Stock-Bond Dynamics and Expected Country Stock Returns

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Stocks and Treasury Bonds

- With advancements of ETFs, international investment based on the macro environment became more popular.
- A common top-down approach requires us to first understand how local/global risk factors influence the prices of assets.
- Stocks and Treasury bonds are the traditional financial asset classes. It is natural to assume that their dynamics would affect the portfolio decision.
- While much is known what derives the stock-bond return (SB) dynamics, lesser is known about their implication for the country equity risk premium.

Should negative SB correlation imply higher stock returns?

- Flight-to-quality

  When uncertainty increases, investors prefer to have safer bonds over risky equity holdings.

  $\rightarrow$ The SB correlation is negative when uncertainty is high

  $\rightarrow$ The risk premium should be *higher* when the SB correlation is *negative*.

- Natural hedging

  Most investors in the world hold stocks and bonds together in their portfolio.

  $\rightarrow$ Investors may dislike if the returns on two asset classes move together.

  $\rightarrow$ SB correlation should be positively related to the risk premium.

Drivers of the SB relationship

In standard consumption-based models, bond yields are affected by consumption growth expectation (+), consumption volatility (uncertainty) (-) and expected inflation (+).

- ▷ Shocks to economic growth expectation and uncertainty both lead to a negative SB relationship.
  - The uncertainty effect is consistent with flight-to-quality.
  - A negative SB relationship should correspond to a higher risk premium.
  - This implies that the SB relationship is always negative.
- ▷ Inflation increases bond yields, but the effect on stock prices is ambiguous.
  - The effect on stock prices can be positive or negative (e.g., David and Veronesi 2014)

Overview of the model

A (consumption-based) model is proposed that shows:

- ▷ More country-specific news leads to a positive SB correlation
  - Higher inflation relative to its competing countries reduces a country's growth potential
  - Such shocks will increase bond yields and reduce stock prices (*positive* SB relationship).
- ▷ More country-specific news leads to a relatively higher equity risk premium
  - Higher global risk may lead to a higher global risk premium
  - The relative performance of a country affected by country-specific risk

Overview of the empirical result

- ▷ Higher country-specific volatility leads to a positive stock-bond correlation.
  - Inflation shocks specific to the country lowers economic growth expectation relative to the world
  - Global growth expectation shocks increase bond yields and stock prices
  - Country-specific growth expectation shocks lower bond yields and increase stock prices
- ▷ Equity markets of countries with a positive stock-bond relationship outperform countries with a negative relationship
  - A long-short country portfolio yields 7-11% per year
  - The countries invested in the long side varies.

Literature (1): Cross-country returns

- The importance of global factor and the exposure to the factor (e.g., International CAPM; Adler and Dumas 1983; Dumas and Solnik 1995)
- *Dividend yields*, *term premium* (Jensen, Mercer, and Johnson 1986) or *momentum* (Hou, Karolyi, and Kho 2011, Cedenese et al. 2019)
- Liquidity (e.g., Bekaert, Harvey, and Lundblad 2007, Goyenko and Sarkissian 2014)
- Idiosyncratic volatility (Bali and Cakici 2010)

Literature (2): Stock-bond returns

- ▷ Inflation derives variations in the SB correlation
  - Song (2017), Campbell, Pflueger, and Viceira (2020)
  - Correlation between inflation and real growth matters
- ▷ Real variables matter
  - Duffee (2022), Kozak (2022), Chernov, Song, Lochstoer (2023), Jones and Pyun (2023)
  - Persistence of shocks should affect the change in signs of the SB correlation
- ▷ Country-specific (local) shocks leads to positive comovement (This paper)
  - Country-specific shocks are more likely to be transient
  - Country specific real shocks are negatively related to country-specific inflation shocks

Consumption dynamics

Epstein-Zin (1991) preference for country i and the world (*):

$$m_{t+1}^{i/*} = \theta \log \beta - \frac{\theta}{\psi} \Delta c_{t+1}^{i/*} + (\theta - 1) R_{TW,t+1}^{i/*},$$

Country i:

$$\Delta c_{t+1}^i = \mu + x_t^* + x_t^i + \sqrt{v_t^i}\epsilon_{c,t+1}^i + \sqrt{v_t^*}\epsilon_{c,t+1}^* \tag{1}$$

$$x_{t+1}^i = \xi_l x_t^i + \sigma_{xl}\sqrt{v_t^i}\epsilon_{x,t+1}^i$$

$$v_{t+1}^i = v_{l0} + v_{l1} v_t^i + \sigma_l \sqrt{v_t^i}\epsilon_{v,t+1}^i$$

$$\pi_{t+1}^i = p_0 + p_1 \pi_t^i + \sigma_{pl}\sqrt{v_t^i}\epsilon_{\pi,t+1}^i + \sigma_{pg}\sqrt{v_t^*}\epsilon_{\pi,t+1}^*$$

$$\Delta d_{t+1}^i = \mu_d + \phi\left(\lambda_d x_t^i + (1-\lambda_d) x_t^*\right) + \sigma_{dl}\sqrt{v_t^i}\epsilon_{d,t+1}^i + \sigma_{dg}\sqrt{v_t^*}\epsilon_{d,t+1}^*),$$

World:

$$\Delta c_{t+1}^* = \mu + x_t^* + \sqrt{v_t^*}\epsilon_{c,t+1}^* \tag{2}$$

$$x_{t+1}^* = \xi_g x_t^* + \sigma_{xg}\sqrt{v_t^*}\epsilon_{x,t+1}^*$$

$$v_{t+1}^* = v_{g0} + v_{g1} v_t^* + \sigma_g \sqrt{v_t^*}\epsilon_{v,t+1}^*,$$

Parameter Assumptions – I

Panel A. Parameter specification

Preference parameters	
γ	7.5
ψ	2
β	0.9987

Inflation parameters	
p_1	0.970
$\bar{\pi}$	0.002
σ_{pg}	0.085
σ_{pl}	0.057

Consumption parameters	
μ	0.0018
ξ_g	0.989
ξ_l	0.930
σ_{xg}	0.034
σ_{xl}	0.067

Dividend Parameters	
μ_d	0.0019
ϕ_d	5.0
λ_g	0.2
σ_{dg}	9.0
σ_{dl}	6.5

Variance parameters	
ω_{g1}	0.961
ω_{l1}	0.986
$\sqrt{\bar{v}_t{}^i}$	0.0052
$\sqrt{\bar{v}_t{}^*}$	0.0028
σ_g	0.00089
σ_l	0.00087

Parameter Assumptions – II

Correlation between inflation and consumption growth expectation

Correlations			
	Model 1	Model 2	Model 3
ρ_l	−0.15	−0.15	−0.25
ρ_g	−0.15	0.15	−0.35

- ▷ Model 1 matches the entire sample
- ▷ Model 2 matches the post-1998 period
- ▷ Model 3 matches the 1990-1998 period

Asset Moments

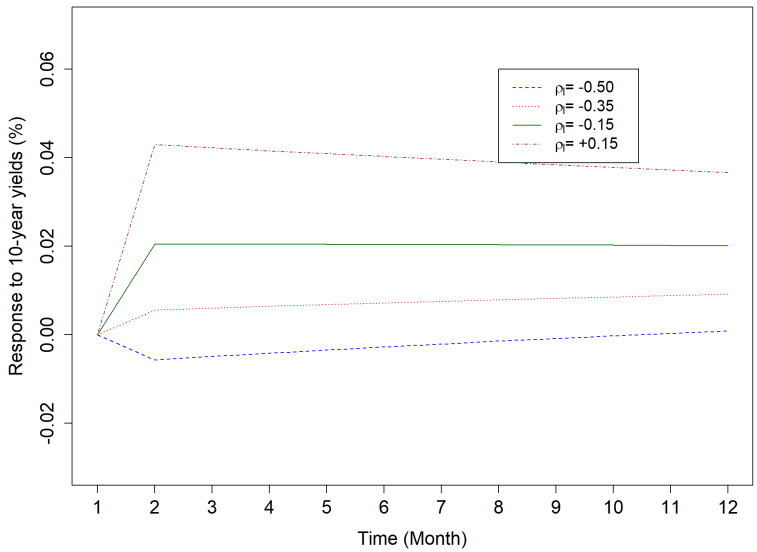
Panel B. Consumption, dividend, inflation, and asset pricing moments

	Model			Data	
	Model 1	Model 2	Model 3	US (Median)	Global Mean
$\text{Cor}(\Delta c^i, \Delta c^j)$		0.346		0.368	0.350
$\text{Cor}(\Delta d^i, \Delta d^j)$		0.490		0.494	0.380
$\text{Cor}(\Delta \pi^i, \Delta \pi^j)$		0.389		0.639	0.352
Nominal yields (10Y)	4.79%	4.67%	4.85%	4.26%	5.18%
Stock returns	7.88%	7.99%	7.80%	7.16%	7.14%
Stock market volatility	18.42%	18.59%	18.30%	15.22%	20.76%
$\text{Cor}(\Delta y^i, \Delta y^j)$	0.503	0.602	0.426	0.593	0.464
$\text{Cor}(R_m^i, R_m^j)$	0.595	0.602	0.591	0.697	0.584
ρ_{SB}	−0.043	−0.272	0.173	−0.089	0.007
1990-1998				0.300	0.212
1999-2022				−0.333	−0.047
β_{SB}	−1.714	−9.69	7.45	−1.693	−1.041
1990-1998				3.913	7.667
1999-2022				−7.030	−2.677

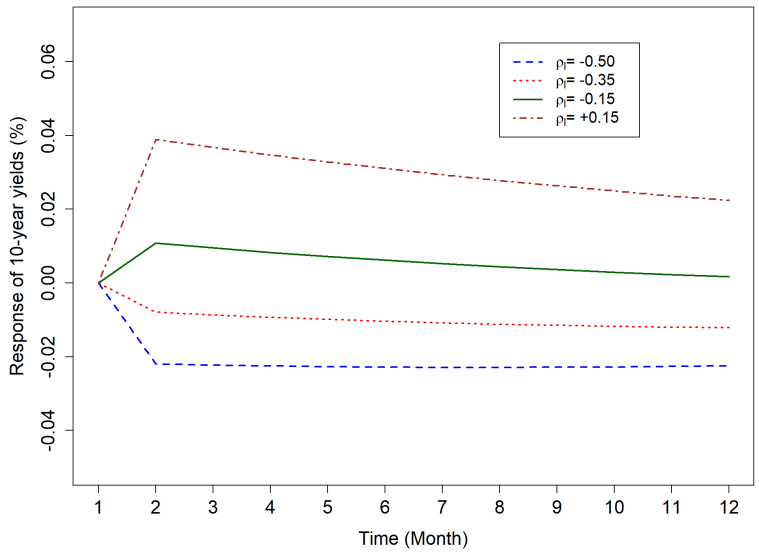
Model Implications: Bond yield/stock price response

The response to stock prices of country-specific inflation shocks is negative.

For bonds:

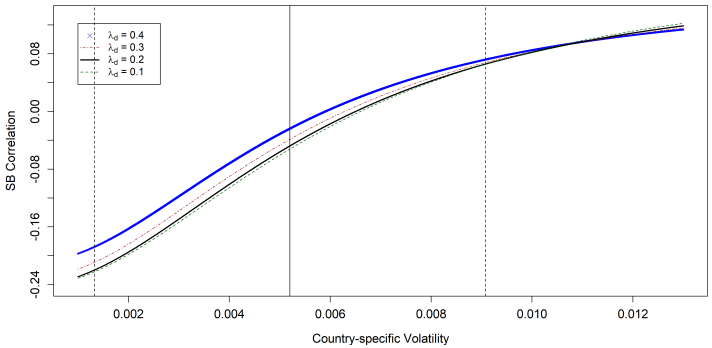


(a) Global growth expectation shock

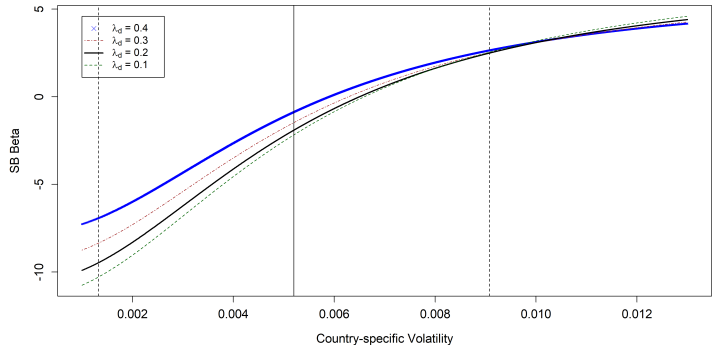


(b) Local growth expectation shock

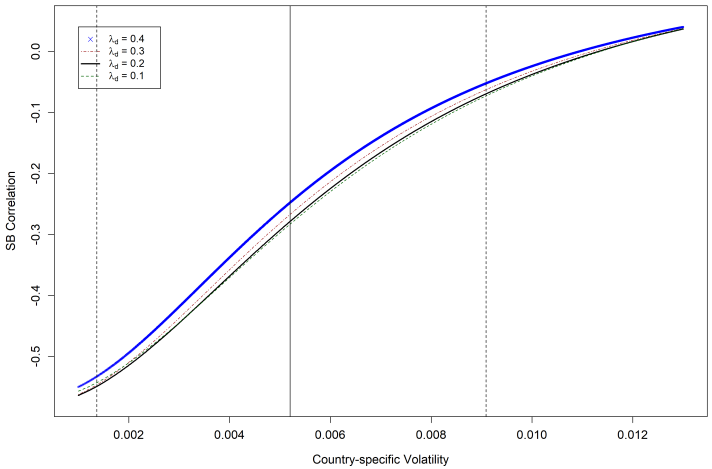
Model Implications: SB Beta/Correlations



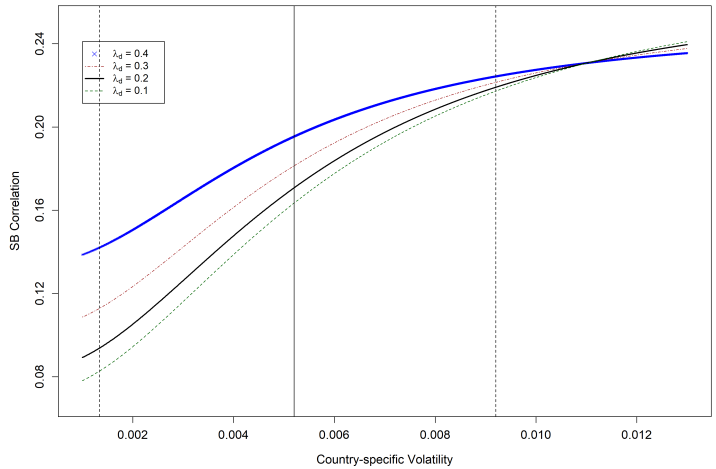
(a) Nominal 10Y SB correlation



(b) Nominal 10Y SB beta

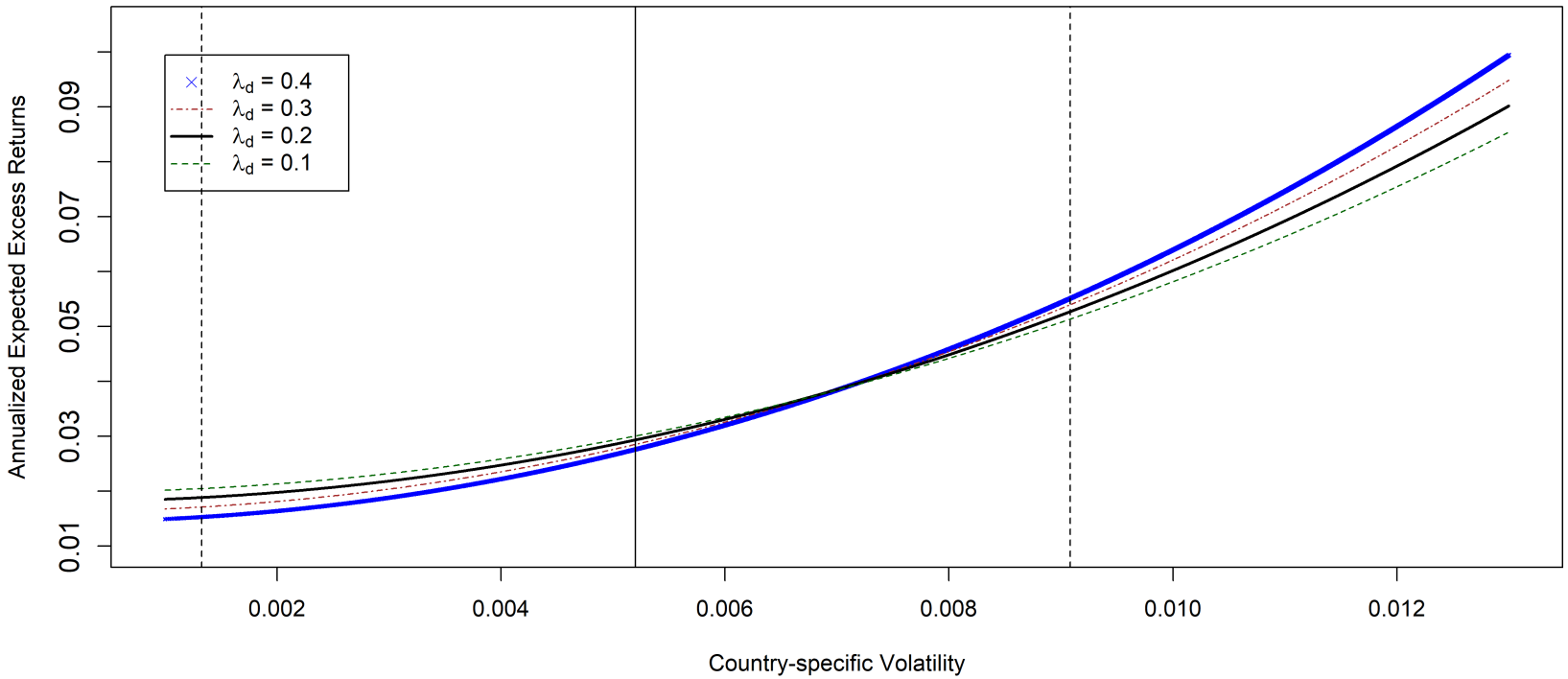


(c) SB Correlation (Model 2)



(d) SB Correlation (Model 3)

Model Implications: Market Risk Premium



(a) Market Risk Premium

Correlation between inflation-real growth expectation

- Test whether the relationship between shocks to expected economic growth and inflation rate of a country controlling for the global growth and inflation rate is *negative*
- World Economic Outlook of IMF provides forecasts of the economy's growth and inflation expectations for multiple years.
- Measure revisions to 0-year (nowcast)/1-year/2-year forecasts
- Partial correlations of revisions between economic growth and inflation forecasts controlling for global revisions

Inflation-Real growth expectation

Panel A. Nowcast error

	$\mathrm{Cor}(\Delta\hat{x}^g_{t,t}, \Delta\hat{\pi}^g_{t,t})$				$\mathrm{Cor}(\Delta\hat{x}^i_{t,t}, \Delta\hat{\pi}^i_{t,t} \mid \Delta\hat{x}^g_{t,t}, \Delta\hat{\pi}^g_{t,t})$			
	1990-2022	1990-1998	1999-2022	Diff.	1990-2022	1990-1998	1999-2022	Diff.
$g =$ World average	−0.059	−0.315	0.198	0.513	−0.208	−0.247	−0.207	0.040
	(−0.46)	(−1.29)	(1.38)		(−4.36)	(−3.75)	(−4.60)	(0.14)
$g =$ Adv. economy	0.325	−0.141	0.339	0.480	−0.168	−0.106	−0.122	−0.016
	(2.71)	(−0.53)	(2.47)		(−2.64)	(−1.46)	(−2.47)	(−0.25)

Panel B. One-year-ahead forecast error

	$\mathrm{Cor}(\Delta\hat{x}^g_{t,t+1}, \Delta\hat{\pi}^g_{t,t+1})$				$\mathrm{Cor}(\Delta\hat{x}^i_{t,t+1}, \Delta\hat{\pi}^i_{t,t+1} \mid \Delta\hat{x}^g_{t,t+1}, \Delta\hat{\pi}^g_{t,t+1})$			
	1990-2022	1990-1998	1999-2022	Diff.	1990-2022	1990-1998	1999-2022	Diff.
$g =$ World average	−0.123	−0.470	0.005	0.475	−0.194	−0.232	−0.220	0.012
	(−0.98)	(−2.06)	(0.03)		(−4.36)	(−3.14)	(−6.99)	(0.14)
$g =$ Adv. economy	0.154	0.086	0.163	0.077	−0.124	−0.158	−0.105	0.052
	(1.23)	(0.32)	(1.13)		(−2.64)	(−2.24)	(−2.68)	(0.73)

Stock market response

Regress annual stock returns on long-term forecast revisions

	Stock returns ($R_{m,t}$)					
			g =World		g =Average	
$\Delta\hat{x}^i_{t,t+2}$	8.454	8.413		3.711		4.183
	(3.03)	(3.01)		(2.04)		(3.80)
$\Delta\hat{\pi}^i_{i,t,t+2}$		−0.219		−0.126		−0.274
		(−0.87)		(−0.46)		(−1.22)
$\Delta\hat{x}^g_{t,t+2}$			6.569	9.721	5.259	8.430
			(3.09)	(2.52)	(3.01)	(1.90)
$\Delta\hat{\pi}^g_{t,t+2}$			−3.444	−1.401	0.348	0.527
			(−1.44)	(−0.59)	(1.05)	(2.72)
Country FE	Y	Y	Y	Y	Y	Y
R^2	0.151	0.152	0.236	0.188	0.176	0.194
N	1674	1674	1474	1474	1674	1674

Bond market response

Regress bond yield changes on long-term forecast revisions

	First-difference in bond yields (Δy_t)					
			g =World		g =Average	
$\Delta \hat{x}^i_{t,t+2}$	−0.081	−0.068		−0.354		−0.451
	(−0.63)	(−0.54)		(−2.35)		(−3.38)
$\Delta \hat{\pi}^i_{t,t+2}$		0.067		0.010		0.072
		(2.49)		(0.27)		(2.45)
$\Delta \hat{x}^g_{t,t+2}$			0.182	0.544	0.302	0.733
			(0.58)	(1.66)	(1.30)	(2.95)
$\Delta \hat{\pi}^g_{t,t+2}$			0.586	0.572	−0.091	−0.091
			(2.20)	(2.08)	(−3.18)	(−3.22)
Country FE	Y	Y	Y	Y	Y	Y
R^2	0.234	0.267	0.275	0.281	0.246	0.257
N	1674	1674	1474	1474	1674	1674

SB relationship and country-specific volatility

- The framework suggests a positive comovement between stock and bond prices when *country-specific risk is high*
- Country-specific risk measured by
  1) Volatility of consumption growth measured using a stochastic volatility model

$$\Delta c_t^i = \beta_0^i + \beta_1^i \Delta c_t^* + \exp(h_t^i/2)\epsilon_t^i$$
$$h_{t+1}^i = \mu_h^i + \varphi_h^i(h_t^i - \mu_h^i) + \sigma_h^i \eta_t^i,$$

  2) Country-specific volatility of international CAPM model

Bond market response

	$\hat{\rho}_{SBd,i}$			
CS volatility	14.156	13.929	8.941	2.730
	(2.75)	(2.76)	(4.08)	(1.76)
Global volatility		−38.390	−3.650	−27.515
		(−1.59)	(−2.55)	(−1.58)
Country FE	N	N	Y	Y
Time FE	Y	Y	N	Y
R^2	0.515	0.519	0.218	0.708

	$\hat{\beta}_{SBd,i}$			
CS volatility	309.739	304.346	197.330	54.080
	(2.53)	(2.52)	(2.75)	(1.82)
Global volatility		−909.675	−145.030	−675.810
		(−1.62)	(−3.31)	(−1.87)
Country FE	N	N	Y	Y
Time FE	Y	Y	N	Y
R^2	0.422	0.424	0.209	0.608

Main result - Total returns

Panel A. Based on total returns (1999-2022)

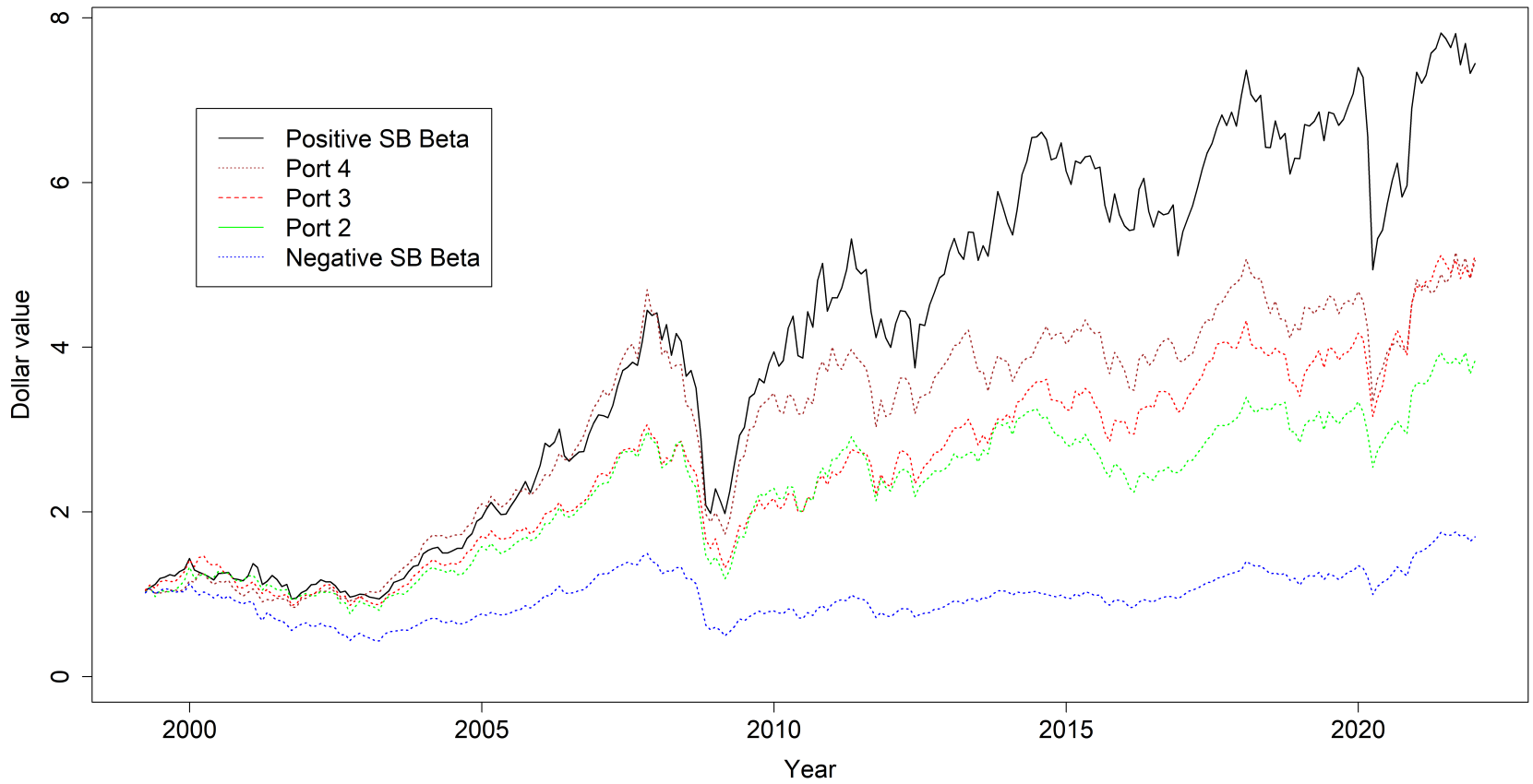
	Daily SB beta estimation				
	USD ret.	α_{CAPM}	Local ret.	Currency	$\hat{\beta}_{SBd}$
Port 1	0.45	−0.15	0.32	0.12	−13.48
	(1.26)	(−1.35)	(1.01)	(0.85)	
Port 2	0.58	−0.02	0.56	0.00	−7.83
	(1.63)	(−0.17)	(1.90)	(−0.00)	
Port 3	0.81	0.47	0.77	0.01	−3.76
	(2.32)	(2.55)	(2.82)	(0.08)	
Port 4	0.90	0.34	0.85	0.02	0.72
	(2.71)	(2.37)	(3.21)	(0.18)	
Port 5	1.03	0.72	1.17	−0.18	5.74
	(2.69)	(3.96)	(3.69)	(−1.72)	
H–L	0.57**	0.88***	0.84***	−0.30**	19.22
	(2.49)	(4.65)	(3.67)	(−2.54)	

Main result - Price returns

Panel B. Based on price returns (1990-2022)

	Daily SB beta estimation				
	USD ret.	α_{CAPM}	Local ret.	Currency	$\hat{\beta}_{SBd}$
Port 1	0.09	−0.41	0.03	0.05	−10.16
	(0.32)	(−2.60)	(0.12)	(0.48)	
Port 2	0.41	−0.04	0.42	−0.03	−4.98
	(1.43)	(−0.24)	(1.75)	(−0.29)	
Port 3	0.84	0.31	0.78	0.03	−1.67
	(2.90)	(2.00)	(3.26)	(0.31)	
Port 4	0.92	0.42	0.82	0.08	2.17
	(3.17)	(2.25)	(3.35)	(0.72)	
Port 5	0.94	0.32	1.02	−0.12	7.45
	(2.61)	(1.45)	(3.26)	(−1.18)	
H–L	0.85***	0.73***	0.99***	−0.17	17.61
	(3.31)	(2.93)	(4.15)	(−1.44)	

Time-series of SB beta-sorted equity portfolios in USD



Is sovereign default risk in bond yields priced? *Unlikely...*

- ▷ Sovereign bond yields moves when credit spread varies.
- ▷ If default risk is priced in the stock market, an shocks to CDS spread and stock returns should be negatively related. → Ceteris paribus, a positive SB relationship is expected.
- ▷ Consider a decomposition of first-difference in bond yields:

$$R^i_{S,t+1} = a^i + b^i(-\Delta y^i_{t+1} + \Delta CDS^i_{t+1}) + c^i(-\Delta CDS^i_{t+1}) + \epsilon^i_{t+1}$$

Portfolios formed after sorting by risk-free yield beta

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Returns	0.33	0.70	0.31	0.46	0.79	0.47**
in USD	(0.89)	(1.97)	(0.86)	(1.22)	(2.08)	(2.34)

Portfolios formed after sorting by CDS beta

	Port 1	Port 2	Port 3	Port 4	Port 5	H –L
Returns	0.66	0.56	0.46	0.59	0.41	−0.25
in USD	(1.57)	(1.25)	(1.25)	(1.31)	(1.02)	(−1.45)

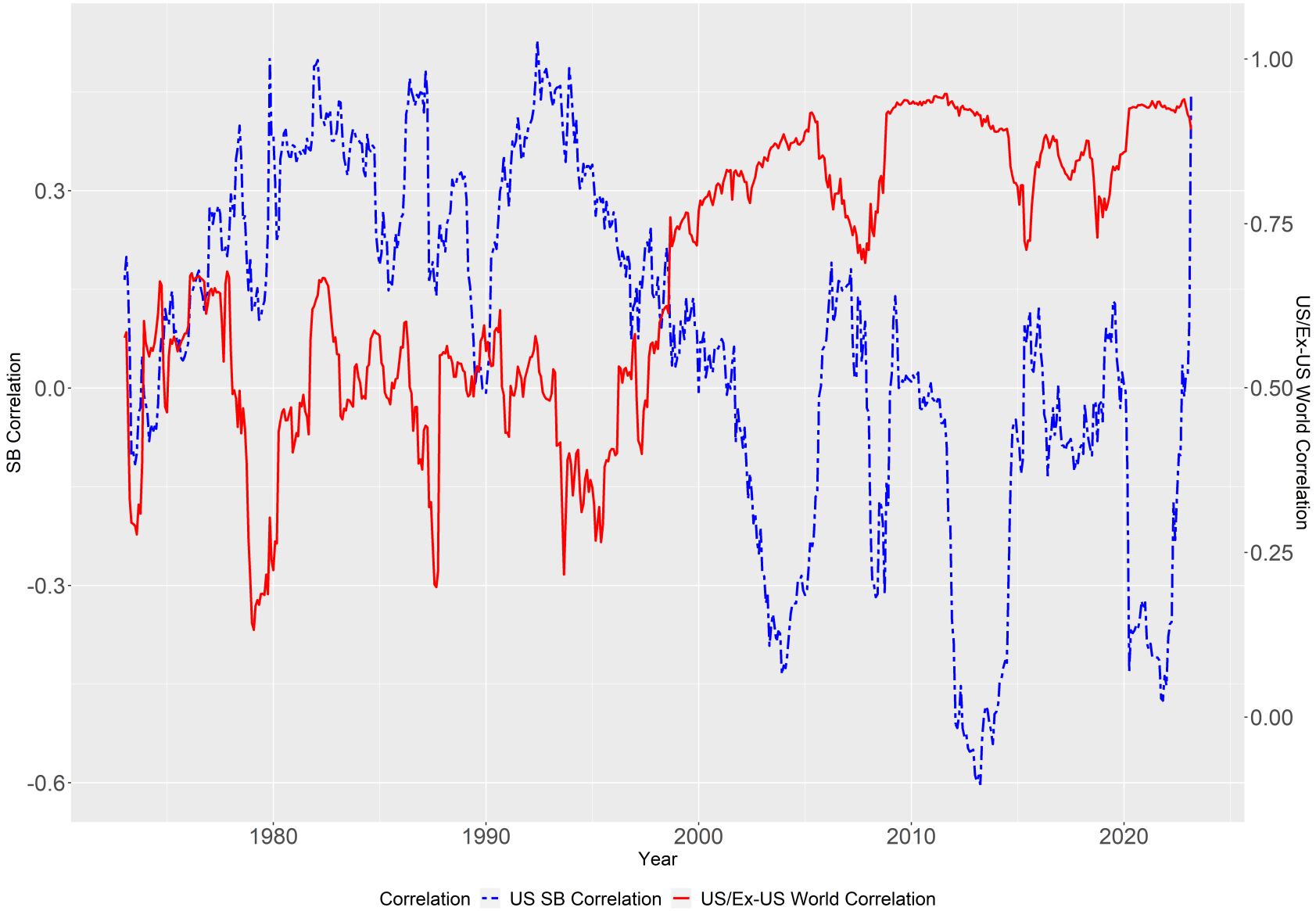
Cross-sectional regressions

Panel A. Baseline specification and control for macroeconomic variables

	Model 1	Model 2	Model 3	Model 4	Model 5
$\hat{\beta}_{SBd,t}$	0.060***	0.090***	0.059***	0.058**	0.077***
	(2.94)	(3.94)	(2.81)	(2.57)	(3.27)
$\overline{\hat{\beta}_{SBd,t}}$		−0.063***			
		(−2.99)			
Inflation Forecast			−6.41		−7.96
			(−0.98)		(−1.15)
Total GDP				0.00	0.01
				(0.09)	(0.18)
GDP per cap				−0.30	−0.39
				(−1.02)	(−1.19)
GDP Forecast				−8.79	−15.44
				(−1.13)	(−1.36)
R^2	0.111	0.134	0.197	0.347	0.402

▶▶ Alternative

Globalization and SB correlation



Conclusion

- Countries with a positive relationship between returns on stocks and bonds have higher future stock returns.
- Stock and bond returns are relatively positively related if
  - there is more uncertainty shock within the country or region.
  - sovereign bond yield is volatile.
- Evidence of local risk priced in the international equity market

Cross-sectional regressions

Panel B. Control for return predictors

	Model 1	Model 2	Model 3	Model 4
$\hat{\beta}^{i}_{d,t}$	0.027**	0.030**	0.030*	0.034**
	(2.17)	(2.28)	(1.75)	(2.08)
Dividend Yield	−0.98			−4.51
	(−0.12)			(−0.65)
Term Spread		−0.03		−0.04
		(−0.40)		(−0.57)
Momentum			0.36	0.47
			(0.57)	(0.71)
R^2	0.149	0.163	0.191	0.319

Cross-sectional regressions

Panel C. Control for liquidity factors

	Model 1	Model 2	Model 3	Model 4	Model 5
$\hat{\beta}^{i}_{SBd,t}$	0.067***	0.057***	0.059**	0.069***	0.098**
	(2.82)	(2.98)	(2.58)	(3.02)	(2.18)
Zero trading volume	−0.11				0.57
	(−0.83)				(0.77)
Treasury illiquidity		0.00			0.00
		(−0.50)			(0.85)
Zero return			−0.259*		−0.63
			(−1.66)		(−0.73)
Amihud	−0.11			60.92	−203.57
	(−0.83)			(0.69)	(−0.90)
R^2	0.205	0.204	0.206	0.206	0.423

Go Back

Main Result - Alternative Specifications

A. Weekly Estimation

Total returns							Price returns					
	Port 1	Port 2	Port 3	Port 4	Port 5	H–L	Port 1	Port 2	Port 3	Port 4	Port 5	H–L
Returns	0.28	0.32	0.53	0.52	0.93	0.65***	0.02	0.23	0.50	0.67	0.66	0.66**
in USD	(0.74)	(0.86)	(1.45)	(1.38)	(2.27)	(2.73)	(0.05)	(0.77)	(1.71)	(2.08)	(1.76)	(2.57)
ICAPM	−0.18	0.10	0.32	0.30	0.92	1.11***	−0.35	−0.02	0.22	0.28	0.44	0.81***
	(−1.77)	(0.60)	(2.47)	(2.03)	(4.32)	(5.16)	(−2.45)	(−0.15)	(1.60)	(1.60)	(2.01)	(3.83)
Returns	0.22	0.26	0.35	0.62	1.05	0.83***	0.00	0.25	0.49	0.67	0.81	−0.81***
in local $	(0.68)	(0.85)	(2.11)	(2.06)	(3.14)	(3.60)	(0.01)	(1.05)	(2.04)	(2.51)	(2.45)	(3.40)
Currency	0.06	0.06	−0.07	−0.09	−0.11	−0.17	0.01	−0.03	0.02	0.00	−0.14	−0.15
returns	(0.40)	(0.41)	(−0.47)	(−0.68)	(−0.97)	(−1.59)	(0.09)	(−0.24)	(0.16)	(0.01)	(−1.06)	(−1.09)

B. Monthly Estimation

Total returns							Price returns					
	Port 1	Port 2	Port 3	Port 4	Port 5	H–L	Port 1	Port 2	Port 3	Port 4	Port 5	H–L
Returns	0.15	0.26	0.32	0.72	0.71	0.57**	0.55	0.52	0.46	0.87	0.96	0.42**
in USD	(0.47)	(0.87)	(1.13)	(2.27)	(1.95)	(2.34)	(1.72)	(1.81)	(1.57)	(2.67)	(2.68)	(2.06)
ICAPM	−0.18	−0.01	−0.07	0.42	0.46	0.66***	−0.11	0.08	0.28	0.41	0.85	0.96***
	(−1.17)	(−0.11)	(−0.43)	(2.80)	(2.31)	(3.27)	(−0.85)	(0.71)	(2.07)	(2.79)	(4.64)	(4.77)
Returns	0.13	0.30	0.31	0.71	0.80	0.68***	0.60	0.44	0.57	0.88	1.07	0.50***
in local $	(0.44)	(1.26)	(1.27)	(2.79)	(2.61)	(3.04)	(2.28)	(1.82)	(2.31)	(3.39)	(3.61)	(2.72)
Currency	0.02	−0.05	0.01	0.01	−0.09	−0.10	−0.05	0.07	−0.10	−0.01	−0.11	−0.07
returns	(0.20)	(−0.40)	(0.10)	(0.05)	(−0.80)	(−0.90)	(−0.40)	(0.69)	(−0.85)	(−0.07)	(−0.93)	(−0.64)

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