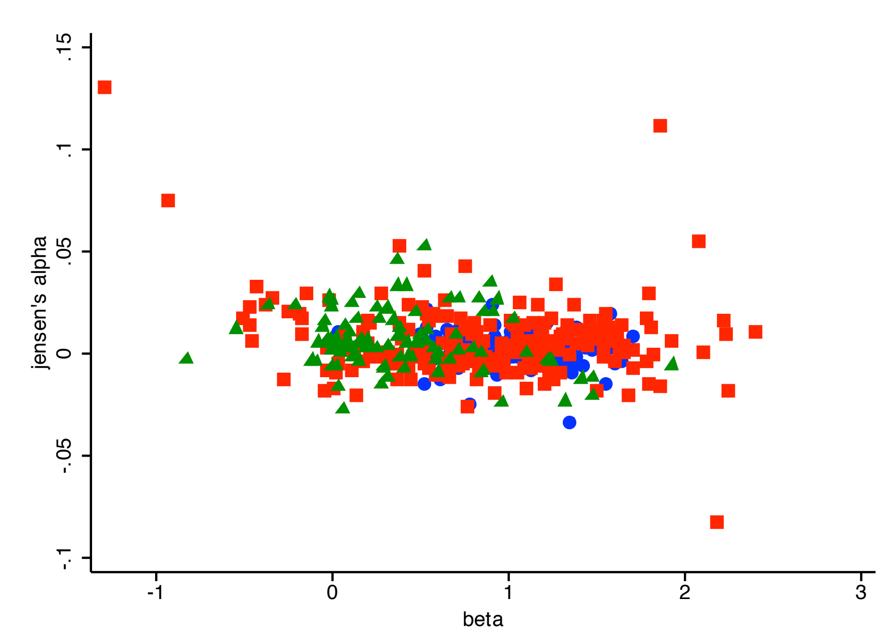
Notes: Blue circles, red squares, and green triangles correspond to developed, emerging, and frontier stock markets respectively. Annualized figures are shown.

Figure 7: 5-Year Alphas



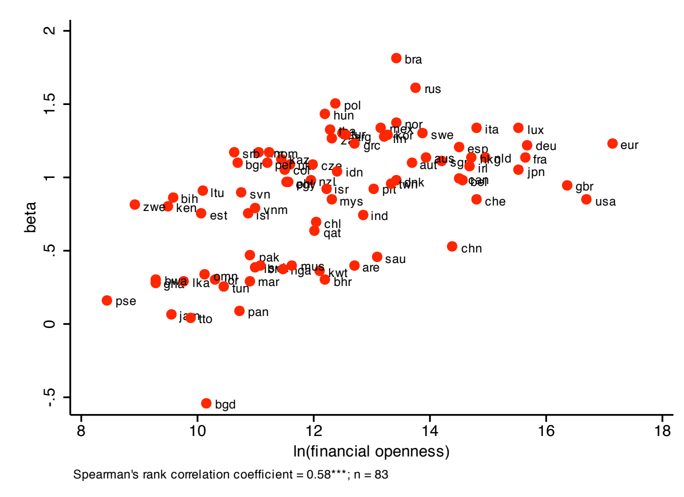
Notes: Blue circles, red squares, and green triangles correspond to developed, emerging, and frontier stock markets respectively. The horizontal axis marks the final year of each non-overlapping 5-year period. Jensen's alpha is the average return on the national stock market portfolio over and above that predicted by the CAPM.

Figure 8: Alphas vs Betas

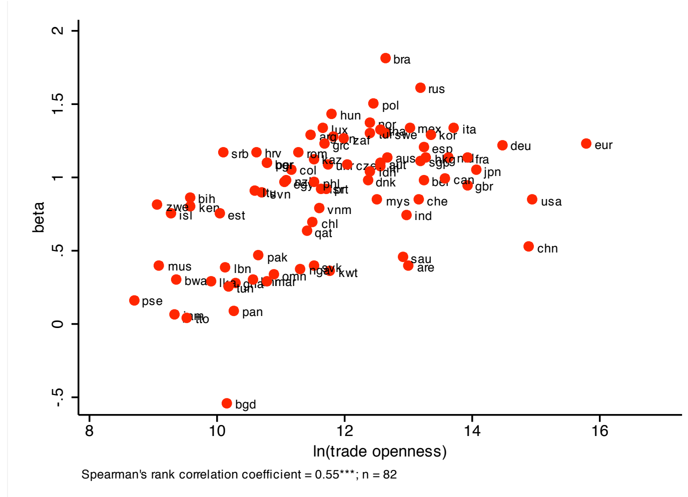


Notes: Blue circles, red squares, and green triangles correspond to developed, emerging, and frontier stock markets respectively. 5-year alphas and betas are employed. Jensen's alpha is the average return on the national stock market portfolio over and above that predicted by the CAPM. Parametric and non-parametric correlations between alpha and beta are close to zero.

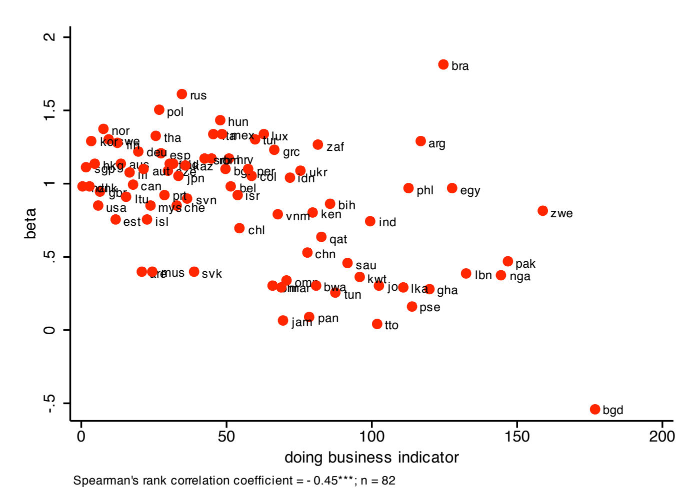
Figure 9: Betas vs. Covariates over the Cross Section



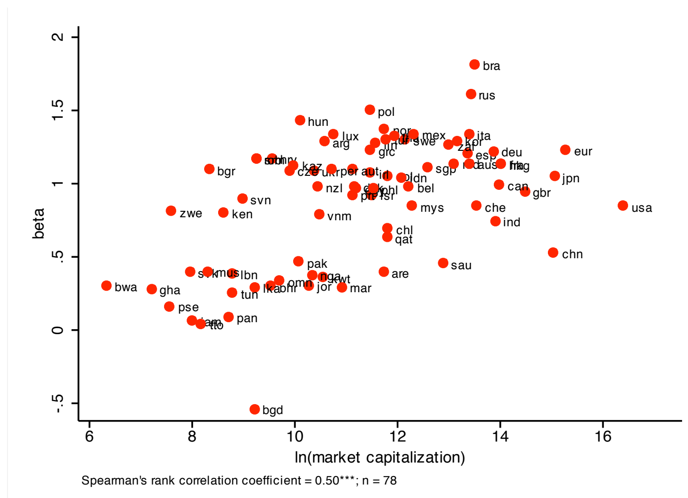
(a)



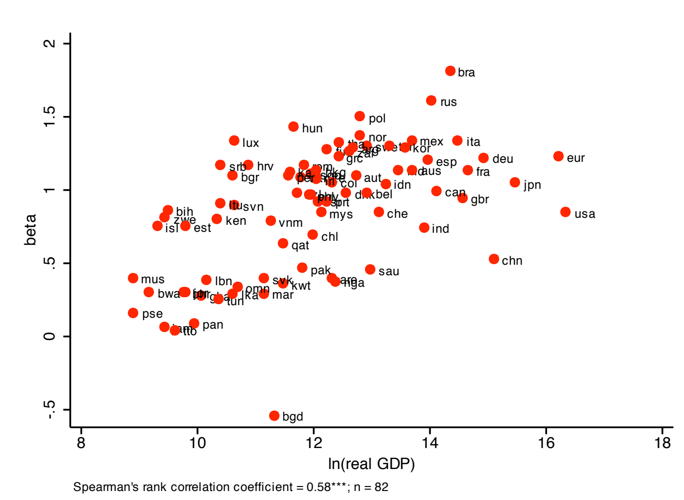
(b)



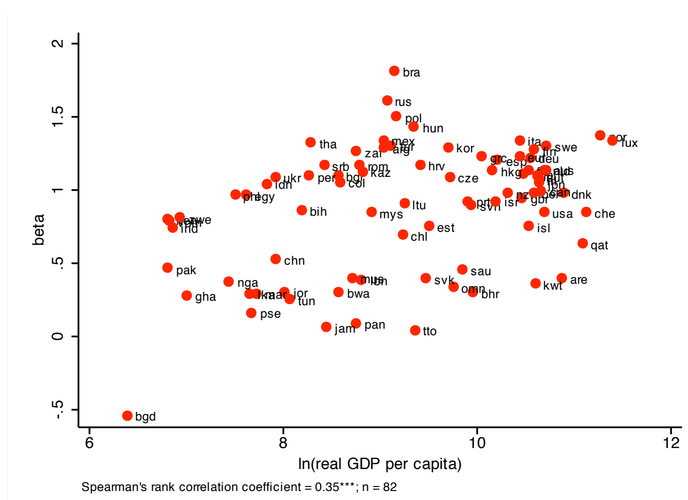
(c)



(d)

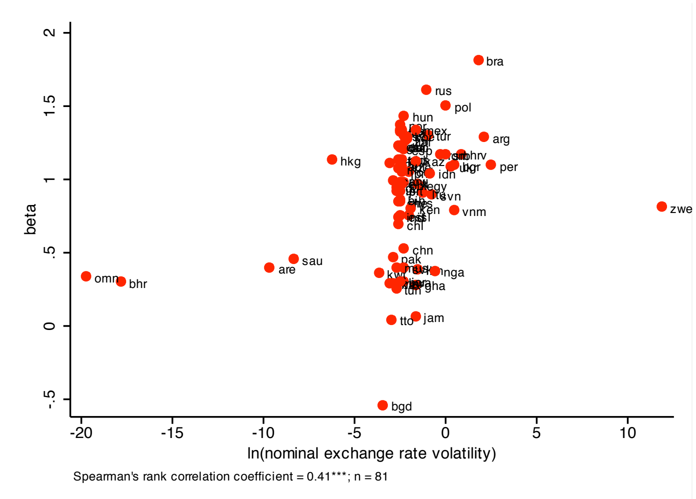


(e)

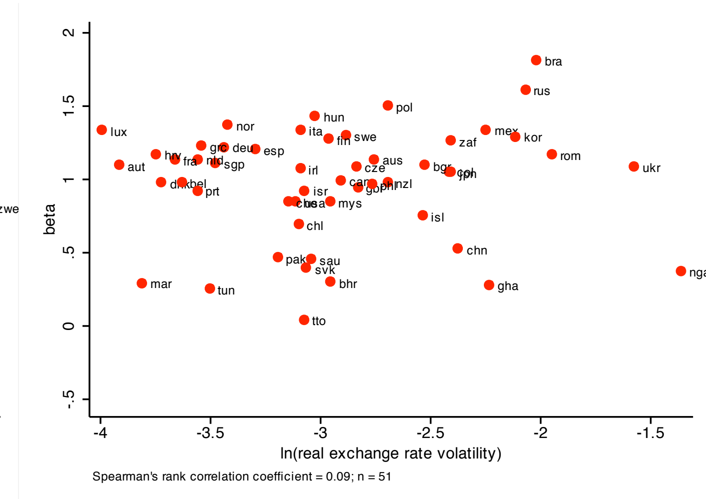


(f)

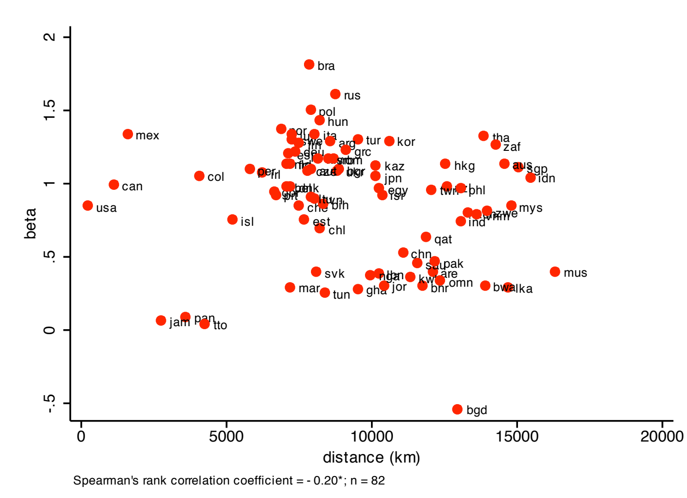
Figure 9 (continued): Betas vs. Covariates over the Cross Section



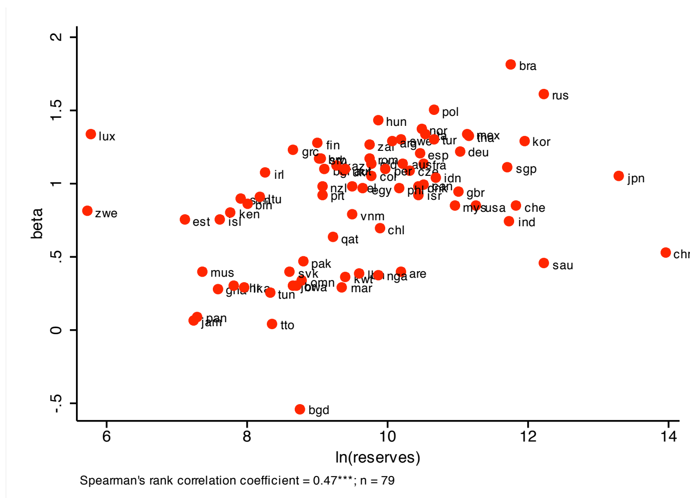
(g)



(h)



(i)



(j)

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Period employed is 1988-2017.

Table 1: Country and Corresponding Stock Market Index Lists

	Developed Countries				Emerging Countries				Frontier Countries		
	Country	Code	BBG Index		Country	Code	BBG Index		Country	Code	BBG Index
1	Australia	AUS	AS52	1	Argentina	ARG	BURCAP	1	Bahrain	BHR	BHSEASI
2	Austria	AUT	ATX	2	Brazil	BRA	IBOV	2	Bangladesh	BGD	DSEX
3	Belgium	BEL	BELPRC	3	Chile	CHL	IGPA	3	Bosnia & Herzegovina	BIH	SASX-10
4	Canada	CAN	SPTSX	4	China (PRC)	CHN	SHCOMP	4	Botswana	BWA	BGSMDC
5	Denmark	DNK	KAX	5	Colombia	COL	COLCAP	5	Bulgaria	BGR	SOFIX
6	Finland	FIN	HEX	6	Czech Republic	CZE	PX	6	Croatia	HRV	CRO
7	France	FRA	CAC	7	Egypt	EGY	EGX30	7	Jamaica	JAM	JMSMX
8	Germany	DEU	DAX	8	Estonia	EST	TALSE	8	Jordan	JOR	JOSMGNFF
9	Iceland	ISL	ICEXI	9	Ghana	GHA	GGSECI	9	Kazakhstan	KAZ	KZKAK
10	Ireland	IRL	ISEQ	10	Greece	GRC	ASE	10	Kenya	KEN	NSEASI
11	Italy	ITA	ITLMS	11	Hong Kong	HKG	HSI	11	Kuwait	KWT	KWSEIDX
12	Japan	JPN	NKY	12	Hungary	HUN	BUX	12	Lebanon	LBN	BLOM
13	Luxembourg	LUX	LUXXX	13	India	IND	SENSEX	13	Lithuania	LTU	VILSE
14	Netherlands	NLD	AEX	14	Indonesia	IDN	JCI	14	Mauritius	MUS	SEMDEX
15	NewZealand	NZL	NZSE	15	Israel	ISR	TA-35	15	Oman	OMN	MSM30
16	Norway	NOR	OSEBX	16	Korea, Rep.	KOR	KOSPI	16	Palestine	PSE	PASISI
17	Portugal	PRT	BVLX	17	Malaysia	MYS	FBMKLCI	17	Panama	PAN	BVPSBVPS
18	Singapore	SGP	STI	18	Mexico	MEX	INMEX	18	Romania	ROM	BET
19	Spain	ESP	IBEX	19	Morocco	MAR	MCSINDEX	19	Serbia	SRB	BELEXLIN
20	Sweden	SWE	OMX	20	Nigeria	NGA	NGSEINDX	20	Trinidad & Tobago	TTO	TTCOMP
21	Switzerland	CHE	SPI	21	Pakistan	PAK	KSE100	21	Tunisia	TUN	TUSISE
22	United Kingdom	GBR	UKX	22	Peru	PER	SPBL25PT	22	Vietnam	VNM	VNINDEX
23	United States	USA	SPX	23	Philippines	PHL	PCOMP	23	Zimbabwe	ZWE	ZHINDUSD
				24	Poland	POL	WIG20				
A	**World Markets**	**WLD**	**MXWD**	25	Qatar	QAT	DSM	**E**	**Frontier Markets**	**FNR**	**MXFM**
B	**Developed Markets**	**DVD**	**MXWO**	26	Russia	RUS	INDEXCF				
C	**Euro Markets**	**EUR**	**MXEM**	27	Saudi Arabia	SAU	SASEIDX				
				28	Slovakia	SVK	SKSM				
				29	Slovenia	SVN	SBITOP				
				30	South Africa	ZAF	JALSH				
				31	Sri Lanka	LKA	CSEALL				
				32	Taiwan	TWN	TWSE				
				33	Thailand	THA	SET50				
				34	Turkey	TUR	XU100				
				35	Ukraine	UKR	PFTS				
				36	UAE	ARE	ADSMI				
				D	**Emerging Markets**	**EMG**	**MXEF**				

Notes: Country classifications are based upon those available from MSCI and Calomiris and Mamaysky (2018). Most countries have a single constant classification over the time interval. For each country we use the classification that fits the country for the majority of the sample period.

Table 2: Cross-Section CAPM Regressions: Long Time Horizons

	(1)	(2)	(3)	(4)
Sample	World	Developed	Emerging	Frontier
A. world portfolio: acwi mxwd				
Beta	0.004***	0.004***	0.005***	0.003
	(0.001)	(0.000)	(0.001)	(0.002)
Constant	0.003***	0.002***	0.004***	0.005***
	(0.000)	(0.000)	(0.001)	(0.001)
Sigma	0.004	0.002	0.004	0.006
R-squared	0.26	0.63	0.34	0.05
Observations	120	47	49	24
Average excess world portfolio return		0.004		
Average risk-free rate		0.001		
B. world portfolio: mxwo				
Beta	0.004***	0.004***	0.005***	0.003
	(0.001)	(0.000)	(0.001)	(0.002)
Constant	0.003***	0.002***	0.004***	0.005***
	(0.000)	(0.000)	(0.001)	(0.001)
Sigma	0.004	0.002	0.004	0.006
R-squared	0.25	0.65	0.33	0.05
Observations	120	46	49	24
Average excess world portfolio return		0.003		
Average risk-free rate		0.001		
C. world portfolio: mxef				
Beta	0.007***	0.006***	0.007***	0.004
	(0.001)	(0.001)	(0.001)	(0.003)
Constant	0.003***	0.002***	0.003***	0.006***
	(0.000)	(0.000)	(0.001)	(0.001)
Sigma	0.004	0.002	0.004	0.006
R-squared	0.32	0.59	0.42	0.06
Observations	120	47	48	24
Average excess world portfolio return		0.008		
Average risk-free rate		0.001		
D. world portfolio: mxfm				
Beta	0.007***	0.006***	0.007***	0.007*
	(0.001)	(0.001)	(0.002)	(0.004)
Constant	0.003***	0.002***	0.003***	0.003*
	(0.000)	(0.000)	(0.001)	(0.002)
Sigma	0.004	0.002	0.004	0.006
R-squared	0.32	0.62	0.29	0.14
Observations	120	47	49	23
Average excess world portfolio return		0.007		
Average risk-free rate		0.000		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses.

Table 3: Cross-Section CAPM Regressions: Short Time Horizons I

Sample	(1) World	(2) Developed	(3) Emerging	(4) Frontier
A. 2013-2017				
Beta	0.004***	0.005***	0.001	0.007*
	(0.001)	(0.001)	(0.002)	(0.004)
Constant	0.001***	0.000**	0.002	0.003*
	(0.001)	(0.000)	(0.002)	(0.002)
Sigma	0.005	0.003	0.006	0.006
R-squared	0.10	0.48	0.01	0.17
Observations	120	47	49	24
Average excess world portfolio return		0.008		
Average risk-free rate		−0.001		
B. 2008-2012				
Beta	−0.004***	−0.004***	−0.002	−0.009**
	(0.001)	(0.001)	(0.002)	(0.004)
Constant	0.002***	0.002***	0.003**	0.002
	(0.001)	(0.000)	(0.001)	(0.003)
Sigma	0.008	0.006	0.008	0.010
R-squared	0.07	0.17	0.02	0.18
Observations	120	47	49	24
Average excess world portfolio return		0.001		
Average risk-free rate		−0.001		
C. 2003-2007				
Beta	0.013***	0.015***	0.012***	0.024***
	(0.001)	(0.001)	(0.002)	(0.005)
Constant	0.010***	0.001**	0.014***	0.018***
	(0.002)	(0.001)	(0.003)	(0.003)
Sigma	0.012	0.004	0.012	0.011
R-squared	0.32	0.82	0.35	0.32
Observations	116	47	48	21
Average excess world portfolio return		0.013		
Average risk-free rate		0.000		
D. 1998-2002				
Beta	−0.002**	−0.004***	−0.000	0.038***
	(0.001)	(0.001)	(0.002)	(0.011)
Constant	0.002**	0.002***	0.003	−0.001
	(0.001)	(0.000)	(0.002)	(0.002)
Sigma			0.009	0.010
R-squared			0.00	0.36
Observations	110	45	46	18
Average excess world portfolio return		−0.004		
Average risk-free rate		0.002		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses. Robust regressions employed where appropriate.

Table 4: Cross-Section CAPM Regressions: Short Time Horizons II

Sample	(1) World	(2) Developed	(3) Emerging	(4) Frontier
E. 1993-1997				
Beta	0.005***	0.008***	−0.012	0.050
	(0.002)	(0.002)	(0.007)	(0.032)
Constant	0.006***	0.005***	0.015***	0.016
	(0.001)	(0.001)	(0.005)	(0.010)
Sigma		0.005	0.020	0.030
R-squared		0.42	0.17	0.34
Observations	86	44	32	10
Average excess world portfolio return		0.008		
Average risk-free rate		0.002		
F. 1988-1992				
Beta	−0.001	−0.003*	−0.001	0.048***
	(0.011)	(0.002)	(0.017)	(0.011)
Constant	0.010**	0.003***	0.026**	0.009
	(0.005)	(0.001)	(0.011)	(0.005)
Sigma	0.024	0.007	0.037	0.011
R-squared	0.002	0.04	0.000	0.42
Observations	63	37	20	6
Average excess world portfolio return		−0.001		
Average risk-free rate		0.002		
G. 1983-1987				
Beta	0.010***	0.010***	0.014	
	(0.002)	(0.002)	(0.022)	
Constant	0.006***	0.005***	0.009	
	(0.001)	(0.001)	(0.013)	
Sigma				
R-squared				
Observations	40	28	10	
Average excess world portfolio return		0.010		
Average risk-free rate		0.004		
H. 1978-1982				
Beta	0.002	−0.000	0.010	
	(0.002)	(0.002)	(0.005)	
Constant	0.001	0.002**	−0.004	
	(0.001)	(0.001)	(0.004)	
Sigma	0.005	0.004	0.007	
R-squared	0.06	0.001	0.42	
Observations	22	16	6	
Average excess world portfolio return		−0.002		
Average risk-free rate		0.001		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses. Robust regressions employed where appropriate.

Table 5: Cross-Section CAPM Regressions: Short Time Horizons III

Sample	(1) World	(2) Developed	(3) Emerging	(4) Frontier
I. 1973-1977				
Beta	−0.004*	−0.007***	−0.007	
	(0.002)	(0.002)	(0.005)	
Constant	0.003*	0.001	0.012	
	(0.002)	(0.001)	(0.008)	
Sigma	0.006		0.010	
R-squared	0.11		0.38	
Observations	19	15	6	
Average excess world portfolio return		−0.007		
Average risk-free rate		−0.001		
J. 1968-1972				
Beta	0.002*	0.002*		
	(0.001)	(0.001)		
Constant	0.002***	0.002***		
	(0.000)	(0.000)		
Sigma				
R-squared				
Observations	18	15		
Average excess world portfolio return		0.004		
Average risk-free rate		0.001		

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses. Robust regressions employed where appropriate.

Table 6: Systematic Risks: Long Time Horizons

Equity	(1) World	(2) Developed	(3) Emerging	(4) Frontier	(5) Test of Equality
A. world portfolio: acwi mxwd					
mean	0.87	1.08	0.94	0.54	0.000
median	0.96	1.09	0.96	0.39	0.000
observations	86	25	37	24	86
B. world portfolio: dm mxwo					
mean	0.85	1.09	0.90	0.55	0.000
median	0.95	1.09	0.92	0.38	0.000
observations	86	24	37	24	85
C. world portfolio: em mxef					
mean	0.58	0.60	0.72	0.36	0.000
median	0.58	0.59	0.75	0.25	0.007
observations	86	25	36	24	85
D. world portfolio: fm mxfm					
mean	0.67	0.68	0.72	0.58	0.127
median	0.70	0.69	0.71	0.61	0.252
observations	86	25	37	23	85

Notes: P-values reported for tests of equality in column (5). F*-test used for test of equal sub-group means. Mood's median test used for test of equal sub-group medians. In corresponding order, panels A, B, C and D pertain to the time intervals 1988-2017, 1968-2017, 1988-2017 and 2002-2017 respectively.

Table 7: Systematic Risks: Short Time Horizons

Equity	(1) World	(2) Developed	(3) Emerging	(4) Frontier	(5) Test of Equality
A. 2013-2017					
mean	0.82	1.11	0.88	0.42	0.000
median	0.87	1.12	0.87	0.44	0.000
observations	86	25	37	24	86
B. 2008-2012					
mean	1.05	1.22	1.10	0.77	0.001
median	1.14	1.30	1.14	0.72	0.014
observations	86	25	37	24	86
C. 2003-2007					
mean	0.92	1.14	1.06	0.41	0.000
median	0.96	1.18	1.19	0.37	0.000
observations	82	25	36	21	82
D. 1998-2002					
mean	0.70	0.93	0.84	0.14	0.000
median	0.70	0.97	0.75	0.10	0.000
observations	77	24	35	18	77
E. 1993-1997					
mean	0.70	0.89	0.85	−0.13	0.000
median	0.77	0.88	0.85	−0.01	0.002
observations	61	22	29	10	61
F. 1988-1992					
mean	0.52	0.89	0.36	−0.04	0.001
median	0.62	0.88	0.55	−0.00	0.004
observations	42	17	19	6	42
G. 1983-1987					
mean	0.67	0.90	0.46	0.14	0.002
median	0.85	0.94	0.39	0.14	0.014
observations	24	13	9	2	24
H. 1978-1982					
mean	0.78	0.99	0.61		0.201
median	0.80	0.90	0.44		0.294
observations	9	4	5	0	9
I. 1973-1977					
mean	0.83	0.85	0.80		0.946
median	0.79	0.84	0.66		0.270
observations	7	4	3	0	7
J. 1968-1972					
mean	0.73	0.92	0.36		0.132
median	0.79	0.97	0.36		0.083
observations	6	4	2	0	6
Test of Equality Over Time					
means	0.000	0.000	0.014	0.000	
medians	0.006	0.003	0.005	0.000	
1968-2017, panel over 5-year intervals					
mean	0.81	1.02	0.86	0.36	0.000
median	0.86	1.01	0.86	0.30	0.000
observations	479	163	212	104	479

Notes: P-values reported for tests of equality in column (5) and *Test of Equality Over Time*. F*-test used for test of equal sub-group/period means. Mood's median test used for test of equal sub-group/period medians.

Table 8: 5-Year Panel Regressions

world portfolio:	acwi mxwd			dm mxwo		
	(1) Fixed Effects	(2) Pooled OLS I	(3) Pooled OLS II	(4) Fixed Effects	(5) Pooled OLS I	(6) Pooled OLS II
A.						
financial openness	0.216***	−0.019	−0.006	0.210***	−0.012	0.010
	(0.069)	(0.042)	(0.042)	(0.080)	(0.040)	(0.040)
trade openness	0.877**	0.067	0.133	0.783**	0.084	0.160*
	(0.378)	(0.098)	(0.104)	(0.387)	(0.095)	(0.100)
market cap.	0.150**	0.074**	0.084**	0.177**	0.092***	0.112***
	(0.075)	(0.038)	(0.041)	(0.077)	(0.035)	(0.037)
relative gdp	0.552*	0.151***	0.148***	0.564**	0.147***	0.134***
	(0.323)	(0.026)	(0.025)	(0.283)	(0.025)	(0.024)
reserves	−1.207*	−0.135	−0.095	−1.286*	−0.168	−0.113
	(0.701)	(0.157)	(0.154)	(0.688)	(0.161)	(0.158)
exchange rate vol. I	−0.019	0.050***	0.047***	−0.024	0.047***	0.044***
	(0.054)	(0.019)	(0.016)	(0.050)	(0.018)	(0.015)
Time dummies	yes	yes	no	yes	yes	no
Within R-squared	0.38			0.41		
Between R-squared	0.25			0.27		
Overall R-squared	0.16	0.33	0.22	0.17	0.35	0.22
B.						
financial openness	0.340*	−0.031	0.008	0.429**	−0.022	0.016
	(0.210)	(0.055)	(0.052)	(0.214)	(0.055)	(0.051)
trade openness	0.791**	0.196*	0.232**	0.556*	0.208**	0.249**
	(0.331)	(0.110)	(0.110)	(0.326)	(0.108)	(0.109)
market cap.	0.145*	0.093**	0.072*	0.160*	0.097***	0.076*
	(0.089)	(0.041)	(0.043)	(0.088)	(0.038)	(0.041)
relative gdp	0.878***	0.109***	0.138***	0.813***	0.111***	0.143***
	(0.255)	(0.033)	(0.031)	(0.275)	(0.033)	(0.031)
reserves	−0.444	−0.598***	−0.397**	−0.418	−0.644***	−0.423**
	(0.686)	(0.199)	(0.191)	(0.688)	(0.193)	(0.190)
exchange rate vol. II	0.095**	0.145**	0.145**	0.117**	0.135**	0.133**
	(0.050)	(0.062)	(0.063)	(0.053)	(0.059)	(0.059)
Time dummies	yes	yes	no	yes	yes	no
Within R-squared	0.48			0.48		
Between R-squared	0.19			0.21		
Overall R-squared	0.12	0.29	0.21	0.12	0.31	0.23

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses. Dependent variable is the national stock market beta. Exchange rate vol. I (II) is nominal (real) exchange rate volatility.