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JEL Classification: G12, G17, G01

Keywords: Financial Stability, monetary policy, Fiscal policy, regulatory policy

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Global Price of Risk and Stabilization Policies

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1 Introduction

The global price of risk impacts financial conditions around the world. While integration into world capital markets can fuel growth, it can also lead to increased volatility by exposing countries to fluctuations in the global price of risk. Therefore, there is the potential for a risk-return tradeoff: higher world capital market integration potentially increases both risk and growth. Such a tradeoff, if it exists, has implications for the conduct of economic stabilization policies.

In this paper, we document that countries' exposure to the global price of risk does indeed correspond to increased growth and increased volatility. Furthermore, we find evidence that interactions between the global price of risk and stabilization policies impact macroeconomic and financial stability. We quantify the degree to which monetary, fiscal, and prudential policies interact with the global price of risk to influence economic outcomes across countries. We uncover a risk-return tradeoff in growth and stability that is cross sectionally related to a country's exposure to the pricing of risk, and which is tilted by the conduct of monetary, fiscal, and prudential policy. While the positive risk-return tradeoff has been studied by Rancière, Tornell, and Westermann (2008), documenting the link to the global price of risk is new to the literature.

Our estimation of the global price of risk is motivated by the observation that intermediaries play a key role in the global propagation of shocks. Financial institutions including global banks and asset managers intermediate capital allocations across the world. However, global intermediaries are subject to various regulatory and risk management constraints. Intermediary asset pricing theories suggest that for global institutions, a key state variable measuring the tightness of financial conditions around the world is the VIX, which captures equity market volatility in the US. Empirically, it is indeed the case that global banks' VaR constraints, global capital flows, global credit growth, and global asset prices comove tightly with the VIX (see Rey (2015) and Figure 1). Longstaff, Pan, Pedersen, and Singleton (2011) estimate that the price of sovereign risk correlates strongly with the VIX; along similar lines, Adrian, Crump, and Vogt (2018) show that risk premia in US equity and Treasury markets are nonlinear functions of the VIX. We build on the logic of this literature and measure the impact of the global price of risk on economic outcomes across countries.

We estimate the global price of risk by forecasting returns with an unknown, nonlinear function of the VIX (Adrian, Crump, and Vogt (2018)). The nonlinearity of this forecasting relationship is consistent with equilibrium pricing models that feature intermediaries with VaR constraints. Such models generate highly nonlinear equilibrium asset pricing kernels that can be expressed as a function of market volatility (Adrian and Boyarchenko (2012)). We adopt a nonparametric approach, which leaves us agnostic about the particular shape and degree of the nonlinearity. Each countries' stock and bond returns have a loading on the global price of risk variable (i.e. the nonlinear transformation of the VIX) measuring the countries' degree of riskiness or safeness. For example, US Treasuries have a negative exposure to the global price of risk, suggesting declining compensation for bearing risk when the VIX is high, whereas equity returns have positive exposures.

To set the stage for our macroeconomic study, we start with a time series investigation. We run a panel vector autoregression that includes output gaps, inflation rates, short rates, the global price of risk, and equity market returns. The VAR features highly significant, economically large interactions between the global price of risk and the country specific macroeconomic and financial variables: an increase in the global price of risk forecasts a large contraction in the output, short rates, and stock markets. Shocks to the country specific macro and financial variables, particularly the output gap, also forecast the global price of risk. Consistent with the findings of Bekaert, Hoerova, and Duca (2013) and Miranda-Agrippino and Rey (2014), we observe significant interactions between the short rate and global price of risk, pointing towards a risk taking channel of monetary policy.

We next turn to our main analysis, which is cross sectional. We start by investigating the cross country relationships between macroeconomic outcomes and country exposures to the global price of risk. We uncover a strongly significant risk return tradeoff: higher country exposure to the global price of risk relates positively to both macroeconomic risk and growth. This finding holds for a variety of relevant aggregates, including average GDP growth and GDP growth volatility, credit growth and post crisis nonperforming loans, and pre crisis output gains and post crisis output losses. The cross sectional R^2s are large (between 50 and 64 percent), and the economic magnitudes of the coefficients are sizable.

To our knowledge, we are the first to document such a *positive* risk-return tradeoff systematically. Rancière, Tornell, and Westermann (2008) present a theory of a positive risk return tradeoff and motivating evidence, but do not make the connection to the global price of risk. Ramey and Ramey (1995) and Acemoglu, Johnson, Robinson, and Thaicharoen (2003) document a *negative* relationship between volatility and growth. These contrasting findings depend primarily on the set of countries under study, and the time period. We focus on a set of countries for which we can obtain stock and bond excess returns, which includes developed countries and fairly advanced emerging markets. Furthermore, we only study data since 1995, when long term bond excess return data across countries is available.

We then analyze stabilization policies. We estimate Taylor rules by regressing the short rate of each country on the output gap, the inflation rate, and real effective exchange rate appreciation, and we recover the Taylor rule coefficients. Larger Taylor rule coefficients on output and inflation indicate more aggressive monetary stabilization. For fiscal policy, we compute the correlation between the output gap and the fraction of government spending to GDP. More negative correlations indicate greater counter cyclicality of fiscal spending. We also use a macroprudential policy index from Cerutti, Claessens, and Laeven (2015), and the index of capital controls by Fernández, Klein, Rebucci, Schindler, and Uribe (2015). These indicators of stabilization policies are strongly correlated with cross-country exposures to the global price of risk.

An important contribution of our paper concerns the interrelations between global price of risk exposures, stabilization policies, and countries' risk-return tradeoffs. In our basic specification, we regress country-level measures of risk (e.g., growth volatility) on a corresponding measure of return (e.g. average growth), as well as interactions between return and global price of risk exposure, return and policy parameters, and triple interactions of return, global price of risk exposure, and policy parameters. This empirical approach documents that the risk-return tradeoff is steepened by exposure to the global price of risk, and flattened by more aggressive countercyclicality of stabilization policies. This finding holds for various measures of risk and return (e.g. GDP growth and volatility, inflation and inflation volatility, credit growth and credit volatility, etc) as well as for the various stabilization policies (monetary policy aggressiveness, fiscal policy countercyclicality, and macroprudential policy). We also investigate capital controls, but do not find a significant impact on the macro risk return tradeoff.

We draw two conclusions. First, risk and return should be considered jointly when considering stabilization policy tradeoffs. Second, country exposures to the global price of risk interact with monetary, fiscal, and prudential stabilization policies. These stylized facts can be used as a basis for macro-financial modeling, to better asses the role of economic policies in such settings. Unfortunately, our results cannot establish causal economic mechanisms, an endeavor that we leave to future research.

1.1 Outline

The remainder of the paper is organized as follows. In Section 2, we estimate the global price of risk and present dynamic interactions with macroeconomic variables. Section 3 documents the risk-return tradeoff: countries that have higher exposure to the global price of risk tend to grow faster, but also tend to be more volatile. In section 4, we show that monetary, fiscal, and prudential stabilization policies tilt the risk-return tradeoff favorably. We conclude in section 5. The Appendix A presents a model for the pricing of risk and provides details on the data. A supplementary appendix provides additional results.

2 Estimating the Global Price of Risk

2.1 Theoretical Motivation

Our central conjecture is that macroeconomic outcomes are related to local capital markets' exposures to the global price of risk. This section describes our approach for jointly estimating the global price of risk as well as individual country exposures to it. The approach is motivated by asset pricing theories that implicitly define prices of risk as common predictors of excess returns (Adrian, Crump, and Moench (2014)). More concretely, the absence of arbitrage generically gives rise to decompositions of expected returns into risk exposures that vary cross-sectionally and a common price of risk,

$$E_t[r^c_{t+h}] = \beta^c_t \, \phi_t, \tag{2.1}$$

where r^c_{t+h} measures the $t+h$ period ahead excess return of an asset in country $c = 1, \ldots, N$.

In Appendix A, we present a model in which (2.1) arises naturally from the Euler equations of financial intermediaries that optimally allocate capital subject to a value-at-risk constraint. In that model, β^c_t reflects asset c's covariance with the return on the global wealth portfolio, and ϕ_t is a function of both the tightness of intermediaries' value-at-risk constraints and aggregate market volatility. We refer to ϕ_t as the global price of risk, since it reflects the compensation that intermediaries earn in excess of the risk-free rate for holding assets that increase their exposure to systematic market risk, $\phi_t = \partial E_t[r^c_{t+h}]/\partial \beta^c_t$.

To obtain estimates of the global price of risk, we restrict (2.1) in two ways. First, we assume that the time variation in expected returns is driven primarily through the price of risk, allowing us to set $\beta^c_t = \beta^c$. Second, motivated by the empirical relationship between bank value-at-risks and aggregate market volatility as proxied by the VIX (Figure 1), we impose the testable hypothesis that $\phi_t = \phi(vix_t)$ for some unknown function $\phi(\cdot)$. Thus, the version of (2.1) we take to the data is

$$r^c_{t+h} = a^c + b^c \phi\left(vix_t\right) + \eta^c_{t+h}, \qquad c = 1, \ldots, N. \tag{2.2}$$

Visual inspection of equations (2.2) and (2.1) suggests that $\phi(vix_t)$ captures salient features of the price of risk ϕ_t if it (a) jointly forecasts returns across global assets, and (b) if the slopes b^c cross-sectionally resemble asset pricing betas to the global wealth portfolio.

2.2 Empirical Implementation

To assess whether $\phi(vix_t)$ has joint predictive power for global asset returns, we estimate (2.2) via sieve reduced rank (SRR) regressions (Adrian, Crump, and Vogt (2018)). SRR regressions accommodate the fact that as a price of risk, $\phi(vix_t)$ is a common right-hand side variable in equations $c = 1, \ldots, N$, which implies certain rank restrictions during estimation. At the same time, they remain agnostic about the functional form of $\phi(\cdot)$ by allowing the cross-section and time-series of returns to identify its shape. This flexibility is achieved via the method of sieves, a class of nonparametric estimators that rely on constructing functional approximations to the true object of interest.[1] Specifically, the method of sieves involves basis function approximations to the unknown function $\phi(\cdot)$ that grow slowly with the sample size. A prototypical approximation for $\phi(\cdot)$ then is a linear combination $\tilde{\phi}(v) = \sum_{j=1}^{m_T} \tilde{\gamma}_j B_j(v)$, where $B_j(v)$ are the basis functions. As the sample size grows ($T \to \infty$), the number of basis functions must increase slowly ($m_T \to \infty$), allowing ever-increasing flexibility in approximating the true ϕ. Asymptotically, the basis function approximations $\tilde{\phi}(\cdot)$ become arbitrarily flexible and close to $\phi(\cdot)$ in the sense formalized in Adrian, Crump, and Vogt (2018).[2]

Our data set consists of monthly end-of-month equity market index returns from 30 coun-

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[1] For an overview of sieves, see Chen (2007).

[2] There is a scale indeterminacy that results from premultiplying the basis function coefficients γ_j with the loadings b^c. We choose the convenient normalization that $b^1 = 1$, giving ϕ the interpretation as the global equity market risk premium.

tries, 10-year sovereign bond returns from the same 30 countries, plus a global equity market index return, for a total of 61 asset returns. Bond returns are constructed by interpolating each country's zero coupon yield curve to the 10-year point at month t and to the 9-year 11-month point at time $t+1$, reflecting the returns to a trading strategy in which every month a 10-year bond is purchased and subsequently resold as a 9-year 11-month bond. All stock and bond returns are converted to USD, and excess returns are with respect to the US 3-month Treasury rate, reflecting the financing costs of global financial intermediaries that obtain short-term funding in USD markets. Finally, multi-period returns are continuously compounded and annualized, that is, $r^c_{t+h} \equiv (12/h)[\tilde{r}^c_{t+1} + \cdots + \tilde{r}^c_{t+h}]$, where $\tilde{r}^c_t$ is the one-month USD excess return for asset c. The sample runs from 1995 to 2014.[3]

Table 1 shows the SRR estimation results of (2.2) on our panel of stock and bond returns. The rows of the table describe the assets used in our panel estimation, so that $c = 1$ denotes the global equity market excess return, $c = 2, \ldots, 31$ correspond to the international equity market excess returns, and $c = 32, \ldots, 61$ denote the sovereign bond excess returns. The left half of the table shows point estimates for an $h = 6$ month forecast horizon, and the right panel shows estimates for an $h = 12$ month forecast horizon. Within each panel, we report estimated intercepts and loadings $\hat{b}^c$ for two separate specifications: the first specification imposes linearity on $\phi(vix_t) = vix_t$ as a baseline, and the second specification allows $\phi(vix_t)$ to assume a general nonlinear shape.

The table implies several main findings. First, the majority of excess returns of these 61 global assets load significantly on $\phi(vix_t)$, suggesting that it is a strong common predictor of global asset returns. The predictability of $\phi(vix_t)$ is statistically strongest for equities and appears weaker for bonds at the $h = 6$ horizon. Second, nonlinearities matter: In all of the specifications, we fail to establish evidence that the VIX on its own can jointly predict excess returns in a linear fashion. Third, all equity indices and most of the sovereign bonds load positively on $\phi(vix_t)$, but a few sovereign bonds have negative loadings. For these bonds,

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[3] Further details about the data set can be found in Appendix B.

which consist of the US, Japan, and Hong Kong, investors appear to earn a negative risk premium. We discuss this negative risk premium and its interpretation below.

Next, we turn to investigating whether the SRR estimated loadings $\hat{b}^c$ are related to the betas β_c of the global wealth portfolio, which we proxy with the global equity market index. Figure 2 shows a scatter plot of 61 SRR estimated $\hat{b}^c$s against global market betas $\hat{\beta}^c$. The plot reveals a strong positive relationship between SRR loadings and betas, with a t-statistic in excess of 17 and an R^2 of 84%. The plot also highlights the global equity market, which has an SRR $\hat{b}^c = 1$ imposed via a scale normalization and a beta of one by construction. Additionally, the plot reveals an interesting bifurcation between stocks and bonds. While stocks are largely concentrated in the upper right quadrant (reflecting betas and SRR b^cs in excess of one), bonds are largely concentrated in the lower left quadrant, reflecting smaller covariances with the equity market. We stress that the strong cross-sectional relationship between betas and SRR b^cs is not mechanical: the regressions to obtain equity market betas use *contemporaneous* one month excess returns as left-hand side variables and the global equity market 1-month excess return as the right-hand side variable. By contrast, the SRR regressions use 6-month ahead compounded returns estimated on a lagged nonlinear function of the VIX. Hence the betas and b's come from regressions with different right-hand side variables and different time offsets.

Taken together, the results in this subsection suggest that (a) $\phi(vix_t)$ is a strong common predictor of international stock and bond returns, and (b) the b^c loadings have a strong cross-sectional relationship to global equity market betas. Since both of these conditions define the global price of risk through (2.1) under a time-invariant beta assumption, we conclude that $\phi(vix_t)$ likely represents a good approximation to the global price of risk ϕ_t in (2.1).

2.3 Interpreting the Global Price of Risk

Since $\phi(vix_t)$ and its loadings b^c play a key role in what follows, we briefly explore their properties. We note in particular that since the SRR equations (2.2) leave the functional form $\phi(\cdot)$ unspecified, its shape is determined solely by the lead-lag relationship between international asset returns and the VIX. In other words, SRR estimates of $\phi(\cdot)$ have a shape that is simultaneously informed by the cross-section and time series relationship between global stock and bond returns and the VIX. To visualize this shape, Figure 3 shows the SRR estimated expected excess returns, $\hat{E}_t[r^c_{t+h}] = \hat{a}^c + \hat{b}^c\hat{\phi}\,(vix_t)$, scaled by unconditional return standard deviation to standardize units across assets with naturally different volatilities. Figure 4 plots the time series of the VIX and $\hat{\phi}(vix_t)$ over our sample period.

The shape of the figure features a number key insights. First, the estimated global market excess return $\hat{E}_t[r^1_{t+h}] = \hat{a}^1 + \hat{\phi}(vix_t)$ (black line) is highly nonlinear, consistent with the theories presented in Adrian and Boyarchenko (2012) and Vayanos (2004). Second, all equity market expected excess returns have positive loadings on $\hat{\phi}(vix_t)$ (red lines), with some loadings exceeding the global market's loading of one, indicating high exposure to the global price of risk. Third, most sovereign bond expected excess returns have positive loadings on $\hat{\phi}(vix_t)$, with a handful displaying negative loadings. The negative loadings reveal a flight-to-safety: when the VIX rises above its long-run mean of around 20, expected returns to risky assets increase, while expected returns to certain sovereign bonds decline as their prices are bid up in times of heightened risk aversion. For VIX levels above 50, which occurred exclusively during the 2008 crisis, there is a reversal of expected returns.

The estimation of $\hat{\phi}(vix_t)$ thus confirms the theoretical conjecture that volatility is a driver of expected returns across global stocks and bonds. Furthermore, country exposures b^c to the global price of risk are systematically linked to risk factor exposures as captured by global equity market betas. We will next investigate the extent to which $b^c \cdot \phi(vix_t)$ interacts with macroeconomic variables in a panel VAR, thus extending earlier work by Adrian, Moench, and Shin (2010) and Miranda-Agrippino and Rey (2014) who have used risk appetite estimates in macro VARs.

2.4 Global Price of Risk and Macroeconomic Outcomes

To understand the dynamic interaction of the global price of risk with macroeconomic performance, we estimate a panel vector autoregression on our entire cross-section of 30 countries.[4] We want to understand to what extent the global price of risk interacts with output, inflation, and monetary policy. We employ six state variables in our estimation: output gaps,[5] inflation, policy rates, global price of risk multiplied by each country's risk exposure, and the country specific market return. All of these variables are country specific. The global price of risk enters the VAR as the product of $\phi(vix_t)$, which is the same for all countries but time varying, and country c's exposure b^c, which is different for each country but constant over time. Thus, the state variable $b^c \cdot \phi(vix_t)$ has a cross sectional distribution reflecting the degree to which global pricing of risk impacts each country differently.

To compute impulse response functions, we use a standard Choleski decomposition: state variables are ordered from most to least exogenous (output gap, inflation, policy rate, global price of risk, market return). The ordering of the first three variables are standard in the monetary policy VAR literature: inflation cannot influence the output gap contemporaneously, and the policy rate cannot influence output or inflation contemporaneously. Our fourth set of restrictions implies that the global price of risk can only impact the output gap, inflation, and the policy rate, with a lag. Similarly, the equity market return is restricted to only affect other state variables with a lag. We apply the Bayesian information criterion to select two lags for the VAR.

Estimation results for the panel VAR are reported in Table 2. In the VAR, we find the global price of risk significantly forecasts the policy rate and equity market returns. The global price of risk is in turn significantly forecasted by output gaps (at the one percent

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[4] We use the panel VAR of Holtz-Eakin, Newey, and Rosen (1988) as implemented by Inessa Love and Ryan Decker, available at `http://econweb.umd.edu/~decker/code.html` (see Love and Zicchino (2006) and Fort, Haltiwanger, Jarmin, and Miranda (2013) for applications).

[5] We define the output gap as deviation from a Hodrick and Prescott (1997) filtered trend, where the penalty parameter is chosen to minimize the distance between the our US output gap estimate and the CBO's.

level), inflation (at the ten percent level), the policy rate (at the ten percent level), and equity market returns (at the one percent level). There is therefore evidence of statistically significant interaction between the global price of risk and macroeconomic aggregates. To understand economic magnitudes, we examine the impulse response functions.

Figure 5 plots impulse response functions for all our state variables (with quarters on the x-axis, standard deviations on the y-axis, and bootstrapped 95% confidence bands). The upper left three by three panel of impulse response functions displays traditional monetary policy VAR state variables: output, inflation, and the policy rate. Positive shocks to output increase inflation, and the policy rate moves to counteract shocks to the output gap.

More relevant are the interactions between macroeconomic variables and the global price of risk. As one would expect, we find the price of risk falls in response to positive output and equity market shocks. The response of the price of risk to inflation is weak, and centered around zero, suggesting that inflation is not a significant source of risk in our sample. Conversely, shocks to the global price of risk are followed by prolonged periods of lowered output and inflation, and accommodative monetary policy. These responses are economically large: the response of output, inflation, and the policy rate to a one standard deviation increase in the price of risk peak at around one third, one tenth, and one quarter of a standard deviation, respectively. Consistent with the results of Adrian, Crump, and Vogt (2018), and with our own SRR regression exercises, shocks to the global price of risk are associated with a contemporaneous fall in excess returns, but forecast positive excess returns at longer horizons. Furthermore, after accounting for the role of risk pricing, there is no evidence that the policy rates respond to fluctuations in equity markets.

Our time series results add to a growing literature on the importance of price of risk variables for monetary policy variables. In a U.S. context, Miranda-Agrippino and Rey (2014) find a comparable impact of the VIX on the effective federal funds rate, and additionally show that innovations to the VIX lower banking leverage, domestic credit, and global inflows. Adrian, Moench, and Shin (2010) present similar evidence that the pricing of risk interacts with macroeconomic activity and monetary policy. In another related study, Bekaert, Hoerova, and Duca (2013) find that innovations to risk aversion and uncertainty lower the policy rate and increase jobless claims. We expand on previous studies by explicitly allowing for nonlinearities in the relationship between the pricing of risk and the VIX, as suggested by theory, and by dramatically expanding the cross section of countries under consideration.

Having established the significance of the global price of risk for macro and monetary policy variables in the time series, we next consider the cross section. The cross sectional results contain the main contributions of the paper. While the time series results indicate important linkages between the pricing of risk and macroeconomic aggregates, the cross sectional analysis will allow us to understand the relationship between macroeconomic volatility and growth.

3 Cross-sectional Pricing of Risk and Economic Stability

Our results from the previous section indicate that there is significant interaction between the global price of risk and macroeconomic aggregates in the time series. We next come to the main empirical contribution of our paper, which is to examine the relationships of countries' exposure to the global price of risk and macroeconomic performance across countries. Intuitively, countries might face a tradeoff relative to world market integration. On the one hand, a large literature shows that openness, either measured as openness to trade or openness of the capital account, tends to improve growth (e.g. Frankel and Romer (1999), Bekaert, Harvey, and Lundblad (2005)). On the other hand, a country's openness can increase exposure to shocks to global risk appetite (Buch, Döpke, and Pierdzioch (2005)). Countries might therefore face a risk-return tradeoff, where exposure to global risk appetite might be associated with higher growth, but also greater risk.

To understand the association of countries' exposure to the global price of risk, we present cross-sectional results that link global price of risk exposure to macroeconomic growth and volatility. To do so, we analyze the cross sectional relationship between each country's exposure to the price of risk b^c—estimated from the SRR return forecasting regression (2.2)—and economic and financial stability outcomes across countries. We measure economic and financial performance and stability indicators including GDP growth and GDP volatility, inflation and inflation volatility average returns and downside volatility of each country's stock and bond market return frequency, pre-crisis growth and crisis output losses, credit booms and busts, credit volatility, and the Aizenman, Chinn, and Ito (2008) financial openness index.

3.1 Global Risk in the Cross Section

We begin by examining simple univariate relationships between risk exposure and macro variables. Figures 6 and 7 display a striking cross-sectional relationship between risk loadings and macrofinancial outcomes. Countries with large b^c experience significantly higher macroeconomic returns, specifically in the form of higher average GDP growth, and are also exposed to a variety of macroeconomic and financial risks. The correlations between equity loadings and real GDP growth, GDP growth volatility, and equity market downside volatility are particularly strong, with t-statistics of 6.35, 5.07, and 10.92 respectively, well above conventional significance levels. Equity b^c explain over half the cross-sectional variation in GDP growth rates, and just under half the variation in GDP volatility. The economic effects implied by OLS coefficients are extremely large. To be concrete, consider the equity b^c specification, where estimated exposures lie in the range [0.5, 2.5]. An increase in b^c of 0.2, corresponding to 10% of the observed range, or roughly, the difference between Australia and New Zealand, corresponds to a 0.59% increase in the *average annual growth rate*.

The strong cross sectional correlations between GDP growth and global price of risk exposures b^c, and between GDP volatility and global price of risk exposures b^c for equities is in no way mechanical. The b^c are estimated purely from financial market data, not involving any macroeconomic data. They are driven by the forecasting relationship between the nonlinear forecasting function of the VIX and local stock and bond market returns. To our knowledge, no theoretical work has been conducted that establishes such linkages. What we are measuring is a type of risk-return tradeoff, where increasing exposure to the global price of risk is linked to both higher growth and higher volatility.

Interestingly, the relationships between mean GDP growth and growth volatility, and bond loadings are weakly negative, suggesting the equity and bond loadings contain different information and may be more or less relevant for different macroeconomic risks. In addition to considering the two loadings separately, we also sum the equity and bond b^c, to pool information from the cross-section of stocks and bonds. The combined loadings display a significant, positive relationship with GDP growth and GDP volatility, as well a weaker, but still significantly positive, relationship with inflation and inflation growth. In addition to the aforementioned correlation with equity market downside volatility, b^c loadings are (positively) related to bond market downside volatility, bank credit volatility, and (negatively related to) financial openness.

In Table 3, we regress macroeconomic, banking, and financial market outcomes jointly on the equity and bond b^c. This table lends further support to the notion that equity and bond b^c contain different information about a country's exposure to the global price of risk. Most strikingly, after controlling for equity b^cs, the relationship between bond b^c and GDP growth and volatility is strongly negative and significant. In general, equity loadings appear to contain more information than bond loadings, in the sense that they often drive out the significance of the bond loadings in our multivariate specifications. Notably, inflation volatility and bond market downside volatility are the exception to this rule. In addition to average GDP growth, equity and bond loadings are positively related to credit booms and pre-crisis gains in output.

3.2 Global Risk Exposure and the Risk-Return Tradeoff

In the previous subsection, we relied on statistically strong univariate evidence to argue for the existence of a macro risk-return tradeoff mediated by exposure to the global price of risk. However, it is fair to ask: what is the "raw" correlation between macroeconomic risk and return, and does b^c still play a role after accounting for that relationship? To answer this questions, we run regressions of the form

$$\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 b^c + \varepsilon_c \tag{3.1}$$

where σ_c represents various macroeconomic risks (GDP growth volatility, crisis peak nonperforming loans (NPL), etc.) and r_c represents the corresponding macroeconomic return (average GDP growth, credit boom, etc.). Depending on the macrofinancial variable under consideration, we use equity loadings, bond loadings, or the sum of equity and bond loadings for the b^c.[6]

Our results are displayed in Table 4. In each specification, column (1) reports the raw risk-return tradeoff and column (2) adds the relevant b^c, to see whether the macroeconomic risks are primarily driven by macroeconomic returns, or exposure to the global price of risk. Our results suggest that exposure to the global price of risk plays a role for a majority of the outcomes we consider. For GDP growth, adding b^c to the regression drives out the significance of average growth, and substantially improves the R^2. Neither equity nor bond market downside volatility are significantly related to average returns, but both have a strong positive relationship to b^c; on the other hand, peak nonperforming loans is related to both credit booms and b^c, and both inflation and bank credit volatility are unrelated to b^c after controlling for average inflation and bank credit. The units for GDP, inflation, bank credit, and equity and bond markets are all annualized percentage points, while crisis NPL is expressed as a percentage of all loans outstanding. However, given the sensitivity of our point estimates to model specification, we caution the reader not to read too much into the coefficient magnitudes.

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[6] Specifically, we use equity loadings for the GDP and equity market regressions, bond loadings for the inflation and bond market regressions, and the sum of equity and bond loadings for both credit regressions. These choices were dictated largely by the results in Table 3, which suggests that for some outcomes, the risk-return tradeoff is primarily related to either equity or bond loadings, whereas in others, both loadings appear to contain similar information.

These results are again, to the best of our knowledge, entirely new to the literature. In particular, we note the strength of the GDP regression. 37 percent of GDP volatility across countries is explained by GDP growth, and adding the b^c variables brings the explanatory power up to 51 percent. These results suggest that the risk-return tradeoff is a notable consideration in analyzing growth. Furthermore, the regressions show that exposure to the global financial cycle plays into the macro risk-return tradeoff.

3.3 Re-Examining the Cross-Section of Growth and Volatility

In influential work, Ramey and Ramey (1995) document a negative relationship between GDP growth and GDP volatility, which appears at odds with our findings here. We thus present further analysis of the risk-return tradeoff across different subsets of countries and different time periods to reconcile our findings with those by Ramey and Ramey (1995). As Ramey and Ramey (1995) show that their results do not depend on control variables, we focus here on univariate relationships.

Table 5 presents the relationship growth and volatility for two different time periods, 1962–1985 and 1986–2011, with the earlier period corresponding to the sample of Ramey and Ramey (1995) and the later one to our sample. We investigate both samples for four sets of countries, the universe of countries from the Penn World Tables (PWT, version 8.1), the 90 countries investigates by Ramey and Ramey (1995)[7], the OECD[8] countries (also investigated by Ramey and Ramey (1995)), and the 30 countries that represent the baseline for our study.

The results in the table are revealing along two dimensions. We note the positive risk-return tradeoff only in our sample and the OECD sample. Furthermore, while this tradeoff is positive in both the earlier and later time periods, it becomes both larger and more

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[7] Because of data limitations, there are some inconsistencies between our sample and Ramey and Ramey (1995). In particular, our sample does not include Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia, or Slovenia (formerly Yugoslavia), the Democratic Republic of the Congo (formerly Zaire), or Myanmar (formerly Burma), to insure consistency across the two time periods we examine.

[8] We use the list of countries that were members of the OECD as of 1995.

significant in the more recent period. We confirm the negative relationship between growth and volatility for the whole sample of PWT countries, and for the Ramey and Ramey (1995) sample. We conjecture that this difference in sign is related to the increased importance of international capital flows, which provide countries with opportunities to grow faster at the cost of larger macroeconomic risks, and which are most relevant for the middle income countries in our sample. These countries are both stable enough to attract international capital, and poor enough for the returns to capital to be quite high.

3.4 Discussion of the Macro Risk-Return Tradeoff

Our key empirical finding in the cross section of countries is that of a positive risk-return relationship. Countries that have higher exposure to the global price of risk tend to grow faster, but also tend to be more volatile. The positive risk return tradeoff has been modeled by Rancière, Tornell, and Westermann (2008) in a domestic context, where countries' fast endogenous growth is associated with larger downside risk. However, that mechanism does not offer a role for the exposure to the global financial cycle.

Giovanni and Levchenko (2009) study the relationship between trade openness and volatility, documenting that sectors that are more open to international trade are more volatile. Furthermore, trade is accompanied by increased specialization which leads to increased aggregate volatility. The relationship between trade openness and overall volatility that Giovanni and Levchenko (2009) document is thus positive and economically significant. Furthermore, Frankel and Romer (1999) show a positive relationship between trade and growth. Hence these two strands of the literature indirectly establish a positive link between growth and volatility, via trade. Of course, trade openness is only one possible source of countries' exposure to the global price of risk.

Our results also point towards a very different channel than the one studied by Acemoglu and Zilibotti (1997), who also consider the link between growth and risk. Using a different set of countries and a different time period, those authors show that higher income tends to be associated with lower subsequent output volatility. They develop a theory of market incompleteness, where economic development goes hand in hand with financial development. Hence growth can only be achieved when markets are becoming more complete, thus generating a positive relationship between growth and volatility. However, there is no role for the global pricing of risk in the theory of Acemoglu and Zilibotti (1997).

Obstfeld (1994) models the interaction of financial integration and endogenous growth in an international context. In his setting, countries can achieve higher growth rates by making riskier investments. Financial integration typically increases countries' growth rates, especially for emerging markets, but this increase in growth comes from an increased willingness to allocate capital to risky investments, which in turn is due to a reduction in the variation of the risky return from portfolio diversification. While there is a risk-return tradeoff by assumption, financial integration reduces risk due to diversification, whereas our results on the global financial cycle suggest risk may actually be amplified.

4 Stabilization Policies and the Risk-Return Tradeoff

Having established the strong explanatory power of exposure to the global price of risk for the positive relationship between macroeconomic risk and growth across countries, we now turn to the interaction between stabilization policy and the risk-return tradeoff. We want to understand to what extent monetary, fiscal, and macroprudential policies impact the interaction between the risk-return tradeoff and the global price of risk.

Stabilization policies aim at minimizing the volatility of macroeconomic aggregates such as GDP, inflation, or credit-to-GDP around a trend. They are thus not targeting long run growth, but rather short run growth around longer term trends. Our previous results, however, indicate that economic stability might interact with longer term growth rates. This is an unusual and intriguing result that has received little attention outside of the endogenous growth literature with incomplete risk sharing discussed above.

We conjecture that more aggressive stabilization policies can mitigate the positive correlation between risk and growth, thus reducing the impact of the global price of risk on domestic stability while preserving the positive impact of openness on growth. If that conjecture is true, it would suggest that monetary, fiscal, and macroprudential policies should be considered jointly, taking their interaction of the pricing of risk on both stability and growth into account.

4.1 Quantifying Stabilization Policies

Following an extensive monetary policy literature, we assume that the risk free rate in each country r_t^f is determined according to a Taylor rule (Taylor (1993, 1999), Woodford (2001)). For each country, we estimate a Taylor rule empirically in the following manner:

$$r_t^f = \delta_0 + \delta^{output} \left(y_t - \bar{y}_t \right) + \delta^{infl} \left(\pi_t \right) + \delta^{exch} \left(a_t \right) + \varepsilon_t^M \tag{4.1}$$

where $y_{t+1} - \bar{y}_t$ is the output gap, π is inflation, a is appreciation of real effective exchange rate, and ε_t^M is the Taylor rule residual, capturing variation in the risk free rate of each country orthogonal to the output gap, inflation, and exchange rate fluctuations. Relative to the classic Taylor rule, we also include the response of the monetary authority to fluctuations in the exchange rate to account for our international setting (see Taylor (2001) for an overview). Taylor rule coefficients $\delta^{output}, \delta^{infl}$ measure the dependence of each countries' risk free rate on the output gap and on inflation, respectively.

Estimates of the Taylor rule coefficients are provided in Table 6. While most coefficients are positive, a number of countries have coefficients that are statistically indistinguishable from zero, and some have significantly negative coefficients, implying acyclical or even procyclical monetary policy. The vast majority or countries with negative output gap coefficients are European. An interesting pattern emerges: peripheral European countries (Czech Republic, Spain, Ireland, Poland, and Portugal) tend to have negative output gap coefficients, while central/northern European countries (Austria, Belgium, Switzerland, Germany, Finland, France, the Netherlands, and Norway) generally have significant, large, positive coefficients. This suggests that monetary authorities in Europe tend to set interest rate policy in a way that is more closely aligned with the economics of the northern economies rather than the southern / peripheral economies. Indeed, Clarida, Galı, and Gertler (1998) report that the largest European economies (Germany, France, and Italy) pursued an implicit inflation targeting regime, with German monetary authorities taking the lead, even before European Monetary Union. Of course, much of our sample includes the European Monetary Union which implies that monetary policy is set for the Union as a whole. This appears to be detrimental to the periphery. However, it is worth noting that some countries that are outside the Euro area also exhibit $\delta^{output} < 0$ (Poland and the Czech Republic), while Switzerland and Denmark have $\delta^{output} > 0$. These results are reflective of these countries' exchange rate management relative to the Euro. South Africa also has a statistically significant and economically large negative coefficient of $\delta^{output} = -.56$.

Just as we summed the equity and bond b^c to measure a country's overall exposure to the global price of risk, we also take the sum of δ^{output} and δ^{infl}, to estimate total monetary policy aggressiveness. Figure 8 relates Taylor Rule coefficients to combined global risk exposure b^c. We find that δ^{output} contains the most information orthogonal to that contained in the b^c's, motivating our choice of the coefficient on the output gap as our preferred measure of a country's monetary policy stance.

We also estimate the countercyclicality of fiscal policy as the correlation between the output gap and government spending as a fraction of GDP:

$$\phi_g = \frac{cov(y_t - \bar{y}_t, g_t)}{\sigma_{y_t - \bar{y}_t}\sigma_{g_t}} \tag{4.2}$$

where $y_t - \bar{y}_t$ denotes the output gap and g_t is government spending as a fraction of GDP. As displayed in Table 6, almost every country in our sample has a strong, negative value for ϕ_g, implying a substantial amount of countercyclicality. Only Portugal, Taiwan, and the U.K. have positive estimates, indicating fiscal retrenchment during economic downturns. Additionally, we calculate the time-series average of (government spending/GDP) for each country in our sample, to get an estimate of the steady-state size of government.

A third macro policy variable is an index of prudential policies aimed at financial institutions, described in Cerutti, Claessens, and Laeven (2015). These authors catalogue a vast array of prudential policies employed by both emerging markets and advanced economies over the 2000 - 2013 period. These policies include exchange rate and capital controls, and restrictions on borrowers, as well as restrictions on financial institutions. Because our focus is on global risk transfers through global banks, we focus on the latter regulations, which include dynamic loan-loss provisions, countercyclical capital buffer requirements, leverage ratios, SIFI surcharges, limits on interbank exposures and foreign currency exposures, concentration limits, reserve requirements, taxes on financial institutions and activities, and direct limits on credit growth. Each of these prudential variables is coded as a 0-1 dummy, and their sum within a given country and year is the financial-institution targeted macro prudential index. We take the time series average of this index as our measure of macroprudential policies across countries, normalizing by the U.S. index average to make the measure interpretable. Anticipating our results on the macro risk-return tradeoff, the authors find that countries with more aggressive macroprudential policies have some success managing financial cycles, though at the cost of lower overall credit growth. Average values for the macroprudential index can also be found in Table 6.

4.2 Stabilization Policies and the Global Price of Risk

The macroeconomic stabilization polices identified above turn out to be strongly correlated with our estimated global price of risk exposures. Figure 8 shows that the stance of monetary policy, measured as either the Taylor Rule coefficient on inflation, the coefficient on output, or as the total Taylor Rule aggressiveness, is strongly negatively correlated with risk exposure, measured as the sum of equity and bond b^c. In Table 7 we consider regressions of Taylor Rule coefficients, as well as other policy variables, on equity, bond, and summed b^c separately. Here we can see that δ^{infl} is strongly related to stock b^c. Beyond Taylor Rule coefficients, we see that fiscal policy variables are negatively related to stock b^c, but positively related to bond b^c, while macroprudential variables are negatively related to stock, bond, and combined b^c.

We also examine three government reactions to crises, taken from Laeven and Valencia (2012): gross fiscal outlays used to restructure the financial sector; amount of liquidity provided during the crisis; and the change in the monetary base between its peak during the crisis and its pre-crisis level. Both fiscal bailouts and liquidity injections are consistently positively related to global risk exposure, while monetary expansion is negatively related. A number of alternative explanations could account for these patterns of correlations in the data: countries with high risk exposures may be more likely to experience crises, which in turn necessitate bailouts and liquidity provision. Alternatively, implicit government guarantees could result in greater risk-taking, measured as a higher b^c. Either way, countries with higher exposure to global risk also tend to have smaller monetary expansions during crises.

In the next subsection, we directly take up the issue of whether stabilization policies can tilt the risk-return tradeoff: allowing countries the benefits of exposure to the global financial cycle, while mitigating some of the risks. Our focus will be on *systematic, pro-active* policies, including monetary, fiscal, and macroprudential policy, rather than on reactions to crises which have already materialized.

4.3 Stabilization Policies Tilt the Risk-Return Tradeoff

We next show that more aggressive monetary, fiscal, or macroprudential policies tend to tilt the risk-return tradeoff favorably, attenuating (in a regression sense) the impact of exposure to the global price of risk on macroeconomic volatility (see Figure 9 for a graphical representation of this mechanism). We examine the same set of outcomes discussed in Section 3 and displayed in Table 4. Results for monetary, fiscal, and macroprudential policy are displayed in Tables 8, 9, and 10, respectively. In each case, we report results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is

$$\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 (r_c \cdot b^c) + \gamma_3 (r_c \cdot p_c) + \gamma_4 (r_c \cdot b^c \cdot p_c) + \varepsilon_c, \tag{4.3}$$

where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and p_c denotes country c's policy stance. We are interested in the partial effect

$$\frac{\partial \sigma_c}{\partial r_c} = \gamma_1 + \gamma_2 b^c + \gamma_3 p_c + \gamma_4 (b^c \cdot p_c) \tag{4.4}$$

which captures the slope of the risk-return tradeoff, mediated by global risk exposure b and stabilization policy p. Our results for GDP growth show that countercyclical monetary and fiscal policy mitigate the risk-return tradeoff, and that they do so primarily through their interaction with the exposure to global price of risk. There is also weaker evidence that macroprudential policy can have this affect as well. Interestingly, inflation volatility is most strongly related to macroprudential policy, and is only weakly related to monetary and fiscal policy, and conversely, crisis peak nonperforming loans are strongly related to monetary and fiscal policy, but not macroprudential policy. Both equity and bond market downside volatility are related to monetary policy, whereas only bond market downside volatility is related to fiscal policy.

These results, while far from definitive, suggest a meaningful role for policy as a moderator of global risk exposure. The inclusion of policy variables, where they are significant, often sharpens the relationship between b^c and σ. For example, in both the monetary and fiscal policy specifications, including the $r \cdot p$ interaction term increases the magnitude, as well as the statistical significance, of the coefficient on $r \cdot b^c$, even when the coefficient on $r \cdot p$ is not itself statistically significant. In contrast, the pure risk-return relationship, summarized by the coefficient on r, which is positive in the raw specification (column (1)), more often than not becomes significantly negative after the inclusion of global risk exposure and policy interaction terms. This is further evidence of the primacy of the global price of risk channel in determining macro/financial outcomes. Furthermore, it suggests that endogenous growth models with financial risk, and a positive risk-return tradeoff may be a fruitful area of exploration and collaboaration for future growth and macro-finance theorists.

5 Conclusion

Using a broad cross-section of international equity and sovereign bond excess returns, we estimate a global price of risk as a nonlinear function of the VIX. Countries' exposure to the global price of risk measures their integration into world capital markets, suggesting a risk-return tradeoff, as higher world capital integration increases both output and output volatility. This finding is corroborated in both the time series and the cross section. Furthermore, we uncover evidence that stabilization policies can insulate countries from their exposure to the global price of risk by tilting the risk-return tradeoff favorably.

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A Theoretical Framework for the Global Price of Risk

We refer to $\phi\left(vix_t\right)$ as the global price of risk, in the sense of the intermediary asset pricing model presented in this section. To start, we assume that asset allocation decisions in this economy are delegated to risk-neutral global financial institutions that each solve a portfolio choice problem subject to a value-at-risk constraint,

$$\max_{y_t^i} E_t[y_t^{i\prime} r_{t+1}] \qquad s.t. VaR_t^i \leq w_t^i, \tag{A.1}$$

where y_t^i denotes the vector of portfolio allocations for institution i expressed as fractions of its wealth, r_{t+1} denotes the vector of portfolio excess returns, and w_t^i is the equity cushion of institution i. Following Danielsson, Shin, and Zigrand (2012) and Adrian, Etula, and Shin (2010), we assume that each firm's value-at-risk can be expressed as a constant multiple of its portfolio standard deviation, i.e.

$$VaR_t^i = \kappa\, w_t^i \sqrt{Var_t[y_t^{i\prime} r_{t+1}]}.$$

The Lagrangian for this problem is

$$L(y_t^i) = E_t[y_t^{i\prime} r_{t+1}] + \lambda_t^i \left[1 - \kappa \sqrt{Var_t[y_t^{i\prime} r_{t+1}]}\right]. \tag{A.2}$$

where λ_t^i is the Lagrange multiplier measuring the shadow value of relaxing the intermediary's value-at-risk constraint. The intermediary's first-order conditions then give rise to asset demands

$$y_t^i = \frac{1}{\kappa^2 \lambda_t^i} Var_t[r_{t+1}]^{-1} E_t[r_{t+1}], \tag{A.3}$$

where we have used the fact that since the intermediary is risk-neutral its value-at-risk constraint must always bind. Furthermore, plugging the asset demands into the binding constraint $\kappa(y_t^{i\prime}\Sigma_t y_t^i)^{1/2} = 1$, implies that

$$\begin{aligned} \kappa(y_t^{i\prime}\Sigma_t y_t^i)^{1/2} &= 1 \\ \kappa^2 \left(\frac{1}{(\kappa\lambda_t^i)^2} \mu_t' \Sigma_t^{-1} \Sigma_t \Sigma_t^{-1} \mu_t\right) &= 1 \\ \lambda_t^i &= \left(\mu_t' \Sigma_t^{-1} \mu_t\right)^{1/2}. \end{aligned}$$

Since the right-hand side does not vary with i, all intermediaries share the same Lagrange multiplier on the value-at-risk constraint, which is exogenously determined by the economy's investment opportunities $\mu_t \equiv E_t[r_{t+1}]$ and $\Sigma_t \equiv Var_t[r_{t+1}]$.

The asset demands (A.3) have a noteworthy interpretation: even though the institutions are risk-neutral, the optimal portfolio weights are identical to those of a mean-variance investor whose risk aversion parameter is proportional to the shadow value of the risk constraint, λ_t. Consequently, the standard CAPM market clearing conditions give rise to the following equilibrium expected excess returns for an asset in country c,

$$E_t[r^c_{t+1}] = \beta^c_t\, \phi_t, \tag{A.4}$$

where $\beta^c_t \equiv Cov_t[r^c_{t+1}, r^W_{t+1}]/Var_t[r^W_{t+1}]$ measures asset c's beta to the aggregate wealth portfolio, and $\phi_t \equiv \kappa^2 \lambda_t Var_t[r^W_{t+1}]$ defines the global price of risk as a function of the tightness of intermediaries' VaR constraints λ_t and a measure of aggregate volatility $Var_t[r^W_{t+1}]$.

B Data

We synthesize country-level data on prices, output, financial, and policy variables from a wide variety of sources. In what follows, we provide a brief guide to our data and our sources.

Macroeconomic Data

Monthly headline and core CPI over the period 1985-2016 are from the OECD, national statistical agencies, and central banks, all obtained via Haver Analytics. Note that these data are only available at a quarterly frequency for Australia and New Zealand. For countries with shorter histories for core CPI, we regress (log-differenced) core CPI onto (log-differenced) headline CPI (where both are available), generate predicted values for core CPI, and use these predicted values when actual core CPI is not observed.

Quarterly real and nominal GDP, and final (nominal) governmental consumption expenditure data over the period 1985-2016 are from the OECD, national statistical agencies, and central banks, also obtained via Haver Analytics. Annual real GDP and population over the period 1960-2011 are from the Penn World Tables 8.1 and the World Bank World Development Indicators Database. We define potential output as deviations of log RGDP from a very slow moving Hodrick and Prescott (1997) filtered trend ($\lambda = 200000$) for the purpose of estimating an output gap. We choose λ to match the U.S. output gap series produced by the Congressional Budget Office.

Financial Data

Daily country-level equities indices are from the Wall Street Journal, Financial Times, and individual exchanges via Haver Analytics, Compustat / Capital IQ Global Index Prices via Wharton Research Data Services, and from Frazzini and Pedersen (2014), available at `http://www.econ.yale.edu/~af227/data_library.htm/data_library.htm`. When we have an index from multiple sources, or multiple indices per country, we use the one with a longer history. Lower frequency analysis of daily financial time series use end-of-period prices, unless otherwise specified.

We obtain daily (model implied) zero coupon sovereign bond yields from Bloomberg and Quandl. Synthetic yields from Bloomberg are available at 3-month, 6-month, 1-year, 2-year, 3-year, 4-year, 5-year, 6-year, 7-year, 8-year, 9-year, 10-year, 15-year, 20-year, and 30-year maturities. Quandl's coverage along the yield curve is typically sparser, although there are exceptions (e.g., the US Treasury / Federal Reserve Board, Bank of England, and

Bank of Canada all provide yields at even finer maturity intervals). We fit Nelson-Siegel-Svensson curves to these data, recover monthly NSS parameters, and use these parameters to generate monthly sovereign bond returns. Our estimation of the global price of risk uses monthly returns on 10-year sovereign bonds.

Daily spot dollar exchange rates are from the Wall Street Journal Middle Rate, NY Close via Haver Analytics. Monthly real effective exchange rates are from `http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/`. See Darvas (2012) for details on the construction of the series. We also collect direct information on the conditions at financial intermediaries. Weekly mutual fund flows are from the Investment Company Institute (ICI), obtained via Haver Analytics, and quarterly dealer Value-at-Risk estimates are obtained via Bloomberg.

Regulation, Policy, and Institutions

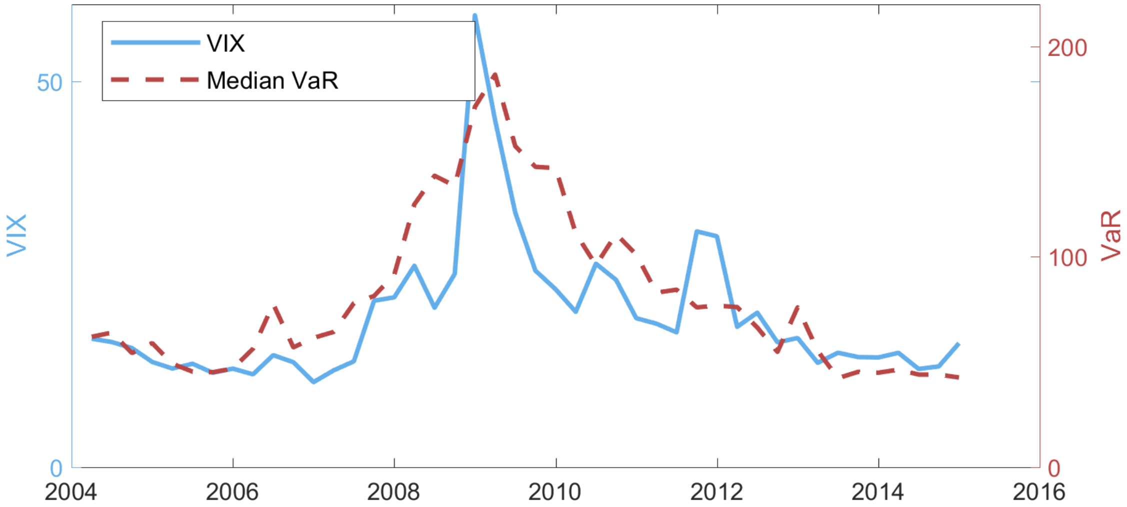
For our cross sectional analysis of trade and financial openness, we use annual capital openness measures from Fernández, Klein, Rebucci, Schindler, and Uribe (2015), as well as annual "Trilema Indices" (fixed/flexible exchange rates, financial openness, and monetary policy independence) from Aizenman, Chinn, and Ito (2008), both based on data from the International Monetary Fund's *Annual Report on Exchange Arrangements and Exchange Restrictions*

Our analysis of macroprudential regulations and banking crises uses data on country level prudential regulations from Cerutti, Claessens, and Laeven (2015), and data on banking crises, the policy response, and outcomes (crisis length, output loss, fiscal costs, peak liquidity, monetary expansion, peak nonperforming loans, increases in public debt, and credit booms) from Laeven and Valencia (2012). We obtain further data on currency, inflation, equity, sovereign debt, and banking crises from Reinhart and Rogoff (2011).

Figure 1: **VIX, Dealer VaR, and Fund Flows**

This figure plots the VIX (left axis, solid blue line) (and values of the VIX above its sample median) against two other measures of financial conditions: the median Value-at-Risk (VaR) at major dealer-banks (right axis, dashed red line), and combined stock fund outflows and bond fund inflows. Stock fund outflows are the sum of US equity, non-US equity, and hybrid equity mutual fund outflows. Bond fund inflows are the sum of government bond fund inflows and government money market mutual fund inflows. The data for subfigure (a) are quarterly observations from 2004:1 to 2014:4 using VaRs from Bank of America, Citigroup, Goldman Sachs, JP Morgan, Morgan Stanley, Credit Agricole, Bear Stearns, Credit Suisse, Deutsche Bank, Daiwa, Jeffries, Lehman, Merrill Lynch, Nomura, RBS, Societe Generale, TD Bank, and UBS.The data for subfigure (b) are monthly observations from 2000:1 to 2014:12. Sources: Bloomberg, ICI Trends in Mutual Fund Activity.

(a) VIX and Dealer VaR



(b) Large VIX Moves versus Stock Fund Outflows and Bond Fund Inflows

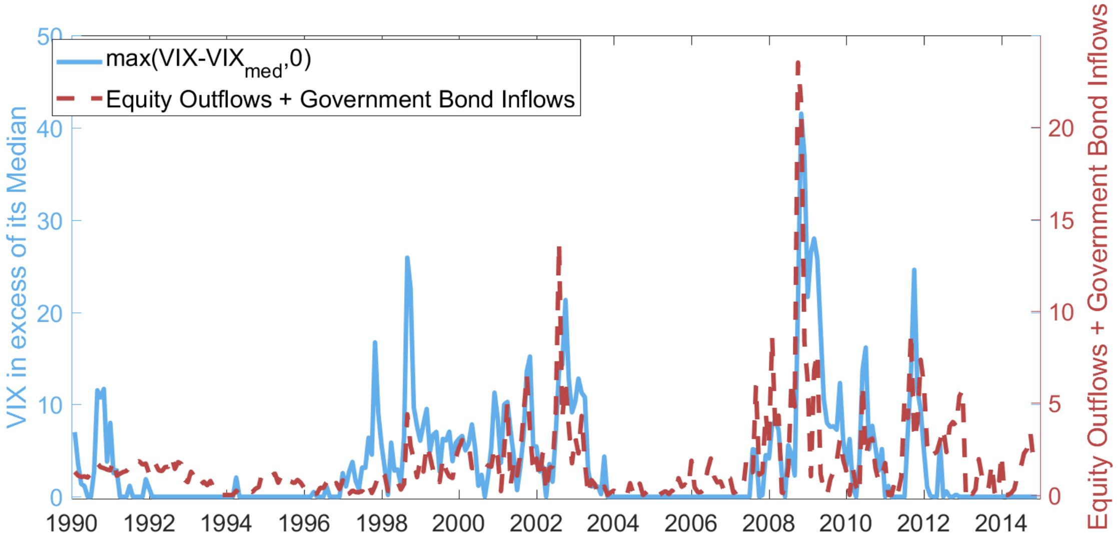


Figure 2: **Relating the CAPM β to Global Risk Loadings b^c**

This figure plots global risk loadings b^c, obtained from sieve reduced rank regressions $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$ against country-specific CAPM β^c estimates. Both the b^c and β^c loadings are estimated with respect to the global market excess return (MKT). We calculate each risk measure for 30 country stock returns (in red), and corresponding 30 10-year sovereign bond excess returns (in blue). The forecast horizon for the b^c estimates is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

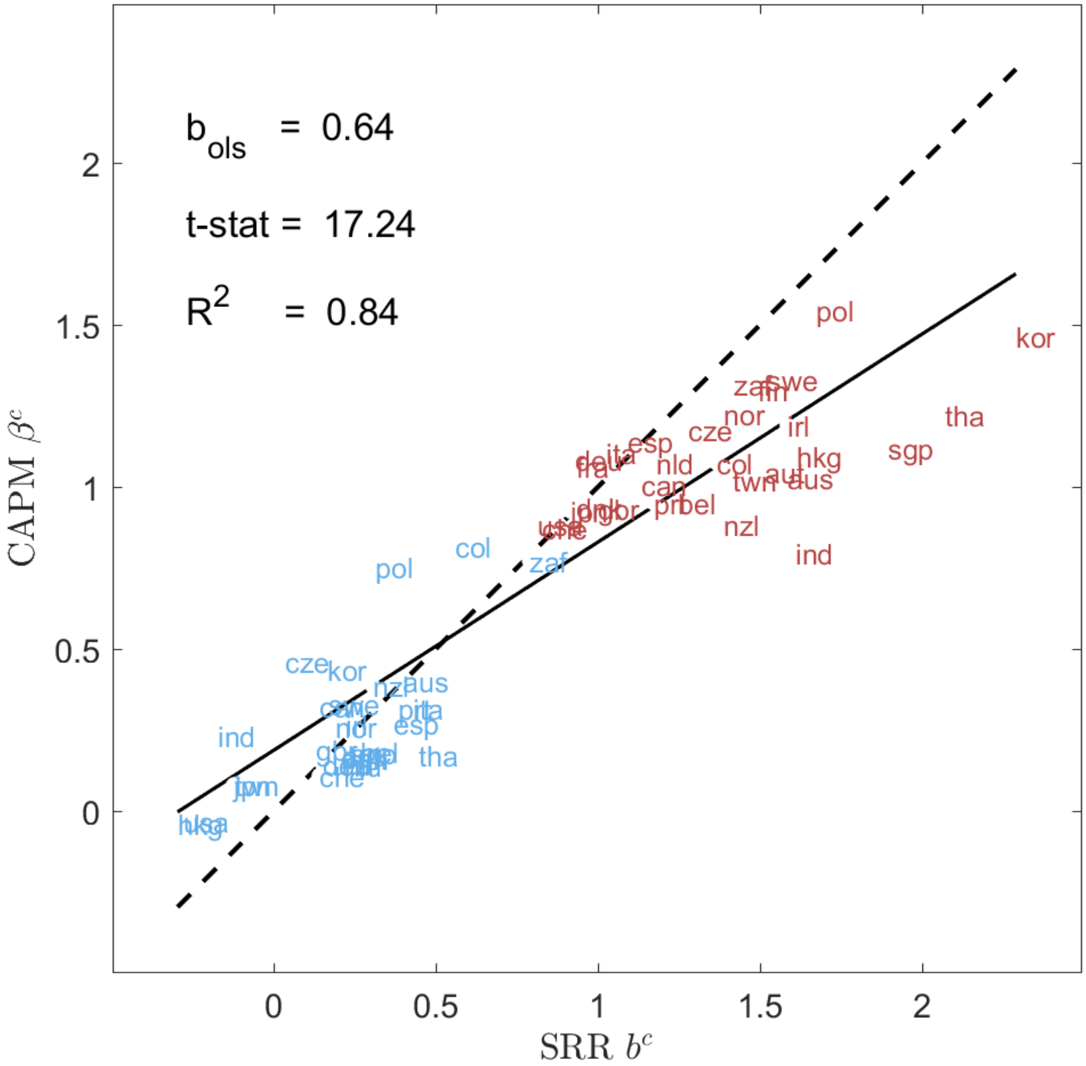


Figure 3: **Expected Excess Returns for Stocks and Bonds by Country**

This figure plots normalized SRRR estimated excess returns on asset c, $\hat{E}_t[Rx^c_{t+h}]/\hat{\sigma}(Rx^c_{t+h})$, where $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c_h + \hat{b}^c_h\hat{\phi}_h(v_t)$, $\hat{\sigma}(Rx^c_{t+h})$ scales by unconditional excess return standard deviation, and where c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. All stock excess returns have positive $\hat{b}^c_h$ loadings and are denoted in red. Bond excess returns with negative $\hat{b}^c_h$ loadings ("flight-to-safety bonds") are plotted in dark blue. The remaining bond excess returns with positive $\hat{b}^c_h$ loadings ("risky bonds") are shown in dashed light blue. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

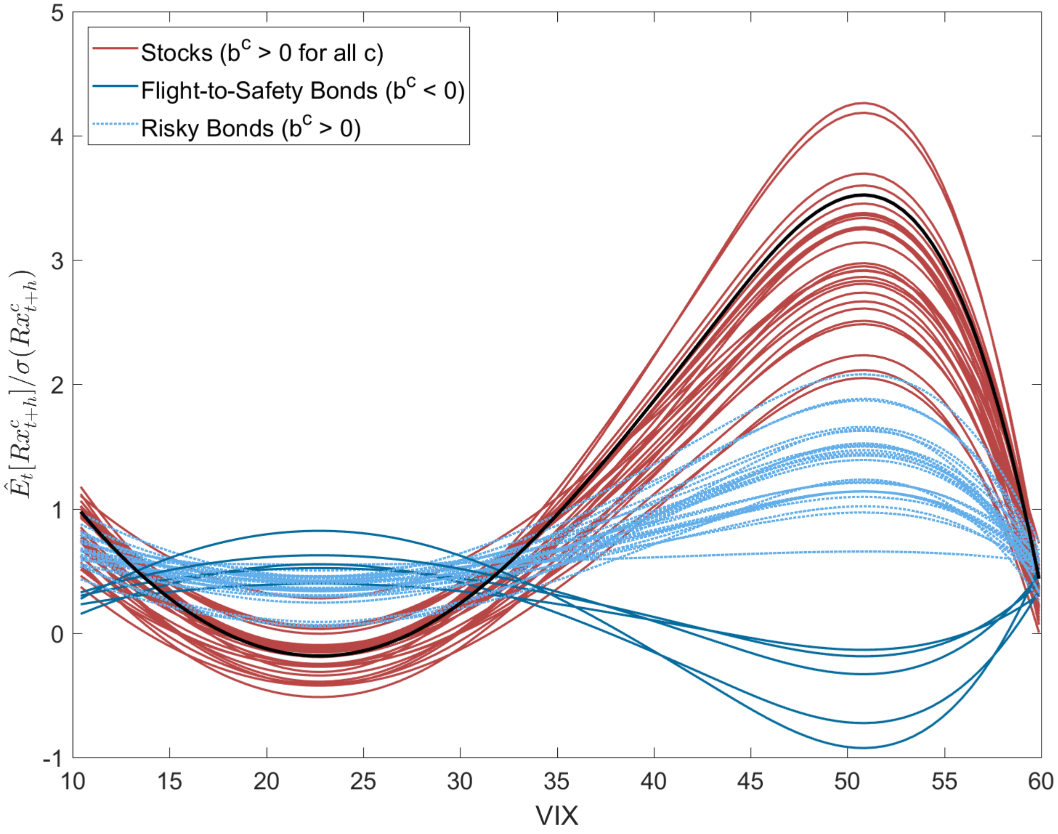


Figure 4: VIX **and** $\phi(VIX)$

This figure plots the time series of the VIX, and the estimated global price of risk $\hat{\phi}(VIX)$. The price of risk is estimated via SRR regressions of excess returns on sieve expansions of the VIX: $\hat{R}x^c_{t+h} = \hat{\alpha}^c_h + \hat{b}^c_h \hat{\phi}_h(v_t) + \hat{\varepsilon}^c_{t+h}$, where c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. The exposure of the global market portfolio to the global price of risk, b^{MKT}, is normalized to 1. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

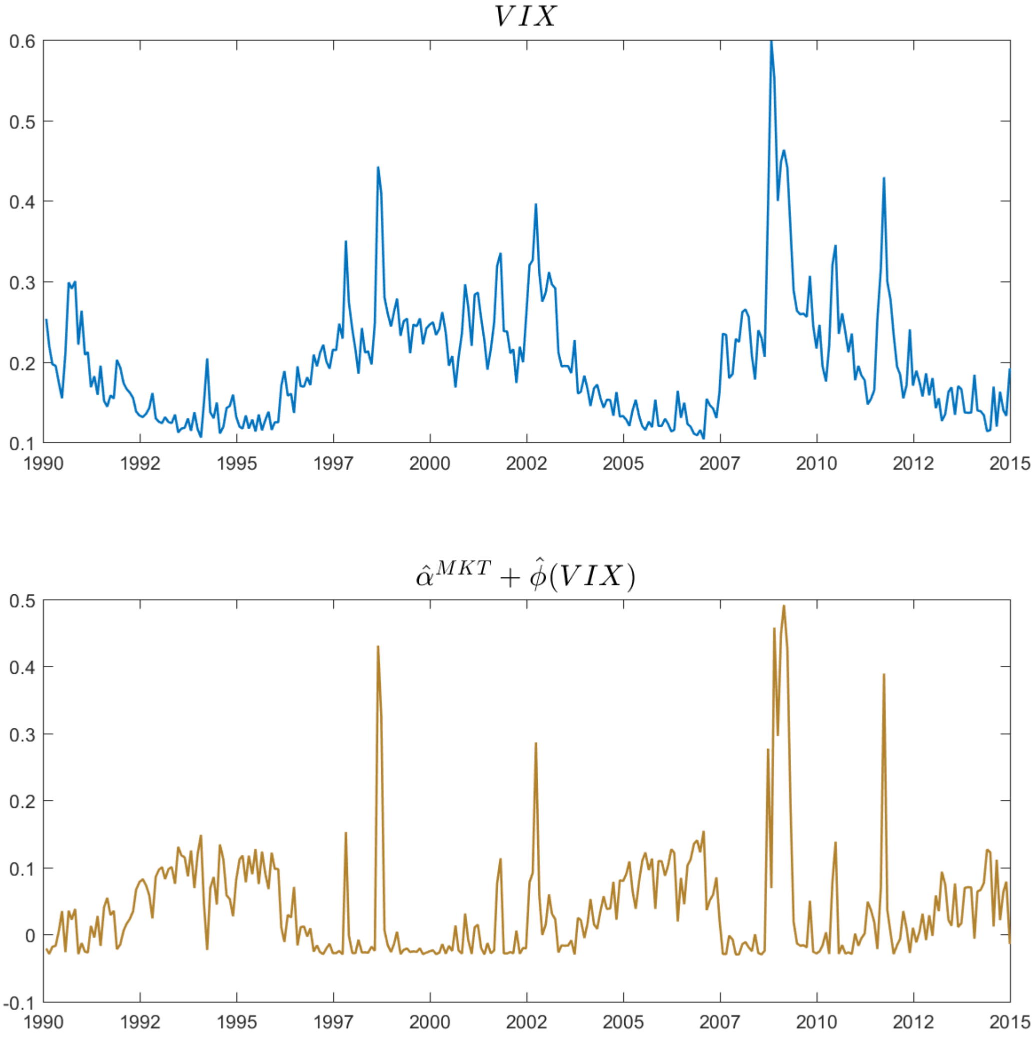


Figure 5: **Impulse Response Functions**

This figure plots impulse response functions estimated from a panel vector autoregression of 30 countries. All variables are normalized by their within-country time-series standard deviation. Quarters are on the x-axis. Bootstrapped 95% confidence bands are estimated from 500 Monte Carlo samples. See Love and Zicchino (2006) and `http://econweb.umd.edu/~decker/code.html` for details on the estimation procedure.

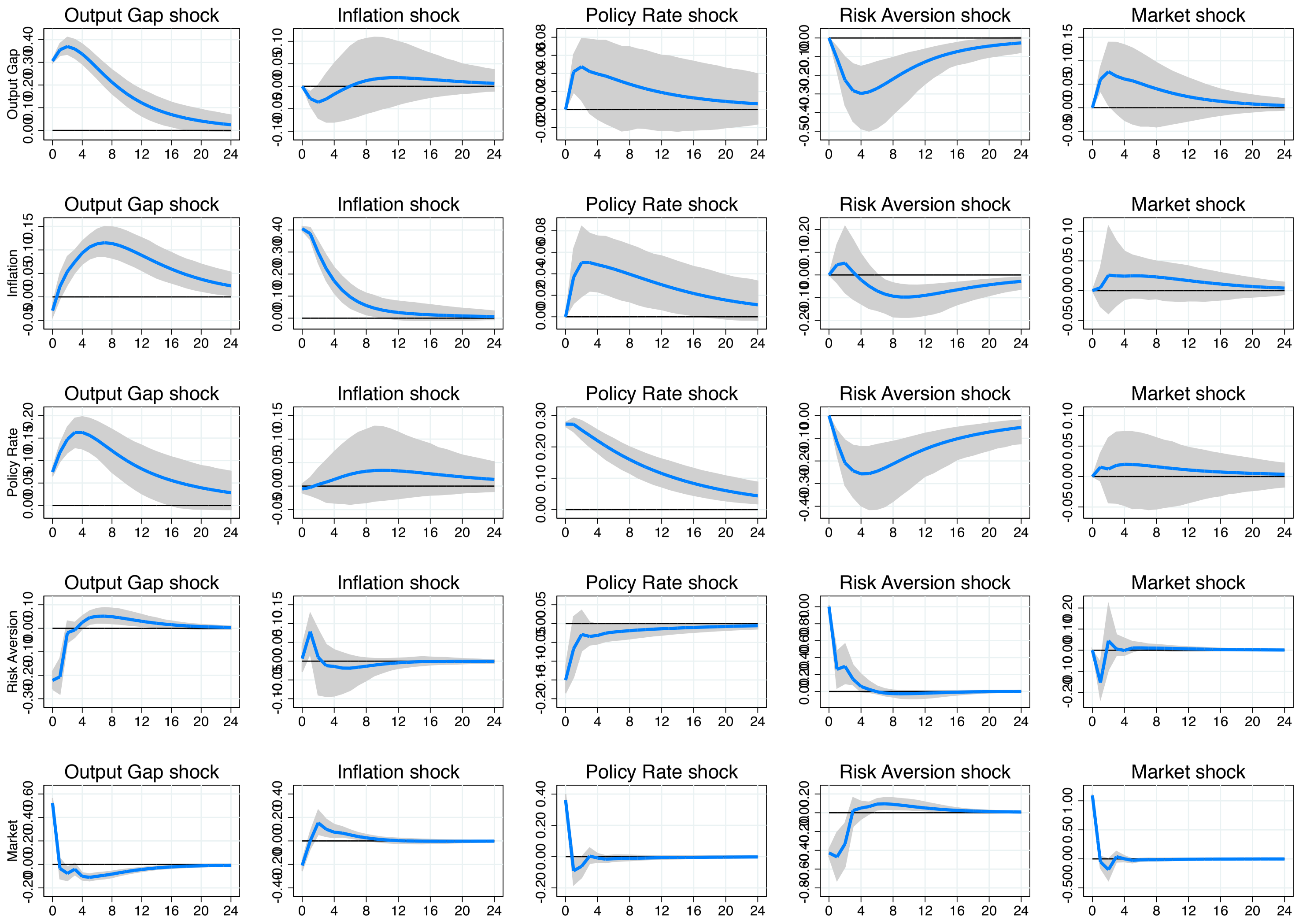


Figure 6: **Relating Global Risk Loadings b^c to Macro Outcomes**

This figure plots the indicated macroeconomic outcome variables against global risk loadings b^c, obtained from sieve reduced rank regressions $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

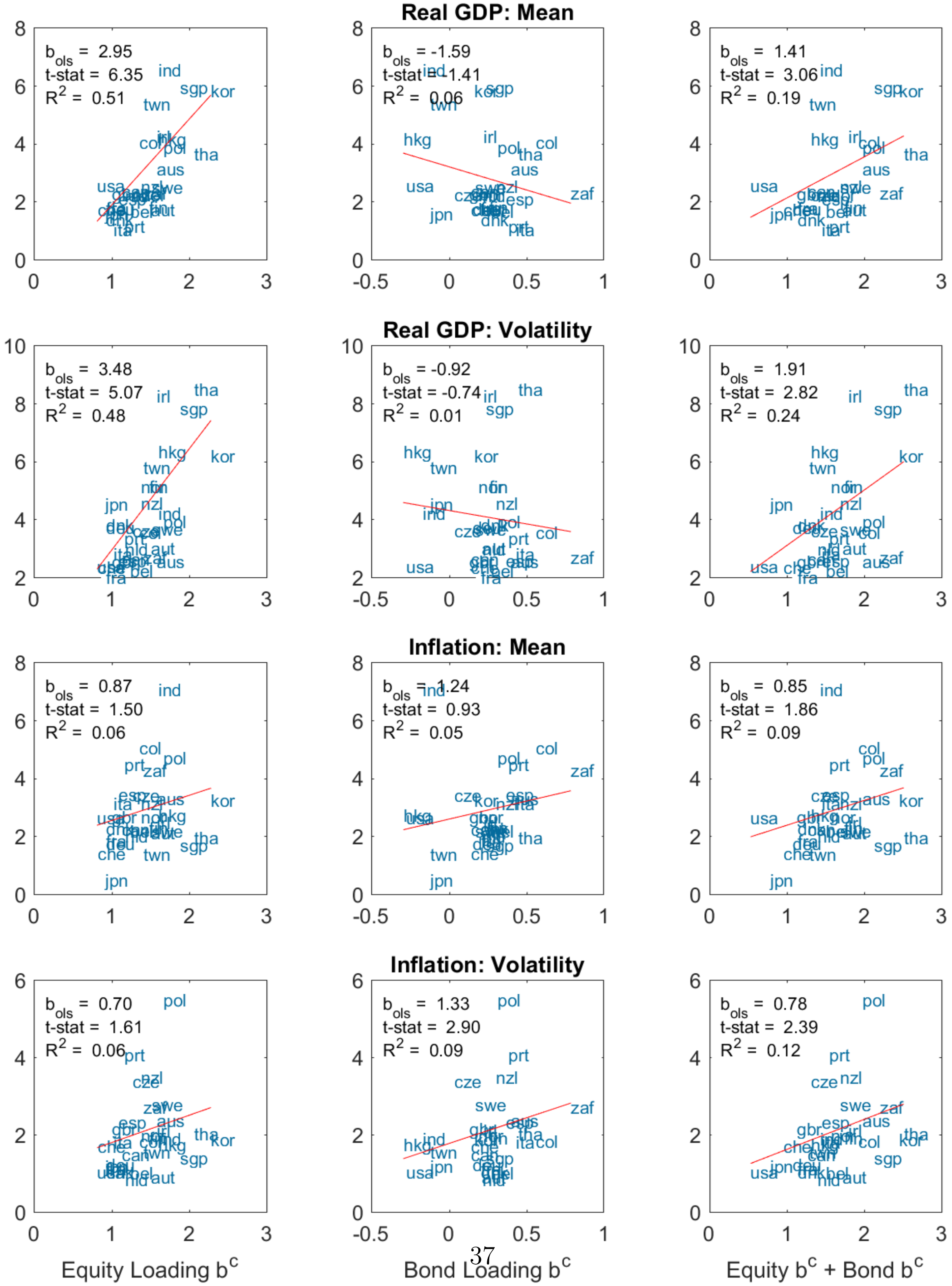


Figure 7: **Relating Global Risk Loadings b^c to Financial Outcomes**

This figure plots the indicated financial outcome variables against global risk loadings b^c, obtained from sieve reduced rank regressions $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

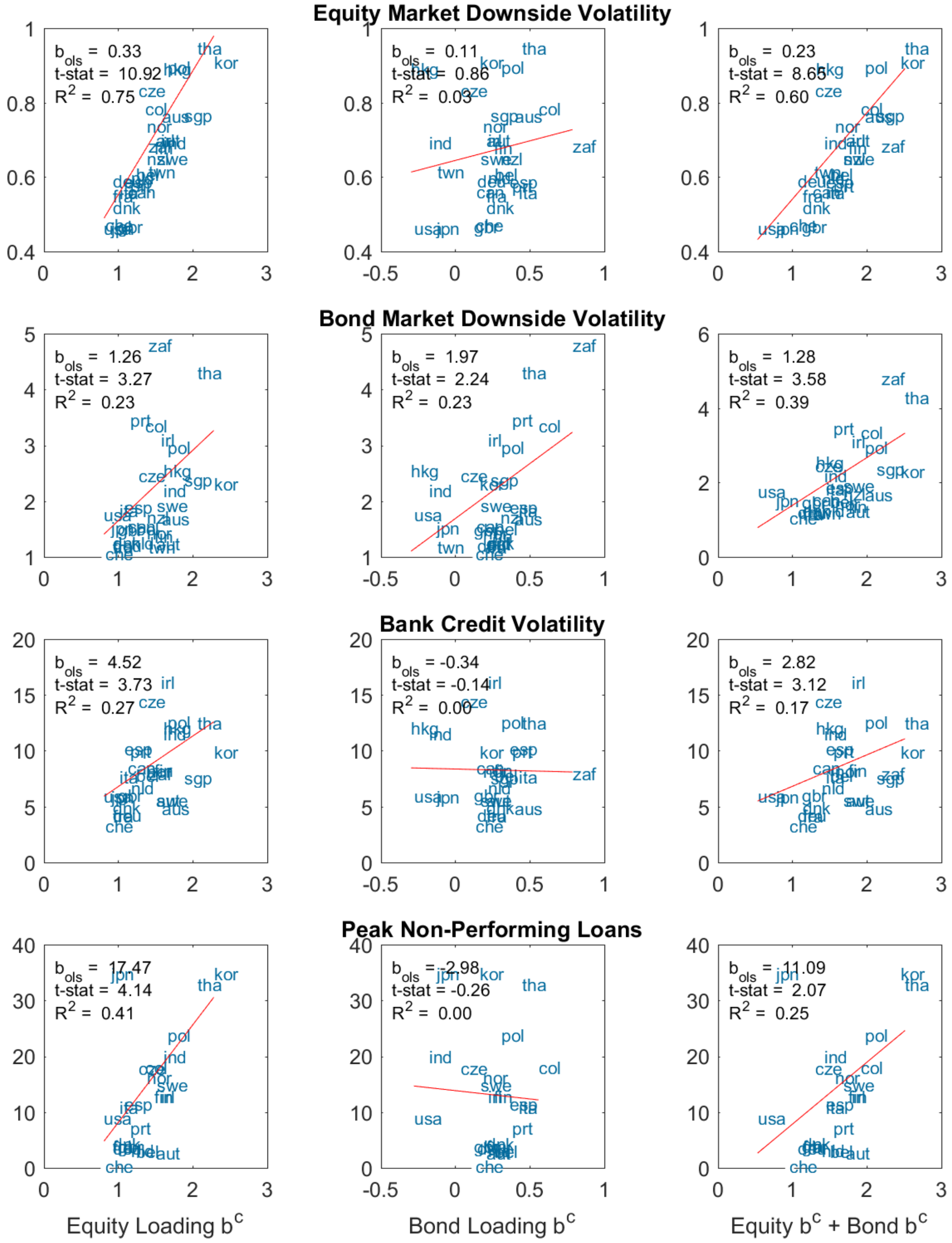


Figure 8: **Relating Taylor Rule Coefficients to Global Risk Loadings** b^c

This figure plots global risk loadings b^c, obtained from sieve reduced rank regressions $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c \hat{\phi}(vix_t)$ against country-specific Taylor Rule coefficients. The index c for the b^c global risk loadings ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

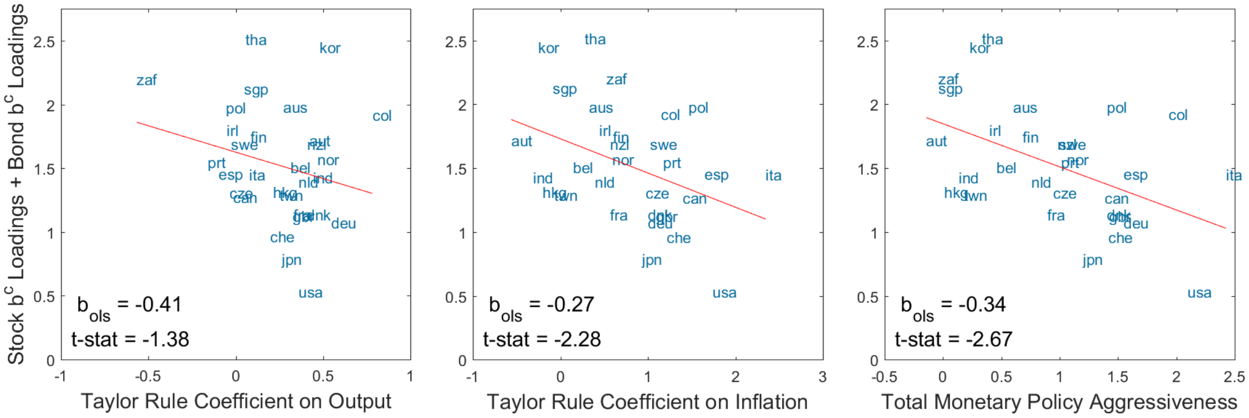


Figure 9: **Risk-Return Tradeoff Mediated by Global Risk Factor Exposure and Policy**

This figure plots macro outcome risk-return tradeoffs and their sensitivities to changes in the global risk factor exposures and the offsetting effects of a stabilizing policy stance, as measured by the partial effects from the regression $E[risk_c|x] = \gamma_0 + \gamma_1(ret_c) + \gamma_2(ret_c \times b^c) + \gamma_3(ret_c \times p_c) + \gamma_4(ret_c \times b^c \times p_c)$.

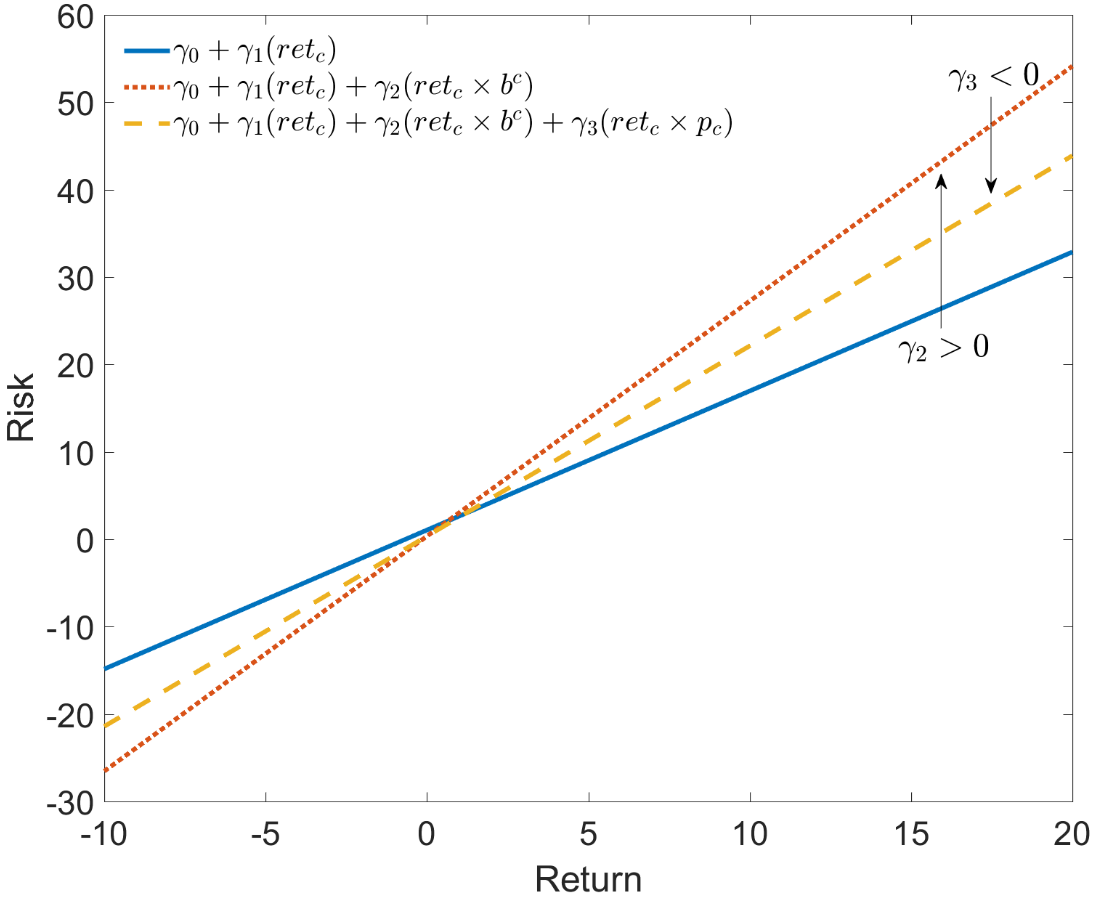


Table 1: **Nonlinear VIX Predictability using the Cross-Section: USD Returns**

This table reports results from predictive sieve reduced rank regressions (SRR) for each of $h = 6$ and 12 month ahead forecasting horizons: (1) estimates of a_h^c and b_h^c from the SRR $r_{t+h}^c = a_h^c + b_h^c vix_t + \eta_{t+h}^c$ of country c's excess returns on linear vix_t; (2) estimates of a_h^c and b_h^c from the SRR $r_{t+h}^c = a_h^c + b_h^c \phi_h(vix_t) + \eta_{t+h}^c$ of country c's excess return on the common nonparametric function $\phi_h(\cdot)$ of vix_t. Standard errors for the SRR regression are derived in Adrian, Crump, and Vogt (2018). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level. The *J p-value* reports the likelihood that the dependence on vix_t is jointly significant across countries and asset classes. Equity index excess returns are denoted by *equity*, while sovereign bond index excess returns are denoted by *bond*. MKT is the global market excess return.

	Horizon h = 6				**Horizon h = 12**			
	(1) Linear VIX		(2) Nonlinear VIX		(1) Linear VIX		(2) Nonlinear VIX	
	a^c	b^c	a^c	b^c	a^c	b^c	a^c	b^c
MKT	−0.02	1.00	0.10	1.00***	0.00	1.00	−0.03	1.00***
aus equity	−0.07	2.16	0.16	1.65***	−0.03	2.33	−0.04	1.56***
aut equity	−0.09	1.57	0.10	1.48***	−0.01	0.97	−0.08	1.39***
bel equity	0.03	0.44	0.13	1.34***	0.05	0.38	−0.05	1.40***
can equity	−0.05	1.73	0.13	1.12***	0.01	1.45	−0.02	1.15***
che equity	0.07	0.03	0.11	0.83***	0.06	0.09	−0.01	0.90***
deu equity	0.03	0.14	0.09	0.91***	0.06	−0.35	−0.04	1.06***
dnk equity	0.09	0.10	0.14	0.96***	0.11	−0.26	0.00	1.17***
esp equity	0.09	−0.28	0.13	1.26***	0.12	−0.99	−0.03	1.25***
fin equity	−0.01	1.14	0.13	1.17**	0.05	0.55	−0.02	1.16**
fra equity	0.01	0.60	0.10	0.98***	0.03	0.52	−0.03	1.04***
gbr equity	0.00	0.60	0.10	1.13***	0.02	0.56	−0.05	1.14***
hkg equity	−0.01	0.99	0.15	1.85***	0.01	0.96	−0.10	1.91***
irl equity	0.02	0.53	0.14	1.67***	0.12	−1.41	−0.05	1.38***
ita equity	−0.03	0.91	0.08	1.01***	0.04	0.03	−0.04	0.97***
jpn equity	−0.09	0.97	0.02	0.75***	−0.11	1.95	−0.08	0.75***
nld equity	0.04	0.07	0.11	1.24***	0.06	−0.36	−0.07	1.46***
nor equity	0.04	0.55	0.14	1.36**	0.07	0.18	−0.05	1.65***
nzl equity	−0.03	1.38	0.13	1.29***	−0.02	1.93	−0.02	1.14***
prt equity	−0.01	0.34	0.08	1.25***	0.07	−0.87	−0.08	1.29***
swe equity	−0.04	1.72	0.16	1.49***	0.00	1.81	−0.03	1.46***
usa equity	0.00	0.92	0.11	0.86***	0.03	0.79	−0.01	0.86***
aus bond	0.00	1.13	0.10	0.42	0.01	1.46	0.04	0.44**
aut bond	0.02	0.53	0.07	0.30	0.01	0.85	0.04	0.23*
bel bond	0.02	0.57	0.08	0.36	0.03	0.69	0.04	0.27**
can bond	0.02	0.64	0.08	0.25	0.04	0.67	0.05	0.28*
che bond	−0.02	0.84	0.05	0.13	−0.02	1.38	0.04	−0.01
deu bond	0.02	0.45	0.07	0.23	0.02	0.65	0.04	0.14
dnk bond	0.03	0.48	0.08	0.30	0.04	0.53	0.05	0.18
esp bond	0.12	−0.50	0.11	0.49*	0.13*	−1.16	0.04	0.47*
fin bond	0.05	0.23	0.08	0.35	0.05	0.35	0.04	0.25*
fra bond	0.04	0.25	0.07	0.30	0.04	0.42	0.04	0.24*
gbr bond	0.04	0.18	0.07	0.29*	0.05	0.03	0.05	0.13
hkg bond	0.05	0.13	0.04	−0.23	0.02	0.64	0.08	−0.30
irl bond	0.13	−0.80	0.09	0.40	0.12	−1.00	0.03	0.45**
ita bond	0.11	−0.18	0.12	0.54*	0.14*	−0.97	0.05	0.58**
jpn bond	−0.07	1.17	0.00	−0.23	−0.09	2.25**	0.02	−0.17
nld bond	0.02	0.52	0.07	0.31	0.02	0.79	0.04	0.21*
nor bond	0.00	0.73	0.06	0.26	0.00	1.14	0.03	0.26*
nzl bond	0.00	0.95	0.09	0.38**	−0.01	1.68	0.04	0.36***
prt bond	0.13	−0.80	0.10	0.55	0.15*	−1.60	0.02	0.63*
swe bond	0.09	−0.17	0.10	0.36*	0.07	0.08	0.04	0.37**
usa bond	0.06	−0.08	0.04	−0.25**	0.04	0.35	0.07	−0.25
J p-val		0.049		0.000		0.006		0.000

Table 2: **Panel Vector Autoregression**

This table reports coefficient estimates and standard errors (in parentheses) from panel vector autoregression on 30 countries. All variables are normalized by their unconditional, within-country, time series standard deviation. Bootstrap standard errors are computed from 500 Monte Carlo samples. See Love and Zicchino (2006) and `http://econweb.umd.edu/~decker/code.html` for details on the estimation. *, **, and *** indicate significance at the 10%, 5 %, and 1% levels, respectively.

	Output Gap	Inflation	Policy Rate	Price of Risk	Equity Market
Output Gap (1Q lag)	1.035***	0.002	0.171**	0.007	-3.257
	(33.086)	(0.043)	(2.154)	(1.081)	(-0.488)
Inflation (1Q lag)	0.024	1.031***	0.058	-0.007	-12.055**
	(1.014)	(31.131)	(0.711)	(-1.196)	(-2.011)
Policy Rate (1Q lag)	-0.031	-0.072	0.790***	-0.012***	1.671
	(-0.852)	(-1.625)	(6.985)	(-2.979)	(0.365)
Price of Risk (1Q lag)	-0.443***	-0.317*	-0.653*	0.490***	-147.563***
	(-2.660)	(-1.906)	(-1.878)	(11.724)	(-3.476)
Equity Market (1Q lag)	-0.000	0.000	0.000	-0.000***	0.104***
	(-1.349)	(1.500)	(1.316)	(-9.673)	(5.691)
Output Gap (2Q lag)	-0.075**	-0.015	-0.169**	-0.005	-7.847
	(-2.550)	(-0.455)	(-2.205)	(-0.881)	(-1.212)
Inflation (2Q lag)	-0.036	-0.084**	-0.061	0.007	3.919
	(-1.484)	(-2.417)	(-0.693)	(1.207)	(0.629)
Policy Rate (2Q lag)	0.035	0.083*	0.187*	0.011***	1.462
	(0.964)	(1.912)	(1.672)	(2.707)	(0.310)
Price of Risk (2Q lag)	-0.298**	-0.218	-0.212	0.211***	-86.941**
	(-2.024)	(-1.485)	(-0.602)	(5.954)	(-2.076)
Equity Market (2Q lag)	-0.000	0.000	0.000	-0.000	-0.072***
	(-1.201)	(0.291)	(1.403)	(-1.044)	(-2.911)

Table 3: **The Risk-Return Tradeoff in the Cross-Section of Macro and Financial Outcomes**

This table reports results from cross-sectional regressions of the indicated outcome variables on global risk loadings b^c, obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c \hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings form the independent regressors in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

Panel A: Macro Outcomes	Real GDP		Inflation	
	Mean	Volatility	Mean	Volatility
Equities	3.20***	3.66***	0.76	0.58
Bonds	−2.38**	−1.82**	1.05	1.18***
p-val	0.00	0.00	0.18	0.01
R^2	0.64	0.53	0.09	0.13
Obs	30	30	30	30

Panel B: Banking Outcomes	Credit		Crisis Output	
	Boom	NPL	Pre-Crisis Gain	Crisis Loss
Equities	0.51***	19.02***	5.64***	4.70***
Bonds	0.73**	−12.33	2.46	−1.73
p-val	0.00	0.00	0.00	0.00
R^2	0.30	0.46	0.41	0.29
Obs	23	23	27	27

Panel C: Financial Market Outcomes	Equity Market		Bond Market	
	Mean	Downside Volatility	Mean	Downside Volatility
Equities	−0.02	0.33***	−0.03	1.09***
Bonds	0.04	0.02	0.11*	1.70*
p-val	0.34	0.00	0.16	0.00
R^2	0.09	0.76	0.06	0.40
Obs	30	30	30	30

Table 4: **Macro Risk-Return Tradeoffs and Global Risk Exposure**

This table reports results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 b^c + \varepsilon_c$, where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and b^c are global risk loadings obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c \hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings are used as independent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	GDP Volatility		Inflation Volatility	
	(1)	(2)	(1)	(2)
r	0.74^{***}	0.28	0.40^{*}	0.37^{*}
b		2.66^{**}		0.87
R^2	0.37	0.51	0.27	0.30
Obs	30	30	30	30
	Crisis Peak NPL		**Bank Credit Volatility**	
	(1)	(2)	(1)	(2)
r	4.80	-1.24	0.54^{***}	0.51^{***}
b		11.80^{*}		0.44
R^2	0.05	0.25	0.35	0.35
Obs	23	23	27	27
	Equity Downside Volatility		**Bond Downside Volatility**	
	(1)	(2)	(1)	(2)
r	-0.38	0.25	0.96	0.05
b		0.34^{***}		1.96^{**}
R^2	0.01	0.76	0.01	0.23
Obs	30	30	30	30

Table 5: **Relationship between Growth Volatility and Mean Growth**

This table reports coefficient estimates from univariate, cross country regressions of the volatility of per capita RGDP growth on the mean of per capita RGDP growth, for four different cross sections over two distinct time periods: all countries, the Ramey and Ramey (1995) sample, OECD countries, and our sample of 30 countries, from 1962 to 1985, and from 1986 to 2011. Note that we regress growth volatility on average growth, whereas Ramey and Ramey (1995) regress average growth on growth volatility). All data are from the most recent version of the Penn World Tables (8.1). OLS *t*-statistics are displayed in parentheses.

	Full sample 209 countries	RR sample 90 countries	OECD sample 25 countries	ASV sample 30 countries
A. 1962 - 1985 sample	3794 obs.	2112 obs.	600 obs.	687 obs.
Growth	-0.36	-0.27	0.30	0.26
	(-3.21)	(-2.09)	(1.53)	(2.10)
Constant	0.06	0.05	0.02	0.02
	(17.94)	(14.35)	(3.00)	(4.48)
B. 1986 - 2011 sample	5305 obs.	2340 obs.	650 obs.	775 obs.
Growth	-0.27	-1.06	0.71	0.49
	(-1.78)	(-4.10)	(2.71)	(4.20)
Constant	0.06	0.06	0.01	0.01
	(14.65)	(9.59)	(2.62)	(5.05)

Table 6: **Summary Table: Policy Instruments**

This table reports Taylor Rule coefficient estimates from quarterly regressions of country-specific short rates on associated output gap and inflation ($R^c_{f,t} = \delta^c_0 + \delta^c_{output} OG^c_t + \delta^c_{infl} infl^c_t + \varepsilon^c_t$), along with sample means of fiscal policy and macroprudential variables used in subsequent tables. Column (1) reports δ^c_{output}, column (2) δ^c_{infl}, and (3) reports $\delta^{output}_c + \delta^{infl}_c$. Column (4) reports the the degree of countercyclicality of fiscal policy, which is proxied by the slope coefficient from a regression of country c's output gap on government consumption. Columns (5) and (6) are the financial sector-targeted macroprudential policy index as defined in Cerutti, Claessens, and Laeven (2015), and the capial openness index, as defined in Fernández, Klein, Rebucci, Schindler, and Uribe (2015), respectively. Both indices are normalized to equal 1 for the U.S.

	Taylor Rule Coefficients			Fiscal Policy	Macroprudential	Capital Openness
	δ^c_{output}	δ^c_{infl}	δ^c_{total}	Output Gap - Fiscal Exp. Corr.	Financial Inst. - Targeted Index	Index
aus	0.27	0.33^{*}	0.60	-0.80	0.34	2.10
aut	0.42^{***}	-0.56	-0.14	-0.55	0.17	0.93
bel	0.31^{*}	0.14	0.46	-0.32	0.68	0.50
can	-0.01	1.40	1.39	-0.81	1.02	0.37
che	0.20	1.22^{***}	1.42	-0.59	0.54	0.74
col	0.78^{***}	1.15^{***}	1.93	-0.08	1.54	4.81
cze	-0.03^{***}	0.98^{**}	0.94	-0.25	0.34	1.88
deu	0.54	1.00^{***}	1.55	-0.45	0.20	0.97
dnk	0.41^{***}	1.00^{***}	1.40	-0.55		0.44
esp	-0.10	1.65^{***}	1.55	-0.19	0.68	0.22
fin	0.09^{***}	0.60^{***}	0.68	-0.60	0.02	0.66
fra	0.33^{***}	0.57^{***}	0.90	-0.76	0.76	0.51
gbr	0.33	1.10^{***}	1.42	0.07	0.00	0.02
hkg	0.21	-0.20^{*}	0.01	-0.81	0.34	0.09
ind	0.44^{*}	-0.31	0.14	-0.20	0.51	6.85
irl	-0.05^{**}	0.45^{***}	0.40	-0.06	0.00	0.35
ita	0.08^{*}	2.35	2.42	-0.13	0.68	0.22
jpn	0.26	0.94	1.20	-0.73	0.34	0.02
kor	0.48^{**}	-0.25^{***}	0.23	-0.68	0.24	2.79
nld	0.36^{***}	0.39^{***}	0.75	-0.48	0.05	0.00
nor	0.47^{***}	0.59	1.06	-0.55	0.37	0.34
nzl	0.41	0.57^{***}	0.98	-0.36	0.00	0.74
pol	-0.06	1.46^{*}	1.41	-0.32	0.34	5.56
prt	-0.16	1.17^{***}	1.01	0.60	0.17	1.01
sgp	0.05^{*}	-0.09^{***}	-0.04	-0.66	0.34	1.08
swe	-0.03^{***}	1.02	1.00	-0.83	0.00	0.39
tha	0.06^{***}	0.28^{***}	0.34	-0.19	0.07	5.38
twn	0.25^{***}	-0.07	0.18	0.14		
usa	0.36^{***}	1.74^{*}	2.09	-0.49	1.00	1.00
zaf	-0.57^{***}	0.53^{**}	-0.04	-0.20	0.02	4.50

Table 7: **Global Risk Loadings and Policy Tools**

This table reports results from cross-sectional regressions of global risk loadings b^c on the indicated policy variables. The global risk loadings b^c are obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings form the dependent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	Dependent Variable: Stock b^c								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Taylor Rule: δ^c_{output}	-0.12								
Taylor Rule: δ^c_{infl}		-0.33***							
Taylor Rule: $\delta^c_{output} + \delta^c_{infl}$			-0.36***						
Fiscal: Mean Gov't Spending/GDP				-3.30**					
Fiscal: Output Gap-Fiscal Expend. Corr.					-0.08				
Macroprudential						-0.11*			
Crisis: Fiscal Bailout Expenditure							0.02***		
Crisis: Liquidity Injection								0.02**	
Crisis: Monetary Expansion									-0.04**
R^2	0.01	0.38	0.44	0.15	0.01	0.11	0.43	0.25	0.21
Obs	30	30	30	30	30	28	23	23	23

	Dependent Variable: Bond b^c								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Taylor Rule: δ^c_{output}	-0.29								
Taylor Rule: δ^c_{infl}		0.06							
Taylor Rule: $\delta^c_{output} + \delta^c_{infl}$			0.02						
Fiscal: Mean Gov't Spending/GDP				1.70*					
Fiscal: Output Gap-Fiscal Expend. Corr.					0.18				
Macroprudential						-0.01			
Crisis: Fiscal Bailout Expenditure							0.01**		
Crisis: Liquidity Injection								0.01**	
Crisis: Monetary Expansion									-0.00
R^2	0.11	0.03	0.00	0.10	0.07	0.00	0.16	0.24	0.00
Obs	30	30	30	30	30	28	23	23	23

	Dependent Variable: (Stock b^c + Bond b^c)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Taylor Rule: δ^c_{output}	-0.41								
Taylor Rule: δ^c_{infl}		-0.27**							
Taylor Rule: $\delta^c_{output} + \delta^c_{infl}$			-0.34**						
Fiscal: Mean Gov't Spending/GDP				-1.59					
Fiscal: Output Gap-Fiscal Expend. Corr.					0.10				
Macroprudential						-0.12			
Crisis: Fiscal Bailout Expenditure							0.03***		
Crisis: Liquidity Injection								0.03***	
Crisis: Monetary Expansion									-0.04**
R^2	0.06	0.16	0.24	0.02	0.01	0.08	0.49	0.37	0.15
Obs	30	30	30	30	30	28	23	23	23

Table 8: **Macro Risk-Return Tradeoffs, Global Pricing of Risk, and Monetary Policy Stance**

This table reports results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2(r_c \cdot b^c) + \gamma_3(r_c \cdot p_c) + \gamma_4(r_c \cdot b^c \cdot p_c) + \varepsilon_c$, where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and p_c denotes country c's policy stance as given by the Taylor Rule coefficient on output: $p_c = \delta_c^{output}$. The global risk loadings b^c are obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings are used as independent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	GDP Volatility				Inflation Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	0.74^{***}	-0.64	-0.35	-1.92^{***}	0.40^{*}	0.34^{**}	0.49^{***}	0.82^{***}
$r \cdot b$		0.67^{*}	0.61^{**}	1.53^{***}		0.29	0.10	-0.34^{**}
$r \cdot p$			-0.49	3.42^{***}			-0.42^{**}	-1.22^{***}
$r \cdot b \cdot p$				-2.50^{***}				1.56^{***}
R^2	0.37	0.48	0.53	0.64	0.27	0.33	0.50	0.68
Obs	30	30	30	30	30	30	30	30

	Crisis Peak NPL				Bank Credit Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	4.80	-37.96^{***}	-37.95^{***}	-31.46^{***}	0.54^{***}	0.58^{**}	0.65^{**}	1.24^{**}
$r \cdot b$		23.69^{***}	23.72^{***}	20.08^{***}		-0.02	-0.05	-0.33
$r \cdot p$			-0.27	-28.25			-0.15	-2.53^{**}
$r \cdot b \cdot p$				14.95				1.22^{**}
R^2	0.05	0.43	0.43	0.43	0.35	0.35	0.36	0.47
Obs	23	23	23	23	27	27	27	27

	Equity Downside Volatility				Bond Downside Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	-0.38	-6.66^{***}	-7.24^{***}	-4.83^{***}	0.96	-1.71	-2.10	-2.08
$r \cdot b$		4.44^{***}	4.66^{***}	3.01^{**}		6.88^{**}	3.81	3.86
$r \cdot p$			0.91	-9.45^{*}			-6.51^{***}	-6.03^{*}
$r \cdot b \cdot p$				7.53^{*}				-1.11
R^2	0.01	0.34	0.36	0.39	0.01	0.24	0.45	0.45
Obs	30	30	30	30	30	30	30	30

Table 9: **Macro Risk-Return Tradeoffs, Global Pricing of Risk, and Fiscal Policy Stance**

This table reports results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2(r_c \cdot b^c) + \gamma_3(r_c \cdot p_c) + \gamma_4(r_c \cdot b^c \cdot p_c) + \varepsilon_c$, where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and p_c denotes country c's policy stance as given by the degree of countercyclicality of fiscal policies to output gap deviations. The global risk loadings b^c are obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c\hat{\phi}(vix_t)$. The index c ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings are used as independent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	GDP Volatility				Inflation Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	0.74^{***}	-0.64	-0.86	-2.24^{***}	0.40^{*}	0.34^{**}	0.34^{**}	0.35^{*}
$r \cdot b$		0.67^{*}	0.83^{**}	1.75^{***}		0.29	0.26	0.24
$r \cdot p$			-0.31	2.15^{**}			-0.11	-0.13
$r \cdot b \cdot p$				-1.66^{**}				0.06
R^2	0.37	0.48	0.51	0.57	0.27	0.33	0.34	0.34
Obs	30	30	30	30	30	30	30	30

	Crisis Peak NPL				Bank Credit Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	4.80	-37.96^{***}	-37.90^{***}	-30.87^{***}	0.54^{***}	0.58^{**}	0.52^{*}	0.17
$r \cdot b$		23.69^{***}	23.50^{***}	19.19^{***}		-0.02	0.03	0.26
$r \cdot p$			0.88	-28.44^{***}			-0.27	0.63
$r \cdot b \cdot p$				16.44^{***}				-0.55
R^2	0.05	0.43	0.43	0.44	0.35	0.35	0.39	0.42
Obs	23	23	23	23	27	27	27	27

	Equity Downside Volatility				Bond Downside Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	-0.38	-6.66^{***}	-6.60^{***}	-3.94	0.96	-1.71	-0.57	-2.12
$r \cdot b$		4.44^{***}	4.53^{***}	2.59		6.88^{**}	5.66^{*}	11.18^{***}
$r \cdot p$			-0.56	-5.62			-2.55^{***}	1.52
$r \cdot b \cdot p$				3.67				-16.51^{***}
R^2	0.01	0.34	0.35	0.36	0.01	0.24	0.32	0.44
Obs	30	30	30	30	30	30	30	30

Table 10: **Macro Risk-Return Tradeoffs, Global Pricing of Risk, and Macroprudential Policy Stance**

This table reports results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2(r_c \cdot b^c) + \gamma_3(r_c \cdot p_c) + \gamma_4(r_c \cdot b^c \cdot p_c) + \varepsilon_c$, where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and p_c denotes country c's policy stance as given by the financial sector targetting macroprudential index defined in Cerutti, Claessens, and Laeven (2015). The index is normalized to equal 1 for the United States. The global risk loadings b^c are obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c \hat{\phi}(vix_t)$. The index i ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings are used as independent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	GDP Volatility				Inflation Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	0.76^{***}	-0.87	0.04	-0.19	0.40^{*}	0.34^{**}	0.55^{***}	0.67^{***}
$r \cdot b$		0.76^{*}	0.43	0.68		0.29	0.32	0.07
$r \cdot p$			-0.48^{*}	0.88			-0.33^{***}	-0.55^{***}
$r \cdot b \cdot p$				-1.04				0.50
R^2	0.36	0.49	0.56	0.58	0.25	0.32	0.50	0.52
Obs	28	28	28	28	28	28	28	28

	Crisis Peak NPL				Bank Credit Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	4.26	-38.49^{***}	-38.05^{***}	-35.24^{***}	0.53^{***}	0.61^{**}	0.87^{*}	0.78
$r \cdot b$		23.69^{***}	23.66^{***}	22.16^{***}		-0.04	-0.13	-0.06
$r \cdot p$			-1.09	-15.71			-0.26	0.17
$r \cdot b \cdot p$				7.99				-0.30
R^2	0.04	0.43	0.43	0.43	0.34	0.35	0.36	0.37
Obs	22	22	22	22	26	26	26	26

	Equity Downside Volatility				Bond Downside Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	-0.43	-7.09^{***}	-9.08^{***}	-5.95^{*}	0.88	-1.60	-1.23	-1.77
$r \cdot b$		4.59^{***}	5.37^{***}	3.24		6.60^{**}	6.51^{**}	8.57^{**}
$r \cdot p$			1.15^{***}	-4.64			-1.41	0.32
$r \cdot b \cdot p$				4.25				-5.85
R^2	0.01	0.34	0.41	0.43	0.01	0.22	0.24	0.27
Obs	28	28	28	28	28	28	28	28

Supplementary Appendix for “Global Price of Risk and Stabilization Policies”

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C Extensions

In this Appendix, we present three additional results. We first consider the connection between our results and those of Martin (2017), who argues that SVIX, a volatility index closely related to the VIX, provides a nonparametric lower bound on the equity risk premium. While we believe our results are broadly consistent with the link between implied volatility and risk premia that Martin (2017) explores, we present evidence that suggests SVIX and $\phi(VIX)$ are not equivalent concepts. We next extend the pricing model using local currency returns, and show that $\phi(VIX)$ can also be estimated purely from a cross section of foreign exchange excess returns. Third, given our hypothesized connection between the global price of risk and financial integration, we explore the role of capital controls for the risk-return tradeoff. Finally, we include an extended discussion of the related literature.

C.1 $\phi(VIX)$ vs. $SVIX^2$

Martin (2017) argues that the $SVIX^2$, a simple variance swap that captures the risk-neutral variance of the simple return on the market, provides an approximately tight lower bound on expected excess returns. Though historically, $VIX > SVIX$, the two series are highly correlated. If our pricing exercises are simply recapitulating the lower bound derived by Martin (2017), abstracting from the small differences between VIX and $SVIX$, our nonlinear forecasting equation $Rx^c_{t+1} = a^c + b^c\phi(v_t) + \varepsilon^c_{t+1}$ should satisfy $a^c \approx 0$, $b^c \approx 1$, and $\phi(VIX) = VIX^2$. Simply inspecting the estimated shape of $\phi(\cdot)$, presented in Figure 3, suggests that $\phi() \neq ()^2$. Nevertheless, to seriously address this question, we re-estimate our nonlinear pricing equation with VIX^2 instead of VIX as a predictor. Figure 10 plots our original estimated function, $\phi(VIX)$ against an estimated function of VIX^2, $\psi(VIX^2)$. It appears our nonparametric procedure selects a ψ such that $\phi \approx \psi \circ ()^2$, i.e., as a function of VIX, the estimated function is unchanged. Furthermore, we can strongly reject the hypothesis that this function is linear in VIX^2, casting doubt on the interpretation of $\phi(VIX)$ as an approximation to $SVIX^2$. This interpretation is underscored by forecasting results not included in the paper which are almost identical to those presented in the main body of the paper.

C.2 Dollar vs. Local Currency Pricing

Table 11 shows our estimated risk factor exposures b^c and the estimated price of risk $\hat{\phi}(vix_t)$ for the cross section of 21 countries where returns are in local currency terms. From a local investor perspective, equities load positively on the world market, indicating risk, while most bonds load negatively (with the interesting exception of Spain, Italy, and Portugal), indicating relative safety. Recall that this was not the case for returns expressed in U.S. dollars. From the perspective of a global financial institution based in the U.S., the only U.S. bonds command a significant safety premium, although there are weakly negative bond loadings for other financial centers as well (Japan, Hong Kong, and Switzerland; see Table 1 for details). We interpret the changing signs of the bond loadings b^c as reflecting primarily currency risk. From a local perspective, bonds are hedging assets for equity market risk, but from a U.S. investor perspective, this hedging value is undermined by fluctuations in the exchange rate.

C.3 Is global risk just carry risk?

An important international finance and macroeconomics literature links currency risk and the carry trade to domestic consumption risk in the United States. Lustig and Verdelhan (2007) argue that foreign currency returns hedge US consumption risk, and this hedging value prevents interest differentials from closing, while Ready, Roussanov, and Ward (2013) explain persistent interest rate differentials between the US and commodity-producing foreign countries with a model of trade specialization and limited shipping capacity. Since our main specification relies on US dollar-denominated global equity and bond returns, it is fair to ask: to what extent is our global risk factor $\phi(vix_t)$ just a proxy for currency risk? To address this question, we estimate $\phi(vix_t)$ directly using foreign exchange excess returns. Figure 12 plots our original ϕ function, estimated with US dollar-denominated global equity and bond returns, against an alternative estimate of ϕ, estimated with the global market and foreign exchange excess returns only. The two functions are statistically indistinguishable, as is evident from their overlapping 95% confidence bands. This results underscores once again that $\phi(vix_t)$ is a common factor in returns across an extremely broad cross-section of assets, and reinforces our interpretation of $\phi(vix_t)$ as the time-varying global price of risk.

C.4 Macro Risk-Return Tradeoffs, Global Pricing of Risk, and Capital Openness

There has been an increasing interest in using capital controls as a tool to smooth out fluctuations arising from the global financial cycle (see Ostry, Ghosh, Habermeier, Chamon, Qureshi, and Reinhardt (2010)). Capital controls inhibit international capital flows. The interaction between the monetary and exchange rate policies of a country can be expected to depend upon its stance towards capital mobility. The ability of countries to borrow and lend in international capital markets allows domestic investment to diverge from domestic savings, which can promote economic efficiency and growth. However, international capital flows can also spread crises across countries. Capital controls aim to mitigate excess volatility associated with capital flows, thus insulating countries from the spreading of disturbances. Within the context of this paper, such disturbances are captured via the global price of risk, which has domestic implications, even though it originates in world capital markets. Since the financial crisis of 2007-9, a number of countries have imposed capital controls, and the IMF has promoted their usage in certain cases.

We proxy capital controls with the index of capital openness from Fernández, Klein, Rebucci, Schindler, and Uribe (2015). The index is based on analysis for the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.[9] The same sets of specifications as in Tables 8, 9, and 10, are re-estimated with the capital openness index as the policy variable. Results are displayed in Table 12. We find no evidence that capital controls can tilt the risk-return trade off for macroeconomic outcomes, although we observe a strongly

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[9] See `http://www.elibrary.imf.org/page/AREAER/www.imfareaer.org`.

significant interaction for financial market outcomes, and some weaker evidence for crisis outcomes.

C.5 Related Literature

Our finding of a positive risk-return tradeoff relates to papers on the relationship between volatility and growth within endogenous growth models. Rancière, Tornell, and Westermann (2008) develop a theory that gives rise to a positive relationship between growth and skewness, particularly relevant from an emerging markets point of view. Acemoglu and Zilibotti (1997) present an endogenous growth theory with market incompleteness that explains why poor countries tend to be more volatile. Obstfeld (1994) models the interaction of financial market integration and endogenous growth. Empirically, Easterly, Kremer, Pritchett, and Summers (1993) and Jones and Olken (2008) document that countries oscillate between high growth and sharp contractions. Barro (2006) argues for the importance of tail risk to growth for asset prices.

The VIX index, which measures the implied volatility of the S&P 500, has previously been used as an indicator for the global price of risk, and as a proxy for risk aversion more generally. Rey (2015) shows that global capital flows, global credit growth, and global asset prices comove tightly with the VIX. Longstaff, Pan, Pedersen, and Singleton (2011) estimate that the price of sovereign risk is strongly correlated with the VIX. Furthermore, Adrian, Crump, and Vogt (2018) show that a nonlinear transformation of the VIX forecasts stock and bond returns, suggesting that the pricing of risk depends on the VIX.

There is also interaction between the stance of monetary policy and the pricing of risk. Interest rate policy has been shown to react to innovations in the VIX (Bekaert, Hoerova, and Duca (2013)). In reverse, vector autoregressions attribute a substantial variation in the VIX to federal fund rate shocks (Miranda-Agrippino and Rey (2014)). The risk taking channel of monetary policy provides a conceptual mechanism for the link between the pricing of risk and the stance of monetary policy via the balance sheet capacity of financial intermediaries (Adrian and Shin (2010), Borio and Zhu (2012)). Borio (2014) and Drehmann, Borio, and Tsatsaronis (2012) characterize the global financial cycle, a concept that is closely related to the global price of risk.

Our findings are tied to the enormous literature on the international transmission of shocks. That literature is focused on global capital flows (Obstfeld and Rogoff (2009, 2005)), contagion (Allen and Gale (2000), Forbes and Rigobon (2002), Kaminsky and Reinhart (2000)), and global imbalances (Caballero and Krishnamurthy (2008), Caballero, Farhi, and Gourinchas (2008)). The distinguishing feature of our contribution relative to this influential and important literature is to focus on the role of the pricing of risk in the international propagation of shocks. Furthermore, our empirical findings document a risk-return tradeoff for macroeconomic outcomes mediated by global price of risk exposures.

There is recently much focus on causes and consequences of capital flows. Gourio, Siemer, and Verdelhan (2014) show that capital inflows respond to both systematic and country-specific shocks to volatility, and they respond more in high uncertainty beta countries. Shek, Shim, and Shin (2015) present estimates of asset managers' role in the determination of emerging market capital flows. Blanchard, Ostry, Ghosh, and Chamon (2015) note that theory and evidence suggests bond inflows are contractionary, while risky asset inflows are expansionary, and draw macroeconomic policy conclusions. While we conjecture that global capital flows are a key mechanism driving our results, we leave the details of this mechanism for future research.

Figure 10: $\phi^{MKT}(VIX_t)$ **vs.** $\psi^{MKT}(VIX_t^2)$

This figure plots the estimated function obtained from unrestricted joint forecasting regressions $Rx_{t+1}^c = a^c + b^c\phi(v_t) + \varepsilon_{t+1}^c$ ($Rx_{t+1}^c = a^c + b^c\psi(v_t^2) + \varepsilon_{t+1}^c$)with 95 percent confidence intervals, using either VIX or VIX^2 as our nonlinear forecasting variable. MKT is the global value-weighted equity market return. In blue, we plot our orginial estimate of $\hat{\phi}(VIX_t)$, while in red, we plot a new estimate of $\hat{\psi}(VIX_t^2)$. In both cases, Rx_{t+1}^c ranges over the global market excess return (MKT), 23 country stock returns, and corresponding 23 10-year sovereign bond excess returns, and the unrestricted regression is estimated by sieve reduced rank regression, yielding parametric estimates of a^c and b^c and a nonparametric estimate of $\phi(VIX_t)$ ($\psi(VIX_t^2)$), with the degree of nonlinearity in the nonparameteric part independently selected via cross-validation. Then the restricted joint forecasting regression is estimated by taking $\phi(VIX_t)$ ($\psi(VIX_t^2)$) as given. The forecast horizon is $h = 6$ months, and the sample consists of the set of countries in our data set that produce a balanced panel of observations from 1995:1 to 2014:12. All returns are expressed in US dollars.

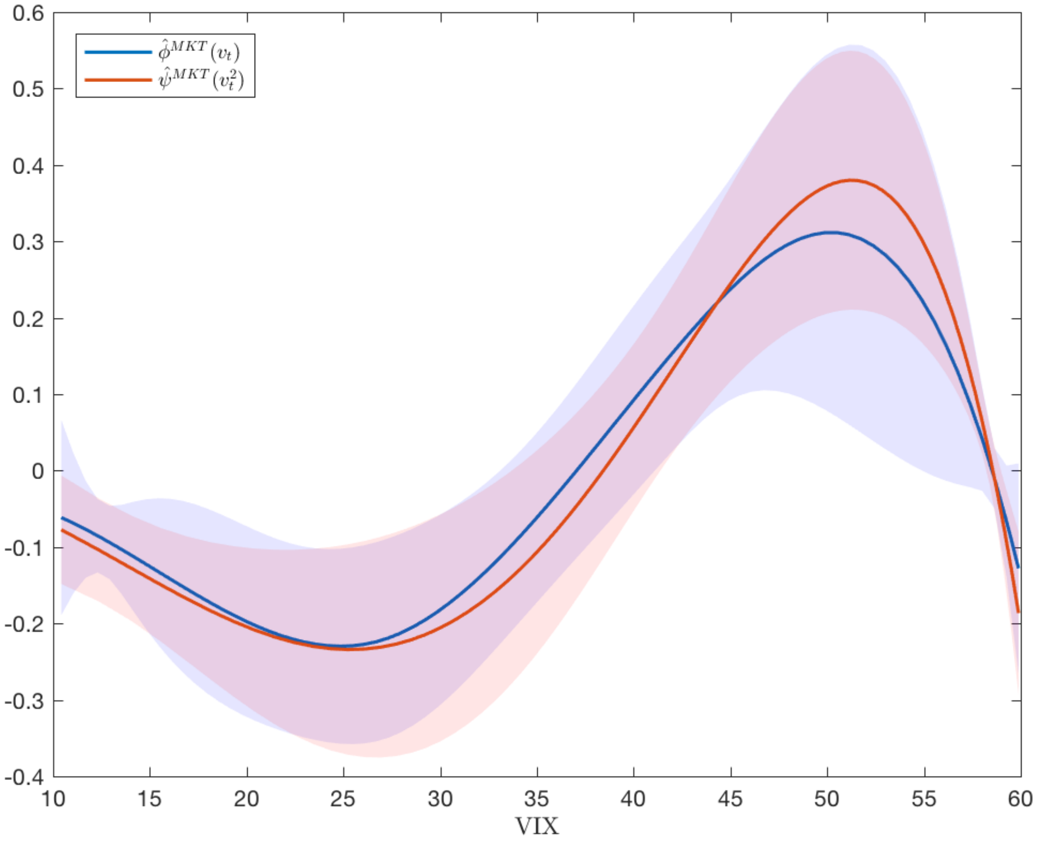

Figure 11: **Expected Excess Returns for Stocks and Bonds by Country**

This figure plots normalized SRRR estimated excess returns on asset i, $\hat{E}_t[Rx^c_{t+h}]/\hat{\sigma}(Rx^c_{t+h})$, where $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c_h + \hat{b}^c_h \hat{\phi}_h(v_t)$, $\hat{\sigma}(Rx^c_{t+h})$ scales by unconditional excess return standard deviation, and where i ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns. All stock excess returns have positive $\hat{b}^c_h$ loadings and are denoted in red. Bond excess returns with negative $\hat{b}^c_h$ loadings ("flight-to-safety bonds") are plotted in dark blue. The remaining bond excess returns with positive $\hat{b}^c_h$ loadings ("risky bonds") are shown in dashed light blue. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in local currency.

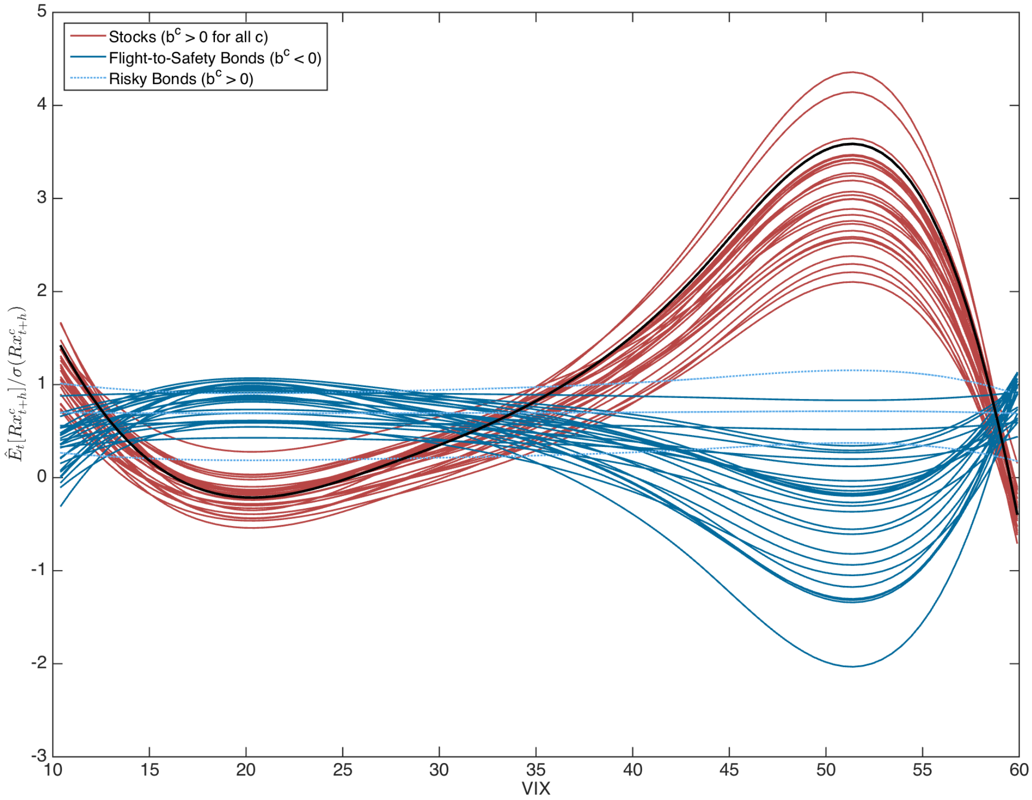

Figure 12: **Estimating $\phi^{MKT}(v_t)$ from Equity and Bond vs. Foreign Exchange Excess Returns**

This figure plots the estimated $\phi(v_t)$ function obtained from unrestricted joint forecasting regressions $Rx^c_{t+1} = a^c + b^c\phi(v_t) + \varepsilon^c_{t+1}$ with 95 percent confidence intervals. MKT is the global value-weighted equity market return. In blue, we plot our orginial estimate of $\hat{\phi}(v_t)$, where Rx^c_{t+1} ranges over the global market excess return (MKT), 21 country stock returns, and corresponding 21 10-year sovereign bond excess returns, while in red, we plot a new estimate of $\hat{\phi}(v_t)$, where Rx^c_{t+1} ranges over the global market excess return (MKT) and 19 country foreign exchange excess returns (we omit the US and Hong Kong, since for these countries the forex excess return is just the inverse of the US risk free rate (RF)). In both cases, the unrestricted regression is estimated by sieve reduced rank regression, yielding parametric estimates of a^c and b^c and a nonparametric estimate of $\phi(v_t)$, with the degree of nonlinearity in the nonparameteric part independently selected via cross-validation. Then the restricted joint forecasting regression is estimated by taking $\phi(v_t)$ as given. The forecast horizon is $h = 6$ months, and the sample consists of the set of countries in our data set that produce a balanced panel of observations from 1995:1 to 2014:12. All returns are expressed in US dollars.

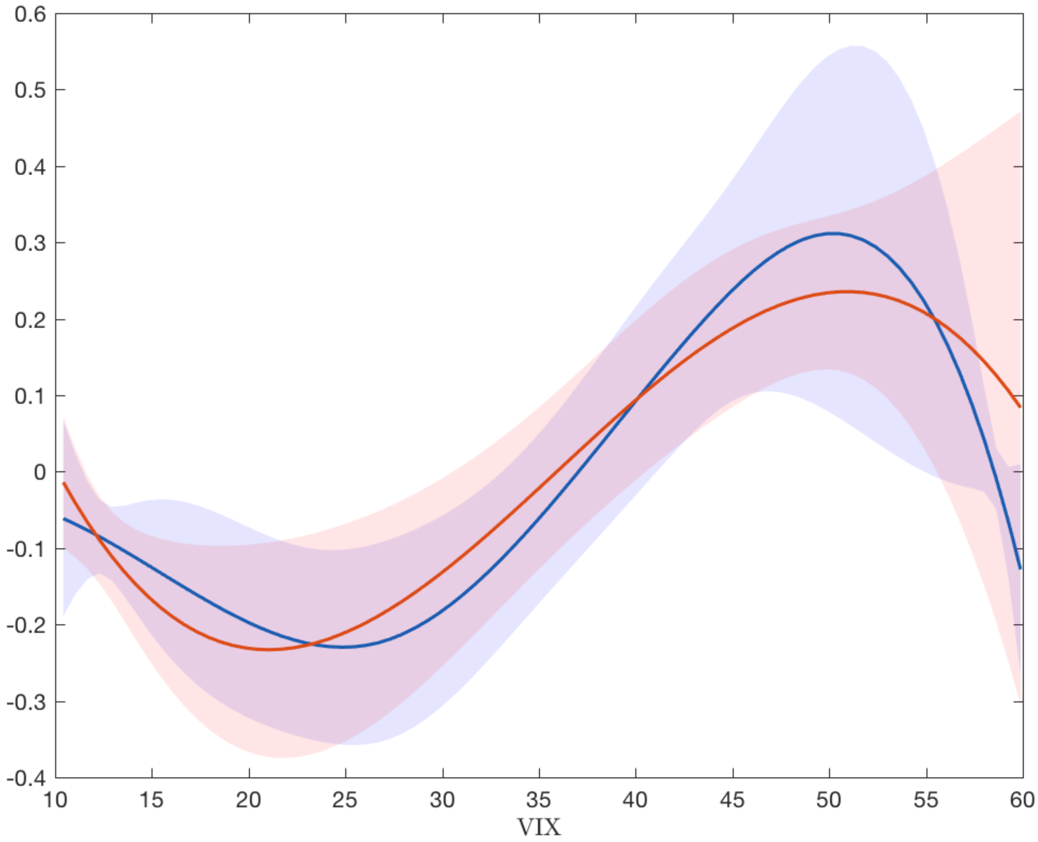

Table 11: **Nonlinear VIX predictability: local currency returns**

This table reports results from two predictive sieve reduced rank (SRR) regressions at the $h = 6$ and $h = 12$ month ahead forecasting horizons: (1) estimates of a_h^c and b_h^c from the SRR regressions $Rx_{t+h}^c = a_h^c + b_h^c v_t + \varepsilon_{t+h}^c$ of country c's equity and 10-year sovereign bond excess returns on linear $v_t = vix_t$; (2) estimates of a_h^c and b_h^c from the SRR regressions $Rx_{t+h}^c = a_h^c + b_h^c \phi_h(v_t) + \varepsilon_{t+h}^c$ of country c's equity and 10-year sovereign bond excess return on the common nonparametric function $\phi_h(\cdot)$ of $v_t = vix_t$. The index c ranges over the global market excess return (MKT), 21 country stock returns, and corresponding 21 10-year sovereign bond excess returns. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level for t-statistics on a^c and for the χ^2-statistic on $b^c\phi_h(\cdot)$ derived in Theorem 1 of Adrian, Crump, and Vogt (2018). The joint test p-value (*J p-val*) reports the likelihood that the sample was generated under the null of no predictability for all excess returns in the cross section. The sample consists of a balanced panel of observations from 1995:1 to 2014:12. All returns are expressed in local currency.

	Horizon h = 6				**Horizon h = 12**			
	(1) Linear VIX		(2) Nonlinear VIX		(1) Linear VIX		(2) Nonlinear VIX	
	a^c	b^c	a^c	b^c	a^c	b^c	a^c	b^c
MKT	−0.02	1.00	1.52	1.00***	0.00	1.00	0.55	1.00***
aus equity	−0.07	2.16	2.43	1.59***	−0.03	2.33	0.88	1.59***
aut equity	−0.09	1.57	2.07	1.39***	−0.01	0.97	0.71	1.35***
bel equity	0.03	0.44	1.78	1.16***	0.05	0.38	0.74	1.35***
can equity	−0.05	1.73	1.87	1.21***	0.01	1.45	0.68	1.19***
che equity	0.07	0.03	1.22	0.78***	0.06	0.09	0.52	0.89***
deu equity	0.03	0.14	1.40	0.92***	0.06	−0.35	0.59	1.08***
dnk equity	0.09	0.10	1.45	0.92***	0.11	−0.26	0.68	1.16***
esp equity	0.09	−0.28	1.63	1.06***	0.12	−0.99	0.69	1.23***
fin equity	−0.01	1.14	1.79	1.16***	0.05	0.55	0.69	1.21***
fra equity	0.01	0.60	1.46	0.96***	0.03	0.52	0.58	1.05***
gbr equity	0.00	0.60	1.59	1.05***	0.02	0.56	0.61	1.13***
hkg equity	−0.01	0.99	2.65	1.76***	0.01	0.96	1.08	2.02***
irl equity	0.02	0.53	2.13	1.41***	0.12	−1.41	0.71	1.29***
ita equity	−0.03	0.91	1.32	0.87***	0.04	0.03	0.51	0.92***
jpn equity	−0.09	0.97	1.16	0.80***	−0.11	1.95	0.36	0.76***
nld equity	0.04	0.07	1.84	1.21***	0.06	−0.36	0.79	1.47***
nor equity	0.04	0.55	1.98	1.29***	0.07	0.18	0.91	1.65***
nzl equity	−0.03	1.38	1.81	1.18***	−0.02	1.93	0.64	1.13***
prt equity	−0.01	0.34	1.45	0.97**	0.07	−0.87	0.67	1.26**
swe equity	−0.04	1.72	2.20	1.43***	0.00	1.81	0.83	1.47***
usa equity	0.00	0.92	1.38	0.89***	0.03	0.79	0.49	0.85***
aus bond	0.13*	−0.77	−0.50	−0.38***	0.10	−0.66	−0.07	−0.28*
aut bond	0.06	0.03	−0.10	−0.11	0.04	0.40	0.02	−0.08
bel bond	0.06	0.07	−0.02	−0.06	0.05	0.23	0.04	−0.03
can bond	0.07	−0.17	−0.25	−0.21***	0.07	−0.16	−0.01	−0.13
che bond	0.02	0.22	−0.12	−0.10	0.01	0.47	−0.03	−0.12
deu bond	0.06	−0.04	−0.21	−0.18*	0.05	0.20	−0.03	−0.17
dnk bond	0.07	0.03	−0.12	−0.13	0.06	0.14	0.00	−0.13
esp bond	0.15**	−0.90	0.09	0.00	0.15**	−1.51	0.14	0.13
fin bond	0.09*	−0.22	−0.03	−0.07	0.07	−0.06	0.03	−0.06
fra bond	0.07*	−0.18	−0.13	−0.13	0.06	0.06	0.02	−0.08
gbr bond	0.03	0.29	−0.14	−0.13	0.04	0.25	−0.05	−0.20*
hkg bond	0.05	0.12	−0.43	−0.33	0.02	0.64	−0.10	−0.31
irl bond	0.15*	−1.07	−0.11	−0.12	0.12*	−1.10	0.09	0.04
ita bond	0.12**	−0.39	0.18	0.06	0.13**	−0.99	0.19	0.20
jpn bond	0.03	−0.15	−0.20	−0.15*	0.02	−0.02	−0.03	−0.10
nld bond	0.06	0.02	−0.10	−0.11	0.04	0.32	0.00	−0.10
nor bond	0.05	0.05	−0.19	−0.17*	0.03	0.37	−0.03	−0.15
nzl bond	0.08	−0.37	−0.60	−0.45***	0.05	0.21	−0.11	−0.32*
prt bond	0.17**	−1.23	0.08	0.00	0.17**	−1.96	0.22	0.28
swe bond	0.13**	−0.80	−0.15	−0.15	0.10*	−0.68	0.04	−0.06
usa bond	0.06	−0.08	−0.42	−0.32**	0.04	0.35	−0.09	−0.28**
J p-val		0.185		0.000		0.042		0.000

Table 12: **Macro Risk-Return Tradeoffs, Global Pricing of Risk, and Capital Openness**

This table reports results from cross-sectional regressions of macro stability outcomes on global risk loadings, policies, macro control variables, and their interactions. The baseline regression is $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 (r_c \cdot b^c) + \gamma_3 (r_c \cdot p_c) + \gamma_4 (r_c \cdot b^c \cdot p_c) + \varepsilon_c$, where σ_c denotes a macroeconomic or financial risk measure as indicated in the table headers, r_c is the corresponding macroeconomic or financial return, and p_c denotes country c's policy stance as given by total capital openness, defined in Fernández, Klein, Rebucci, Schindler, and Uribe (2015). The index is normalized to equal 1 for the United States. The global risk loadings b^c are obtained from sieve reduced rank regressions (SRRR) $\hat{E}_t[Rx^c_{t+h}] = \hat{\alpha}^c + \hat{b}^c \hat{\phi}(vix_t)$. The index i ranges over the global market excess return (MKT), 30 country stock returns, and corresponding 30 10-year sovereign bond excess returns in the SRRR estimation. The resulting 30 b^c country stock return loadings and 30 b^c bond return loadings are used as independent variables in the table below. The forecast horizon is $h = 6$ months, and the sample consists of an unbalanced panel of observations from 1990:1 to 2014:12. All returns are expressed in US dollars.

	GDP Volatility				Inflation Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	0.74^{***}	-0.90	-0.42	0.20	0.41^{*}	0.35^{**}	0.52^{***}	0.61^{***}
$r \cdot b$		0.77^{*}	0.70	0.36		0.30	0.27	0.03
$r \cdot p$			-0.07	-0.27			-0.02	-0.03
$r \cdot b \cdot p$				0.13				0.06
R^2	0.35	0.48	0.55	0.56	0.26	0.33	0.35	0.36
Obs	29	29	29	29	29	29	29	29

	Crisis Peak NPL				Bank Credit Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	4.80	-37.96^{***}	-37.70^{***}	-33.14^{***}	0.54^{***}	0.58^{**}	0.83^{*}	1.04^{**}
$r \cdot b$		23.69^{***}	23.49^{***}	20.75^{***}		-0.02	-0.02	-0.13
$r \cdot p$			0.05	-3.55^{*}			-0.04	-0.09
$r \cdot b \cdot p$				1.75^{*}				0.03
R^2	0.05	0.43	0.43	0.43	0.35	0.35	0.39	0.39
Obs	23	23	23	23	27	27	27	27

	Equity Downside Volatility				Bond Downside Volatility			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
r	-0.53	-6.99^{***}	-7.11^{***}	-10.38^{***}	0.80	-1.70	-3.27^{**}	-1.98
$r \cdot b$		4.53^{***}	4.28^{***}	6.77^{***}		6.67^{*}	5.00^{*}	0.32
$r \cdot p$			0.17	3.85^{***}			0.71^{***}	0.19
$r \cdot b \cdot p$				-2.59^{***}				1.87^{**}
R^2	0.02	0.36	0.38	0.55	0.01	0.22	0.43	0.51
Obs	29	29	29	29	29	29	29	29