# Term Premia and Credit Risk in Emerging Markets: The Role of U.S. Monetary Policy

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# U.S. Monetary Policy Spillovers

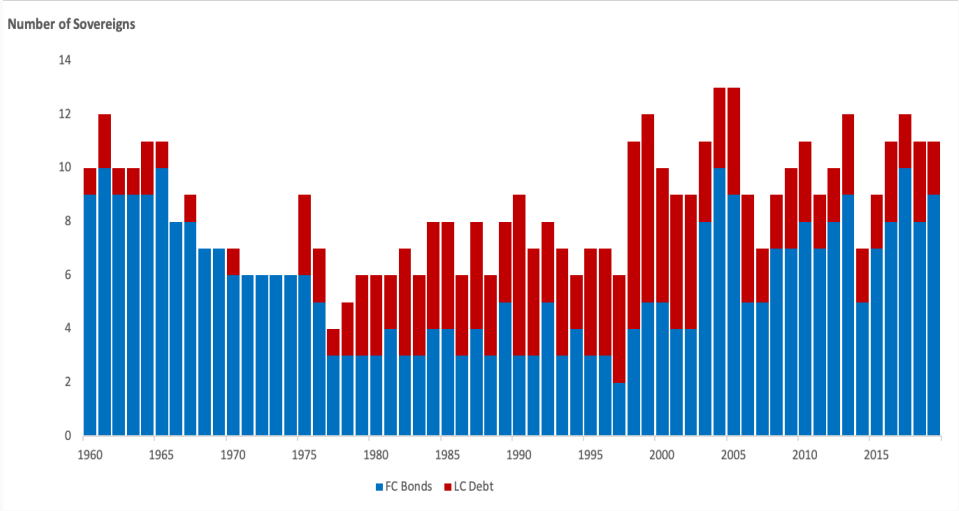
Asset price effects of U.S. monetary policy abroad

- Stocks
- Exchange rates
- Bonds
  - Foreign currency (FC)
  - Local currency (LC): 90% of emerging market sovereign debt in 2018

Understand transmission channels to mitigate undesired effects

- Traditional decompositions of bond yields assume no default risk

# Do Sovereigns Default on Local Currency Debt?




Source: BoC-BoE Sovereign Default Database.

Credit Ratings

# This Paper

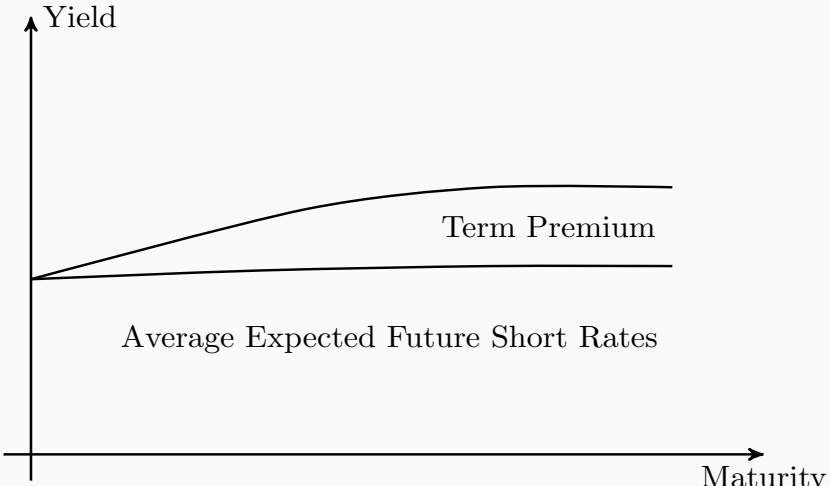
How to decompose the sovereign yields of emerging markets (EM)?

- Accounting for credit risk

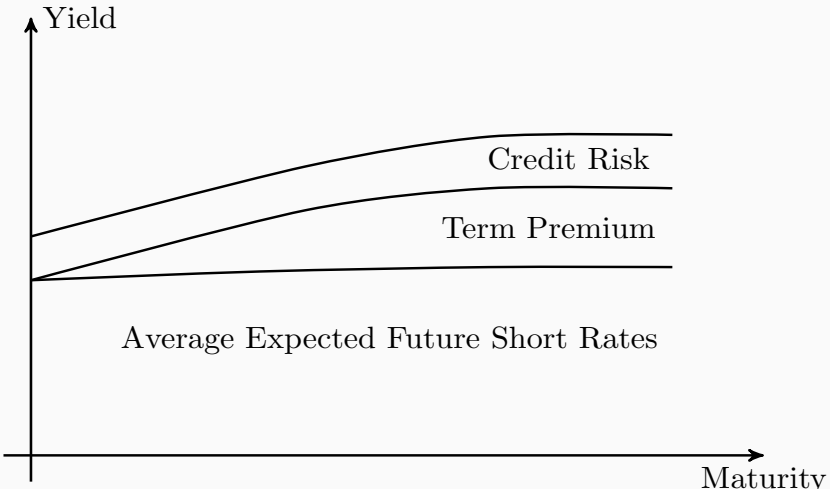
How does U.S. monetary policy transmit to EM sovereign yields?

- Expectations of future policy rates?
- Term premium?
- Creditworthiness?

# Traditional Yield Curve Decomposition



# Proposed EM Yield Curve Decomposition



# U.S. Monetary Policy Spillovers

1. EM yields' response is economically significant, yet delayed
   - Response in EM sometimes lasts longer than in U.S.

2. All three components react to U.S. monetary policy
   - EM central banks expected to follow Fed's monetary stance
   - Similar effects on EM term premia than on U.S. term premium
   - Fiscal implications in EM of U.S. monetary policy

3. Unconventional policies limit EM monetary autonomy along yield curve
   - Global financial cycle more relevant at the long end

# Related Literature

## Synthetic yields and covered interest rate parity deviations

- Du and Schreger (2016); Du, Im, and Schreger (2018a); Du, Tepper, and Verdelhan (2018b)

## Sovereign default in EM local currency bonds

- Reinhart and Rogoff (2011); Du and Schreger (2016); Erce and Mallucci (2018); Ottonello and Perez (2019)

## Global financial cycle

- Rey (2013); Turner (2014); Obstfeld (2015); Kalemli-Özcan (2019); Kolasa and Wesołowski (2020)

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

- Hausman and Wongswan (2011); Bowman, Londono, and Sapriza (2015); Curcuru, Kamin, Li, and Rodriguez (2018); Albagli, Ceballos, Claro, and Romero (2019); Adrian, Crump, Durham, and Moench (2019)

# Yield Curves

# Nominal Yield Curves

Bloomberg par yield curves $\rightarrow$ Zero-coupon yield curves ($y_{t,n}^{LC}$)

- But credit risk in $y_{t,n}^{LC}$

**Approach**: Synthetic LC yields ($\widetilde{y}_{t,n}^{LC}$) as *free of credit risk*

- Swap U.S. Treasury yields into LC using currency derivatives

**Assumption**: Frictionless financial markets (Du and Schreger, 2016)

- Arbitrageurs have access to U.S. and LC bonds
- Derivatives have no counterparty risk
- U.S. yields are free of default risk

# 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 foreign exchange forward premium from USD to LC at time $t$

- $< 1$ Year: Currency forwards
- $\geq 1$ Year: Cross-currency swaps
  - Cross-currency basis swaps
  - Interest rate swaps

# Deviations from CIP (Covered Interest Parity)

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

Measures:

- Convenience yield for advanced economies (AE)
  Du, Im, and Schreger (2018a)
- Sovereign credit risk in EM
  Du and Schreger (2016)
- Financial market frictions for banks
  Du, Tepper, and Verdelhan (2018b)

**Here**: Emphasis on $\widetilde{y}^{LC}_{t,n}$

# Yield Data

15 EM:

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

Daily data starting in January 2000 to January 2019

Maturities: 0.25, 0.5, 1, 2, ..., 10 years

Synthetic yields:

- $y^{US}_{t,n}$: CRSP risk-free rates; Gürkaynak, Sack, and Wright (2007)
- $\rho_{t,n}$: Bloomberg; Datastream

# Affine Term Structure Model

# Model Overview

Standard discrete-time nominal affine term structure model

- Assumes default-free bonds $\rightarrow$ Synthetic yields ($\widetilde{y}^{LC}_{t,n}$) for EM
- Augmented with survey data

Intuition:

- Yields driven by pricing factors $X_t$
- Dynamics of pricing factors ($\mathbb{P}$ and $\mathbb{Q}$ measures)
- No-arbitrage restrictions ensure consistency

▸ Asset Pricing ▸ SDF ▸ Bond Prices ▸ Augmented Version

# EM Yield Decomposition

Fitted synthetic yields

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

Average expected future short rate

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

Term premium

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

Credit risk compensation

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

# Survey Data

No data on long-term forecasts for EM short rates

Implied forecast for EM short rates using existing data

- EM inflation expectations: 5 years ahead and long-term
  - Twice a year from Consensus Economics (CE)
- Implied long-term expectations of U.S real interest rate
  - T-bill rate, CPI inflation from Survey of Professional Forecasters (SPF)

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

▸ Implied Forecasts

# Model Estimation

Estimate parameters by MLE with monthly data

- Joslin, Singleton, and Zhu (2011) normalization

Estimate survey-augmented model by Kalman filter (missing data)

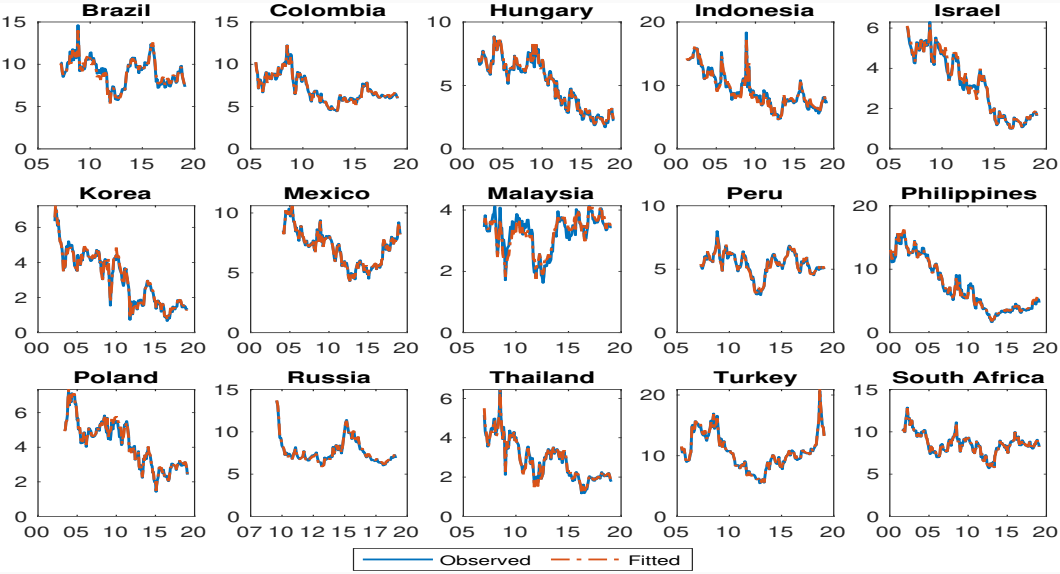
- Surveys as 'noisy' expectations measures (Kim and Orphanides, 2012)

Standard errors by delta method

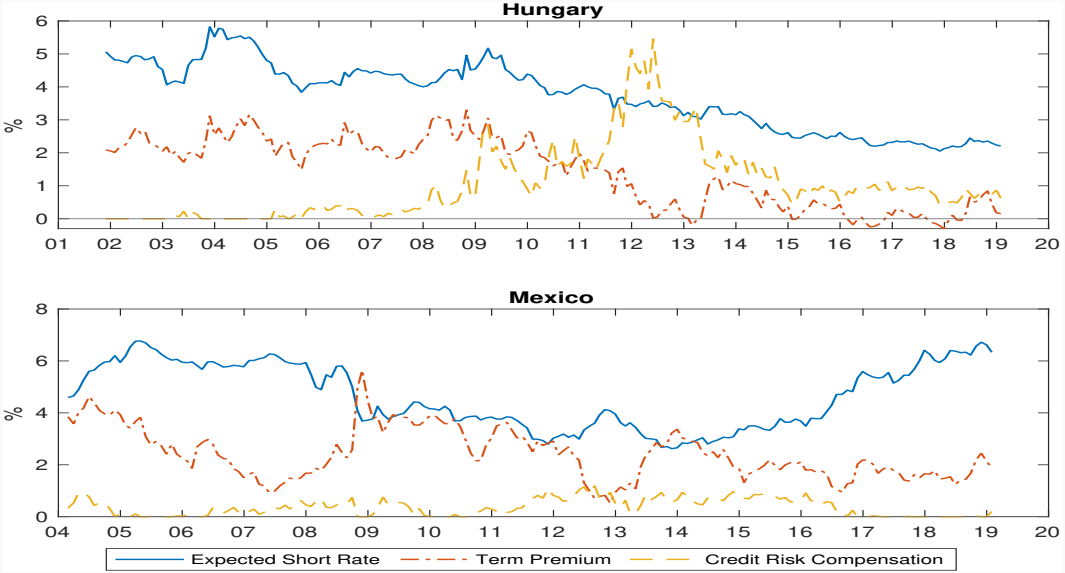
Estimate daily pricing factors

# EM Yield Decomposition

# 10Y

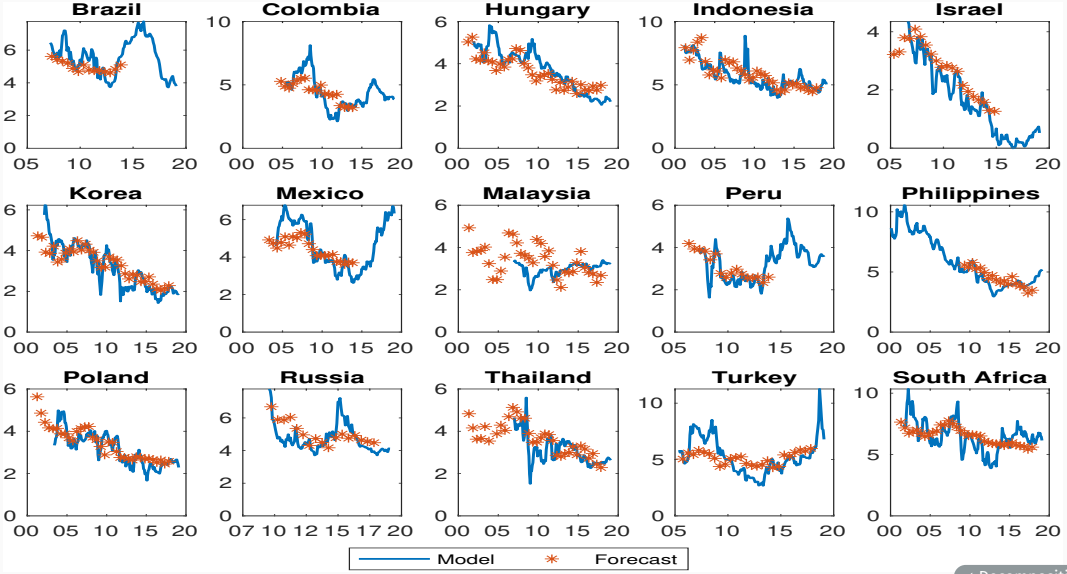

Brazil
Colombia
Hungary
Indonesia
Israel
Korea
Mexico
Malaysia
Peru
Philippines
Poland
Russia
Thailand
Turkey
South Africa
Observed
Fitted

# 10Y




- Expected Short Rates
- Term Premia
- Credit Risk Compensation

# 10Y


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

# Term Premium and Inflation Uncertainty

Term premium compensates for inflation uncertainty in AE (Wright, 2011)

Inflation higher and more volatile in EM than AE (Ha et al., 2019)

Is inflation uncertainty relevant for EM term premia?

$$\tau_{i,t} = \alpha_i + \beta_1 \sigma^{\pi}_{i,t} + \beta_2 \boldsymbol{g}_{i,t} + \boldsymbol{u}_{i,t},$$

- $\sigma^{\pi}_{i,t}$ of permanent component in UCSV model (Stock and Watson, 2007)

# EM Term Premia 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:* 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 more influenced by global forces

- Global financial cycle (Rey, 2013)

Unconventional monetary policies abroad affect EM yields

- Long-term via the term premium (Turner, 2014)
- Short-term via **risk spillovers** (Kalemli-Özcan, 2019)

EM monetary autonomy declines along yield curve (Obstfeld, 2015)

# Implications of Yield Curve Channel

Long-term EM yields comove more than short-term ones

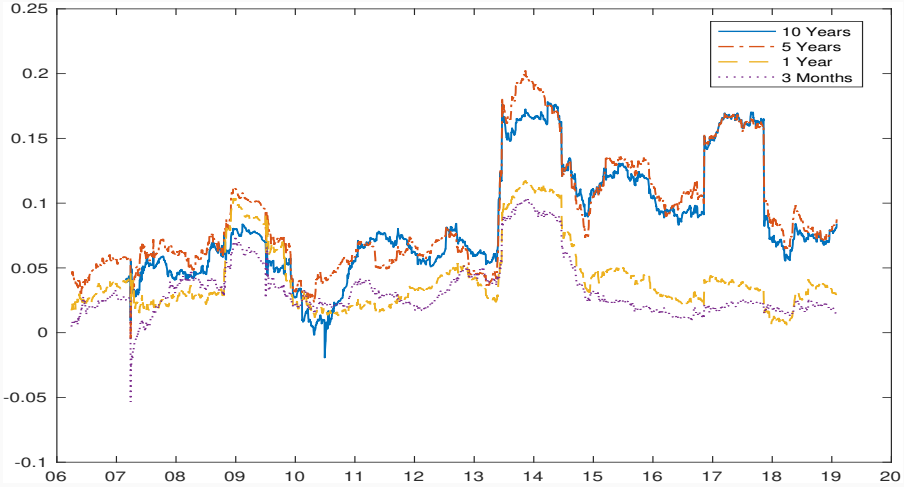
Direct relationships that vary by maturity

- U.S. term premium $\rightarrow$ EM term premium
- U.S. expected future short rates $\rightarrow$ EM expected future short rates

Cross relationships at the **short end**

- U.S. term premium $\rightarrow$ EM expected future short rates

# EM Yields Comovement




▸ D-Y Index

Rolling Correlations

# Is There A Yield Curve Channel?

$$y_{i,t} = \alpha_i + \gamma_1' z_{i,t}^1 + \gamma_2' z_{i,t}^2 + u_{i,t}$$

$y_{i,t}$: nominal EM yields and their three components

$\alpha_i$: country fixed effects

$z_{i,t}^1$: U.S. yield curve decomposition (Kim and Wright, 2005)

$z_{i,t}^2$: Global and domestic drivers

- VIX, EPU (Baker et al., 2016) & global activity (Hamilton, 2019) indexes
- Policy rate, inflation, unemployment, exchange rate (standardized)

Drivers of Emerging Market Nominal Yields and Their Components

| | Nominal | E. Short Rate | Term Premium | Credit Risk |
|---|---|---|---|---|
| | | | 10Y | |
| 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) |
| Local Policy Rate | 0.24*** | 0.30*** | 0.01 | -0.06*** |
| | (0.03) | (0.02) | (0.02) | (0.02) |
| Log(Vix) | 49.95*** | -20.18 | 30.13** | 40.01*** |
| | (12.63) | (10.45) | (10.49) | (9.59) |
| $R^2$ | 0.68 | 0.71 | 0.49 | 0.23 |
| | | | 2Y | |
| 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) |
| Local Policy Rate | 0.64*** | 0.56*** | 0.13*** | -0.05 |
| | (0.03) | (0.03) | (0.02) | (0.03) |
| Log(Vix) | 46.41*** | -20.29 | -9.10 | 75.79*** |
| | (8.16) | (13.92) | (7.68) | (11.92) |
| $R^2$ | 0.80 | 0.75 | 0.35 | 0.29 |
| Fixed Effects | Yes | Yes | Yes | Yes |
| Lags | 4 | 4 | 4 | 4 |
| No. Countries | 15 | 15 | 15 | 15 |
| Observations | 2194 | 2194 | 2194 | 2194 |

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▸ 10Y
▸ 2Y

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▸ 10Y
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▸ 10Y
▸ 2Y

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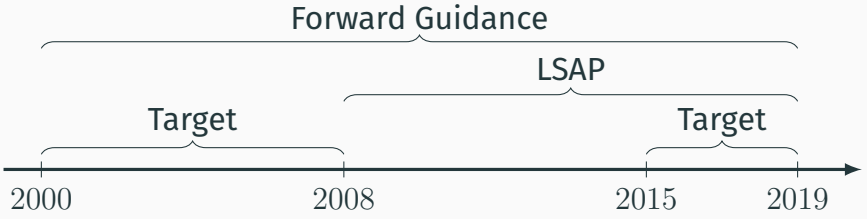
▸ 10Y
▸ 2Y

# U.S. Monetary Policy Surprises

Asset price changes in 2-hour windows around FOMC meetings

- Target: federal funds futures contracts
- Forward guidance: residual of 8th Eurodollar yield on target surprise
- Asset purchases: residual of 10Y Treasury yield on previous surprises




See Kuttner (2001); Gürkaynak et al. (2005); Swanson (2018); Rogers et al. (2018).

# Measuring the Effects on EM Yields

Panel local projections:

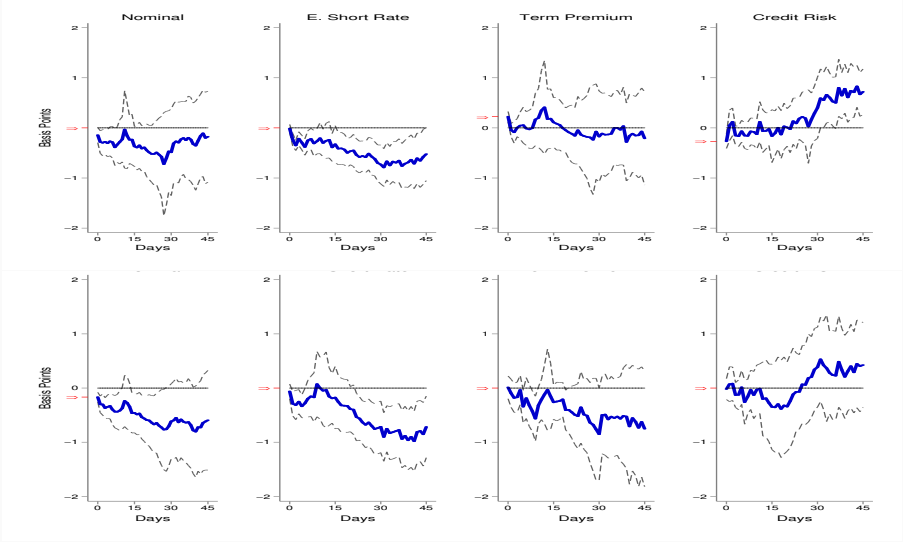
$$y_{i,t+h} - y_{i,t-1} = \alpha_{h,i} + \sum_{j=1}^{3} \beta_h^j \epsilon_t^j + \gamma_h \Delta y_{i,t-1} + \eta_h s_{i,t-1} + u_{i,t+h}$$

- $y_{i,t}$: 10Y and 2Y nominal EM yields and their components
- $h = 0, 1, \ldots, 45$ days
- $\alpha_{h,i}$: 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 Easing on EM Yields

10Y

2Y

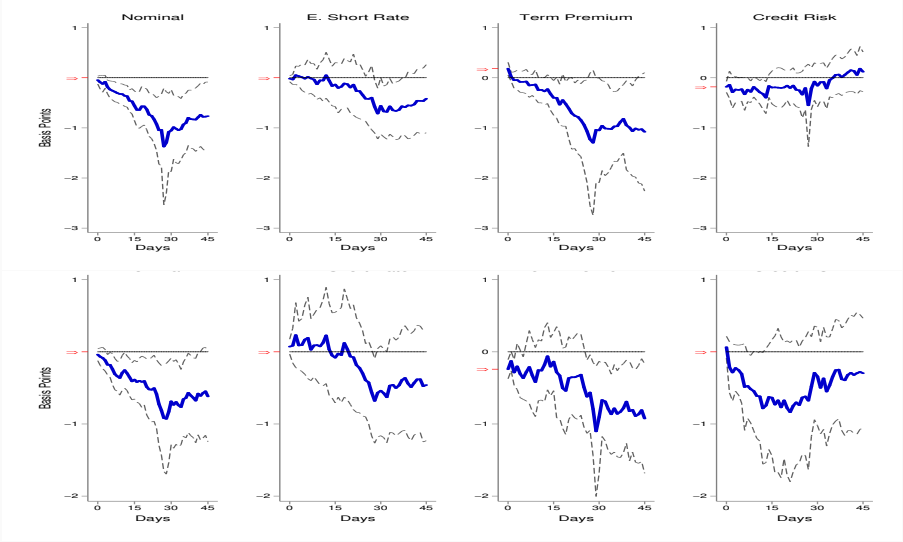



▸ US

# Effects of Forward Guidance Easing on EM Yields: Pre-GFC

10Y

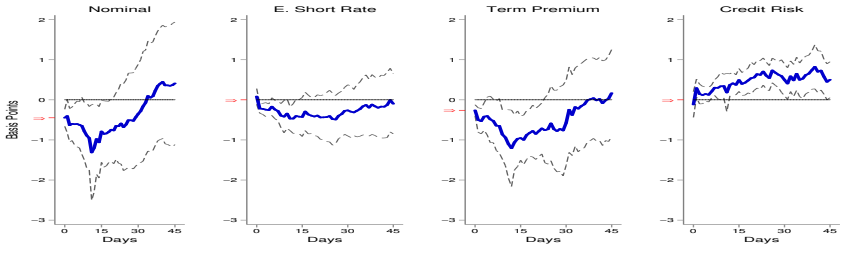
2Y



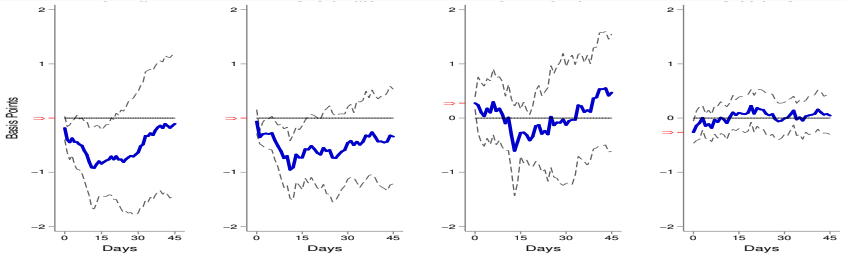

▸ US

# Effects of Forward Guidance Easing on EM Yields: Post-GFC

10Y




2Y

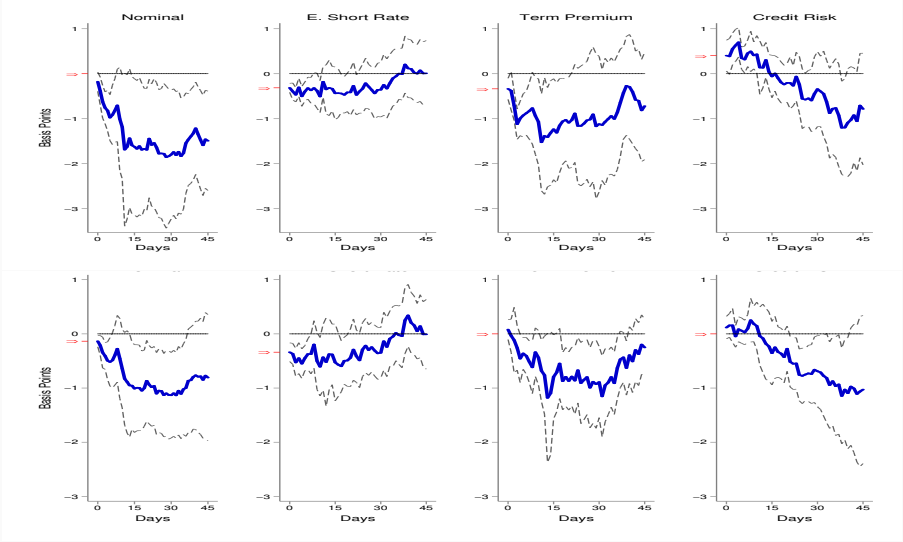



▸ US

# Effects of Asset Purchase Easing on EM Yields

10Y

2Y




▸ US

# Conclusions

# Conclusions

**Three**-part decomposition of EM sovereign yields

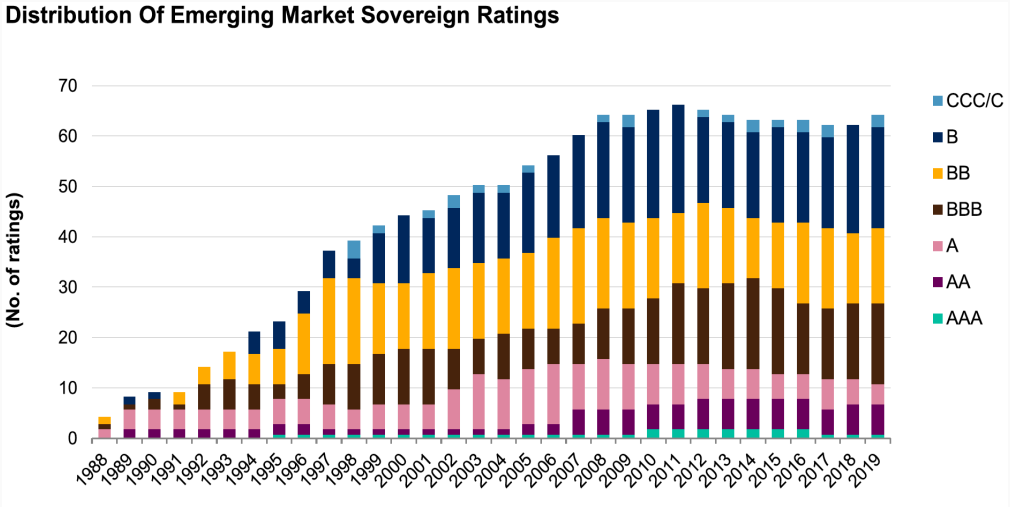
- Average expected short rates
- Term premium
- Credit risk compensation

U.S. monetary policy **spillovers** to EM sovereign yields

1. Responses are economically significant yet delayed
2. Reassessment of policy rate expectations and repricing of risks
3. Evidence of a yield curve channel since 2008

# Appendix

# Credit Risk in Local Currency Yields




Sources: S&P Global Ratings Research and S&P Global Market Intelligence's CreditPro®.

Sovereigns Defaults

# Descriptive Statistics

◂ Yield Data

| | | 3M | 6M | 1Y | 2Y | 5Y | 10Y |
|---|---|---|---|---|---|---|---|
| Nominal Yields | Emerging Markets | | | | | | |
| | Average | 5.1 | 5.3 | 5.4 | 5.7 | 6.3 | 6.8 |
| | S. Dev. | 3.2 | 3.3 | 3.2 | 3.2 | 3.0 | 2.9 |
| | Advanced Economies | | | | | | |
| | Average | 2.0 | 2.1 | 2.1 | 2.3 | 2.7 | 3.2 |
| | S. Dev. | 2.1 | 2.1 | 2.1 | 2.1 | 2.0 | 1.8 |
| Synthetic Yields | Emerging Markets | | | | | | |
| | Average | 5.1 | 5.2 | 5.3 | 5.3 | 5.8 | 6.3 |
| | S. Dev. | 4.3 | 4.1 | 4.0 | 3.7 | 3.4 | 3.2 |
| | Advanced Economies | | | | | | |
| | Average | 1.6 | 1.7 | 1.8 | 2.0 | 2.5 | 3.2 |
| | S. Dev. | 2.1 | 2.1 | 2.2 | 2.1 | 2.0 | 2.0 |

*Notes:* All figures are expressed in annualized percentage points. Advanced economies: Australia, Canada, Denmark, Germany, Japan, Norway, New Zealand, Sweden, Switzerland and the U.K.

# Asset Pricing

Under no arbitrage $\rightarrow \exists$ a stochastic discount factor $M_{t+1} > 0$

$M_{t+1}$ prices all nominal bonds under probability measure $\mathbb{P}$

$$P_{t,n} = \mathrm{E}_t^{\mathbb{P}} \left[ M_{t+1} P_{t+1,n-1} \right]$$

$M_{t+1} \rightarrow \exists$ a risk-neutral measure $\mathbb{Q}$ defined as

$$P_{t,n} = \mathrm{E}_t^{\mathbb{Q}} \left[ \exp\left(-i_t\right) P_{t+1,n-1} \right]$$

# Stochastic Discount Factor

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

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

One-period interest rate

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

Overview

# Bond Pricing

Pricing factors under $\mathbb{P}$ measure

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

Bond prices

$$P_{t,n} = \exp\left(A_n + B_n X_t\right),$$

$$A_n = \mathcal{A}(\delta_0, \delta_1, \mu^{\mathbb{P}}, \Phi^{\mathbb{P}}, \Sigma, n)\ ,\ B_n = \mathcal{B}(\delta_1, \Phi^{\mathbb{P}}, n)$$

Pricing factors under $\mathbb{Q}$ measure

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

# Survey-Augmented Model

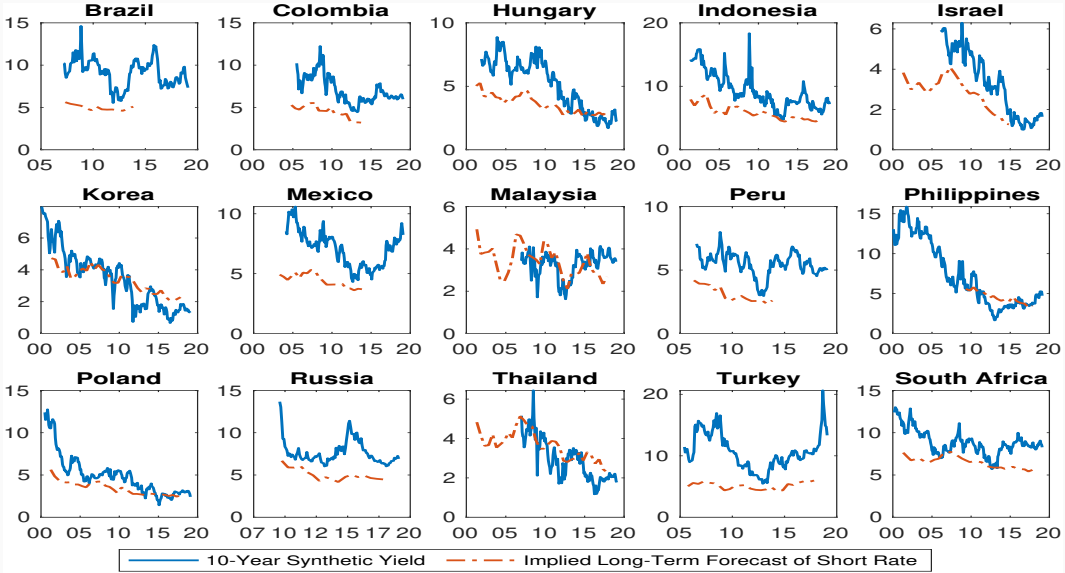
Expected average short rate

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

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

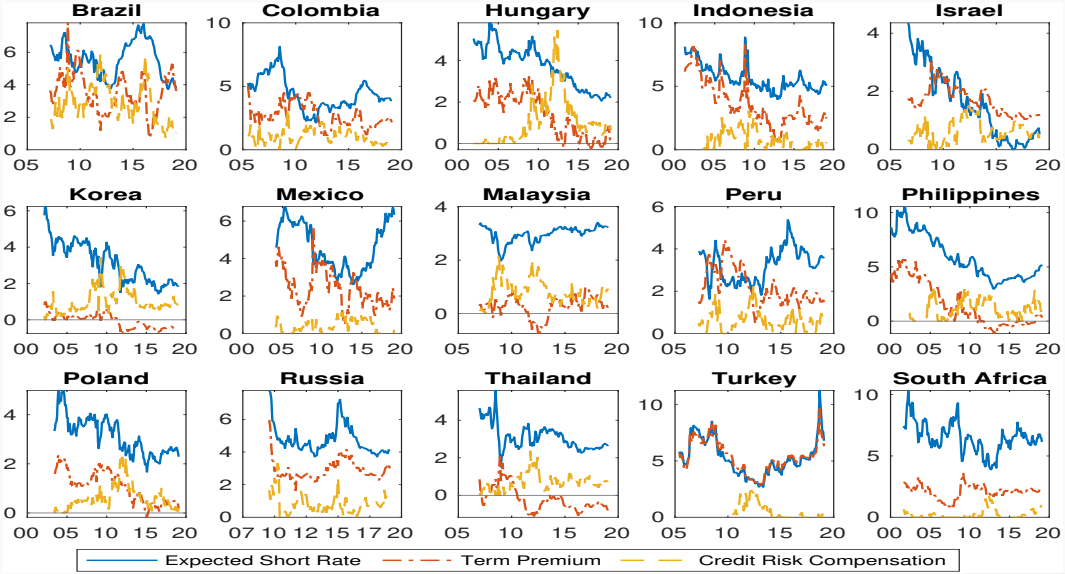
$$f^e_{t,n|m} = \frac{1}{m-n}\mathrm{E}^{\mathbb{P}}_t\left[\sum_{j=n}^{m-1} i_{t+j}\right] = A^e_{n|m} + B^e_{n|m} X_t.$$

# 10Y

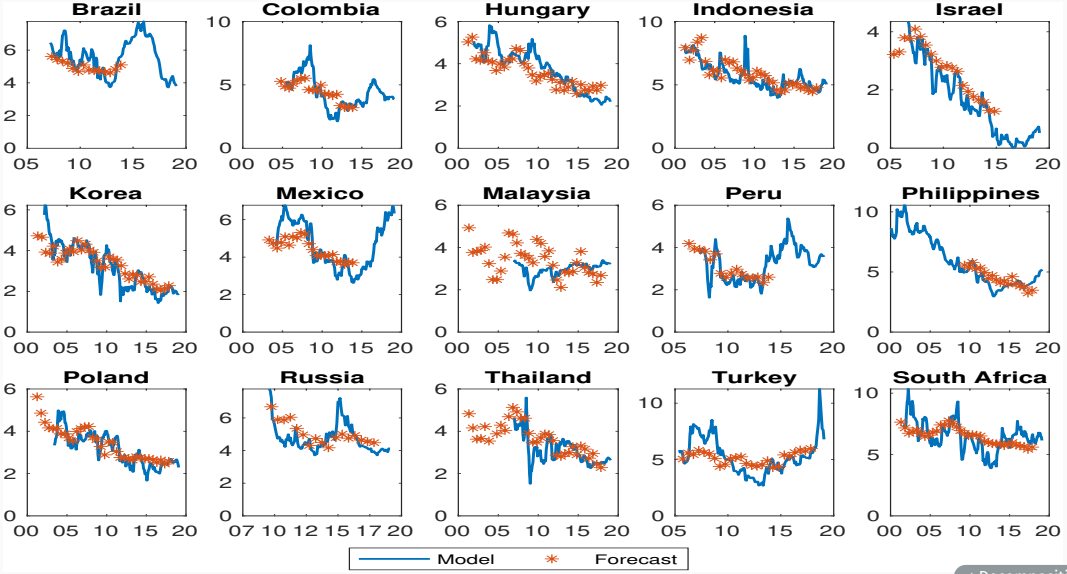



Survey Data

# 10Y

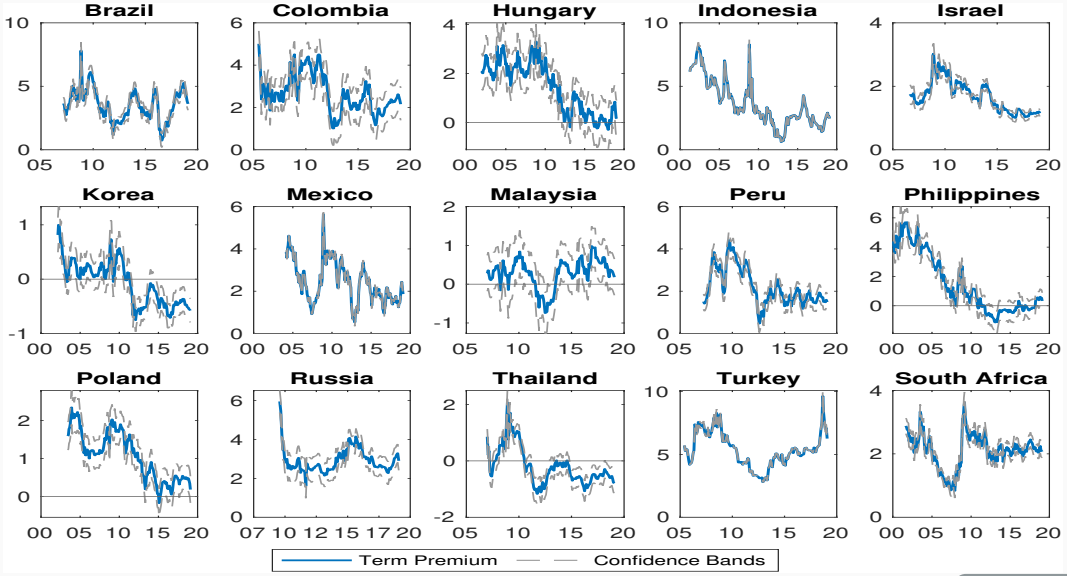

Brazil
Colombia
Hungary
Indonesia
Israel
Korea
Mexico
Malaysia
Peru
Philippines
Poland
Russia
Thailand
Turkey
South Africa
Expected Short Rate
Term Premium
Credit Risk Compensation

# 10Y



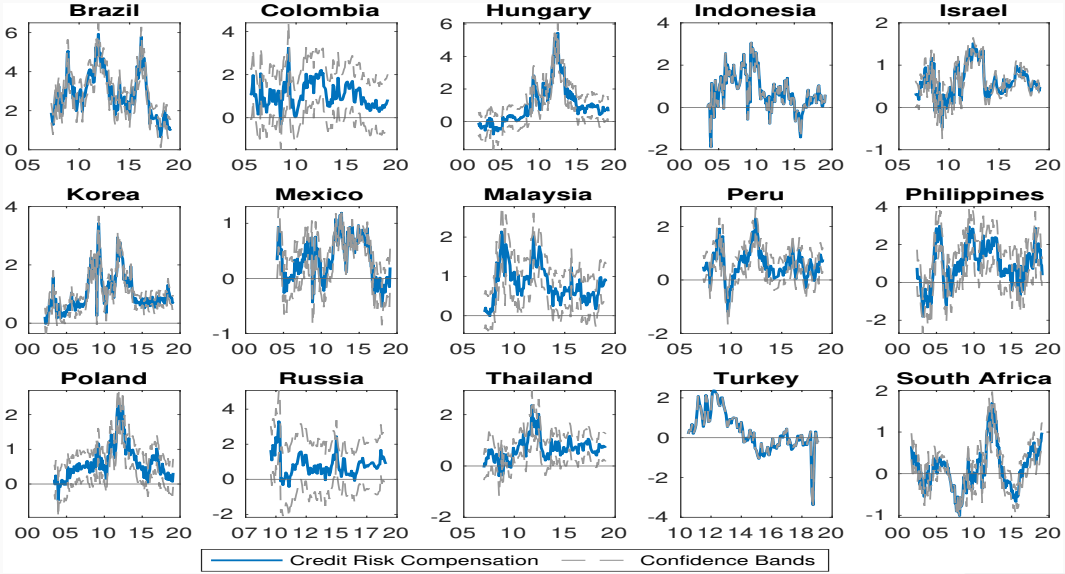

◂ Decomposition

# 10Y



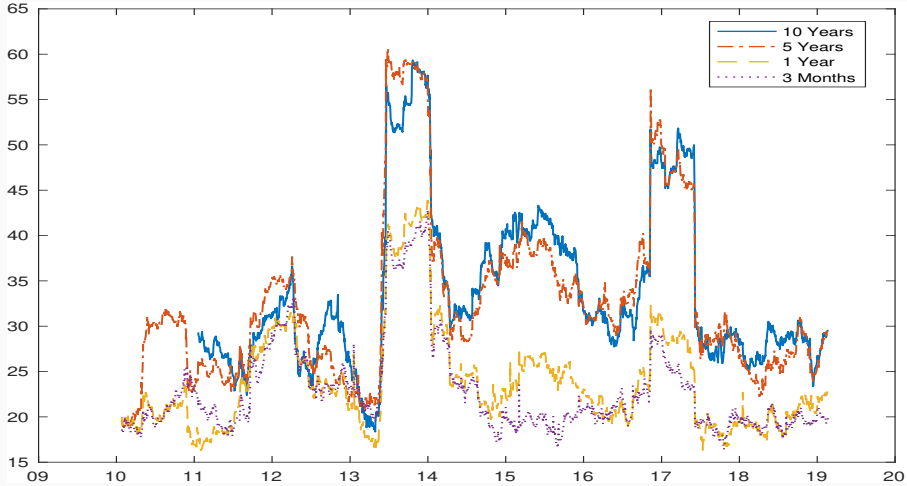

Decomposition

# 10Y




Decomposition

# EM Yields Comovement




Rolling Corr.

Connectedness Index (Diebold and Yilmaz, 2014)

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*** | 0.54*** | 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.

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

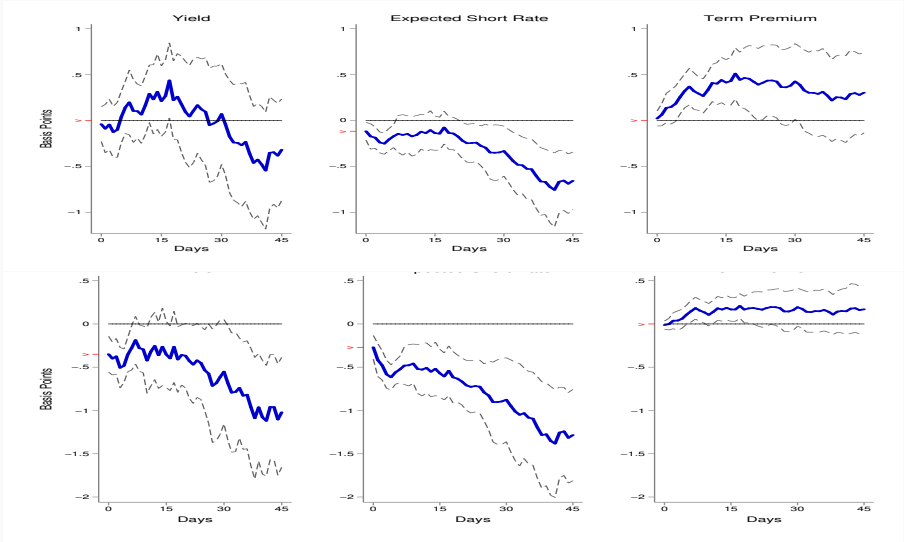
| | Nominal | E. Short Rate | Term Premium | Credit Risk |
|---|---|---|---|---|
| U.S. Term Premium | 1.59*** | 1.68*** | 0.58*** | -0.68** |
| | (0.22) | (0.17) | (0.17) | (0.21) |
| U.S. E. Short Rate | -0.03 | -0.02 | 0.05 | -0.06 |
| | (0.04) | (0.03) | (0.03) | (0.04) |
| Policy Rate | 0.64*** | 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.

# Effects of Target Easing on U.S. Yields

10Y

2Y

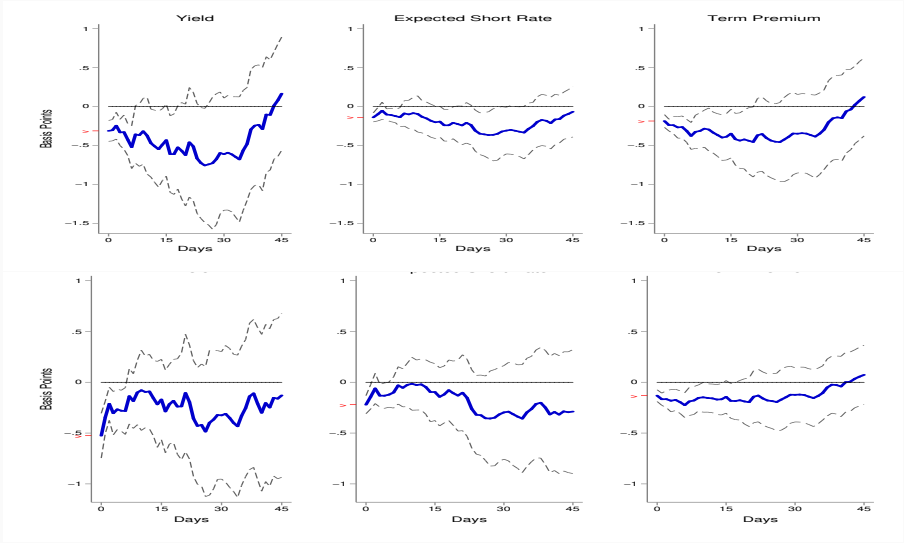



EM

# Effects of Forward Guidance Easing on U.S. Yields: Pre-GFC

10Y

2Y

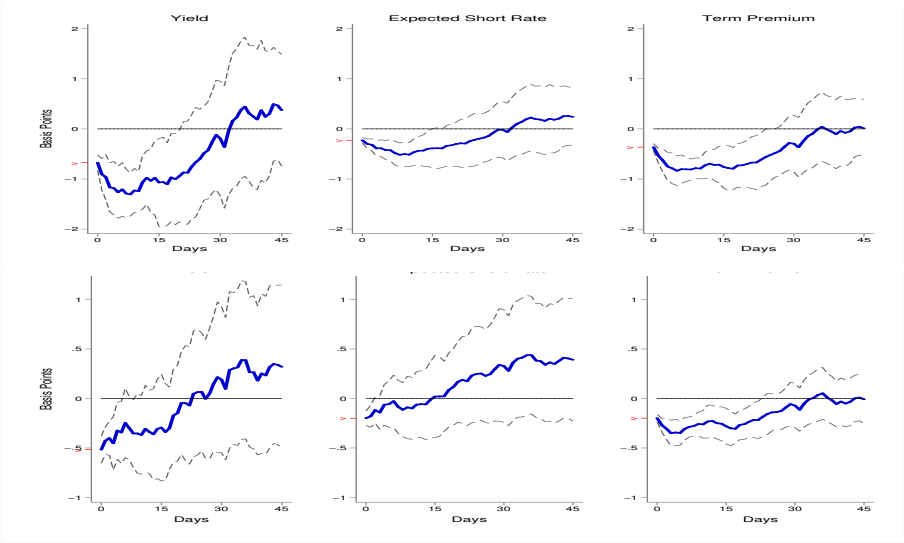



EM

# Effects of Forward Guidance Easing on U.S. Yields: Post-GFC

10Y

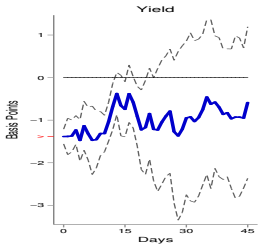
2Y

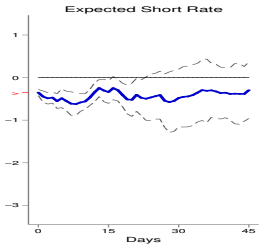


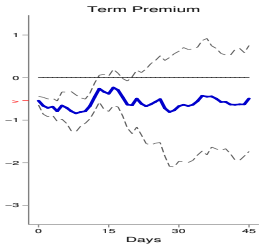

EM

# Effects of Asset Purchase Easing on U.S. Yields

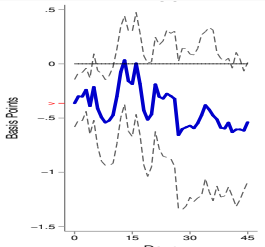
10Y

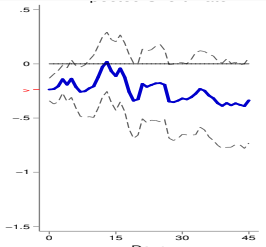


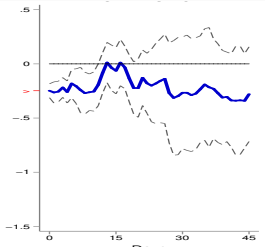




2Y




EM