

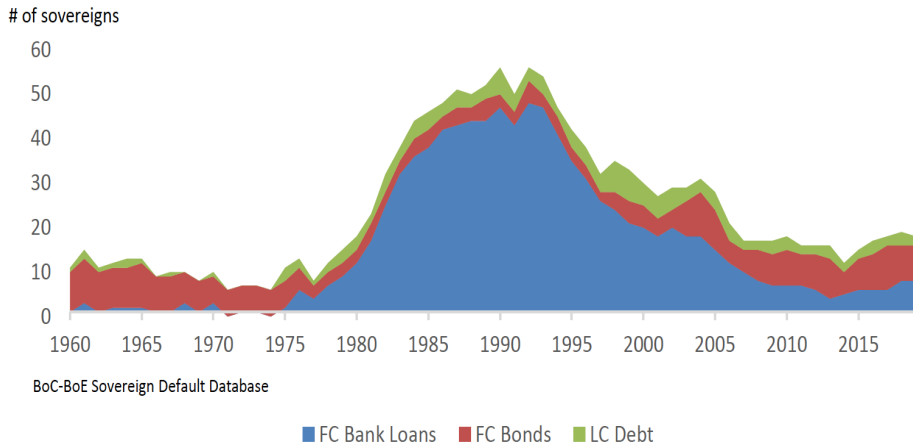
# Sovereign Yields with Credit Risk and U.S. Monetary Policy Spillovers

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September 24, 2020

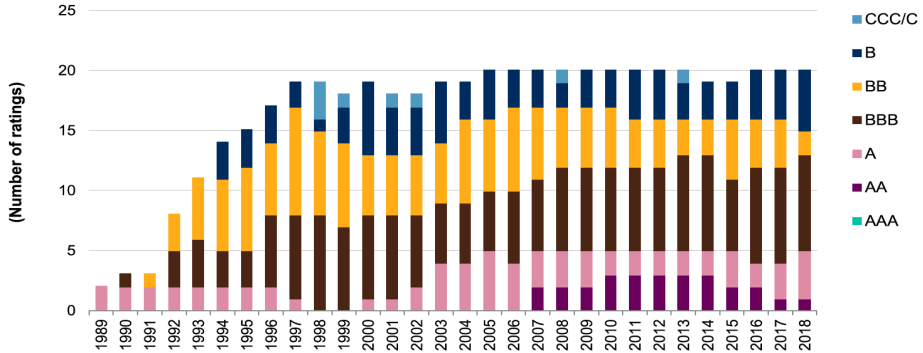
# Do Sovereigns Default on Local Currency Debt?



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?

# 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

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

- $\tilde{y}_{t,n}^{LC}$ :  $n$ -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 ( $\geq 1$  year)



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

- **< 1 Year:** Currency forwards

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

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

# Deviations from CIP (Covered Interest Parity)

$$\phi_{t,n} = y_{t,n}^{LC} - \tilde{y}_{t,n}^{LC}$$

- 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  $\sim$ Jan-2000 to Jan-2019
- Maturities (in years): 0.25, 0.5, 1, 2,  $\dots$ , 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 ( $\tilde{y}_{t,n}^{LC}$ )

# 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 ( $\lambda_0 = \lambda_1 = 0$ )

$$y_{t,n}^{\mathbb{P}} = A_n^{\mathbb{P}} + B_n^{\mathbb{P}} X_t,$$

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

- Term premium

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

- Credit risk compensation

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



# 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  $\mathbb{P}$

$$y_{t,n}^e = \frac{1}{n} \mathbb{E}_t^{\mathbb{P}} \left[ \sum_{j=0}^{n-1} i_{t+j} \right] = A_n^e + B_n^e X_t,$$

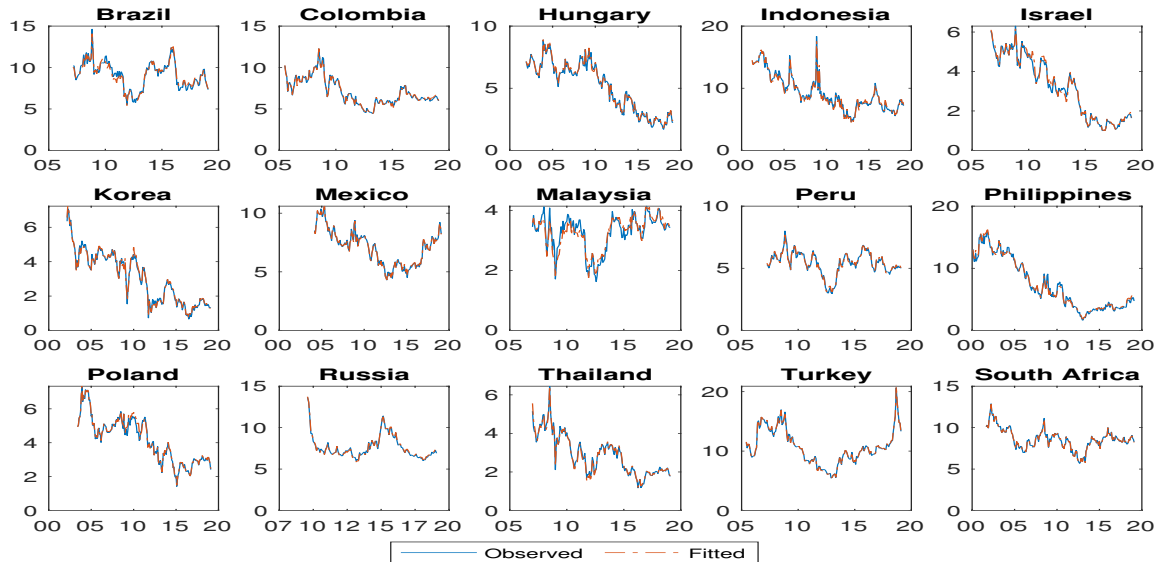
- Forward rate from  $n$  to  $m$  periods hence

$$f_{t,n|m}^e = \frac{1}{m-n} \mathbb{E}_t^{\mathbb{P}} \left[ \sum_{j=n}^{m-1} i_{t+j} \right] = A_{t,n|m}^e + B_{t,n|m}^e X_t.$$

# 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

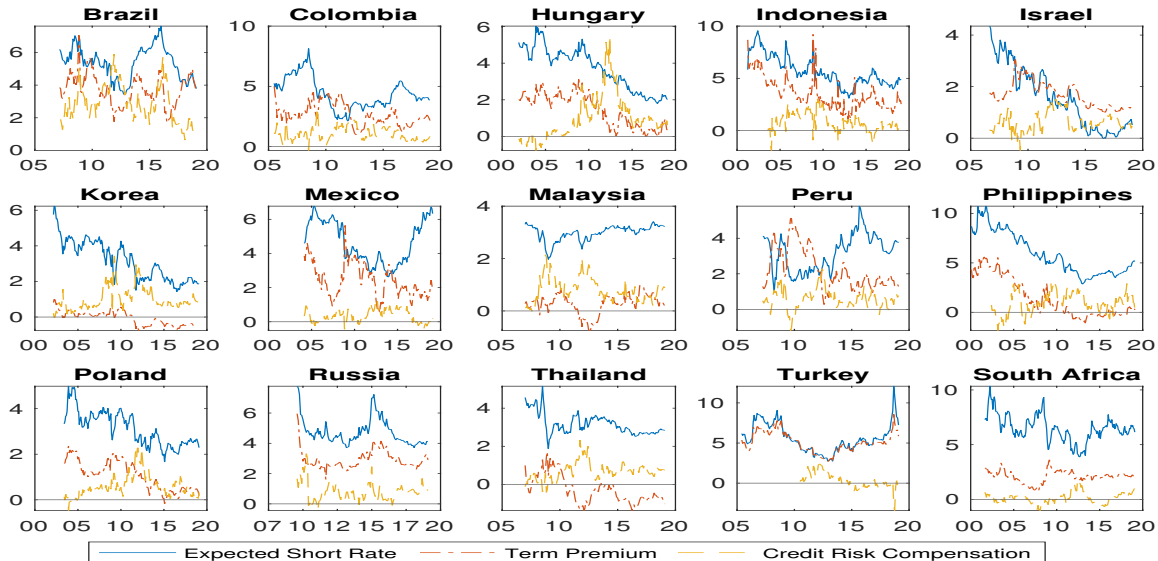
# Decomposition of EM Yields



► 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 (52.2)	75.3 (49.5)	85.7* (37.1)	83.2 (43.7)	88.7*** (24.7)	97.8** (31.6)	103.1*** (15.3)	124.2*** (18.7)	121.9*** (16.1)	151.3*** (18.3)
GDP Growth		-2.56 (3.37)		-2.62 (4.00)		-1.91 (3.53)		-2.14 (1.67)		-3.97* (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

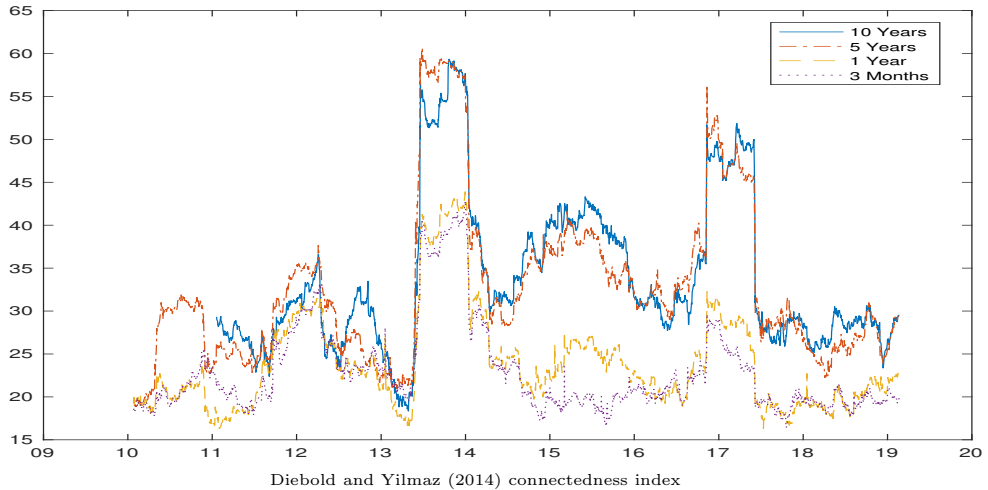
# The Yield Curve Channel

- 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



# 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
- $\alpha_i$ : 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 Risk
U.S. Term Premium	0.97*** (0.14)	0.54*** (0.08)	0.85*** (0.09)	-0.42*** (0.11)
U.S. E. Short Rate	0.17 (0.09)	0.25*** (0.05)	0.08 (0.06)	-0.17** (0.06)
Policy Rate	0.24*** (0.03)	0.30*** (0.02)	0.01 (0.02)	-0.06*** (0.02)
Inflation	15.26*** (2.27)	1.77 (1.56)	7.06*** (1.36)	6.43*** (1.73)
Unemployment	23.88*** (3.43)	1.14 (2.09)	10.74*** (1.65)	12.00*** (2.23)
LC per USD (Std.)	41.58*** (5.74)	33.11*** (3.52)	22.07*** (3.18)	-13.61*** (3.85)
Log(Vix)	49.95*** (12.63)	-20.18 (10.45)	30.13** (10.49)	40.01*** (9.59)
Log(EPU U.S.)	7.08 (5.58)	-3.81 (2.69)	-0.44 (2.72)	11.32** (3.93)
Log(EPU Global)	-61.04** (20.51)	-38.72*** (6.98)	-19.64 (11.75)	-2.68 (10.72)
Global Ind. Prod.	1.16 (1.13)	0.79 (0.86)	-0.10 (0.46)	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 are in parenthesis. \*, \*\*, \*\*\* asterisks respectively indicate significance at the 10%, 5% and 1% level.

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

	Nominal	E. Short Rate	Term Premium	Credit Risk
U.S. Term Premium	1.59*** (0.22)	1.68*** (0.17)	0.58*** (0.17)	-0.68** (0.21)
U.S. E. Short Rate	-0.03 (0.04)	-0.02 (0.03)	0.05 (0.03)	-0.06 (0.04)
Policy Rate	0.64*** (0.03)	0.56*** (0.03)	0.13*** (0.02)	-0.05 (0.03)
Inflation	8.91*** (2.25)	-0.15 (2.58)	7.40** (2.25)	1.67 (2.50)
Unemployment	9.39** (2.91)	-0.62 (2.14)	0.04 (1.61)	9.97*** (2.14)
LC per USD (Std.)	27.18*** (4.84)	25.67*** (4.86)	17.86*** (4.04)	-16.36** (4.91)
Log(Vix)	46.41*** (8.16)	-20.29 (13.92)	-9.10 (7.68)	75.79*** (11.92)
Log(EPU U.S.)	8.42* (3.82)	-0.66 (3.91)	-7.01* (2.79)	16.10*** (4.15)
Log(EPU Global)	-60.39*** (13.69)	-44.01*** (9.62)	-10.88 (9.32)	-5.50 (12.88)
Global Ind. Prod.	2.61*** (0.68)	0.36 (0.93)	-1.16* (0.57)	3.41*** (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 are in parenthesis. \*, \*\*, \*\*\* asterisks respectively indicate significance at the 10%, 5% and 1% level.



# 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

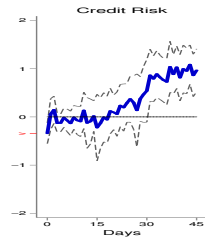
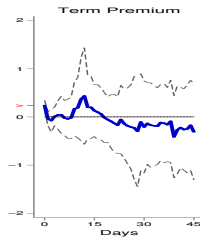
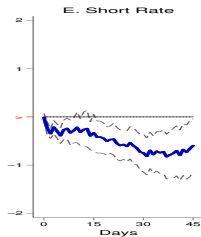
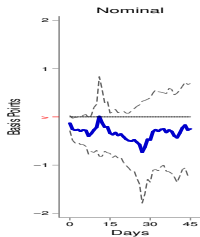
$$y_{i,t+h} - y_{i,t-1} = \alpha_{h,i} + \sum_{j=1}^3 \beta_h^j \epsilon_t^j + \gamma_h \Delta y_{i,t-1} + \phi_h s_{i,t-1} + u_{i,t+h}$$

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

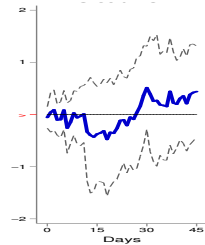
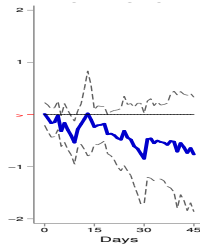
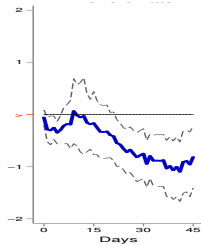
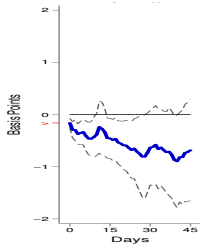
# Effects of Target Surprises

► US

10Y



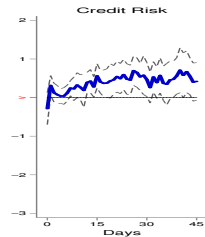
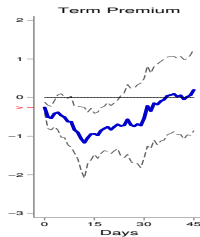
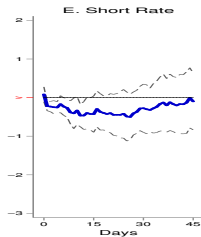
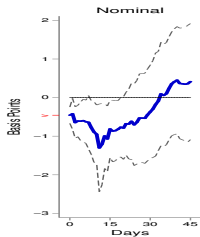
2Y



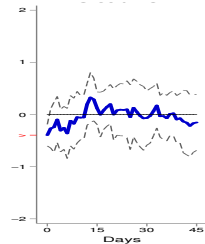
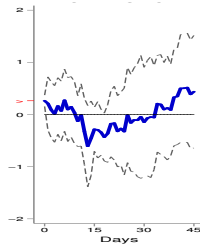
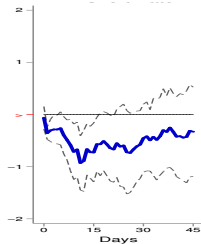
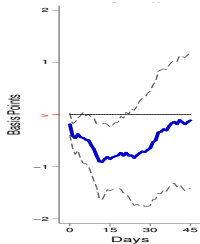
# Effects of Forward Guidance Surprises

► US

10Y



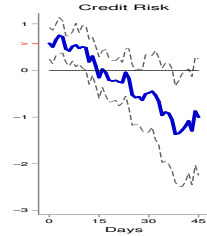
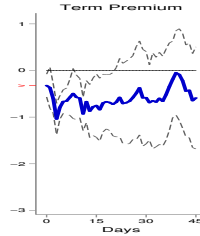
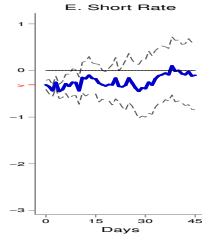
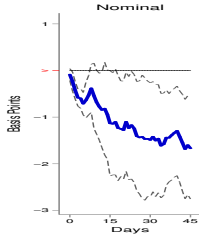
2Y



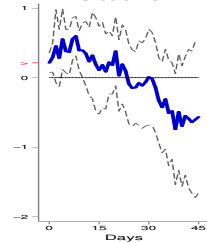
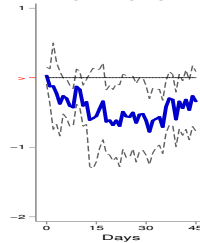
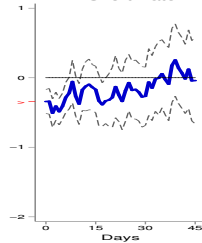
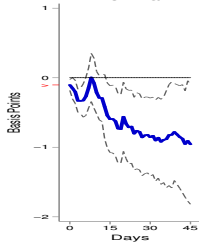
# Effects of Asset Purchase Surprises

► US

10Y



2Y



# 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

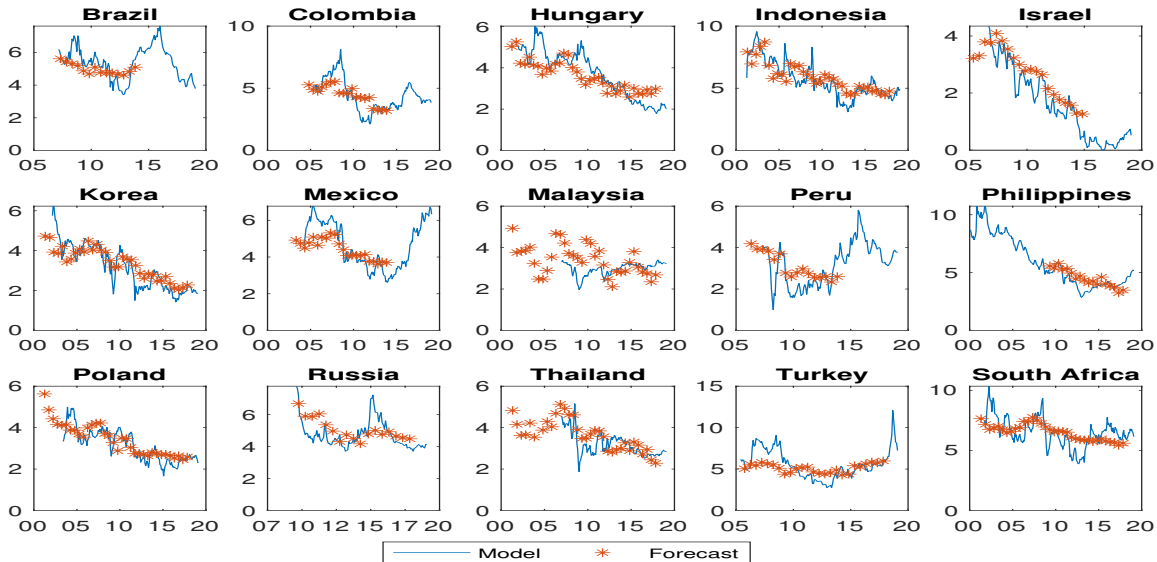
Reinhart-Rogoff '11, Du-Schreger '16, Erce-Mallucci '18, Otonello-Pérez '19

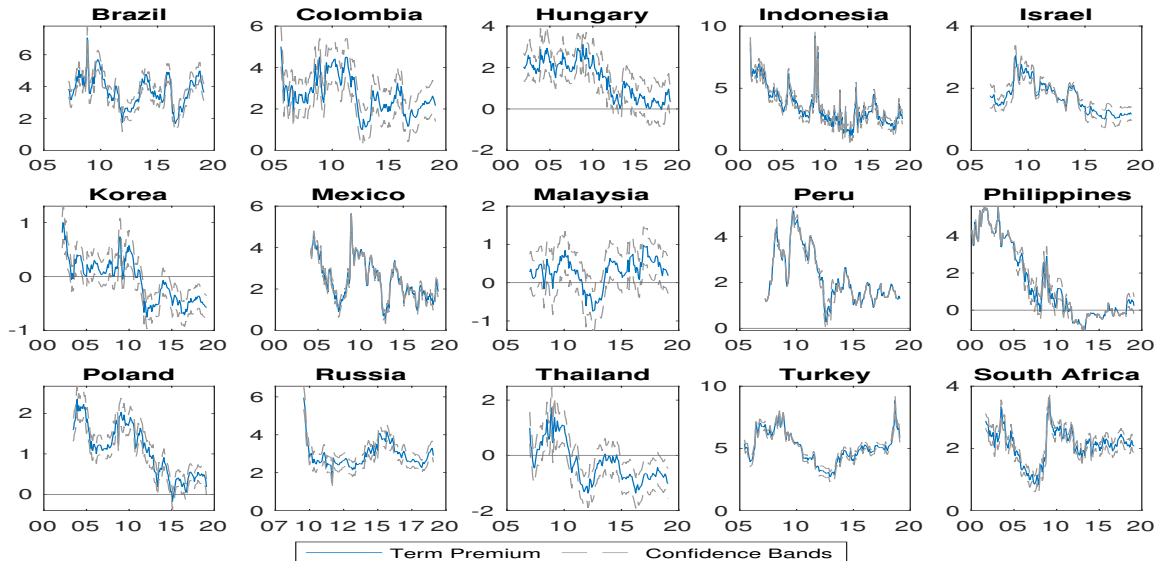
- Spillovers of U.S. monetary policy to EM yields

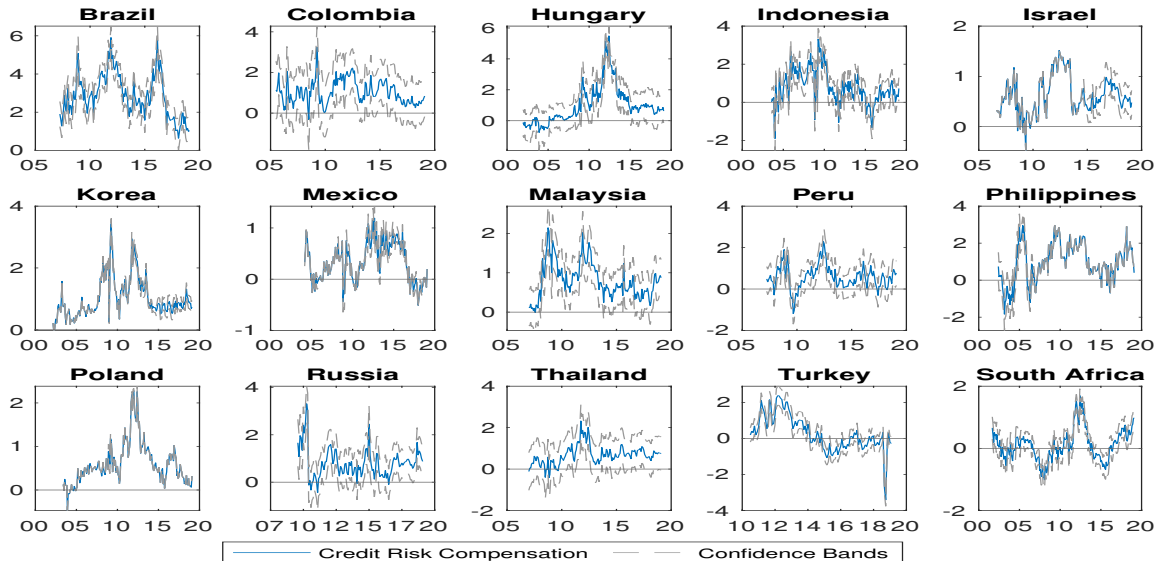
Hausman-Wongswan '11, Bowman-Londono-Saprizá '15, Curcucu-Kamin-Li-Rodríguez '18,

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



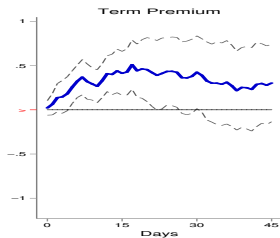
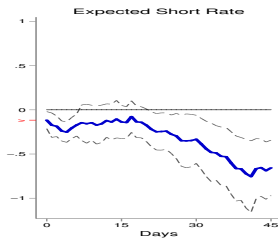
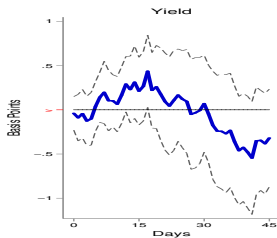




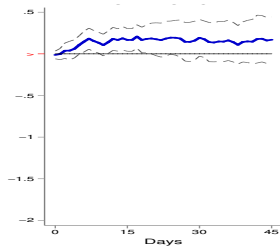
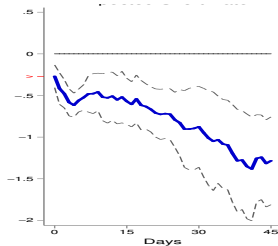
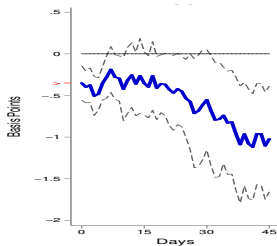


# Effects of Target Surprises

10Y

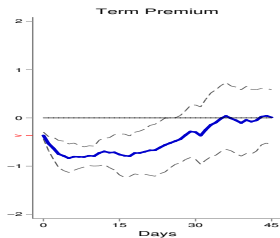
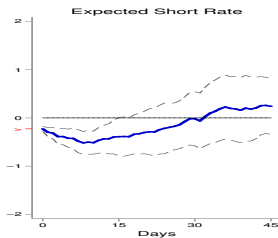
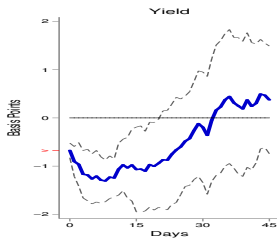


2Y

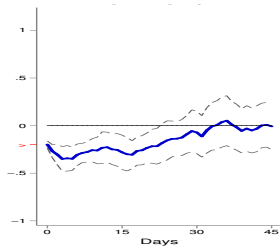
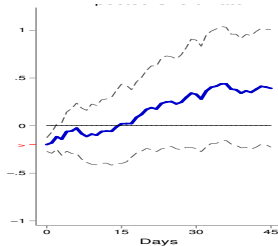
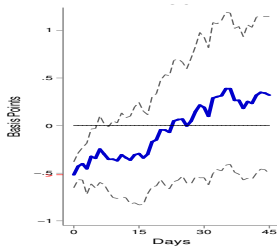


# Effects of Forward Guidance Surprises

10Y

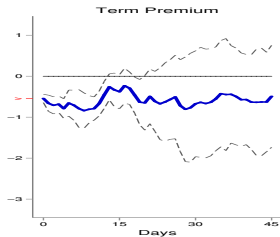
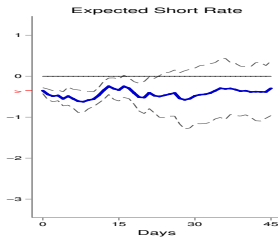
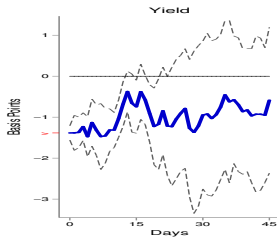


2Y



# Effects of Asset Purchase Surprises

10Y



2Y

