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

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U.S. Monetary Policy Spillovers

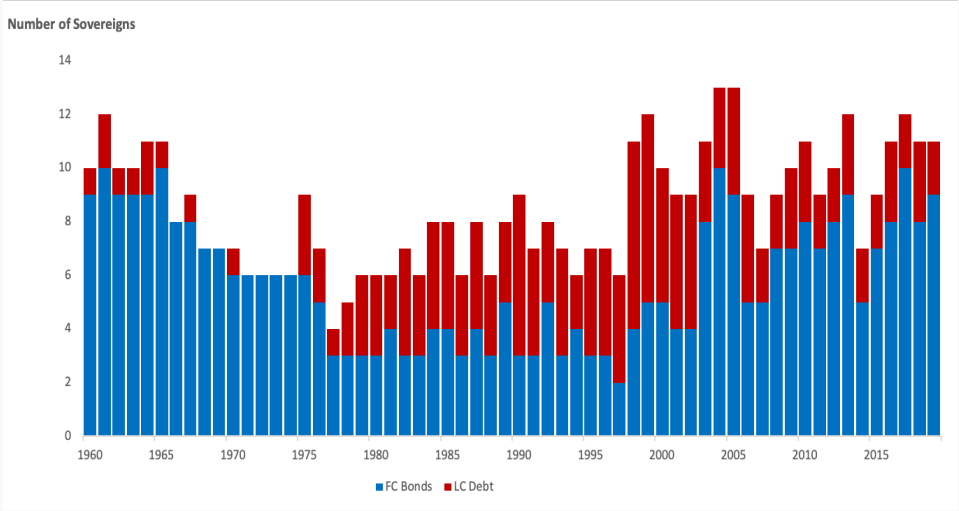
U.S. monetary policy influences asset prices abroad

- Stocks
- Exchange rates
- Bonds
  - Foreign currency (FC)
  - Local currency (LC): more than 80% of emerging market sovereign debt

Understand transmission channels to mitigate undesired effects

- Traditional decompositions of bond yields assume no credit risk

Do Sovereigns Default on Local Currency Debt?



Source: BoC-BoE Sovereign Default Database.

Credit Ratings

This Paper

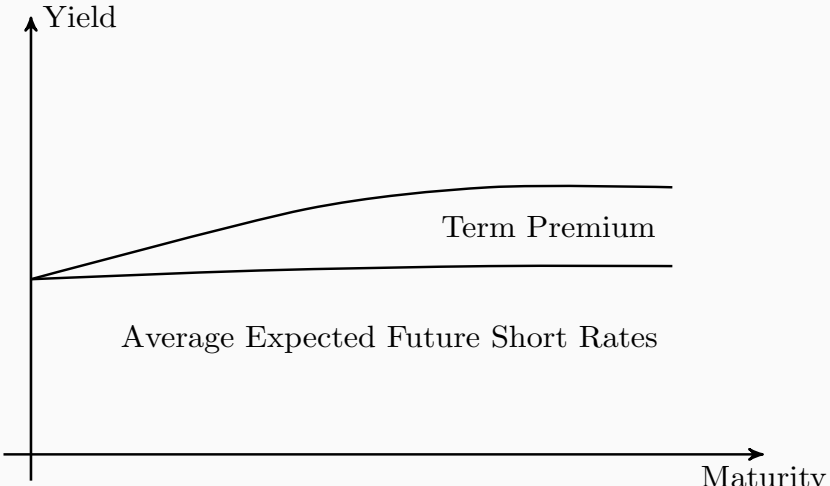
How to decompose the sovereign yields of emerging markets (EMs)?

- Accounting for credit risk

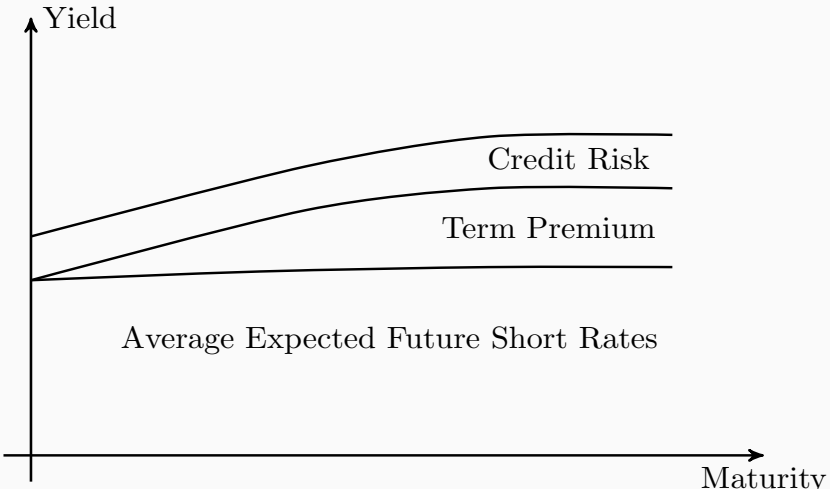
How does U.S. monetary policy transmit to EM sovereign yields?

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

Traditional Yield Curve Decomposition



Proposed EM Yield Curve Decomposition



U.S. Monetary Policy Spillovers to EM Yields

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

2. All three components react to U.S. monetary policy
   - EM central banks expected to follow Fed's monetary stance
   - EM term premia response is similar to U.S. term premium
   - Fiscal implications in EMs 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 yields 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 in LC at time t

$y_{t,n}^{US}$: n-period zero-coupon U.S. yield at time t

$\rho_{t,n}$: n-period foreign exchange forward premium from USD to LC at time t

- < 1 Year: Currency forwards
- ≥ 1 Year: Cross-currency swaps
  - Interest rate swaps
  - Cross-currency basis swaps

Deviations from CIP (Covered Interest Parity)

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

Measures:

- Convenience yield for AEs (Du, Im, and Schreger, 2018a)
- Sovereign credit risk for EMs (Du and Schreger, 2016)
- Financial frictions for banks (Du, Tepper, and Verdelhan, 2018b)

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

Yield Data

15 EMs:

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

Daily data: January 2000 to January 2019

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

Synthetic yields:

- $y_{t,n}^{US}$: 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 ($\widetilde{y}_{t,n}^{LC}$) for EMs
- Augmented with survey forecasts

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

$$y^{LC}_{t,n} = y^{\mathbb{Q}}_{t,n} + \phi_{t,n} = y^{\mathbb{P}}_{t,n} + \tau_{t,n} + \phi_{t,n}$$

$y^{\mathbb{Q}}_{t,n} = A^{\mathbb{Q}}_n + B^{\mathbb{Q}}_n X_t$: Fitted synthetic yields

$y^{\mathbb{P}}_{t,n} = A^{\mathbb{P}}_n + B^{\mathbb{P}}_n X_t$: Average expected future short rates

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

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

Weak Identification

Yields accurately identify $\mathbb{Q}$ parameters, yet $\mathbb{P}$ ones are poorly identified

- Bond yields are persistent
- Unstable yield decompositions

Solutions: Survey data, parameter restrictions, bias-corrected estimators

Surveys provide robust decompositions of AE yields (Guimarães, 2014)

- Surveys anchor the long run mean of interest rates.
- Important for EM yields given small sample sizes

Survey Data

No data on long-term forecasts for EM short rates

Implied forecast for EM short rates from existing data

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

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

Implied Forecasts

Model Estimation

Estimate parameters by ML with monthly data on yields

- Joslin, Singleton, and Zhu (2011) normalization

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

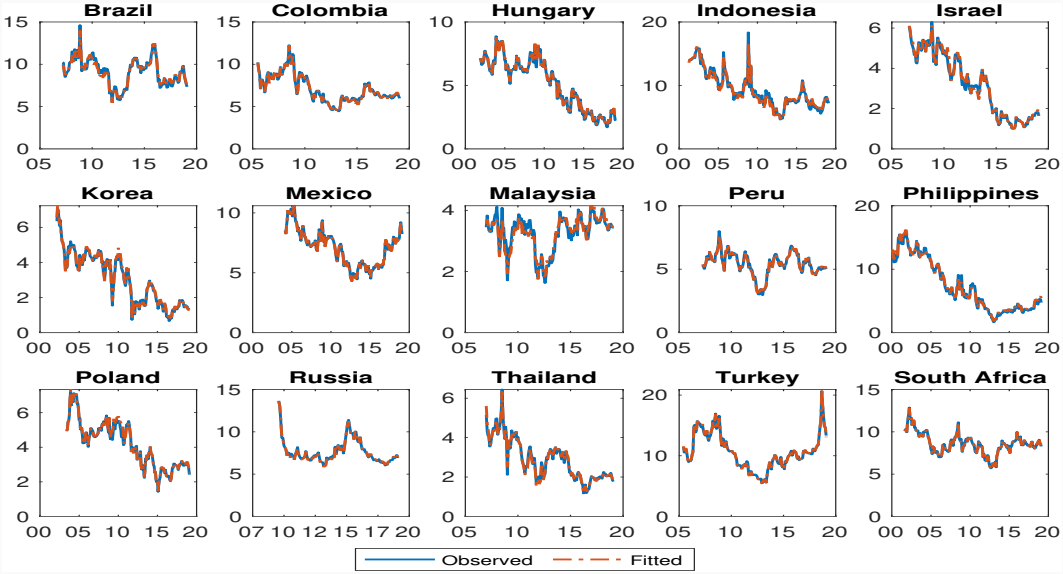
- Surveys as 'noisy' expectations measures (Kim and Orphanides, 2012)

Standard errors by delta method

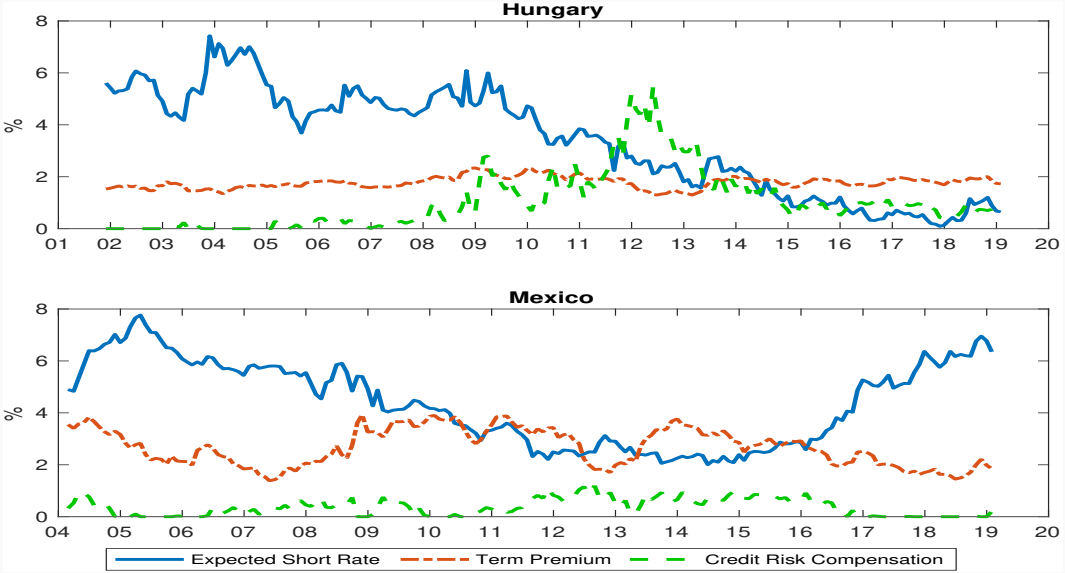
Estimate pricing factors at daily frequency

EM Yield Decomposition

10Y

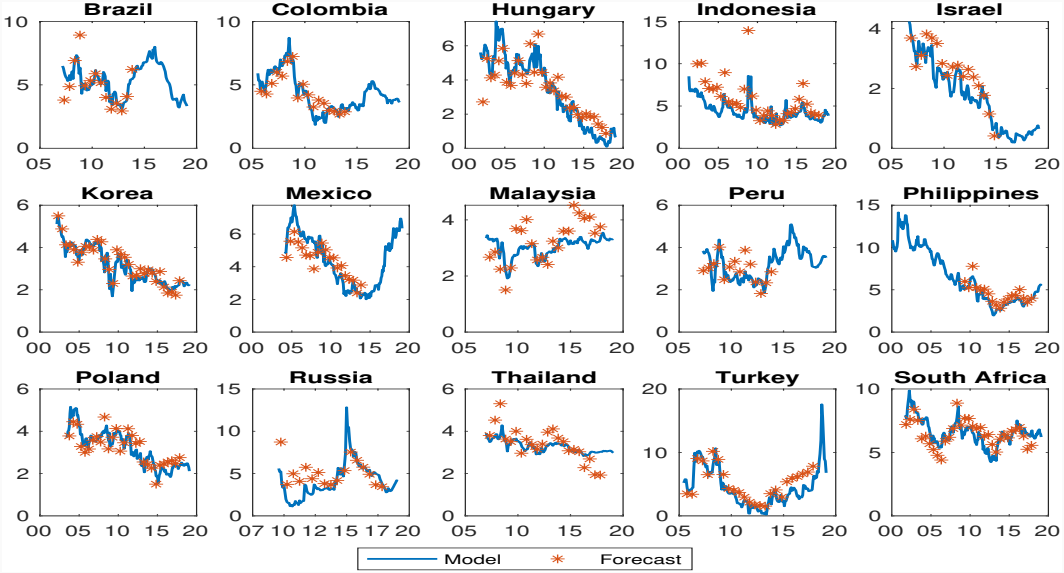

Brazil
Colombia
Hungary
Indonesia
Israel
Korea
Mexico
Malaysia
Peru
Philippines
Poland
Russia
Thailand
Turkey
South Africa
Observed
Fitted

10Y



◂ Decomposition All ▸ 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 premia in AEs compensates for inflation uncertainty (Wright, 2011)

Inflation higher and more volatile in EMs than in AEs (Ha et al., 2019)

Question: Is inflation uncertainty relevant for EM term premia?

$$\tau_{i,t} = \alpha_i + \beta_1 \sigma^{\pi}_{i,t} + \beta_2 GDP_{i,t} + u_{i,t},$$

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

EM Term Premia and Inflation Uncertainty

	6 Months		1 Year		2 Years		5 Years		10 Years	
UCSV-Perm	79.8*	81.1*	78.8**	93.0**	84.4***	105.2***	98.3***	128.7***	118.3***	159.3***
	(30.3)	(34.0)	(23.2)	(32.6)	(20.2)	(27.5)	(18.1)	(25.3)	(18.4)	(27.0)
GDP Growth		-0.49		0.021		1.35		1.66		-0.11
		(2.26)		(2.64)		(1.95)		(1.41)		(2.62)
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	0.07	0.06	0.06	0.06	0.08	0.10	0.13	0.16	0.14	0.18

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

U.S. monetary policy key driver of the global financial cycle (Rey, 2013)

Long-term yields more influenced by global forces

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

U.S. unconventional monetary policies affect EM yields

- Long-term via the term premium (Turner, 2014)
- Short-term via expected short rate (Kalemli-Özcan, 2019)

Implications of Yield Curve Channel

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

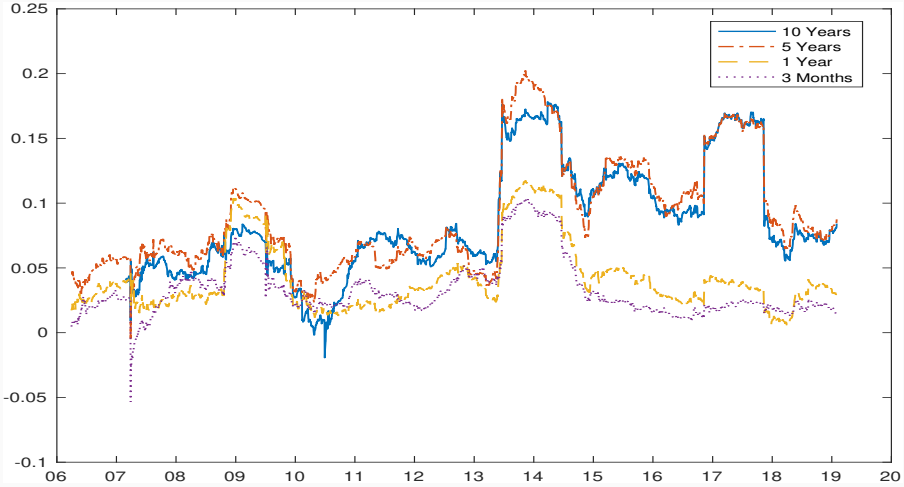
Direct relationship that varies by maturity

- 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*

- **Risk spillovers**: U.S. term premium $\rightarrow$ EM expected future short rates

EM Yields Comovement



▸ D-Y Index

Rolling Correlations

Is There A Yield Curve Channel?

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

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

α_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***	0.66***	0.73***	-0.37***
	(0.14)	(0.10)	(0.05)	(0.10)
U.S. E. Short Rate	0.17	0.13*	0.21***	-0.21***
	(0.09)	(0.06)	(0.05)	(0.05)
Local Policy Rate	0.24***	0.50***	-0.20***	-0.03*
	(0.03)	(0.03)	(0.02)	(0.01)
Log(Vix)	49.95***	-28.79**	37.61***	41.64***
	(12.63)	(10.24)	(8.12)	(8.96)
R^2	0.68	0.72	0.48	0.24
		2Y		
U.S. Term Premium	1.59***	1.57***	0.70***	-0.67***
	(0.22)	(0.22)	(0.13)	(0.19)
U.S. E. Short Rate	-0.03	-0.05	0.08***	-0.08*
	(0.04)	(0.04)	(0.02)	(0.03)
Local Policy Rate	0.64***	0.72***	-0.03	-0.02
	(0.03)	(0.04)	(0.02)	(0.02)
Log(Vix)	46.41***	-28.91*	0.39	76.84***
	(8.16)	(12.45)	(7.85)	(10.79)
R^2	0.80	0.74	0.22	0.34
No. Countries	15	15	15	15
Observations	2194	2194	2194	2194

Notes: Driscoll–Kraay standard errors in parenthesis. *, **, *** asterisks respectively indicate significance at the 10%, 5% and 1% level.

▸ 10Y
▸ 2Y

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▸ 10Y
▸ 2Y

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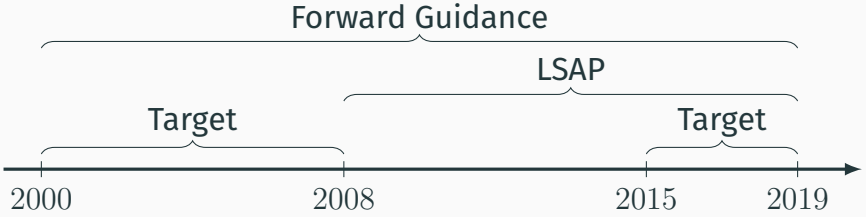
▸ 10Y
▸ 2Y

U.S. Monetary Policy Surprises

Asset price changes in 2-hour windows around FOMC meetings

- Target: change in yield on federal funds futures (Kuttner, 2001)
- Forward guidance: residual of change in yield for 8^{th} Eurodollar futures onto target surprise (Gürkaynak et al., 2005)
- Asset purchases: residual of change in yield of 10Y Treasury futures onto target and FG surprises (Swanson, 2018)



Measuring the Effects on EM Yields

Panel local projections:

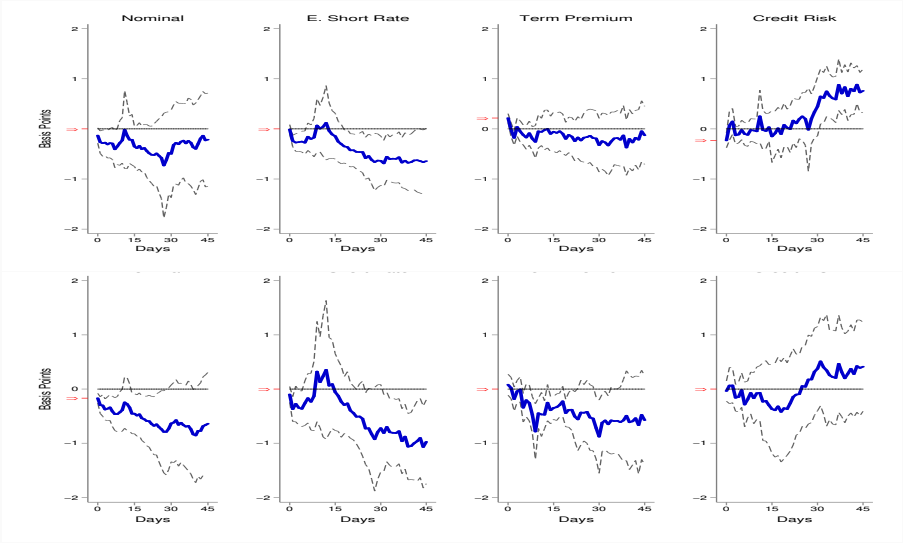
$$y_{i,t+h} - y_{i,t-1} = \alpha_{h,i} + \sum_{j=1}^{3} \beta_h^j \epsilon_t^j + \gamma_h \Delta y_{i,t-1} + \eta_h s_{i,t-1} + u_{i,t+h}$$

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

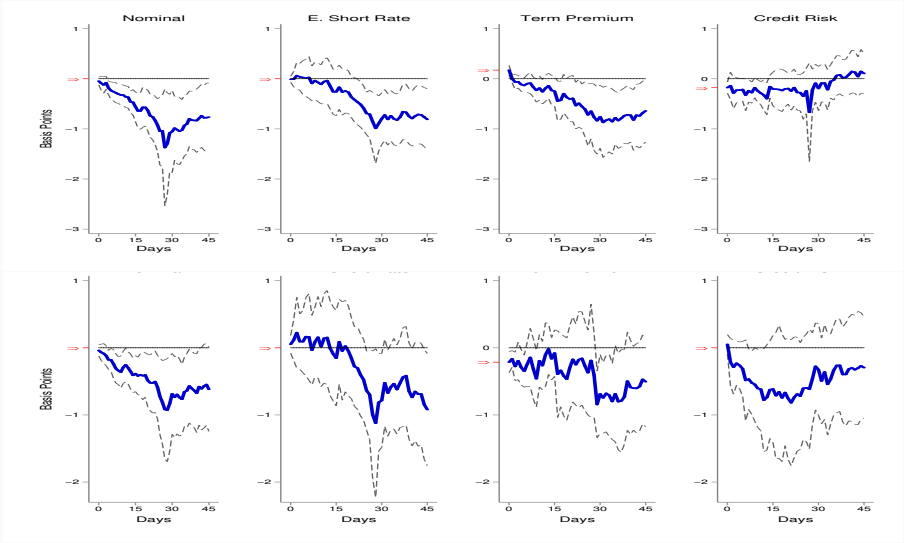
10Y

2Y



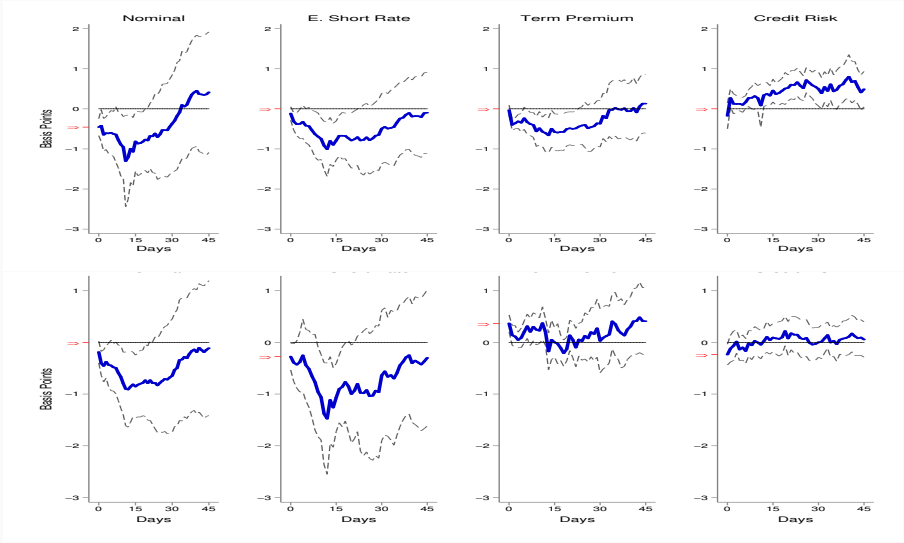
▸ US

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



▸ US

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

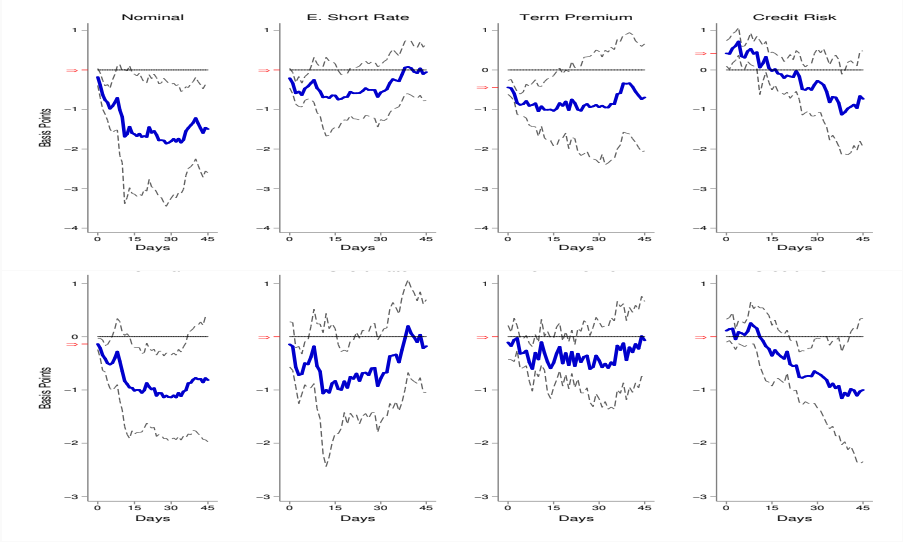


▸ US

Effects of Asset Purchase Easing on EM Yields

10Y

2Y



▸ US

Conclusions

Conclusions

Three-part decomposition of EM sovereign yields

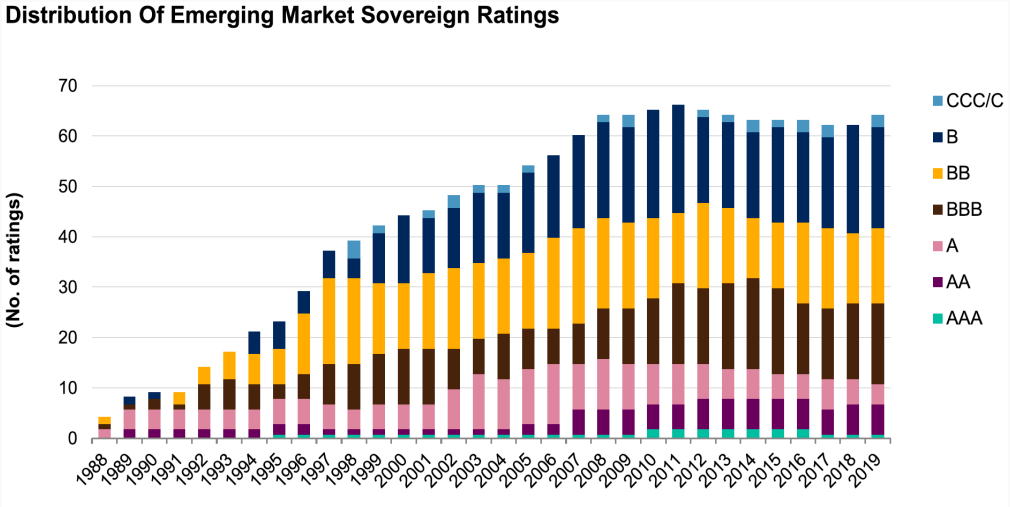
- Average expected short rates
- Term premium
- Credit risk compensation

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

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

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

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

◂ Overview

Survey-Augmented Model

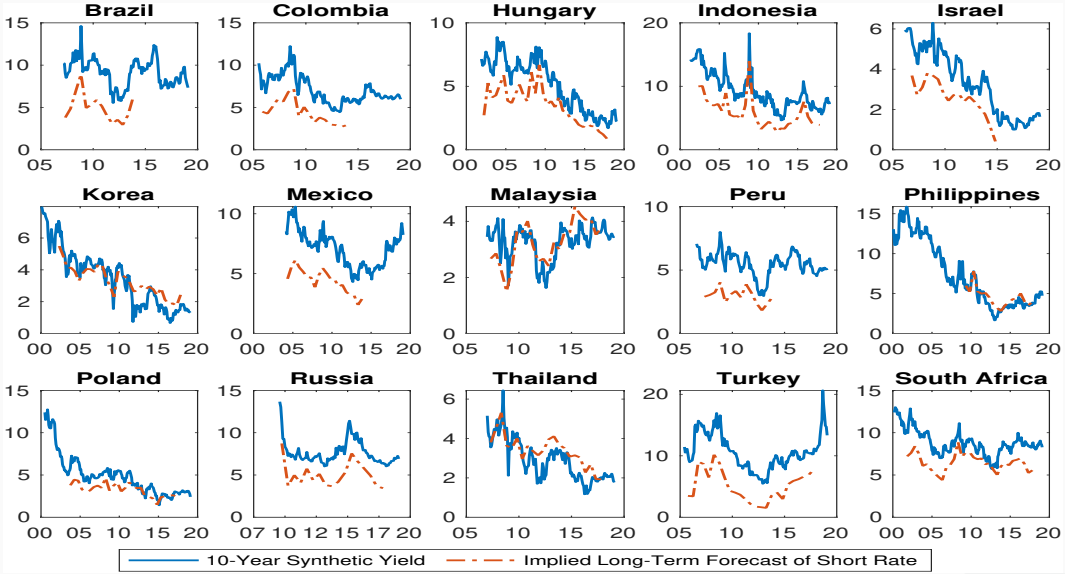
Expected average short rate

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

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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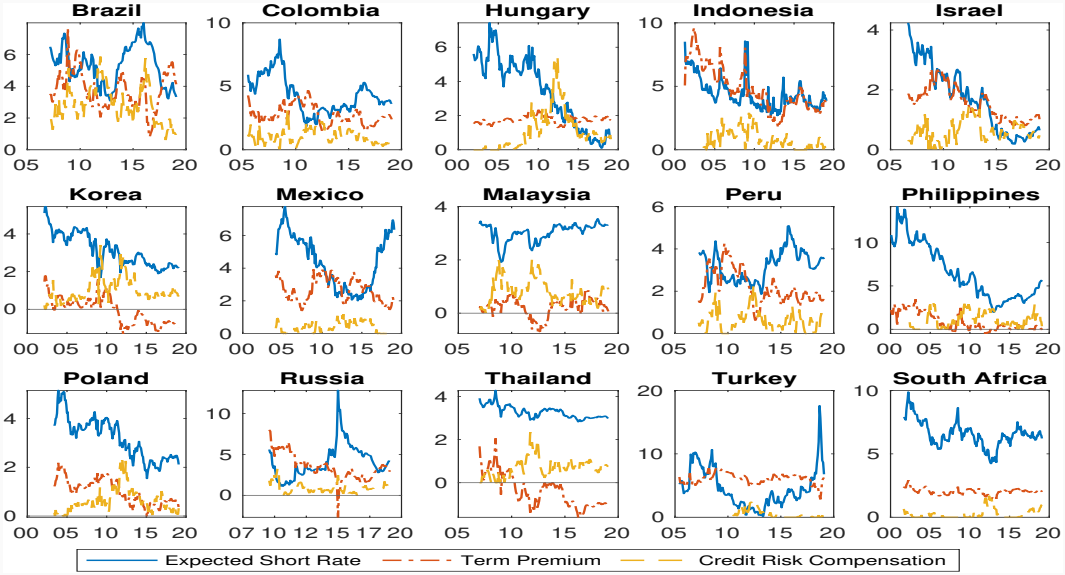
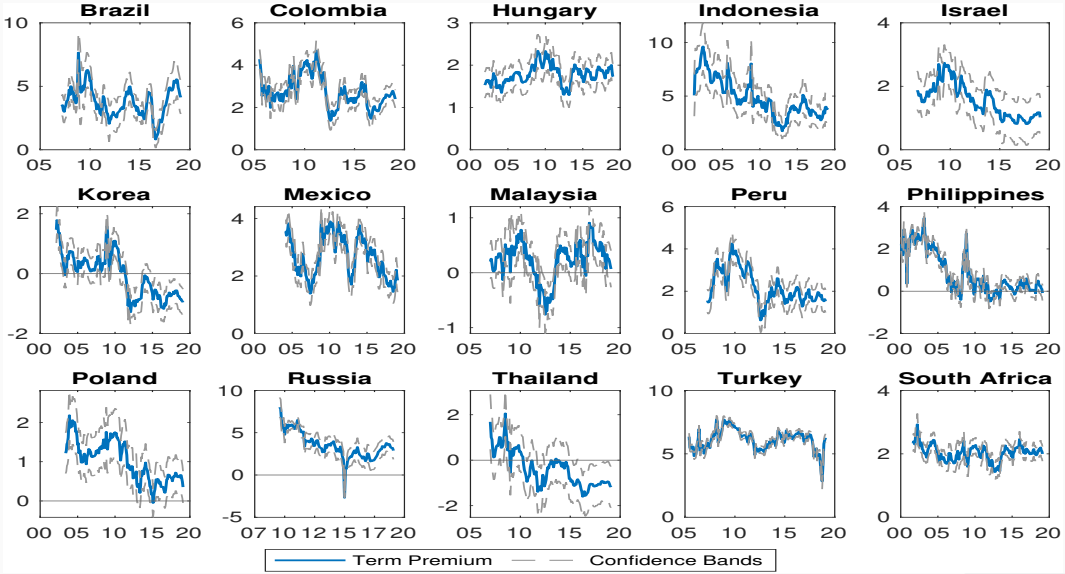
Turkey
South Africa
10-Year Synthetic Yield
Implied Long-Term Forecast of Short Rate

10Y



◂ Decomposition HUF-MXN

10Y



Decomposition

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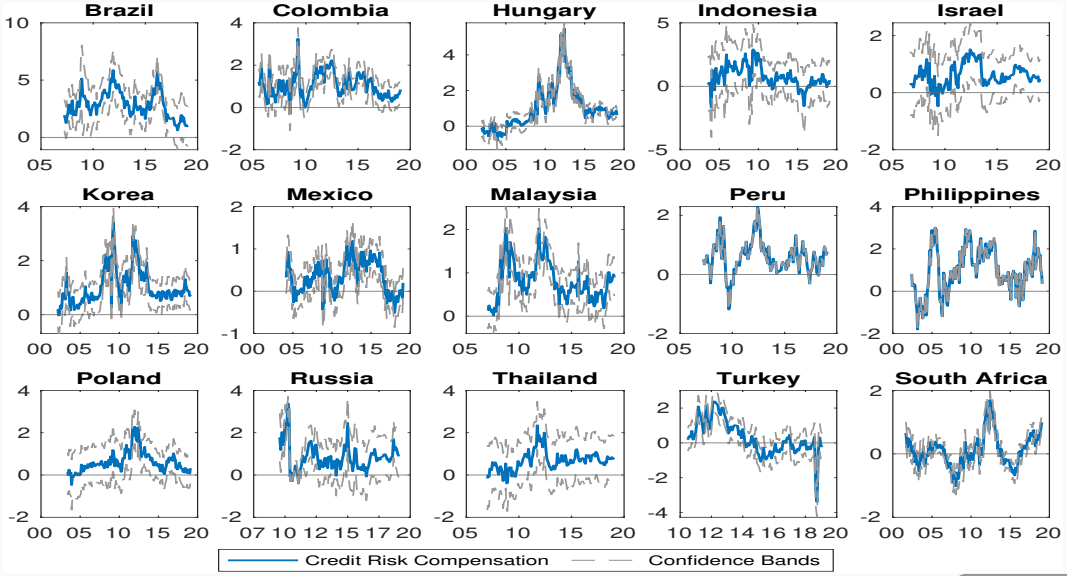
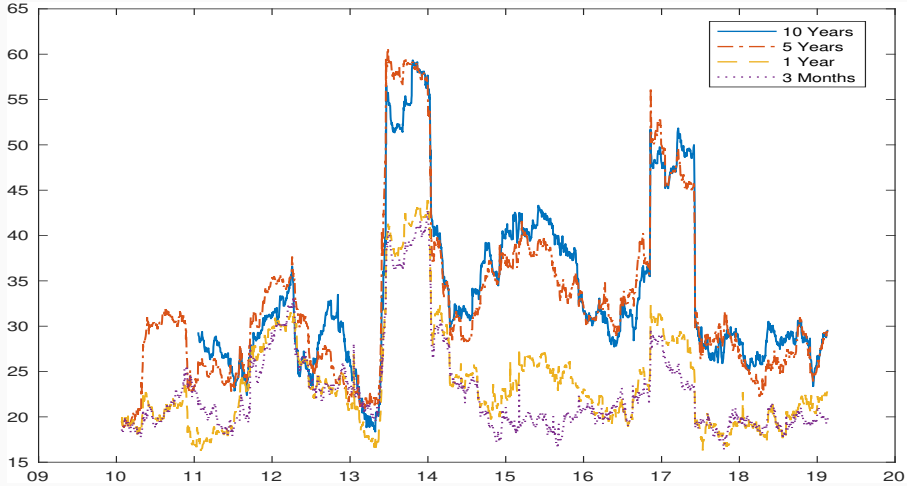


◂ Decomposition

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

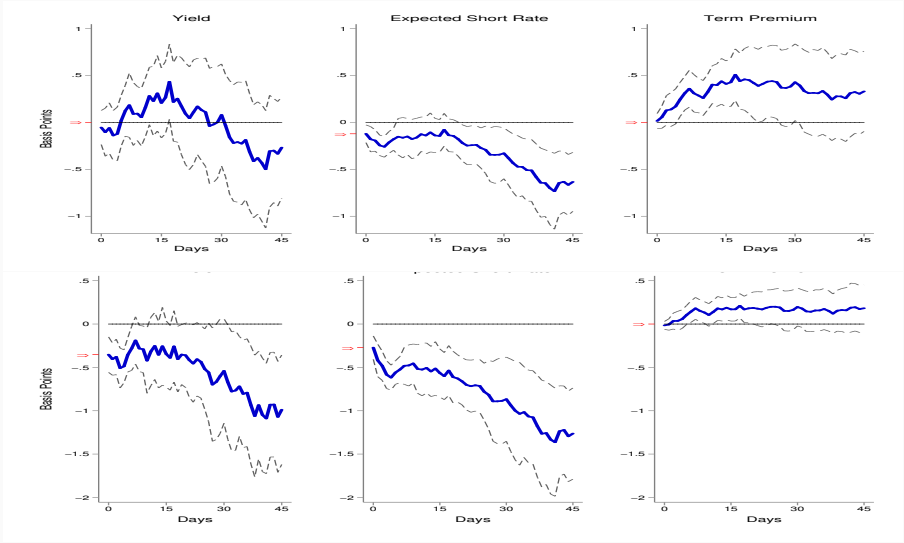
	Nominal	E. Short Rate	Term Premium	Credit Risk
U.S. Term Premium	1.59***	1.68***	0.58***	-0.68**
	(0.22)	(0.17)	(0.17)	(0.21)
U.S. E. Short Rate	-0.03	-0.02	0.05	-0.06
	(0.04)	(0.03)	(0.03)	(0.04)
Policy Rate	0.64***	0.56***	0.13***	-0.05
	(0.03)	(0.03)	(0.02)	(0.03)
Inflation	8.91***	-0.15	7.40**	1.67
	(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

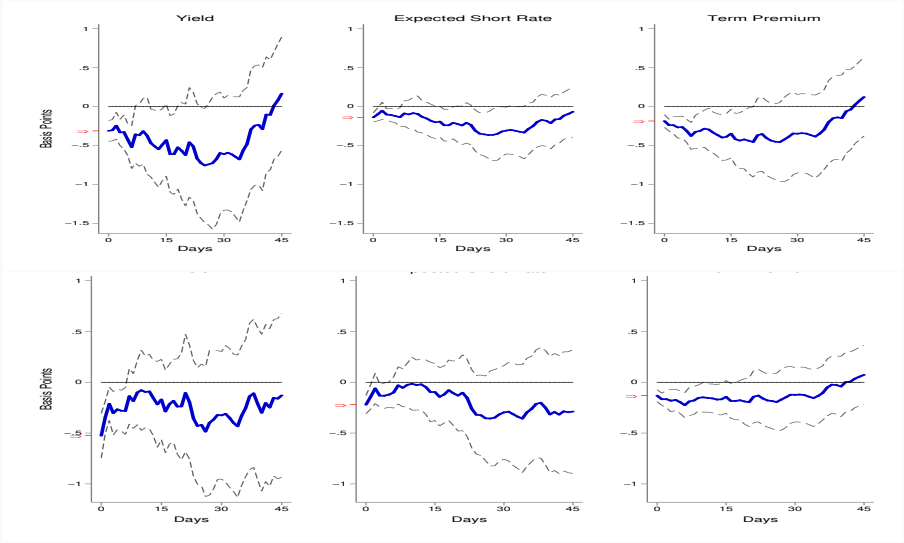


EM

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

10Y

2Y



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

10Y

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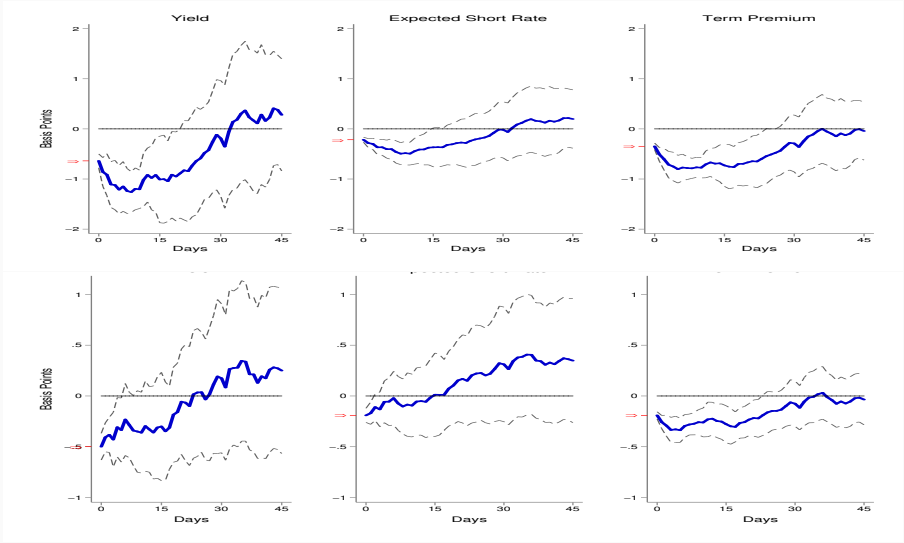

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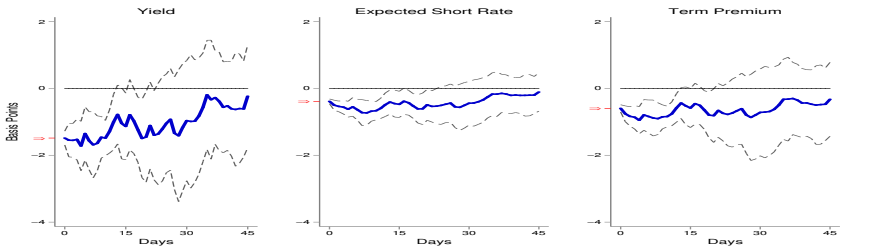
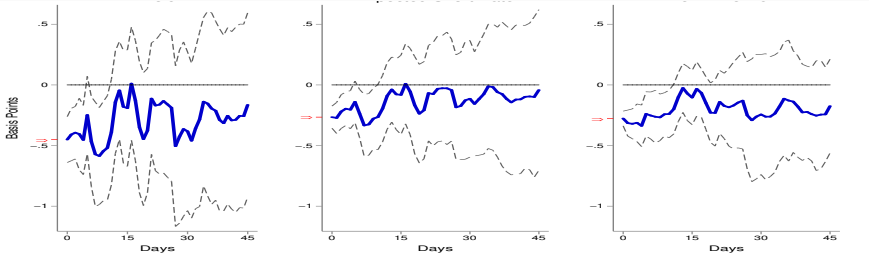
Effects of Asset Purchase Easing on U.S. Yields

10Y



2Y



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