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Abstract

We estimate a highly significant price of risk that forecasts global stock and bond returns as a nonlinear function of the CBOE Volatility Index (VIX). We show that countries' exposure to the global price of risk is related to macroeconomic risks as measured by output, credit, and inflation volatility, the magnitude of financial crises, and stock and bond market downside risk. Higher exposure to the global price of risk corresponds to both higher output volatility and higher output growth. We document that the transmission of the global price of risk to macroeconomic outcomes is mitigated by the magnitude of stabilization in the Taylor rule, the degree of countercyclicality of fiscal policy, and countries' tendencies to employ prudential regulations. The estimated magnitudes are quantitatively important and significant, with large cross-sectional explanatory power. Our findings suggest that macroeconomic and financial stability policies should be considered jointly.

Key words: financial stability, monetary policy, fiscal policy, regulatory policy

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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 impact a country's riskiness by exposing it to fluctuations in the global price of risk. Therefore, there is the potential for a risk-return tradeoff: higher world capital integration potentially increases both risk and growth. If such a tradeoff exists, it would have 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 with higher growth and higher volatility. Furthermore, we find significant interactions between how stabilization policies and the global price of risk 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 theoretically 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, global asset managers, and global insurance companies intermediate capital allocations across the world. However, global intermediaries are subject to various regulatory and risk management constraints. The theoretical relationship between the VIX and balance sheet constraints has been elaborated by Adrian and Shin (2014), who directly show that market volatility can be used as a measure of the tightness of VaR limits of financial institutions. Bruno and Shin (2015) provide a model of global banking where global banks obtain funding in US dollar markets and pass their constraints onto local financial conditions via their lending relationships with local banks. Taken together, these 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 comove closely with the VIX (see Figure 1). Additionally, Rey (2015) shows that global capital flows, global credit growth, and global asset prices comove tightly with the VIX (see Figure 1), and 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 (2015) show that risk premia in US equity and Treasury markets are nonlinear functions of the VIX. We follow build on the logic of this literature and measure how the global price of risk estimated from the VIX impacts economic outcomes in countries across the world.

Following Adrian, Crump, and Vogt (2015), we estimate the global price of risk by forecasting returns with an unknown, nonlinear function of the VIX. The nonlinearity of this forecasting relationship is consistent with general equilibrium 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)). However, 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. A dynamic asset pricing model with the nonlinear function of the VIX, the global equity market return, and the US short rate corresponds closely to our forecasting regressions, and features highly significant prices of risk for all three state variables.

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 on the global price of risk. We uncover a strongly significant risk return tradeoff: higher country exposure to 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 undertake broader empirical study. 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 term structure data, which includes developed countries and fairly advanced emerging markets. Furthermore, we only study data since 1995, when term structure 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 exposures to global risk appetite across countries.

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 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 (2015) 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 (2010a), 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.

1.2 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 6 presents a model for the pricing of risk and provides details on the data. A supplementary appendix provides additional results.

2 Global Price of Risk

2.1 Global Financial Institutions

Asset allocation is largely delegated to financial institutions including banks, asset managers, and insurance companies. The delegation gives rise to principal agent problems which are solved via contractual features between the managers of the institution and their investors. The latter include households and nonfinancial corporations. The literature has particularly focused on the principal agent relationships in the asset management sector (Vayanos (2004), Vayanos and Woolley (2013)), the hedge fund sector (Panageas and Westerfield (2009)), and the banking sector (Adrian and Shin (2014)). In equilibrium, such constraints on financial institutions impact the pricing of risk. For instance, in the intermediary asset pricing theories of He and Krishnamurthy (2008, 2011), the stochastic discount factor is directly expressed as a function of intermediary balance sheet measures.

An important common element emerging from the studies of the constraints faced by financial institutions is that the tightness of the constraints depends on market risk. Higher risk tends to tighten constraints on the institutions, either due to redemption risk in the case of asset managers, the high water mark in the case of hedge funds, or VaR constraints in the banking sector. Hence market volatility constrains risk taking.

This link between the tightness of constraints and market risk is most explicit in the case of VaR constraints. Danıelsson, Shin, and Zigrand (2004, 2012) and Adrian and Shin (2010b, 2014) have put the focus on VaR constraints as a key feature in understanding the risk appetite of such financial institutions. In Danıelsson, Shin, and Zigrand (2012) and Adrian and Boyarchenko (2012), the pricing kernel that emerges depends on intermediary leverage, which is directly related to market volatility due to the VaR constraint. Intuitively, when asset volatility is low, intermediaries' VaR constraint is far from binding, resulting in greater intermediary risk-bearing capacity. Greater risk-bearing capacity, in turn, allows intermediaries to endogenously choose higher leverage. Hence volatility is linked to the price of risk of leverage via the tightness of intermediaries' VaR constraints. Importantly, the relationship between expected returns and the level of volatility is highly nonlinear.

Consistent with such predictions, measures of risk taking by institutions have been shown to be highly significant pricing factors for the time series and cross section of asset prices. Adrian, Etula, and Muir (2014) document that shocks to intermediary leverage price stocks and bonds cross sectionally, and Adrian, Moench, and Shin (2010, 2014) show intermediary leverage forecasts stock and bond returns. The interpretation of these findings is that the pricing kernel is a function of financial intermediaries' balance sheet capacity.

While the previous literature has focused on the role of leverage in the pricing of risk, we will instead focus more directly on the role of the VaR constraint. Figure 1 shows the VaRs of major global banks together with equity market volatility measured by the VIX. The risk bearing capacity of global banking institutions comoves closely with the level of market volatility, which suggests that the VIX can be directly used as a measure of the tightness of intermediary constraints. Compared to VaR, the VIX is available at a higher frequency, and has a longer history, making it better suited for our purposes.

For asset managers, the level of market volatility is also a measure of funding constraints, as the intensity of redemptions depends on the level of volatility. Vayanos (2004) shows that the redemption constraint of an asset manager is mathematically equivalent to a VaR constraint. Intuitively, when market volatility is high, downside risk increases, leading to flight to safety. The bottom panel of Figure 1 depicts the sum of equity fund outflows and government bond fund inflows, together with the VIX, where the latter is truncated at its median. The correlation between the two series is high, suggesting that when market volatility rises above its median, downside risk to asset returns increases, resulting in flight-to-safety.

As a result of this evidence, we will use the VIX to proxy for the balance sheet constraints of financial intermediaries. To make this logic more precise, we present a theoretical framework that links the pricing of risk to the VaR constraints of institutions in Appendix A. The model gives rise to an asset pricing prediction where expected returns are determined by covariation with risk factor exposures, and prices of risk are varying over time. The formal interpretation of $\phi(vix_t)$ as a global price of risk is motivated by the dynamic pricing model arising from Appendix A, which yields the following pricing equation:

$$r^c_{t+h} = \beta^c \left(\lambda_0 + \lambda_1 X_t + \varepsilon^X_{t+h}\right) + e^c_{t+h} \tag{2.1}$$

$$\beta^c = Cov\left(r^c_{t+h}, \varepsilon^X_{t+h}\right) Var^{-1}\left(\varepsilon^X_{t+h}\right) \tag{2.2}$$

$$X_{t+h} = \left[r^M_{t+h}, r^{GSCI}_{t+h}, r^f_{t+h}, \phi\left(vix_{t+h}\right)\right]' \tag{2.3}$$

$$X_{t+h} = \mu + \Phi X_t + \varepsilon^X_{t+h} \tag{2.4}$$

Intuitively, expected returns are determined by risk factor loadings β^c and the pricing of risk $(\lambda_0 + \lambda_1 X_t)$. While β^c is asset specific, the pricing of risk $(\lambda_0 + \lambda_1 X_t)$ is common across countries and assets. Returns are determined by expected returns, plus systematic risk $\beta^c \varepsilon^X_{t+h}$ and idiosyncratic risk e^c_{t+h}. Systematic risk ε^X_{t+1} corresponds to the innovations from the state variable VAR (equation (2.4)), while e^c_{t+1} captures idiosyncratic risk of each country. The vector of state variables $\left[r^M_{t+h}, r^{GSCI}_{t+h}, r^f_{t+h}, \phi\left(vix_{t+h}\right)\right]'$ is motivated by the intermediary asset pricing model of Appendix A, which suggests that r^M_{t+h} is a risk factor due to market clearing, and that $\phi\left(vix_{t+h}\right)$ is a risk factor due to the VaR constraint. The nonlinearity of the pricing of risk as a function of the volatility is an equilibrium relationship that results from the VaR constraint on the financial intermediaries. We further add r^{GSCI}_{t+h} as a risk factor, as commodity prices are an important determinant of cross country performance. Also, much of our analysis is focused on fixed income securities, and hence the risk free rate r^f_{t+h} is an additional risk factor.

2.2 Estimation of the VIX Pricing Function

We first estimate the global price of risk variable by running a forecasting regression of global equity and sovereign bond excess returns of 30 countries on an unknown function of lagged

S&P 500 implied volatility (the VIX). In particular, we estimate

$$r_{t+h}^{c}=a^{c}+b^{c}\phi\left(vix_{t}\right)+\eta_{t+h}^{c}, \tag{2.5}$$

where $c=1$ is the global equity market excess return, $c=2,\ldots,31$ correspond to international equity market excess returns of the 30 countries in our sample, and $c=32,\ldots,61$ denote the sovereign bond excess returns of the same 30 countries. The maturity of the bonds is 10 years, and all returns are in USD, reflecting the perspective of a global financial intermediary that obtains short-term funding in USD markets.

We refer to $\phi\left(vix_{t}\right)$ as a price of risk, in the sense that it captures the compensation that global intermediaries earn in excess of the risk-free rate for holding assets that increase their exposure to volatility, $\phi\left(vix_{t}\right)=\partial E_{t}[r_{t+h}^{c}]/\partial b^{c}$. By leaving $\phi(\cdot)$ unspecified, the predictive regression (2.5) remains agnostic about the exact dependence of global risk premia on the VIX and allows for possible nonlinearities. Because $\phi(\cdot)$ is unknown, we estimate it nonparametrically and jointly with the loadings b^{c} and the intercepts a^{c}, using the sieve reduced rank (SRR) regression framework of Adrian, Crump, and Vogt (2015).

SRR regressions exploit the fact that as a price of risk, $\phi(vix_{t})$ is a common component that drives time-variation across all expected excess returns that have non-zero loadings. At the same time, they remain nonparametric about the shape of $\phi(\cdot)$ by relying on the method of sieves.[1] Intuitively, the method of sieves involves basis function approximations to the unknown function ϕ that grow slowly with the sample size. A prototypical approximation for ϕ then has the form $\tilde{\phi}(v)=\sum_{j=1}^{m_{T}}\tilde{\gamma}_{j}B(v)$, where $B(v)$ are the basis functions. The number of basis functions used in the approximation is required to grow slowly with the sample size ($m_{T}\rightarrow\infty$ slowly as $T\rightarrow\infty$), allowing ever-increasing flexibility in approximating the true ϕ. Asymptotically, the basis function approximations become arbitrarily flexible and close to ϕ in the sense formalized in Adrian, Crump, and Vogt (2015).[2]

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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

SRR estimates $\hat{\phi}(vix_t)$ thus have a shape that is simultaneously informed by the cross-section of global stock and bond risk premia. Figure 2 shows the SRR estimated expected excess returns, $\hat{E}_t[r^c_{t+h}] = \hat{a}^c + \hat{b}^c \hat{\phi}\left(vix_t\right)$, scaled by unconditional return standard deviation to standardize units across assets with naturally different volatilities. 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 exceeding 50, which occurred exclusively during the 2008 financial crisis, there is a reversal of expected excess 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, the strongly non-linear relationship between returns and past volatility is consistent with intermediary asset pricing theories where VaR type constraints impact the effective risk aversion of banks or funds (as in Vayanos (2004), Vayanos and Woolley (2013)), (Adrian and Shin (2014), and Adrian and Boyarchenko (2012)). We will next turn to the cross sectional asset pricing implications, formally introducing the notion of exposure to the global price of risk, and providing estimates of the statistical significance of $\hat{\phi}(vix_t)$ for expected returns.

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global equity market's price of risk.

2.3 Estimation of Global Price of Risk

Table 1 shows our estimated risk factor exposures β and the prices of risk λ for a cross section of 21 countries from the pricing model 2.1.[3] Equity world market betas are generally positive, while certain bond betas to the world equity market (US, Japan, and Hong Kong) are negative. The negative bond beta indicates that these bonds are hedging assets for equity market risk. In contrast, sovereign bonds with large, positive, and statistically significant betas to the world equity market tend to be riskier (Portugal, Spain, Italy) or commodity-producing (Australia, Canada, New Zealand). The betas relative to the US risk free rate are also generally negative for global bonds, while no clear pattern emerges for betas on the $\phi(vix_t)$ factor. Betas on the commodity index GSCI at highly significant and positive for commodity producing countries (Australia, Canada, Norway, New Zealand), and either negative or insignificant for most other countries.

Table 1 also illustrates $\phi(vix_t)$'s role as a price of risk variable. In particular, the last line of the table shows that the prices of risk λ are positive and significant at the 1% level for the global equity market MKT, and negative and significant at the 5% level for the global commodity index, the risk free rate and the global price of risk. These results indicate that all four state variables feature prices of risk that vary as a function of $\phi(vix_t)$. It is important to point out that a simple linear function of the vix_t would not have generated such a result. Furthermore, the negative sign on the price of risk coefficient λ_1 for $\phi(vix_t)$ suggests that in general investors pay for positive exposure to an instrument that hedges against bad states of the world.

The dynamic asset pricing model (2.1) effectively places restrictions on the SRR regression's loadings in (2.5). In particular, inspection of (2.1) and (2.5) reveals that if the dynamic asset pricing model is reasonably well specified, then $\beta^c\lambda_1 = b^c$. Figure 3 shows that this is

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[3] We use twenty-one countries for the dynamic asset pricing estimation as the inference requires a balanced panel with sufficient history. The twenty-one countries used in this particular exercise are chosen for their availability of data going back to 1995, a criterion that can be varied without qualitatively changing the results. In all other analyses we use a broader cross section of 30 countries.

indeed the case: the b^c loading from the SRR corresponds closely to the component of $\beta^c \lambda_1$ that is associated with $\phi(vix_t)$, justifying our interpretation of $\phi(vix_t)$ as a global price of risk in the context of the asset pricing model (2.1) and Appendix A. We therefore adhere to this definition in what follows and refer to the coefficients b^c as loadings or exposures to this global price of risk.

The key takeaways from the dynamic asset pricing model presented in this section are twofold. First, we show that the pricing of risk function $\phi(vix_t)$ is highly significant for the panel of global stock and bond returns (Table 1). Second, the section shows that country exposures b^c to the global price of risk are systematically linked to risk factor exposures (Figure 3). This observation supports the theoretical dynamic asset pricing underpinnings of the global price of risk (Equation 2.1 based on the model from Appendix A). Each countries' exposure to the global price of risk is thus summarized by the product of its country risk exposure b^c with the evolution of the global price of risk variable $\phi(vix_t)$. 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 thus employ six state variables in our estimation: output gaps[5]. A positive output gap corresponds to output above trend., annual inflation rates, policy rates, and equity market index returns. All of these variables are country specific. The global price

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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.

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 the constant across 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.

The VAR is identified with zero restrictions: state variables are ordered from most to least exogenous (output gap, inflation, policy rate, global price of risk, market return). The first three sets of restrictions 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. These restrictions are *a priori* plausible, since macroeconomic aggregates are slower moving than financial variables. Similarly, the equity market return is restricted to only affect other state variables with a lag. Its ordering with the global price of risk, whose shocks occur contemporaneously with measures of aggregate volatility (the so-called leverage effect), can be interchanged without materially affecting the results.

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 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 4 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.

On the other hand, inflation responds weakly to shocks to the output gap, and vice versa. We conjecture that this result is partially an artifact of our sample, which is tilted towards advanced economies during an era of low and stable inflation.[6] Our impulse response functions also reproduce the familiar "price puzzle" (Bernanke, Boivin, and Eliasz (2005), Sims (1992)): positive policy rate shocks lead to *increases* in the output gap and inflation. The standard explanation for this result is "central bank information": the central bank is assumed to have access to information about future output and inflation not included in the VAR. Thus monetary tightenings in anticipation of an expansion, induce a spuriously positive impulse response. Observe, however, that the positive responses of the output gap and inflation, while statistically significant, are quantitatively small, peaking at one twentieth of a standard deviation.

More relevant, from our perspective, 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 (2015), 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, their is no evidence that the policy rates respond to fluctuations in equity markets.

More surprising is the fact that tighter monetary policy (a positive shock to the policy rate) is associated with a *decrease* in risk pricing. This can be understood by noting that cen-

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[6] Note, however, that all the results in this subsection are robust to the exclusion of emerging markets and Eurozone members, though confidence bands tend to increase as the cross section of countries decreases.

tral banks set the policy rate in a forward-looking manner, raising interest rates in response to future expected output growth. The decline in the pricing of risk following a tightening of monetary policy can thus be understood as the incorporation of good news about the future output into the price of risk. This is consistent with recent work by Nakamura and Steinsson (2013) who present evidence that central bank policy contains information not already incorporated into market prices.

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 our 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 (2.5)—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 criss output losses, credit booms and busts, credit volatility, and the Aizenman, Chinn, and Ito (2008) financial openness index.

As our estimated $\phi(v)$ captures global risk pricing, we expect to observe a relationship between the b^c's and these macro outcomes across countries. The theoretical rationale for the analysis of these correlations is that the global price of risk impacts financial conditions in each country, which in turn, influence real and nominal economic outcomes.

3.1 Global Risk in the Cross Section

We begin by examining simple univariate relationships between risk exposure and macro variables. Figures 5 and 6 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

$$\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 b^c + \gamma_3 (r_c \cdot b^c) + \varepsilon_c \tag{3.1}$$

where σ_c represents various macroeconomic risks (GDP growth volatility, crisis peak non-performing 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.[7]

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[7] 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.

Our results are displayed in Table 4. In each specification, column (1) reports the raw risk-return tradeoff , column (2) adds the relevant b^c, and column (3) adds the interaction term $r \times b^c$, to see whether exposure to the global price of risk can tilt the tradeoff. 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.

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 first order phenomenon to consider in analyzing growth. Furthermore, the regressions show that exposure to the global financial cycle is a first order explanation of the 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

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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.

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)[8], the OECD[9] 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. The first thing to note is that we find a 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 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.

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[8] 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.

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

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.

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.

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).

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 determinant of countries' exposure to the global price of risk.

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 7 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 7 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 8 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 are interested in the partial effect

$$\frac{\partial \sigma}{\partial r} = \gamma_r + \gamma_{r\cdot b} b + \gamma_{r\cdot p} p + \gamma_{r\cdot b\cdot p}(b \cdot p) \tag{4.3}$$

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. Note further that 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. This price of risk is motivated by an intermediary asset pricing model in which global banks face value-at-risk constraints that tighten when aggregate volatility increases. 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.

References

Acemoglu, D., S. Johnson, J. Robinson, and Y. Thaicharoen (2003): "Institutional causes, macroeconomic symptoms: volatility, crises and growth," *Journal of monetary economics*, 50(1), 49–123.

Acemoglu, D., and F. Zilibotti (1997): "Was Prometheus unbound by chance? Risk, diversification, and growth," *Journal of political economy*, 105(4), 709–751.

Adrian, T., and N. Boyarchenko (2012): "Intermediary Leverage Cycles and Financial Stability," *Federal Reserve Bank of New York Staff Report*, 567.

Adrian, T., R. Crump, and E. Vogt (2015): "Nonlinearity and flight to safety in the risk-return trade-off for stocks and bonds," *Federal Reserve Bank of New York Staff Report*, 723.

Adrian, T., E. Etula, and T. Muir (2014): "Financial Intermediaries and the Cross-Section of Asset Returns," *Journal of Finance*, 69(6), 2557–2596.

Adrian, T., E. Moench, and H. S. Shin (2010): "Macro risk premium and intermediary balance sheet quantities," *IMF Economic Review*, 58(1), 179–207.

——— (2014): "Dynamic Leverage Asset Pricing," *Federal Reserve Bank of New York Staff Report*, 625.

Adrian, T., and H. S. Shin (2010a): "Financial Intermediaries and Monetary Economics," *Handbook of Monetary Economics*, 3, 601–650.

——— (2010b): "Liquidity and leverage," *Journal of Financial Intermediation*, 19(3), 418–437.

——— (2014): "Procyclical Leverage and Value at Risk," *Review of Financial Studies*, 27(2), 373–403.

Aizenman, J., M. D. Chinn, and H. Ito (2008): “Assessing the emerging global financial architecture: measuring the trilemma’s configurations over time,” Discussion paper, National Bureau of Economic Research.

Allen, F., and D. Gale (2000): “Financial contagion,” *Journal of political economy*, 108(1), 1–33.

Barro, R. J. (2006): “Rare Disasters and Asset Markets in the Twentieth Century,” *Quarterly Journal of Economics*, pp. 823–866.

Bekaert, G., C. R. Harvey, and C. Lundblad (2005): “Does financial liberalization spur growth?,” *Journal of financial Economics*, 77(1), 3–55.

Bekaert, G., M. Hoerova, and M. L. Duca (2013): “Risk, uncertainty and monetary policy,” *Journal of Monetary Economics*, 60(7), 771–788.

Bernanke, B. S., J. Boivin, and P. Eliasz (2005): “Measuring the effects of monetary policy: a factor-augmented vector autoregressive (FAVAR) approach,” *Quarterly Journal of Economics*, 120(1), 387–422.

Blanchard, O., J. D. Ostry, A. R. Ghosh, and M. Chamon (2015): “Are Capital Inflows Expansionary or Contractionary? Theory, Policy Implications, and Some Evidence,” Discussion paper, National Bureau of Economic Research.

Borio, C. (2014): “The Financial Cycle and Macroeconomics: What have we Learnt?,” *Journal of Banking & Finance*, 45, 182–198.

Borio, C., and H. Zhu (2012): “Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism?,” *Journal of Financial Stability*, 8(4), 236–251.

Bruno, V., and H. S. Shin (2015): “Cross-Border Banking and Global Liquidity,” *Review of Economic Studies*, 82(2), 535–564.

Buch, C. M., J. Döpke, and C. Pierdzioch (2005): “Financial Openness and Business Cycle Volatility,” *Journal of International Money and Finance*, 24(5), 744–765.

Caballero, R., E. Farhi, and P.-O. Gourinchas (2008): “An Equilibrium Model of Global Imbalances and Low Interest Rates,” *American Economic Review*, 98(1).

Caballero, R. J., and A. Krishnamurthy (2008): “Collective risk management in a flight to quality episode,” *Journal of Finance*, 63(5), 2195–2230.

Cerutti, E., S. Claessens, and M. L. Laeven (2015): *The Use and Effectiveness of Macroprudential Policies: New Evidence*, no. 15 in 61. International Monetary Fund.

Chen, X. (2007): “Large sample sieve estimation of semi-nonparametric models,” *Handbook of Econometrics*, 6, 5549–5632.

Clarida, R., J. Gali, and M. Gertler (1998): “Monetary policy rules in practice: some international evidence,” *european economic review*, 42(6), 1033–1067.

Danielsson, J., H. S. Shin, and J.-P. Zigrand (2004): “The Impact of Risk Regulation on Price Dynamics,” *Journal of Banking & Finance*, 28(5), 1069–1087.

——— (2012): “Endogenous and systemic risk,” in *Quantifying Systemic Risk*, pp. 73–94. University of Chicago Press.

Darvas, Z. (2012): “Real effective exchange rates for 178 countries: A new database,” Discussion paper, Bruegel.

Drehmann, M., C. Borio, and K. Tsatsaronis (2012): “Characterising the Financial Cycle: Don’t lose Sight of the Medium Term!,” Discussion paper, Bank for International Settlements.

Easterly, W., M. Kremer, L. Pritchett, and L. H. Summers (1993): “Good policy or good luck?,” *Journal of Monetary Economics*, 32(3), 459–483.

Fernández, A., M. W. Klein, A. Rebucci, M. Schindler, and M. Uribe (2015): “Capital control measures: A new dataset,” Discussion paper, National Bureau of Economic Research.

Forbes, K. J., and R. Rigobon (2002): “No contagion, only interdependence: measuring stock market comovements,” *Journal of Finance*, 57(5), 2223–2261.

Fort, T. C., J. Haltiwanger, R. S. Jarmin, and J. Miranda (2013): “How firms respond to business cycles: The role of firm age and firm size,” *IMF Economic Review*, 61(3), 520–559.

Frankel, J. A., and D. Romer (1999): “Does trade cause growth?,” *American economic review*, pp. 379–399.

Frazzini, A., and L. H. Pedersen (2014): “Betting against beta,” *Journal of Financial Economics*, 111(1), 1–25.

Giovanni, J. d., and A. A. Levchenko (2009): “Trade openness and volatility,” *Review of Economics and Statistics*, 91(3), 558–585.

Gourio, F., M. Siemer, and A. Verdelhan (2014): “Uncertainty Betas and International Capital Flows,” Discussion paper, Working Paper, MIT Sloan School of Management.

He, Z., and A. Krishnamurthy (2008): “Intermediary asset pricing,” Discussion paper, National Bureau of Economic Research.

——— (2011): “A model of capital and crises,” *The Review of Economic Studies*, p. rdr036.

Hodrick, R. J., and E. C. Prescott (1997): “Postwar US business cycles: an empirical investigation,” *Journal of Money, credit, and Banking*, pp. 1–16.

Holtz-Eakin, D., W. Newey, and H. S. Rosen (1988): "Estimating vector autoregressions with panel data," *Econometrica: Journal of the Econometric Society*, pp. 1371–1395.

Jones, B. F., and B. A. Olken (2008): "The Anatomy of Start-stop Growth," *Review of Economics and Statistics*, 90(3), 582–587.

Kaminsky, G. L., and C. M. Reinhart (2000): "On crises, contagion, and confusion," *Journal of international Economics*, 51(1), 145–168.

Laeven, L., and F. Valencia (2012): "Systemic Banking Crises Database: An Update," *IMF working paper*, 12(163).

Longstaff, F. A., J. Pan, L. H. Pedersen, and K. J. Singleton (2011): "How Sovereign Is Sovereign Credit Risk?," *American Economic Journal: Macroeconomics*, 3(2), 75–103.

Love, I., and L. Zicchino (2006): "Financial development and dynamic investment behavior: Evidence from panel VAR," *The Quarterly Review of Economics and Finance*, 46(2), 190–210.

Merton, R. C. (1973): "An intertemporal capital asset pricing model," *Econometrica*, pp. 867–887.

Miranda-Agrippino, S., and H. Rey (2014): "World Asset Markets and the Global Financial Cycle," Discussion paper, Technical Report, Working Paper, London Business School.

Nakamura, E., and J. Steinsson (2013): "High frequency identification of monetary non-neutrality," Discussion paper, National Bureau of Economic Research.

Obstfeld, M. (1994): "Risk-Taking, Global Diversification, and Growth," *The American Economic Review*, pp. 1310–1329.

Obstfeld, M., and K. Rogoff (2009): "Global imbalances and the financial crisis: products of common causes," *CEPR Discussion Paper*, 7606.

Obstfeld, M., and K. S. Rogoff (2005): "Global current account imbalances and exchange rate adjustments," *Brookings papers on economic activity*, 2005(1), 67–146.

Ostry, J., A. Ghosh, K. F. Habermeier, M. Chamon, M. Qureshi, and D. Reinhardt (2010): "Capital Inflows: The Role of Controls," *International Monetary Fund Staff Position Note*, 10(04).

Panageas, S., and M. M. Westerfield (2009): "High-Water Marks: High Risk Appetites? Convex Compensation, Long Horizons, and Portfolio Choice," *Journal of Finance*, 64(1), 1–36.

Ramey, G., and V. A. Ramey (1995): "Cross-Country Evidence on the Link Between Volatility and Growth," *The American Economic Review*, 85(5), 1138–1151.

RANCIÈRE, R., A. TORNELL, AND F. WESTERMANN (2008): "Systemic Crises and Growth," *Quarterly Journal of Economics*, pp. 359–406.

REINHART, C. M., AND K. S. ROGOFF (2011): "From Financial Crash to Debt Crisis," *American Economic Review*, 101, 1676–1706.

REY, H. (2015): "Dilemma not trilemma: the global financial cycle and monetary policy independence," Discussion paper, National Bureau of Economic Research.

SHEK, J., I. SHIM, AND H. S. SHIN (2015): "Investor Redemptions and Fund Manager Sales of Emerging Market Bonds: How are they Related?," *BIS Working Paper*.

SIMS, C. A. (1992): "Interpreting the macroeconomic time series facts: The effects of monetary policy," *European Economic Review*, 36(5), 975–1000.

TAYLOR, J. B. (1993): "Discretion versus policy rules in practice," in *Carnegie-Rochester conference series on public policy*, vol. 39, pp. 195–214. Elsevier.

——— (1999): "A Historical Analysis of Monetary Policy Rules," in *Monetary Policy Rules*, pp. 319–348. University of Chicago Press.

——— (2001): "The role of the exchange rate in monetary-policy rules," *The American Economic Review*, 91(2), 263–267.

VAYANOS, D. (2004): "Flight to quality, flight to liquidity, and the pricing of risk," Discussion paper, National Bureau of Economic Research.

VAYANOS, D., AND P. WOOLLEY (2013): "An institutional theory of momentum and reversal," *Review of Financial Studies*, pp. 1087–1145.

WOODFORD, M. (2001): "The Taylor rule and optimal monetary policy," *American Economic Review*, pp. 232–237.

6 Appendix

A Theoretical Framework for the Global Price of Risk

To provide motivation for our empirical specification, we derive a dynamic asset pricing kernel. We assume that all asset allocation decisions are delegated to global financial institutions. Those institutions are subject to two constraints. The first set of constraints are the VaR constraints discussed earlier: the net worth of the institutions must exceed the value of risk of their assets at some confidence level. An additional constraint arises from hedging mandates of the institutions. The hedging mandates are a reduced form representation of the many functions that financial intermediaries play. For example, insurance companies manage asset-liability risk to hedge their payout streams. Banks manage the credit cycle and interest rate risk. Asset managers manage liquidity and redemption risks. We assume that these risks that intermediaries' hedging motives can be summarized by a vector of state variables X. While global financial institutions are risk neutral, their payoff consists of the expected return to their portfolio holdings, minus the covariance of their returns with the vector of state variables. Each global financial institution i is thus assumed to maximize

$$\underset{n_t^i}{max} E_t[n_t^i r_{t+1}] - Cov_t[n_t^i r_{t+1}, X_{t+1}]\psi_t^i \tag{A.1}$$

$$s.t. VaR_t^i \leq w_t^i \tag{A.2}$$

where n_t^i denotes the vector of portfolio allocations, r_{t+1} denotes the vector of portfolio excess returns, X_{t+1} denotes the vector of cross sectional pricing factors, and w_t^i denotes the equity cushion of institution i. The hedging motive is time varying and parametrized by the vector ψ_t^i (having the same dimension as the vector of state variables).

We assume that the VaR constraint can be written as

$$w_t^i \kappa^i (Var_t(n_t^i r_{t+1}) - 1)^{-1/2} \leq w_t^i \tag{A.3}$$

where $Var_t(n_t^i r_{t+1})$ denotes the conditional variance of the portfolio allocation, and κ^i denotes the tightness of the VaR constraint as imposed by regulators. The Lagrangian is then

$$\underset{n_t^i}{max} E_t[n_t^i r_{t+1}] - Cov_t[n_t^i r_{t+1}, X_{t+1}]\psi_t^i - \lambda_t^i[\kappa^i(Var_t(n_t^i r_{t+1}))^{-1/2} - 1]. \tag{A.4}$$

By taking the first order condition, we can derive the demand for each risky asset:

$$n_t^i = \frac{1}{\lambda_t^i \kappa^i}[Var_t(r_{t+1})]^{-1}[E_t[r_{t+1}] - Cov_t[r_{t+1}, X_{t+1}]\psi_t^i] \tag{A.5}$$

The demand function is similar to the demand of a CRRA investor, with two differences. We note that the lagrange multiplier on the VaR constraint, λ_t^i, acts as effective risk aversion. This feature is from Danıelsson, Shin, and Zigrand (2012). Furthermore, expected returns are adjusted for the hedging demand, as in the intertemporal capital asset pricing model of Merton (1973). While the hedging demand could arise from intertemporal hedging motives, it could additionally incorporate other objectives of financial institutions.

Suppose that assets are in supply S_t. Then market clearing implies

$$S_t = \Sigma_i w_t^i n_t^i = \Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i} [Var_t[r_{t+1}]]^{-1} [E_t[r_{t+1}] - Cov_t[r_{t+1}, X_{t+1}]\psi_t^i] \tag{A.6}$$

where $\Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i}$ is a wealth weighted average of the inverse of effective risk aversion of intermediaries, induced by the tightness of the VaR constraint.

We can invert the pricing equation, and derive an expression for expected returns:

$$E_t[r_{t+1}] = Cov_t(r_{t+1}, r_{t+1}^M) \frac{1}{\Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i}} + Cov_t[r_{t+1}, X_{t+1}] \frac{\Sigma_i \frac{w_t^i \psi_t^i}{\lambda_t^i \kappa^i}}{\Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i}} \tag{A.7}$$

Hence expected returns depend on the market factor with a risk aversion parameter that depends on the wealth weighted tightness of the VaR constraint, and of the covariances of returns with the vector of state variables.

Then we can write

$$\begin{aligned} E_t[r_{t+1}] &= \beta_t \Lambda_t, & \text{(A.8)} \\ \beta_t &= \left[\frac{Cov_t(r_{t+1}^M, r_{t+1})}{Var_t\left(r_{t+1}^M\right)}, Cov_t[r_{t+1}, X_{t+1}] \left(Var_t\left(X_{t+1}\right)\right)^{-1} \right], & \text{(A.9)} \\ \Lambda_t &= \begin{bmatrix} Var_t\left(r_{t+1}^M\right) \frac{1}{\Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i}} \\ Var_t\left(X_{t+1}\right) \frac{\Sigma_i \frac{w_t^i \psi_t^i}{\lambda_t^i \kappa^i}}{\Sigma_i \frac{w_t^i}{\lambda_t^i \kappa^i}} \end{bmatrix}. & \text{(A.10)} \end{aligned}$$

The asset pricing equation A.8 implicitly defines a pricing kernel where expected returns are determined by covariation with risk factor exposures, and prices of risk are varying over time. The dependence of Λ_t on the state variables necessitates further specification of the macroeconomic environment. For example, Adrian and Boyarchenko (2012) make assumptions about the productive sector and the household sector, and then solve for the functional form of the prices of risk in closed form. The specification of such a general equilibrium framework goes beyond the scope of the current paper. We will instead assume that vector of risk prices Λ_t are an affine function of the state variables:

$$\Lambda_t = \lambda_0 + \lambda_1 X_t \tag{A.11}$$

However, we allow the state variables X to be nonlinear functions of deeper economic variables. In particular, we assume that prices of risk depend on the level of market volatility in a nonlinear fashion $\phi\left(vix_{t+1}\right)$. In addition to that volatility state variable, we also assume that the excess market return r_{t+1}^M, a commodity excess return r_{t+1}^{GSCI}, and the USD risk free rate r^f_{t+1} are additional state variables so that

$$X_t = \begin{bmatrix} r^M_{t+1} \\ r^{GSCI}_{t+1} \\ r^f_{t+1} \\ \phi\left(vix_{t+1}\right) \end{bmatrix} \tag{A.12}$$

We choose the affine specification in the market return and the risk free rate as we did not detect any evidence of nonlinearity for those variables using our dynamic asset pricing approach explained below. Of course, a fully fledged equilibrium model would in general give rise to nonlinearities of these variables as well.

The theoretical framework is strongly suggestive of this choice of state variables. The market return directly results from equation A.7 as our model features the market return as pricing factor. Furthermore, we will be studying the role of monetary policy, hence a time varying risk free rate which would result from monetary policy shocks is essential. Finally, the assumed VaR constraint gives rise to volatility is a key state variable.

We assume that the dynamic evolution of the state variables follows a first order vector autoregressive process:

$$X_{t+1} = \mu + \Phi X_t + \varepsilon^X_{t+1} \tag{A.13}$$

As a result of these assumptions, the vector of risk factor exposures β is of dimension 1×4, while the prices of risk Λ are of dimension 4×1.

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.

We collect a daily Goldman Sachs Commodity Index (GSCI) price index from the S&P Dow Jones Company. 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

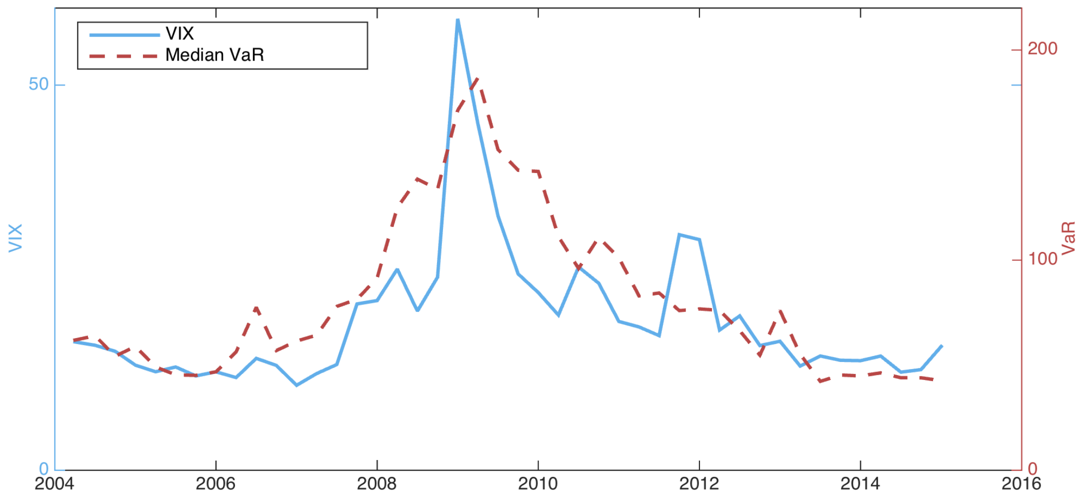
For our cross sectional analysis of trade and financial openness, we use annual capital openness measures from Fernández, Klein, Rebucci, Schindler, and Uribe (2015), as well as annual "Trilema Indices" (fixed/flexible exchange rates, financial openness, and monetary policy independence) from Aizenman, 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 mean) 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

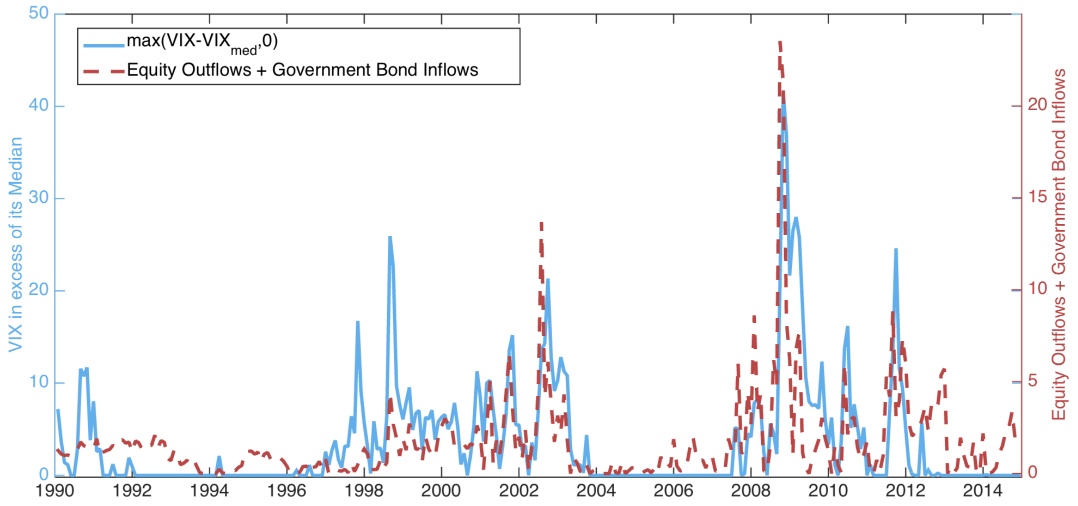


Figure 2: **Expected Excess Returns for Stocks and Bonds by Country**

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 US dollars.

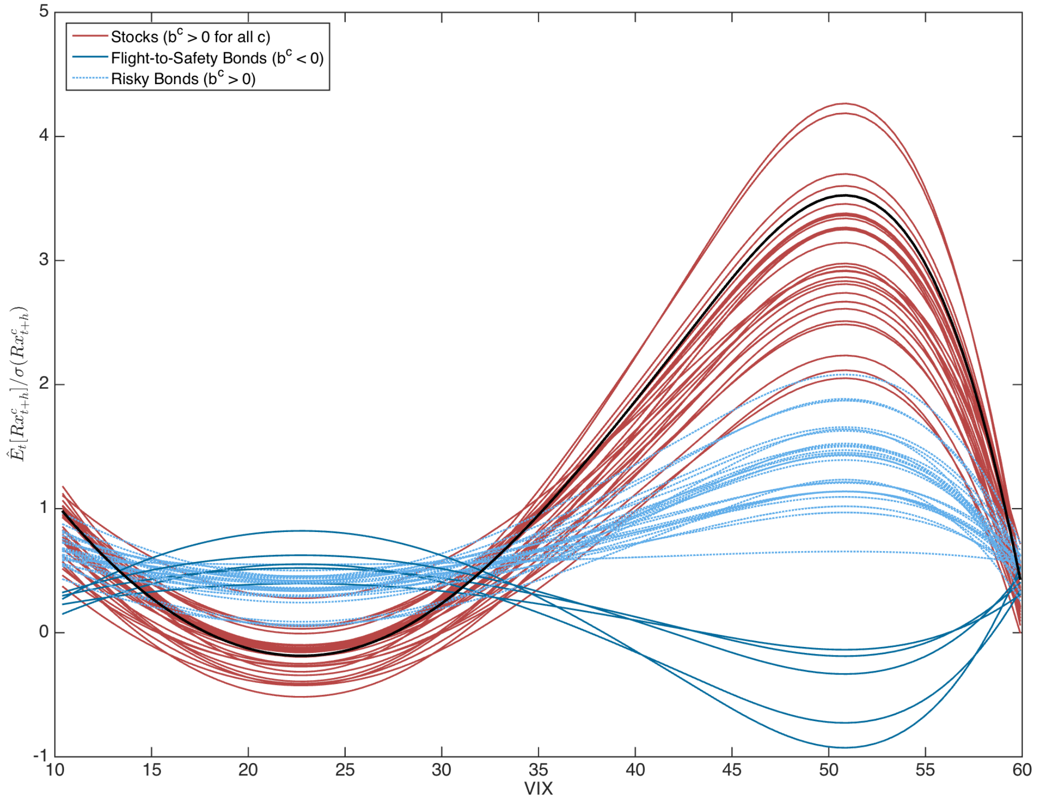


Figure 3: **Global b^c vs. Risk Factor Loadings and Prices of Risk**

This figure plots the results of the unrestricted joint forecasting regressions $Rx^c_{t+1} = a^c + b^c\phi(v_t) + \varepsilon^c_{t+1}$ against the restricted joint forecasting regressions $Rx^c_{t+1} = (\alpha^c + \beta^c\lambda_0) + \beta^c\lambda_1\phi(v_t) + \beta^c u_{t+1} + \varepsilon^c_{t+1}$, obtained from a dynamic asset pricing model with affine prices of risk, as in Adrian, Crump, and Vogt (2015). The innovations $u_{t+1} = Y_{t+1} - E_t[Y_{t+1}]$ correspond to the cross-sectional pricing factors $Y_t = (MKT_t, RF_t, \phi(v_t))$, where MKT is the global value-weighted equity market return, RF is the US risk-free rate, and $\phi(v_t)$ is the nonlinear pricing factor for $v_t = vix_t$. The index c for the b^c global risk loadings ranges over the global market excess return (MKT), 21 country stock returns, and corresponding 21 10-year sovereign bond excess returns. To obtain estimates, the unrestricted regression is estimated by sieve reduced rank regression, yielding parametric estimates of a^c and b^c and a nonparametric estimate of $\phi(v_t)$. Then the restricted joint forecasting regression is estimated by taking $\phi(v_t)$ as given, making a^c and b^c from the unrestricted forecasts directly comparable to $(\alpha^c + \beta^c\lambda_0)$ and $\beta^c\lambda_1$ in the restricted regressions. The comparisons are scattered in the plots.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.

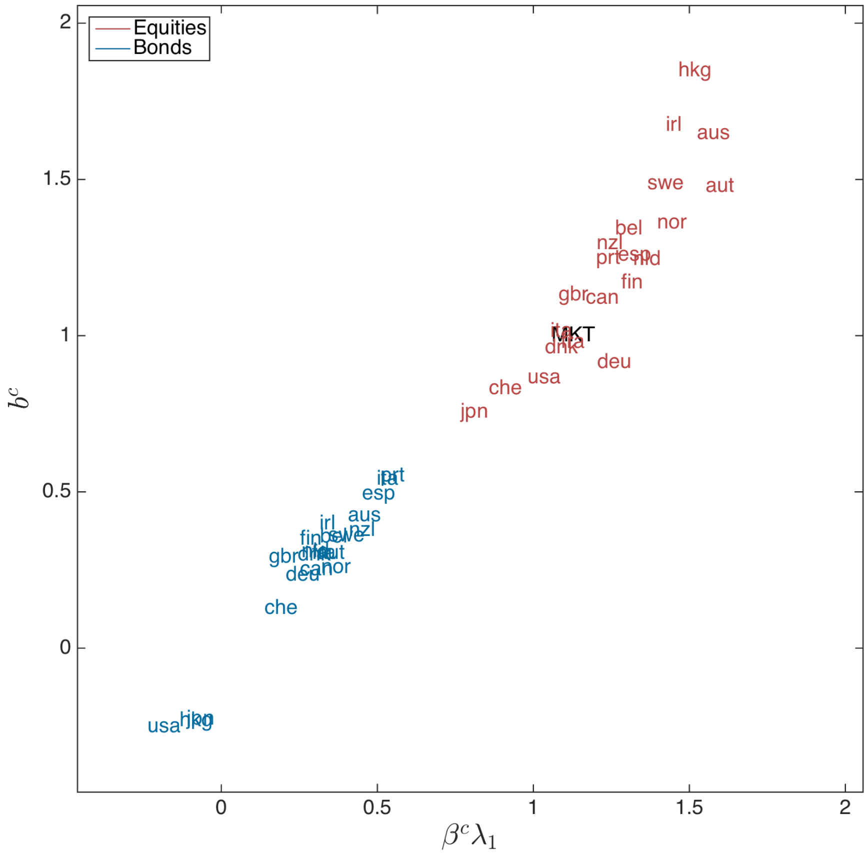


Figure 4: **Impulse Response Functions**

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.

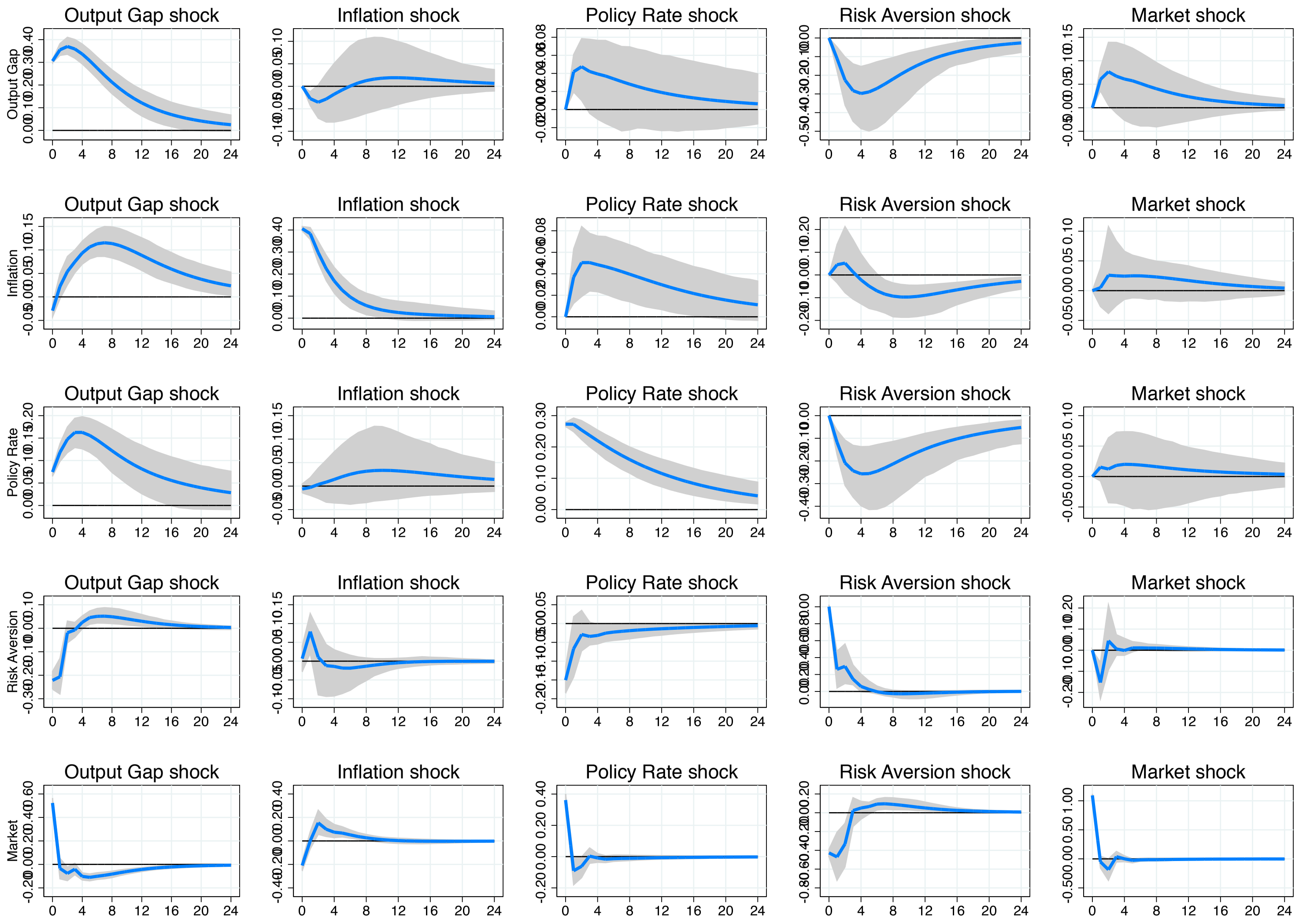


Figure 5: **Relating Global Risk Loadings b^c to Macro Outcomes**

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 i 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.

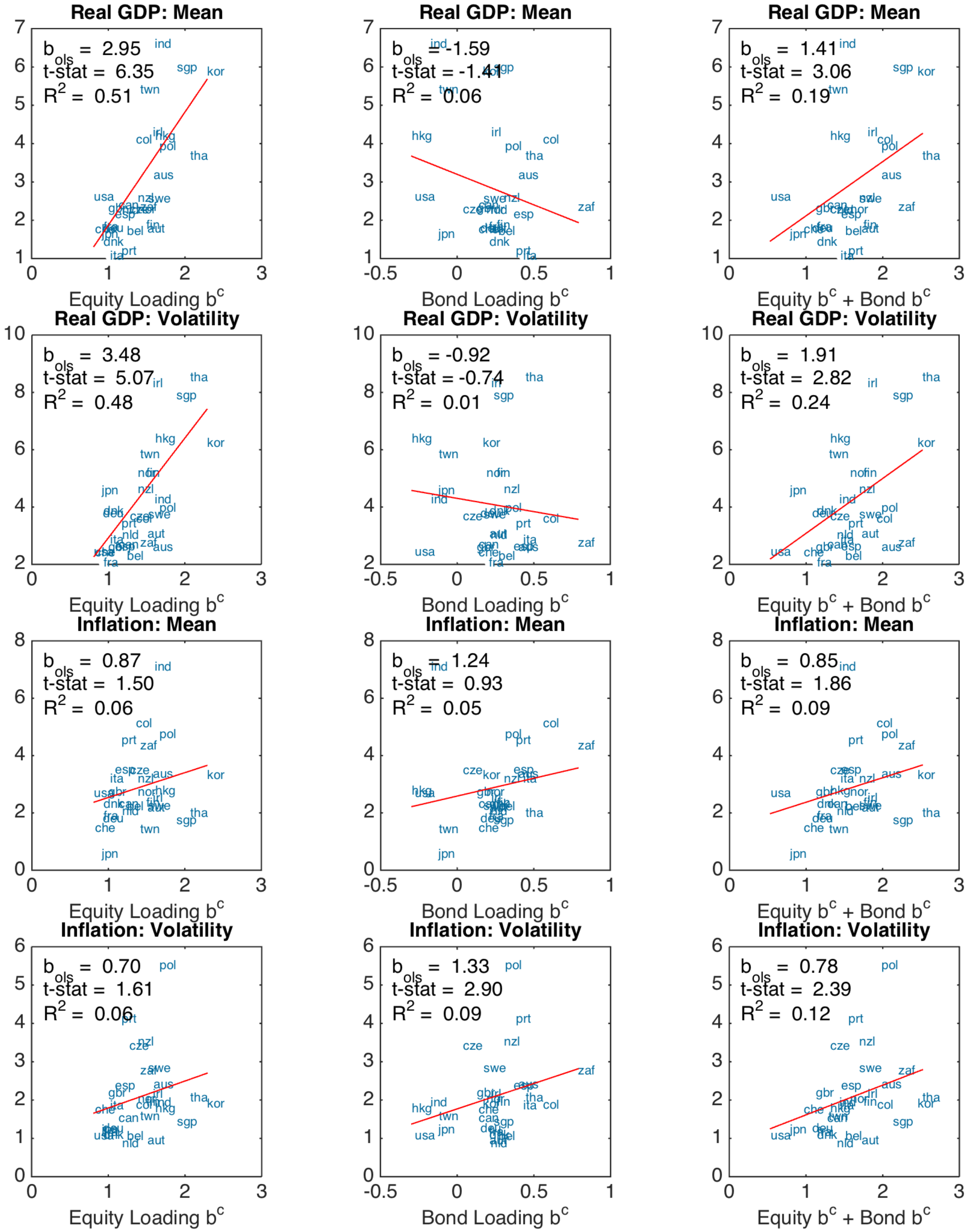


Figure 6: **Relating Global Risk Loadings b^c to Financial Outcomes**

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 i 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.

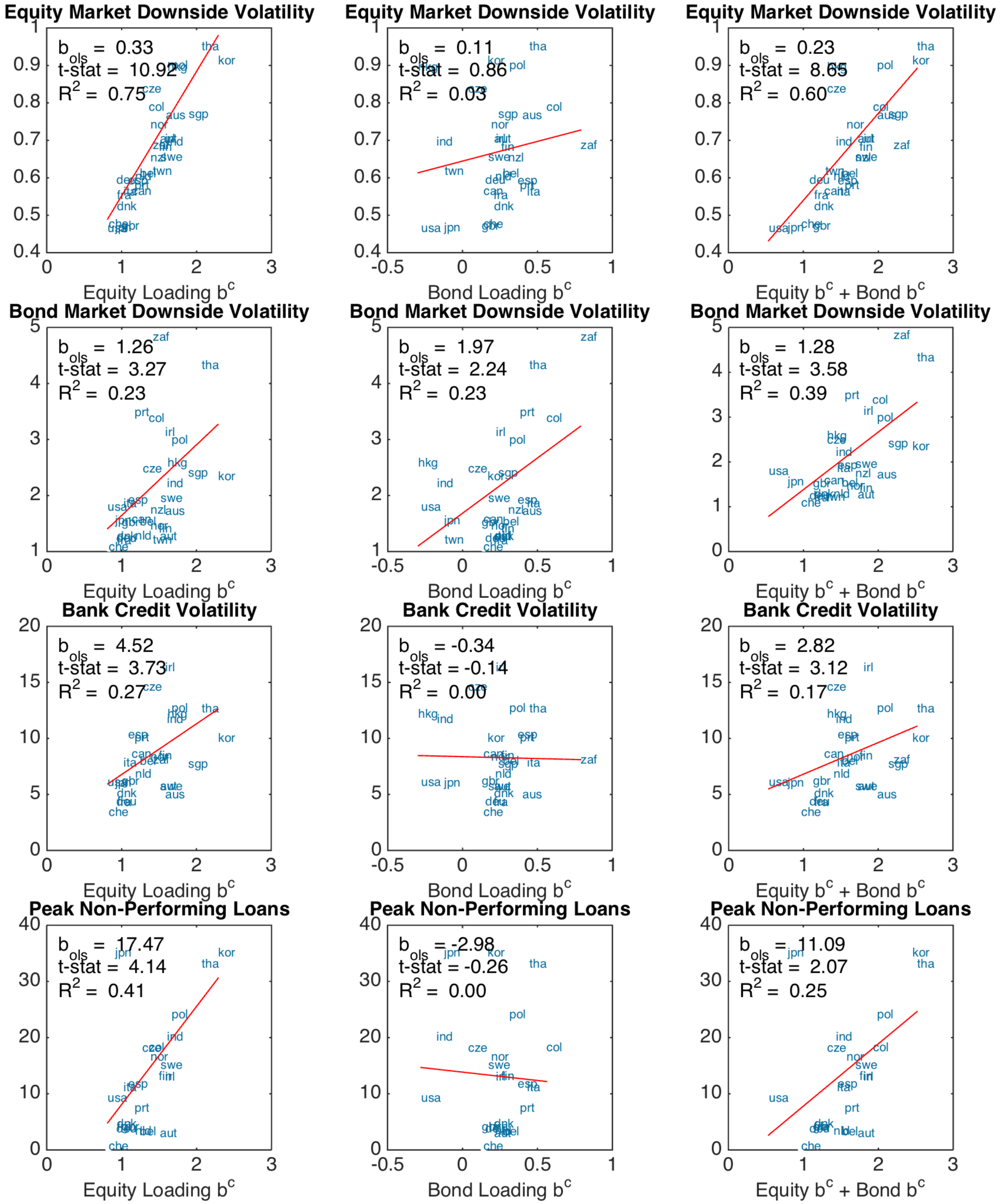


Figure 7: **Relating Taylor Rule Coefficients to Global Risk Loadings b^c**

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 i 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.

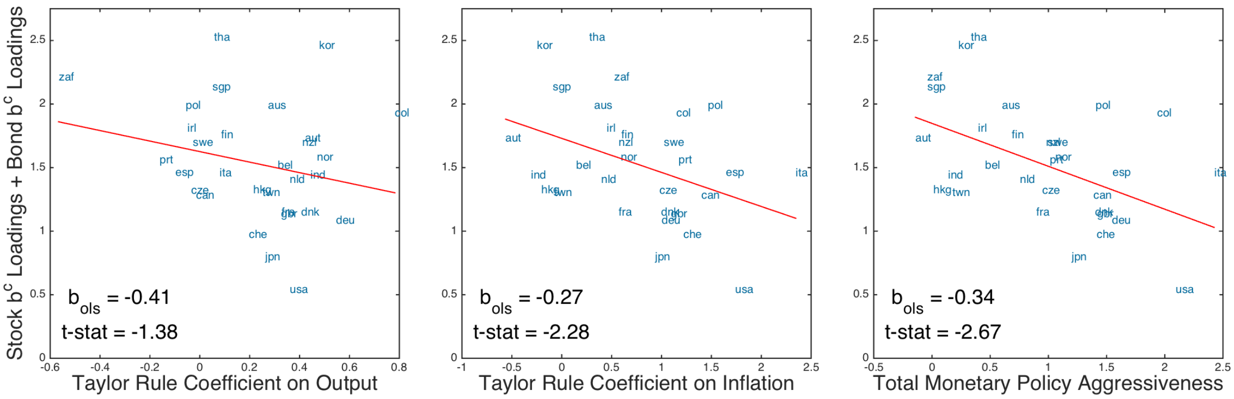


Figure 8: **Risk-Return Tradeoff Mediated by Global Risk Factor Exposure and Policy**

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 $E[risk_c|x] = \gamma_0 + \gamma_1(ret_c) + \gamma_2(ret_c \times b^c) + \gamma_3(ret_c \times p_c) + \gamma_4(ret_c \times b^c \times p_c)$.

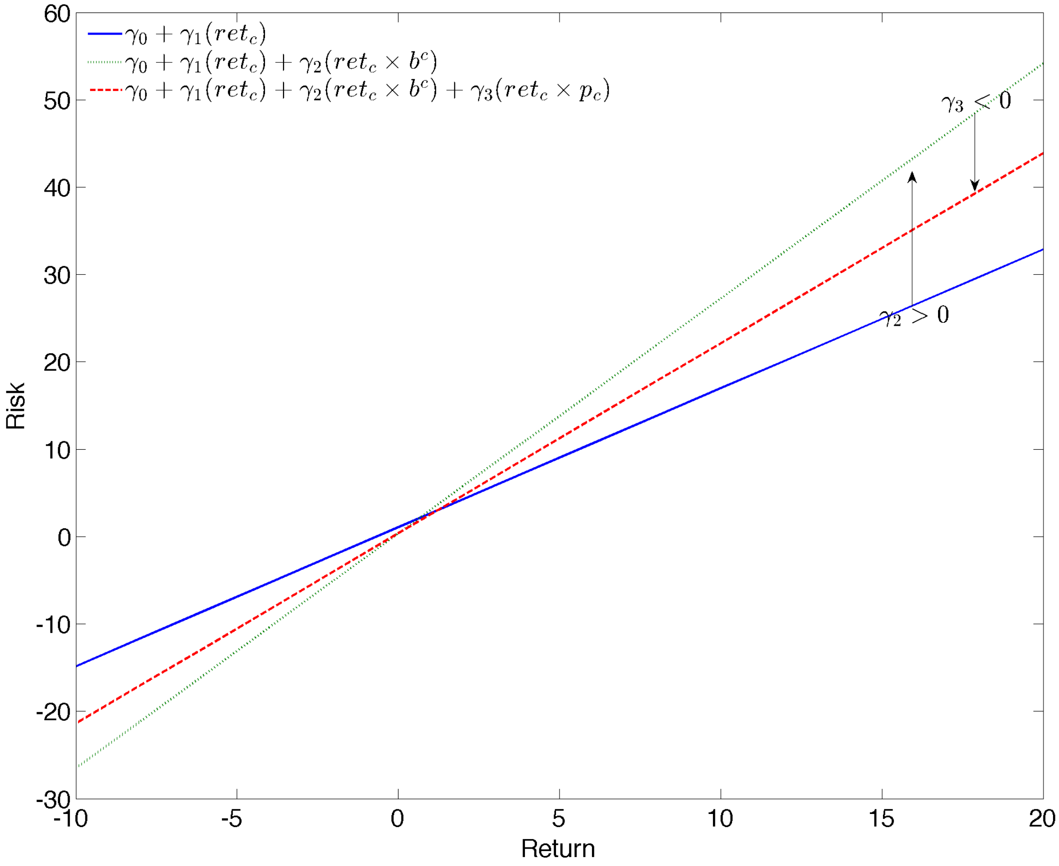


Table 1: **Dynamic Asset Pricing: Factor Risk Exposures and Prices of Risk**

This table provides estimates of factor risk exposures and prices of risk from the dynamic asset pricing model $Rx^c_{t+h} = (\alpha^c + \beta^c \lambda_0) + \beta^c \lambda_1 \phi(v_t) + \beta^c u_{t+h} + \varepsilon^c_{t+h}$, where c ranges over the displayed countries' market excess returns. In a first stage, $\phi(v_t)$ is estimated from a sieve reduced rank regression $Rx^c_{t+h} = a^c + b^c \phi(v_t) + \varepsilon^c_{t+h}$ jointly across c. The factor innovations $u_{t+h} = Y_{t+h} - E_t[Y_{t+h}]$ are then estimated from a VAR on the global market excess return (MKT), 1-month risk-free rate (RF), and nonlinear volatility factor ($\phi(v_t)$), for $v_t = vix_t$. In a second stage, coefficients are estimated jointly across all $i = 1, \ldots, n$ via a reduced rank regression. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level.

Exposures	β^i_{MKT}	β^i_{GSCI}	β^i_{RF}	$\beta^i_{\phi(v)}$	$\beta^i \lambda_1$	$(\alpha^i + \beta^i \lambda_0)$
MKT	0.99***	0.00	0.56	0.00	1.06***	0.10***
aus Equity	0.98***	0.21***	−6.98***	−0.06	1.52***	0.15***
aut Equity	1.16***	0.36***	−3.71	0.57*	1.55***	0.11***
bel Equity	1.16***	0.01	−1.37	0.20	1.26***	0.13***
can Equity	0.93***	0.25***	3.31**	−0.07	1.17***	0.13***
che Equity	0.90***	−0.03	2.05	0.10	0.86***	0.11***
deu Equity	1.24***	−0.03	−0.62	0.43*	1.21***	0.10***
dnk Equity	0.97***	0.18***	4.28**	0.15	1.04***	0.14***
esp Equity	1.24***	−0.04	−3.01	0.44**	1.27***	0.13***
fin Equity	1.48***	−0.09	7.67**	−0.01	1.28***	0.14***
fra Equity	1.12***	0.03	1.95	0.33	1.09***	0.11***
gbr Equity	0.98***	0.03	1.89	−0.15	1.08***	0.10***
hkg Equity	1.08***	0.15*	−5.78*	0.13	1.46***	0.13***
irl Equity	1.19***	0.05	0.96	−0.32	1.43***	0.12***
ita Equity	1.19***	0.03	4.86**	0.34	1.05***	0.09***
jpn Equity	0.82***	0.09*	0.56	0.61**	0.77***	0.02
nld Equity	1.16***	0.09**	−0.30	0.13	1.32***	0.11***
nor Equity	1.07***	0.46***	3.26	0.30	1.40***	0.15***
nzl Equity	0.62***	0.24***	−6.78**	−0.22	1.20***	0.13***
prt Equity	1.27***	0.00	−0.95	0.68**	1.20***	0.08***
swe Equity	1.45***	0.01	4.19	0.27	1.37***	0.15***
usa Equity	0.92***	−0.07***	1.32	−0.25**	0.98***	0.11***
aus Bonds	0.12**	0.12***	−3.73**	−0.12	0.41***	0.10***
aut Bonds	0.05	0.10**	−6.57***	0.17	0.30***	0.07***
bel Bonds	0.07	0.09**	−6.72***	0.23	0.32***	0.07***
can Bonds	0.10**	0.09***	−0.72	−0.09	0.25***	0.08***
che Bonds	−0.13**	0.08**	−6.40***	0.01	0.14	0.05***
deu Bonds	−0.01	0.08**	−6.10***	0.18	0.21**	0.06***
dnk Bonds	0.02	0.07*	−5.72***	0.10	0.24***	0.07***
esp Bonds	0.19***	0.12***	−8.88***	0.50***	0.45***	0.10***
fin Bonds	0.01	0.08**	−5.65***	0.08	0.25***	0.07***
fra Bonds	0.05	0.09**	−7.31***	0.27	0.29***	0.07***
gbr Bonds	0.04	0.02	−0.09	−0.25	0.15*	0.06***
hkg Bonds	−0.26***	−0.03	−2.64	−0.28	−0.13	0.04***
irl Bonds	0.05	0.10**	−6.02***	0.08	0.32***	0.08***
ita Bonds	0.26***	0.13***	−8.55***	0.62***	0.50***	0.12***
jpn Bonds	−0.20***	0.03	−1.54	−0.09	−0.11	0.01
nld Bonds	0.00	0.09**	−6.42***	0.14	0.26**	0.06***
nor Bonds	−0.04	0.19***	−4.61***	−0.07	0.32***	0.06***
nzl Bonds	0.10	0.13***	−4.53**	−0.07	0.41***	0.09***
prt Bonds	0.33***	0.13**	−8.92***	0.81**	0.51***	0.10***
swe Bonds	0.10*	0.13***	−4.08**	0.11	0.34***	0.08***
usa Bonds	−0.23***	−0.02	0.10	−0.13	−0.24***	0.04***

Prices of Risk	*MKT*	*GSCI*	*RF*	$\phi(v)$
λ_1	1.09***	0.96***	−0.03**	−0.33**

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 $\sigma_c = \gamma_0 + \gamma_1 r_c + \gamma_2 b^c + \gamma_3 (r_c \cdot b^c) + \varepsilon_c$, 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)	(3)	(1)	(2)	(3)
r	0.74***	0.28	0.03	0.40*	0.37*	0.33**
b		2.66**	2.15		0.87	−1.35
$r \cdot b$			0.16			0.61
R^2	0.37	0.51	0.51	0.27	0.30	0.34
Obs	30	30	30	30	30	30
	Crisis Peak NPL			**Bank Credit Volatility**		
	(1)	(2)	(3)	(1)	(2)	(3)
r	4.80	−1.24	−35.89**	0.54***	0.51***	0.91**
b		11.80*	1.60		0.44	2.28
$r \cdot b$			22.09**			−0.26
R^2	0.05	0.25	0.43	0.35	0.35	0.37
Obs	23	23	23	27	27	27
	Equity Downside Volatility			**Bond Downside Volatility**		
	(1)	(2)	(3)	(1)	(2)	(3)
r	−0.38	0.25	0.83	0.96	0.05	−1.08
b		0.34***	0.35***		1.96**	0.76
$r \cdot b$			−0.39			4.36
R^2	0.01	0.76	0.76	0.01	0.23	0.24
Obs	30	30	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 ($R^i_{f,t} = \delta^i_0 + \delta^i_{output} OG^i_t + \delta^i_{infl} infl^i_t + \varepsilon^i_t$), along with sample means of fiscal policy and macroprudential variables used in subsequent tables. Column (1) reports δ^i_{output}, column (2) δ^i_{infl}, and (3) reports $\delta^{output}_i + \delta^{infl}_i$. Column (4) reports the the degree of countercyclicality of fiscal policy, which is proxied by the slope coefficient from a regression of country i'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
				Output Gap - Fiscal Exp. Corr.	Financial Inst. - Targeted Index	Index
	δ_c^{output}	δ_c^{infl}	δ_c^{total}			
aus	0.27	0.33*	0.60	-0.80	0.34	2.10
aut	0.42***	-0.58	-0.16	-0.55	0.17	0.93
bel	0.32*	0.18	0.50	-0.32	0.68	0.50
can	-0.04	1.37	1.33	-0.81	1.02	0.37
che	0.20	1.22***	1.42	-0.59	0.54	0.74
col	0.80***	1.13***	1.93	-0.08	1.54	4.81
cze	-0.03***	0.98**	0.95	-0.25	0.34	1.88
deu	0.55	1.01***	1.55	-0.45	0.20	0.97
dnk	0.41***	1.05***	1.46	-0.55		0.44
esp	-0.11	1.64***	1.53	-0.19	0.68	0.22
fin	0.09***	0.60***	0.69	-0.60	0.02	0.66
fra	0.33***	0.60***	0.93	-0.76	0.76	0.51
gbr	0.32	1.08***	1.40	0.07	0.00	0.02
hkg	0.21	-0.19*	0.02	-0.81	0.34	0.09
ind	0.43**	-0.29	0.14	-0.20	0.51	6.85
irl	-0.05**	0.46***	0.41	-0.06	0.00	0.35
ita	0.07	2.36	2.43	-0.13	0.68	0.22
jpn	0.26	0.94	1.20	-0.73	0.34	0.02
kor	0.48**	-0.22***	0.26	-0.68	0.24	2.79
nld	0.36***	0.40***	0.77	-0.48	0.05	0.00
nor	0.47***	0.59	1.06	-0.55	0.37	0.34
nzl	0.40	0.51***	0.91	-0.36	0.00	0.74
pol	-0.04	1.47	1.43	-0.32	0.34	5.56
prt	-0.16	1.17***	1.01	0.60	0.17	1.01
sgp	0.05*	-0.10***	-0.05	-0.66	0.34	1.08
swe	-0.03***	1.02	0.99	-0.83	0.00	0.39
tha	0.06***	0.28***	0.34	-0.19	0.07	5.38
twn	0.24***	-0.08	0.17	0.14		
usa	0.35***	1.76*	2.11	-0.49	1.00	1.00
zaf	-0.56***	0.52**	-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 extend the pricing model using local currency returns. We then consider on CAPM βs as alternative measure of global risk exposure. Lastly, we explore the role of capital controls for the risk-return tradeoff.

C.1 Dollar vs. Local Currency Pricing

Table 11 shows our estimated risk factor exposures β and the prices of risk λ 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, Switzerland).

We interpret the changing signs of the bond betas 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. The betas relative to the U.S. risk free rate differ in sign across countries, and are generally more significant in the U.S. dollar specification. The most salient feature of these U.S. risk free betas is that, while equities betas may be either positive or negative, they are mostly consistent across the two specifications, while the bond betas switch from strongly significant and negative in the U.S. dollar specification, to mostly insignificant in the local currency specification. This pattern holds for the betas relative to the global price of risk $\phi(v)$ as well: equity loadings differ in sign across countries, but not across specification, while bond loadings are significantly more negative in the U.S. dollar specification. Notably, Spanish, Italian, and Portuguese bonds have positive world market and global risk aversion betas, and negative U.S. risk free rate betas, in both dollar and local currency terms. This may be because as Eurozone members, Spain, Italy, and Portugal lack a truly local currency; it could also be related to sovereign risk.

Comparing tables 1 and 11 also shows that the prices of risk λ are positive and significant at the 1% level for the global equity market MKT, negative and significant at the 5% level for the risk free rate, and negative and significant at the 1% level for the VIX pricing variable across specifications. However, the price of risk of $\phi(v)$ in the local currency specification is almost three times as large as compared to the dollar specification.

C.2 CAPM Beta vs. SRR regression b

In section 2.3 above, we showed that SRR regression $b \approx \beta\lambda$ from a dynamic asset pricing model with $\phi(vix)$ as a price of risk, justifying the interpretation of b as exposure to the global price of risk. However, an alternative, and from an empirical finance perspective, perhaps more familiar, measure of the exposure to global risk is the CAPM β on the global market portfolio. In this section, we compare b to β^{MKT}, and find that while the two measures are highly correlated, b contains information about the macro risk-return tradeoff that is absent from β^{MKT}.

Figure 9 shows that SRR regression b and β^{MKT} are closely correlated across equities, sovereign bonds, and combined equity bond loadings. Mechanically, this implies some degree of correlation between β^{MKT} and the policy and outcome variables discussed in previous sections. However, that correlation turns out to be much weaker than one might have suspected. For example, the cross-sectional correlation between β^{MKT} and average GDP growth, though positive, is statistically weak (t-stat = 0.86) and leaves much of the variation in growth rates unexplained ($R^2 = 0.03$), in stark contrast to the powerful relationship between global equity b and mean GDP growth (t-stat = 6.35, $R^2 = 0.52$). Furthermore, the strong negative relationship between global risk exposure and Taylor Rule coefficients completely disappears when we substitute β^{MKT} for b. In unreported regressions, we are unable to reproduce our results on the risk-return tradeoff and the effects of stabilization policy when β^{MKT} is used as the measure of global risk exposure.

C.3 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.[10] 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 significant interaction for financial market outcomes, and some weaker evidence for crisis outcomes.

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

Figure 9: **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, and corresponding 30 10-year sovereign bond excess returns. 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.

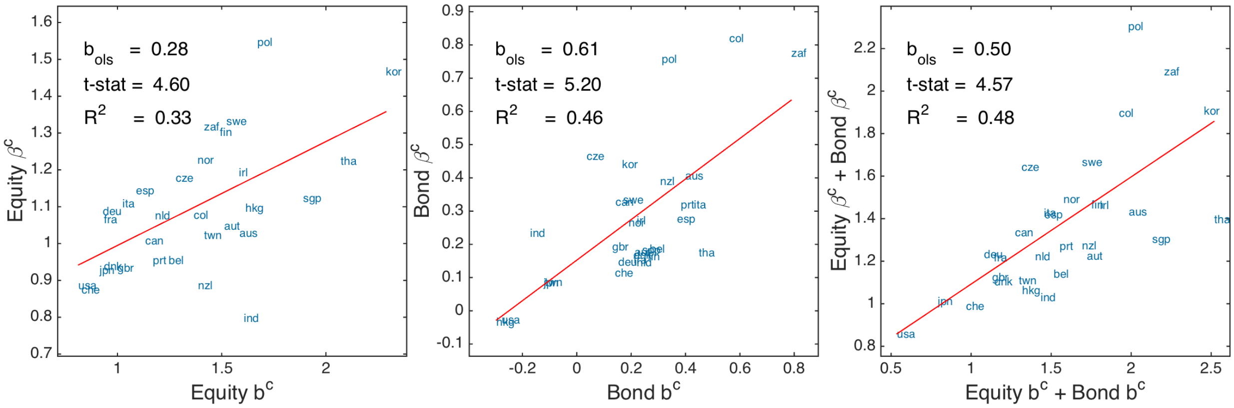

Figure 10: **Expected Excess Returns for Stocks and Bonds by Country**

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.

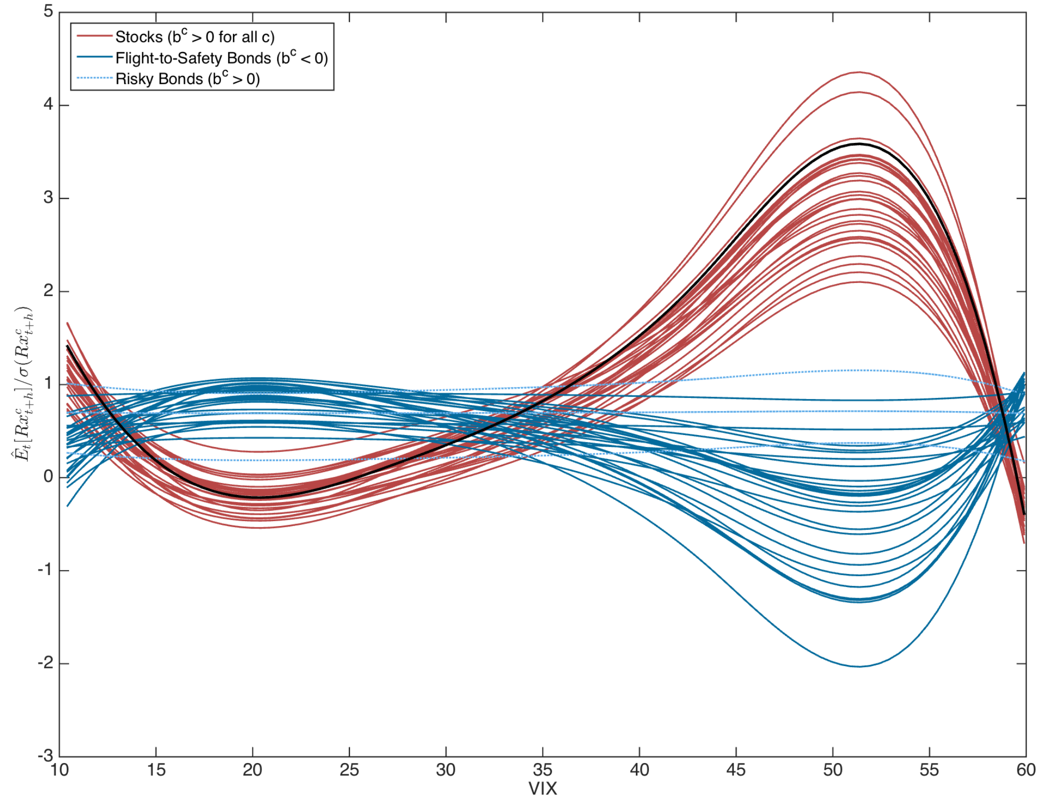

Figure 11: **Global b^c vs. Risk Factor Loadings and Prices of Risk**

This figure plots the results of the unrestricted joint forecasting regressions $Rx^c_{t+1} = a^c + b^c\phi(v_t) + \varepsilon^c_{t+1}$ against the restricted joint forecasting regressions $Rx^c_{t+1} = (\alpha^c + \beta^c\lambda_0) + \beta^c\lambda_1\phi(v_t) + \beta^c u_{t+1} + \varepsilon^c_{t+1}$, obtained from a dynamic asset pricing model with affine prices of risk, as in Adrian, Crump, and Vogt (2015). The innovations $u_{t+1} = Y_{t+1} - E_t[Y_{t+1}]$ correspond to the cross-sectional pricing factors $Y_t = (MKT_t, RF_t, \phi(v_t))$, where MKT is the global value-weighted equity market return, RF is the US risk-free rate, and $\phi(v_t)$ is the nonlinear pricing factor for $v_t = vix_t$. The index c for the b^c global risk loadings ranges over the global market excess return (MKT), 21 country stock returns, and corresponding 21 10-year sovereign bond excess returns. To obtain estimates, the unrestricted regression is estimated by sieve reduced rank regression, yielding parametric estimates of a^c and b^c and a nonparametric estimate of $\phi(v_t)$. Then the restricted joint forecasting regression is estimated by taking $\phi(v_t)$ as given, making a^c and b^c from the unrestricted forecasts directly comparable to $(\alpha^c + \beta^c\lambda_0)$ and $\beta^c\lambda_1$ in the restricted regressions. The comparisons are scattered in the plots.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 local currency.

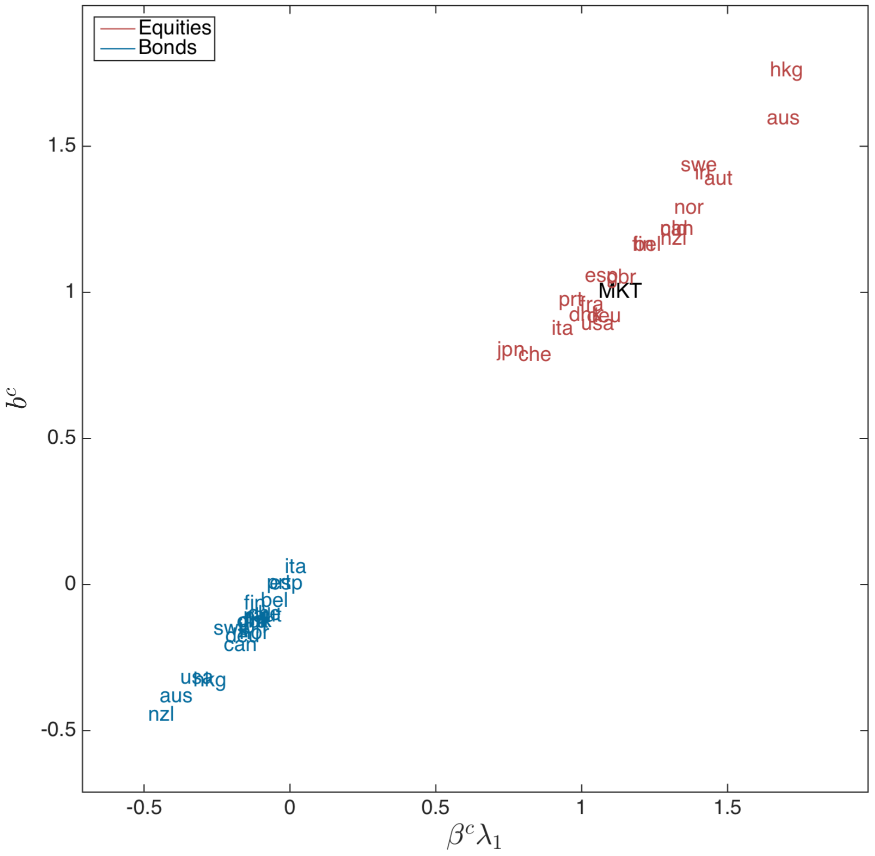

Table 11: **Dynamic Asset Pricing: Factor Risk Exposures and Prices of Risk**

This table provides estimates of factor risk exposures and prices of risk from the dynamic asset pricing model $Rx^c_{t+h} = (\alpha^c + \beta^c\lambda_0) + \beta^c\lambda_1\phi(v_t) + \beta^c u_{t+h} + \varepsilon^c_{t+h}$, where c ranges over the displayed countries' market excess returns. In a first stage, $\phi(v_t)$ is estimated from a sieve reduced rank regression $Rx^c_{t+h} = a^c + b^c\phi(v_t) + \varepsilon^c_{t+h}$ jointly across c. The factor innovations $u_{t+h} = Y_{t+h} - E_t[Y_{t+h}]$ are then estimated from a VAR on the global market excess return (MKT), 1-month risk-free rate (RF), and nonlinear volatility factor ($\phi(v_t)$), for $v_t = vix_t$. In a second stage, coefficients are estimated jointly across all $i = 1, \ldots, n$ via a reduced rank regression. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level.

Exposures	β^i_{MKT}	β^i_{GSCI}	β^i_{RF}	$\beta^i_{\phi(v)}$	$\beta^i\lambda_1$	$(\alpha^i + \beta^i\lambda_0)$
MKT	1.00***	0.01	0.59	0.09	1.06***	1.61***
aus Equity	0.99***	0.22***	−5.96**	0.20	1.63***	2.49***
aut Equity	1.21***	0.36***	−5.25*	0.56**	1.42***	2.13***
bel Equity	1.16***	0.01	−0.18	0.17	1.18***	1.80***
can Equity	0.93***	0.25***	3.09*	0.02	1.27***	1.95***
che Equity	0.91***	−0.03	2.23	0.10	0.78***	1.22***
deu Equity	1.29***	−0.03	−2.05	0.40**	1.02***	1.55***
dnk Equity	0.99***	0.17***	3.80**	0.16	0.96***	1.51***
esp Equity	1.30***	−0.04	−3.67*	0.47**	1.01***	1.56***
fin Equity	1.55***	−0.08	6.05	0.13	1.17***	1.81***
fra Equity	1.15***	0.02	1.20	0.23	0.99***	1.52***
gbr Equity	0.99***	0.03	2.99*	−0.01	1.08***	1.65***
hkg Equity	1.03***	0.14*	−4.32	0.08	1.64***	2.49***
irl Equity	1.21***	0.06	3.37	−0.01	1.39***	2.10***
ita Equity	1.22***	0.02	4.25**	0.21	0.90***	1.36***
jpn Equity	0.82***	0.07	−1.83	0.32**	0.71***	1.03***
nld Equity	1.18***	0.10**	−0.26	0.22	1.27***	1.92***
nor Equity	1.09***	0.45***	2.97	0.28	1.32***	2.02***
nzl Equity	0.63***	0.26***	−5.53*	0.16	1.27***	1.95***
prt Equity	1.31***	−0.02	−1.37	0.46*	0.92***	1.38***
swe Equity	1.44***	0.00	3.93	0.11	1.34***	2.06***
usa Equity	0.94***	−0.05**	2.02	−0.02	1.00***	1.54***
aus Bonds	−0.18***	−0.09***	3.01**	−0.07	−0.45***	−0.59***
aut Bonds	−0.05	−0.05***	−0.01	0.00	−0.13*	−0.13
bel Bonds	−0.04	−0.06***	0.20	−0.03	−0.10	−0.09
can Bonds	−0.05	−0.02*	−0.11	0.08	−0.23***	−0.28***
che Bonds	−0.12***	−0.05***	0.33	−0.05	−0.14**	−0.18**
deu Bonds	−0.11***	−0.07***	0.35	−0.02	−0.22***	−0.27***
dnk Bonds	−0.08*	−0.07***	1.07	−0.06	−0.18***	−0.20**
esp Bonds	0.08*	−0.05**	−1.70	0.13	−0.07	−0.02
fin Bonds	−0.09**	−0.06***	1.09	−0.07	−0.16**	−0.17*
fra Bonds	−0.06*	−0.06***	−0.63	0.02	−0.16**	−0.17*
gbr Bonds	−0.11***	−0.09***	1.34	−0.10	−0.18**	−0.21**
hkg Bonds	−0.15***	0.01	−3.92**	0.24*	−0.33**	−0.44*
irl Bonds	−0.06	−0.07**	1.93	−0.11	−0.13	−0.13
ita Bonds	0.14**	−0.05**	−1.08	0.11	−0.02	0.06
jpn Bonds	−0.07***	0.01	0.34	0.04	−0.18***	−0.24***
nld Bonds	−0.10**	−0.06***	0.28	−0.04	−0.16**	−0.18*
nor Bonds	−0.06	−0.05**	0.06	0.02	−0.17**	−0.20*
nzl Bonds	−0.13***	−0.07***	2.31*	0.04	−0.49***	−0.66***
prt Bonds	0.21**	−0.06*	−1.61	0.22	−0.08	−0.04
swe Bonds	−0.09**	−0.07***	0.91	−0.01	−0.26***	−0.32***
usa Bonds	−0.17***	0.00	−0.88	0.12	−0.38***	−0.51***

Prices of Risk	*MKT*	*GSCI*	*RF*	$\phi(v)$
λ_1	1.26***	1.41*	−0.07*	−1.73**

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