Sovereign Yields with Credit Risk and U.S. Monetary Policy Spillovers

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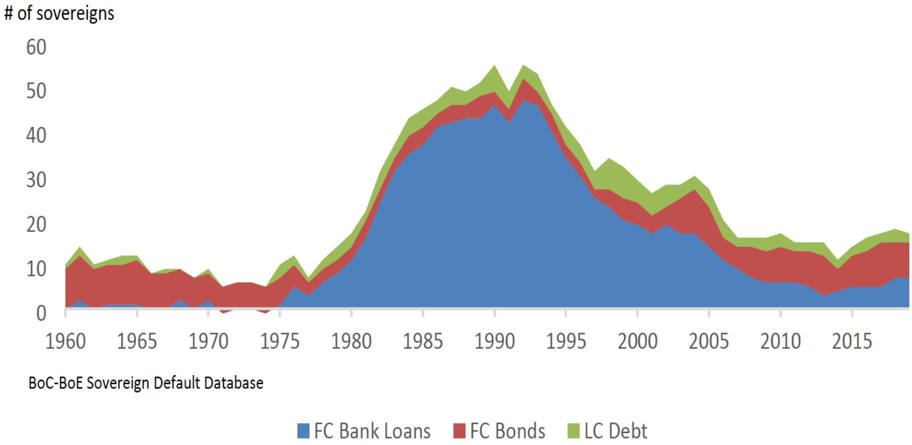
September 24, 2020

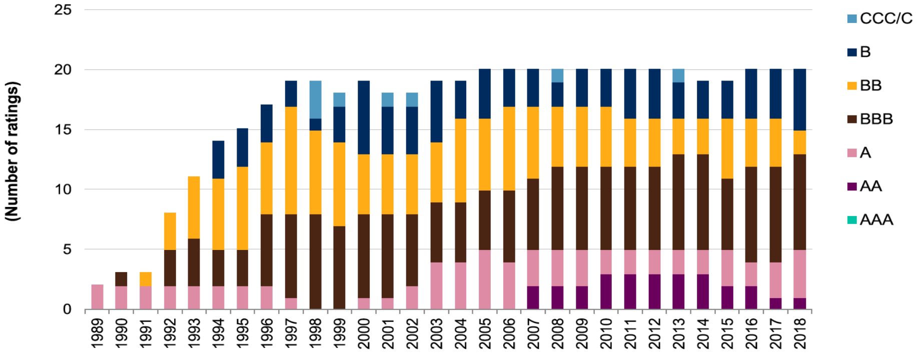
Do Sovereigns Default on Local Currency Debt?



Source: Beers, Jones and Walsh (2020).

Credit Risk in Local Currency Yields

Distribution Of Emerging Market Sovereign Ratings



Source: S&P Global Fixed Income Research.

Research Questions

- How to decompose sovereign yields with credit risk?
- How does U.S. monetary policy transmit to emerging market (EM) yields?
    - Does it influence expectations of future policy rates?
    - Does it affect the term premium?
    - Does it impact creditworthiness?

Related Literature

Roadmap

- Construction of yield curves
- Affine term structure model
- Decomposition of EM yields
- U.S. monetary policy spillovers

Construction of Yield Curves

Nominal Yield Curves

- Local currency (LC) nominal yield curves ($y_{t,n}^{LC}$) from:
  - Bloomberg Fair Value (BFV) par yield curves $\rightarrow$ Zero-coupon yield curves
- **Problem:** Credit risk embedded in LC nominal yields of EM
- **Approach:** Synthetic LC yields can be treated as *free of credit risk*
  - Swap U.S. Treasury yields into LC using **currency derivatives**
  - Why not CDS (credit default swaps)?

Synthetic Yield Curves

$$\widetilde{y}_{t,n}^{LC} = y_{t,n}^{US} + \rho_{t,n}$$

- $\widetilde{y}_{t,n}^{LC}$: n-period zero-coupon *synthetic* yield of a country in LC at time t
- $y_{t,n}^{US}$: n-period zero-coupon yield of the U.S. in USD at time t
- $\rho_{t,n}$: n-period **forward premium** from USD to LC at time t
  - Currency forwards (< 1 year) and cross-currency swaps (≥ 1 year)

Forward Premium ($\rho_{t,n}$)

- < 1 **Year**: Currency forwards

$$(forward_{t,n} - spot_t)/n$$

- ≥ 1 **Year**: Fixed-for-fixed cross-currency swaps (XCS)
    - Cross-currency basis swaps
    - Interest rate swaps

Deviations from CIP (Covered Interest Parity)

$$\phi_{t,n} = y_{t,n}^{LC} - y_{t,n}^{\mathbb{Q}}$$

- Measure of:
  - Sovereign credit risk for EM (Du and Schreger, 2016)
  - Convenience yield for advanced countries (Du, Im, and Schreger, 2018a)
  - Financial market frictions for banks (Du, Tepper, and Verdelhan, 2018b)

Data

- EM (15) countries:

  BRL, COP, HUF, IDR, ILS, KRW, MYR, MXN, PEN, PHP, PLN, RUB, THB, TRY, ZAR

- Daily data from ~Jan-2000 to Jan-2019
- Maturities (in years): 0.25, 0.5, 1, 2, . . . , 10
- Sources:
  - $y_{t,n}^{US}$: CRSP Risk-Free Rates Series, Gürkaynak, Sack, and Wright (2007)
  - $\rho_{t,n}$: Bloomberg + Datastream

Affine Term Structure Model

Model Overview

- Standard discrete-time nominal affine term structure model + Survey data
- A set of pricing factors drives the dynamics of the term structure
- No-arbitrage restrictions ensure consistency in cross section and time series
- Yields are affine functions of the pricing factors
- Assumption: Default-free bonds $\rightarrow$ Synthetic yields ($\widetilde{y}_{t,n}^{LC}$)

Dynamics Under $\mathbb{Q}$ Measure

- Pricing factors under risk-neutral measure $\mathbb{Q}$

$$X_{t+1} = \mu^{\mathbb{Q}} + \Phi^{\mathbb{Q}} X_t + \Sigma \nu_{t+1}^{\mathbb{Q}}$$

- Dynamics of one-period interest rate

$$i_t = \delta_0 + \delta_1' X_t$$

- Fitted yields and loadings

$$y_{t,n}^{\mathbb{Q}} = -\frac{A_n}{n} - \frac{B_n}{n} X_t = A_n^{\mathbb{Q}} + B_n^{\mathbb{Q}} X_t,$$

Dynamics Under $\mathbb{P}$ Measure

- Stochastic discount factor

$$M_{t+1} = \exp\left(-i_t - \frac{1}{2}\lambda_t'\lambda_t - \lambda_t'\nu_{t+1}^{\mathbb{P}}\right)$$

- Market prices of risk

$$\lambda_t = \lambda_0 + \lambda_1 X_t$$

- Pricing factors under physical measure $\mathbb{P}$

$$X_{t+1} = \mu^{\mathbb{P}} + \Phi^{\mathbb{P}} X_t + \Sigma\nu_{t+1}^{\mathbb{P}}$$

EM Yield Decomposition

- Future expected short rate as if investors were risk-neutral ($\lambda_0 = \lambda_1 = 0$)

$$y^{\mathbb{P}}_{t,n} = A^{\mathbb{P}}_n + B^{\mathbb{P}}_n X_t,$$

$$A^{\mathbb{P}}_n = -\tfrac{1}{n} A_n,\ B^{\mathbb{P}}_n = -\tfrac{1}{n} B_n,\ A_n = \mathcal{A}(\delta_0, \delta_1, \mu^{\mathbb{P}}, \Phi^{\mathbb{P}}, \Sigma, n) \ \text{ and } B_n = \mathcal{B}(\delta_1, \Phi^{\mathbb{P}}, n)$$

- Term premium

$$\tau_{t,n} = y^{\mathbb{Q}}_{t,n} - y^{\mathbb{P}}_{t,n}.$$

- Credit risk compensation

$$\phi_{t,n} = y^{LC}_{t,n} - y^{\mathbb{Q}}_{t,n}$$

Informational Deficiency

- Bond yields are persistent $\rightarrow$ Small sample bias (Kim and Orphanides, 2012)
  - Most variability attributed to fluctuations in term premium
- Solutions: survey data, parameter restrictions, bias-corrected estimators
- **Surveys** provide robust decompositions of yields (Guimarães, 2014)
  - Important for EM due to small sample sizes

Survey Data

- No data on long-term forecasts for the short rate in EM
- Implied value from existing data on long-term forecasts
  - EM inflation expectations from Consensus Economics (twice a year)
  - Implied U.S real rate from Survey of Professional Forecasters
    - T-bill rate, CPI inflation
    - Compared against TIPS yields

Survey-Augmented Model

- Implied forecast for the short rate in EM

$$i_{t,n} = \pi_{t,n}^{CEsurvey} + r^*_{t,n} = \pi_{t,n}^{CEsurvey} + \left(i_{t,n}^{SPFsurvey} - \pi_{t,n}^{SPFsurvey} \right)$$

- Expected average short rate under $\mathbb{P}$

$$y^e_{t,n} = \frac{1}{n} \mathrm{E}_t^{\mathbb{P}} \left[\sum_{j=0}^{n-1} i_{t+j} \right] = A^e_n + B^e_n X_t,$$

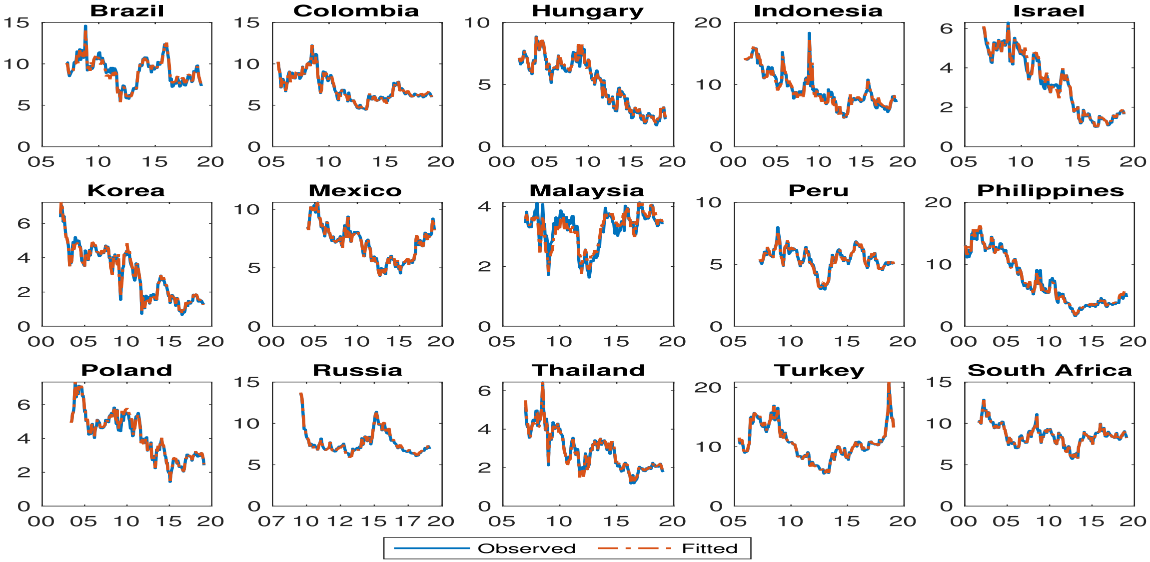
- Forward rate from n to m periods hence

$$f^e_{t,n|m} = \frac{1}{m-n} \mathrm{E}_t^{\mathbb{P}} \left[\sum_{j=n}^{m-1} i_{t+j} \right] = A^e_{t,n|m} + B^e_{t,n|m} X_t.$$

Estimation

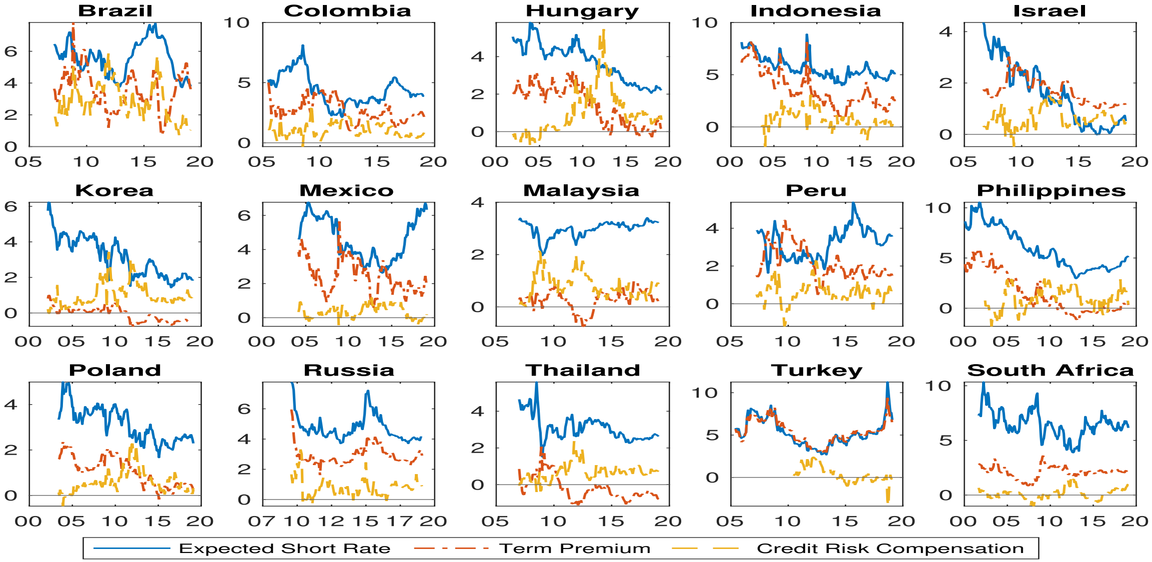
- Estimate parameters by MLE
  - Joslin, Singleton, and Zhu (2011) normalization of the model
- Estimate survey-augmented model by Kalman filter (missing data)
  - Surveys viewed as ‘noisy’ measures of expectations
- Compute standard errors by delta method
- Estimate daily pricing factors

Decomposition of EM Yields



Brazil
Colombia
Hungary
Indonesia
Israel
Korea
Mexico
Malaysia
Peru
Philippines
Poland
Russia
Thailand
Turkey
South Africa
Observed
Fitted

▸ Future Expected Short Rate ▸ Term Premium ▸ Credit Risk Compensation



Term Premium and Inflation Uncertainty

- Compensates investors for bearing inflation uncertainty (Wright, 2011)
- EM inflation higher and more volatile (Ha et al., 2019)
- Is inflation uncertainty more relevant to term premia in EM?

EM Term Premium and Inflation Uncertainty

	6 Months		1 Year		2 Years		5 Years		10 Years	
UCSV-Perm	93.0	75.3	85.7*	83.2	88.7***	97.8**	103.1***	124.2***	121.9***	151.3***
	(52.2)	(49.5)	(37.1)	(43.7)	(24.7)	(31.6)	(15.3)	(18.7)	(16.1)	(18.3)
GDP Growth		-2.56		-2.62		-1.91		-2.14		-3.97*
		(3.37)		(4.00)		(3.53)		(1.67)		(1.55)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lags	3	3	3	3	3	3	3	3	3	3
No. Countries	15	14	15	14	15	14	15	14	15	14
Observations	870	796	870	796	870	796	870	796	870	796
R^2	0.04	0.03	0.04	0.03	0.05	0.05	0.10	0.11	0.11	0.15

Notes: This table reports the slope coefficients of panel data regressions of the model-implied term premia for different maturities on the standard deviation of the permanent component of inflation according to the UCSV model (UCSV-Perm) and GDP growth. The sample includes quarterly data for 15 countries starting in 2000:I and ending in 2018:IV. The term premia is expressed in basis points. GDP growth is expressed in percent. All cases include country fixed effects. Driscoll–Kraay standard errors are in parenthesis. *, **, *** asterisks respectively indicate significance at the 10%, 5% and 1% level.

U.S. Monetary Policy Spillovers

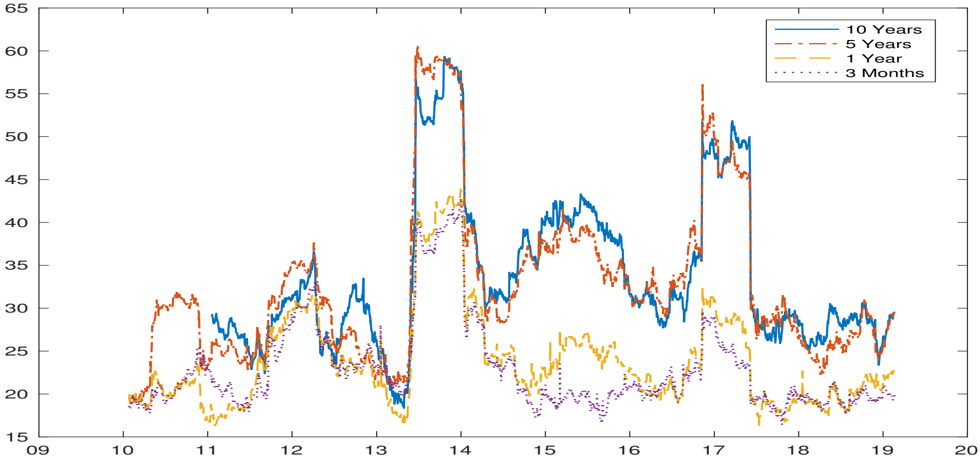
The Yield Curve Channel

- Long-term yields highly correlated, influenced by global forces
- Unconventional monetary policies abroad affect EM long-term yields
  - Via the term premium (Turner, 2014)
- EM monetary autonomy:
  - Declines along the yield curve (Obstfeld, 2015)
  - Limited also at the short end (Kalemli-Özcan, 2019)

Implications of the Yield Curve Channel

- Do long-term EM yields comove more than short-term ones?
  - Diebold and Yilmaz (2014) connectedness index
- Direct relationships
  - Term premium in the U.S. and in EM
  - Expected future short rates in the U.S. and in EM
- Cross relationships at the short end
  - U.S. term premium and expected future short rates in EM

Comovement of EM Yields



Diebold and Yilmaz (2014) connectedness index

Is There A Yield Curve Channel?

$$y_{i,t} = \alpha_i + \beta' z_{i,t} + u_{i,t}$$

- $y_{i,t}$: nominal yields and their three components
- α_i: country fixed effects
- z_{it}: vector of regressors
  - U.S. yield curve decomposition (Kim and Wright, 2005)
  - Global drivers: Vix, EPU index, Hamilton index
  - Domestic drivers: Policy rate, inflation, unemployment, exchange rate

Table 1. Drivers of the Emerging Market 10-Year Nominal Yield and Its Components

	Nominal	E. Short Rate	Term Premium	Credit Rirsk
U.S. Term Premium	0.97***	0.54***	0.85***	-0.42***
	(0.14)	(0.08)	(0.09)	(0.11)
U.S. E. Short Rate	0.17	0.25***	0.08	-0.17**
	(0.09)	(0.05)	(0.06)	(0.06)
Policy Rate	0.24***	0.30***	0.01	-0.06***
	(0.03)	(0.02)	(0.02)	(0.02)
Inflation	15.26***	1.77	7.06***	6.43***
	(2.27)	(1.56)	(1.36)	(1.73)
Unemployment	23.88***	1.14	10.74***	12.00***
	(3.43)	(2.09)	(1.65)	(2.23)
LC per USD (Std.)	41.58***	33.11***	22.07***	-13.61***
	(5.74)	(3.52)	(3.18)	(3.85)
Log(Vix)	49.95***	-20.18	30.13**	40.01***
	(12.63)	(10.45)	(10.49)	(9.59)
Log(EPU U.S.)	7.08	-3.81	-0.44	11.32**
	(5.58)	(2.69)	(2.72)	(3.93)
Log(EPU Global)	-61.04**	-38.72***	-19.64	-2.68
	(20.51)	(6.98)	(11.75)	(10.72)
Global Ind. Prod.	1.16	0.79	-0.10	0.46
	(1.13)	(0.86)	(0.46)	(0.93)
Fixed Effects	Yes	Yes	Yes	Yes
Lags	4	4	4	4
No. Countries	15	15	15	15
Observations	2194	2194	2194	2194
R^2	0.68	0.71	0.49	0.23

Notes: Driscoll–Kraay standard errors in parenthesis. Lag length up to which the residuals may be auto-

Table 1. Drivers of the Emerging Market 2-Year Nominal Yield and Its Components

	Nominal	E. Short Rate	Term Premium	Credit Rirsk
U.S. Term Premium	1.59***	1.68***	0.58***	-0.68**
	(0.22)	(0.17)	(0.17)	(0.21)
U.S. E. Short Rate	-0.03	-0.02	0.05	-0.06
	(0.04)	(0.03)	(0.03)	(0.04)
Policy Rate	0.64***	0.56***	0.13***	-0.05
	(0.03)	(0.03)	(0.02)	(0.03)
Inflation	8.91***	-0.15	7.40**	1.67
	(2.25)	(2.58)	(2.25)	(2.50)
Unemployment	9.39**	-0.62	0.04	9.97***
	(2.91)	(2.14)	(1.61)	(2.14)
LC per USD (Std.)	27.18***	25.67***	17.86***	-16.36**
	(4.84)	(4.86)	(4.04)	(4.91)
Log(Vix)	46.41***	-20.29	-9.10	75.79***
	(8.16)	(13.92)	(7.68)	(11.92)
Log(EPU U.S.)	8.42*	-0.66	-7.01*	16.10***
	(3.82)	(3.91)	(2.79)	(4.15)
Log(EPU Global)	-60.39***	-44.01***	-10.88	-5.50
	(13.69)	(9.62)	(9.32)	(12.88)
Global Ind. Prod.	2.61***	0.36	-1.16*	3.41***
	(0.68)	(0.93)	(0.57)	(0.76)
Fixed Effects	Yes	Yes	Yes	Yes
Lags	4	4	4	4
No. Countries	15	15	15	15
Observations	2194	2194	2194	2194
R^2	0.80	0.75	0.35	0.29

Notes: Driscoll–Kraay standard errors in parenthesis. Lag length up to which the residuals may be auto-

U.S. Monetary Policy Surprises

- Asset price changes: 2-hour windows around FOMC meetings since 2000
- Surprises: Kuttner (2001); Gürkaynak, Sack, and Swanson (2005)
    - Target (2000-2008): federal funds futures contracts
    - Forward guidance (2000-2019): residual of ED8 yield on target surprise
    - Asset purchase (2009-2019): residual of 10Y Treasury yield on target and forward guidance surprises

U.S. Monetary Policy Effects on EM Yields

$$y_{i,t+h} - y_{i,t-1} = \alpha_{h,i} + \sum_{j=1}^{3} \beta_h^j \epsilon_t^j + \gamma_h \Delta y_{i,t-1} + \phi_h s_{i,t-1} + u_{i,t+h}$$

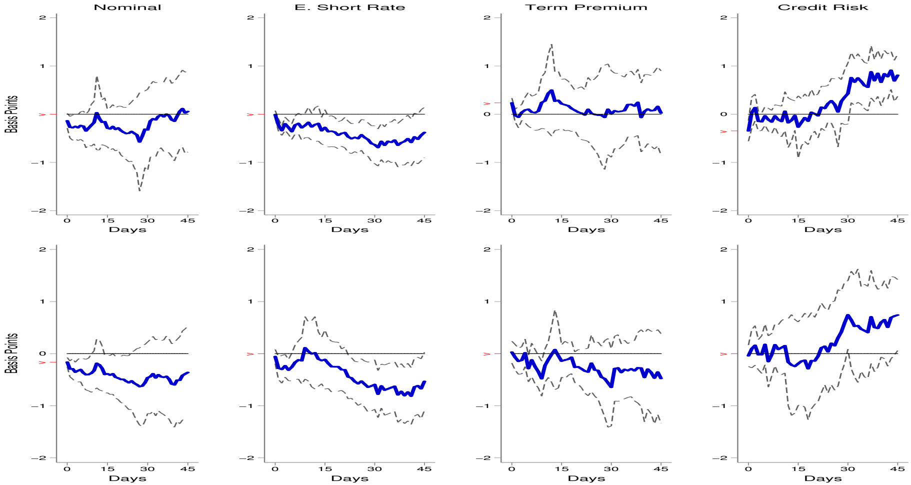
- $y_{i,t}$: 10- and 2-year nominal yields and their components
- h: horizon in days with $h = 0, 1, \ldots, 45$
- $\alpha_{h,i}$: country fixed effects
- ϵ_t^j: three types of monetary policy surprises
- $s_{i,t-1}$: one-day lag in the exchange rate

Effects of Target Surprises

▸ US

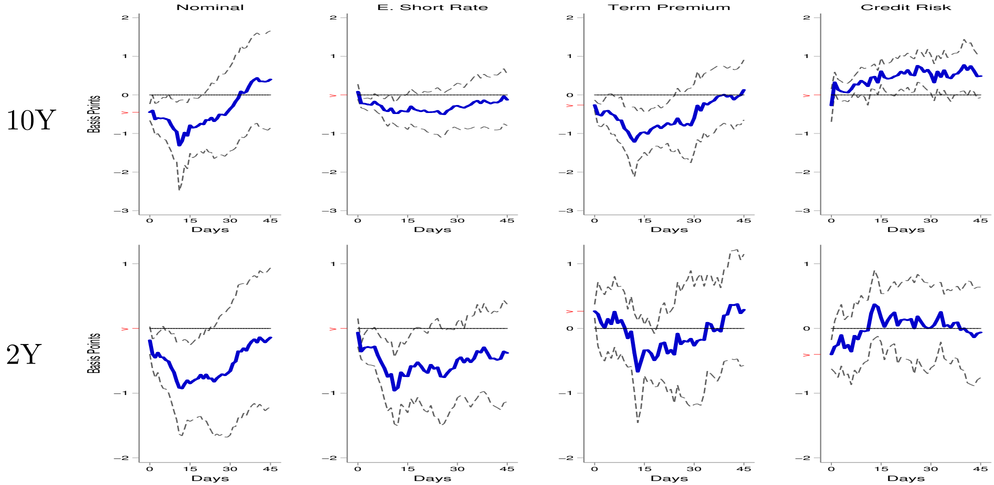
10Y

2Y



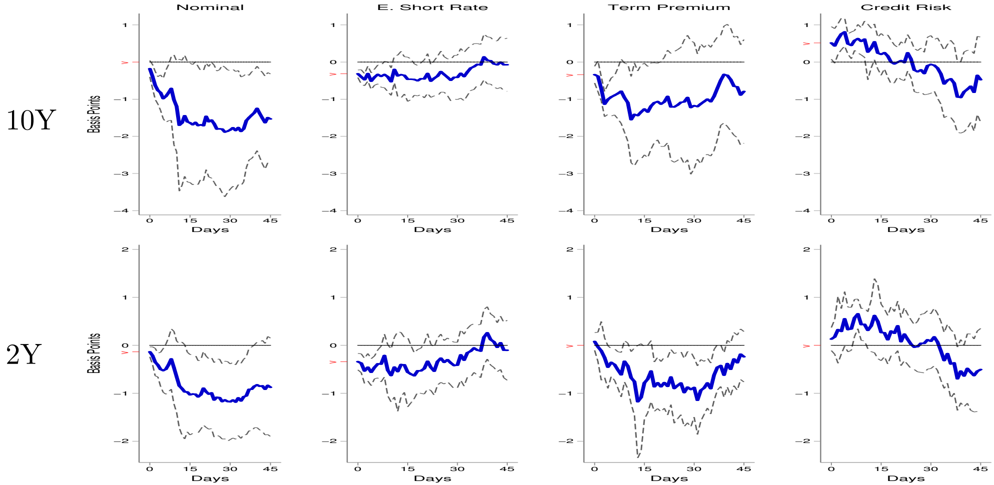
Effects of Forward Guidance Surprises

▸ US



Effects of Asset Purchase Surprises

▸ US



Conclusions

- EM yields decomposed into three parts
  - Future expected short rate
  - Term premium
  - Credit risk compensation
- U.S. monetary policy spillovers
  - Responses are economically significant and delayed
  - Reassessment of policy rate expectations, repricing of risks
  - Evidence of a yield curve channel since 2008

Appendix

Related Literature

- Applications of synthetic yields

  Du-Schreger '16, Du-Im-Schreger '18, Du-Tepper-Verdelhan '18

- Sovereign default in EM local currency bonds

  Reinhart-Rogoff '11, Du-Schreger '16, Erce-Mallucci '18, Otonello-Pérez '19

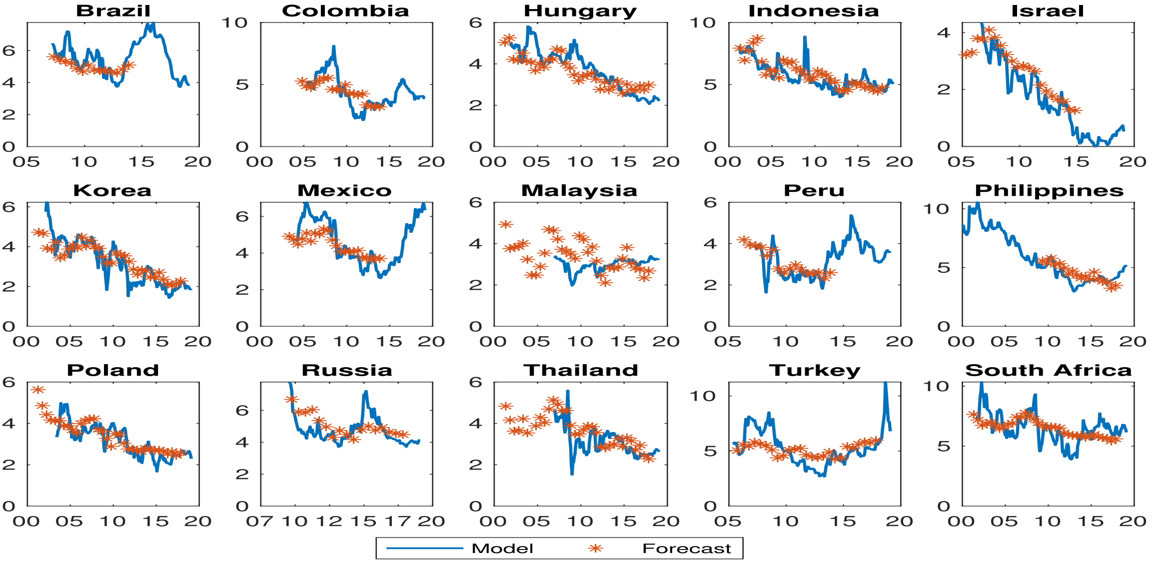
- Spillovers of U.S. monetary policy to EM yields

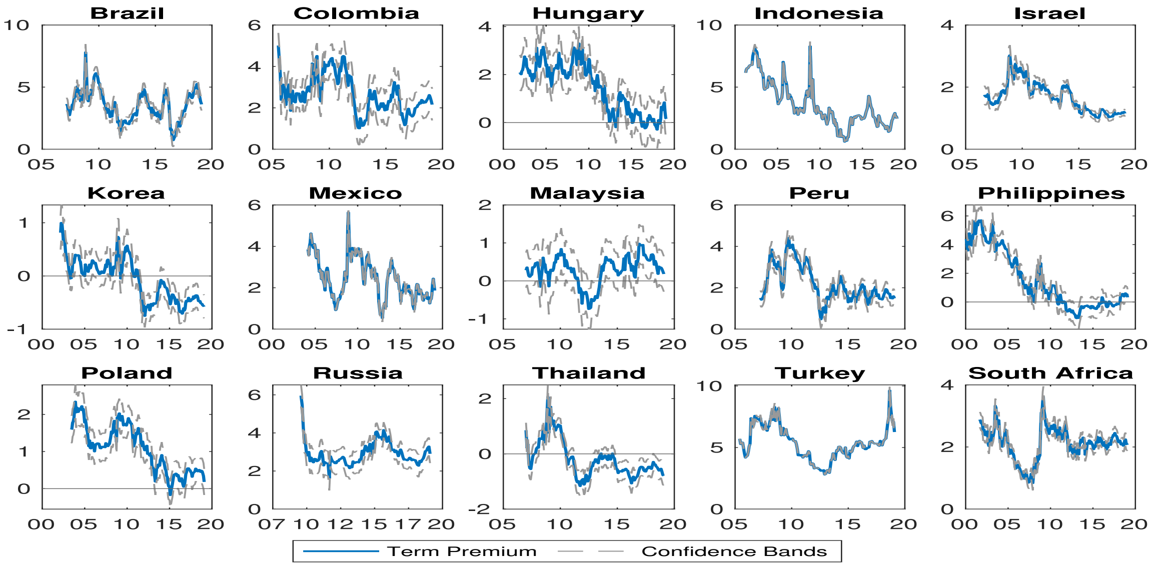
  Hausman-Wongswan '11, Bowman-Londono-Sapriza '15, Curcuru-Kamin-Li-Rodríguez '18,

  Albagli-Ceballos-Claro-Romero '19, Adrian-Crump-Durham-Moench '19

◂ Contributions

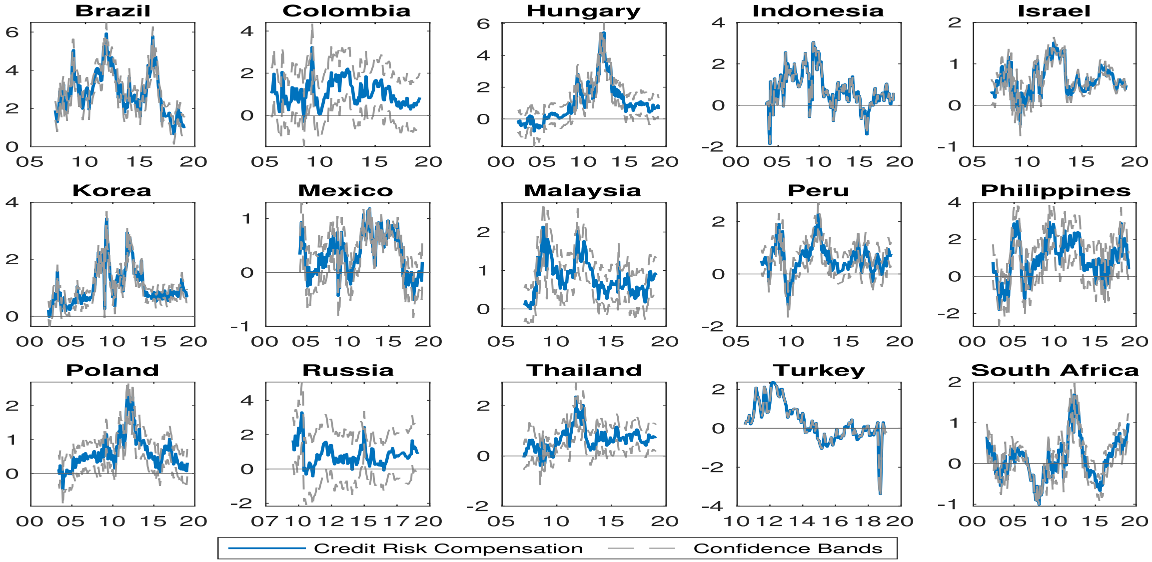
▸ Decomposition





Decomposition
Brazil
Colombia
Hungary
Indonesia
Israel
Korea
Mexico
Malaysia
Peru
Philippines
Poland
Russia
Thailand
Turkey
South Africa
Term Premium
Confidence Bands

Decomposition



Effects of Target Surprises

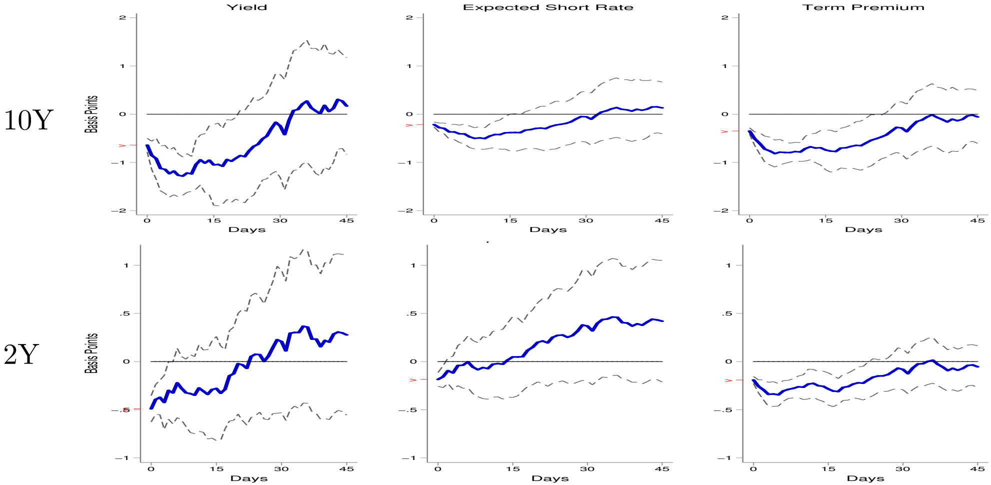
EM

10Y

2Y

Effects of Forward Guidance Surprises

▸ EM



Effects of Asset Purchase Surprises

EM

10Y

2Y