

BANK FOR INTERNATIONAL SETTLEMENTS

Financial crisis, unconventional monetary policy and international spillovers

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Quantitative easing (QE)

*On December 16, 2008, the Federal Open Market Committee (FOMC), in an effort to fight what was shaping up to be the worst recession since 1937-38, reduced the federal funds rate to nearly zero. From then on, with all its conventional ammunition spent, the Federal Reserve was squarely in the **brave new world of quantitative easing** ...*

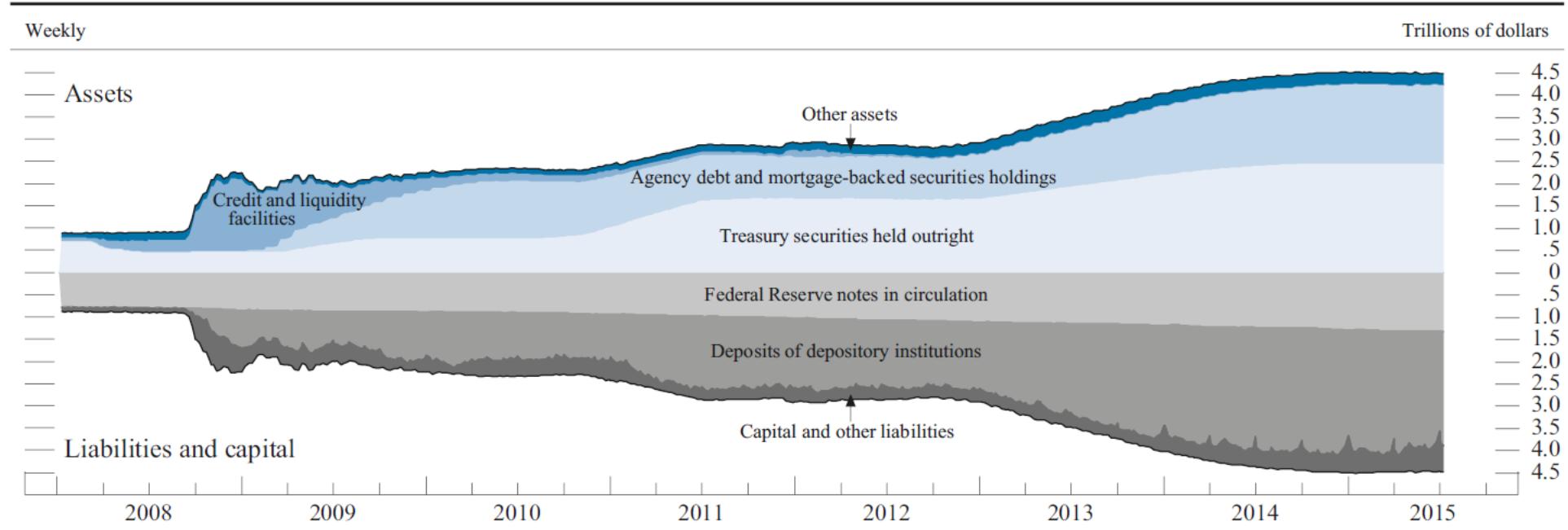
*Roughly speaking, **quantitative easing** refers to changes in the composition and/or size of a central bank's balance sheet that are designed to ease liquidity and/or credit conditions.*

Alan Blinder (2010)



US Federal Reserve balance sheet expansion

In trillions of US dollar



NOTE: "Credit and liquidity facilities" consists of primary, secondary, and seasonal credit; term auction credit; central bank liquidity swaps; support for Maiden Lane, Bear Stearns, and AIG; and other credit facilities, including the Primary Dealer Credit Facility, the Asset-Backed Commercial Paper Money Mutual Fund Liquidity Facility, the Commercial Paper Funding Facility, and the Term Asset-Backed Securities Loan Facility. "Other assets" includes unamortized premiums and discounts on securities held outright. "Capital and other liabilities" includes reverse repurchase agreements, the U.S. Treasury General Account, and the U.S. Treasury Supplementary Financing Account. The data extend through July 8, 2015.

SOURCE: Federal Reserve Board, Statistical Release H.4.1, "Factors Affecting Reserve Balances."

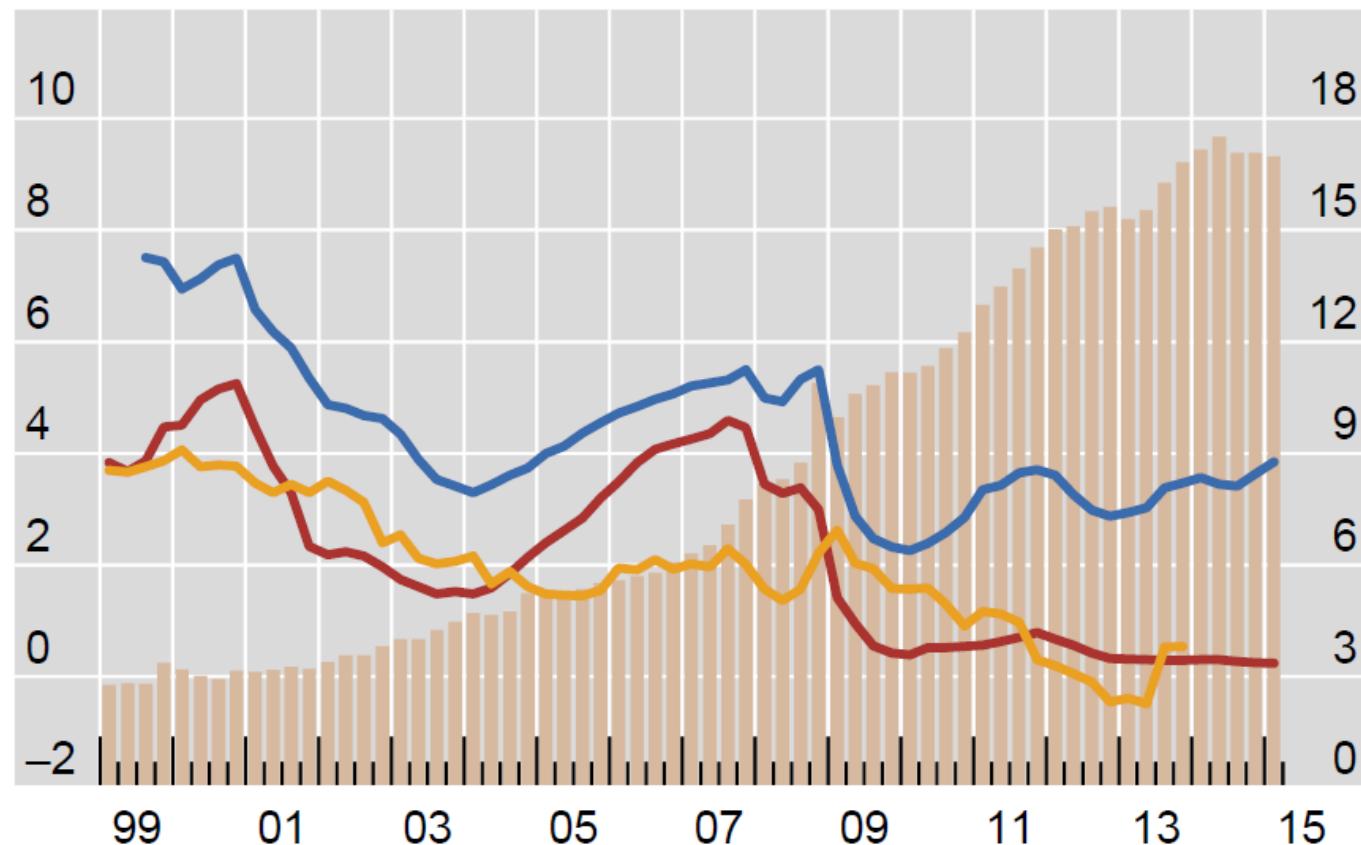
- After the end of asset purchases in October 2014, Federal Reserve total assets steady at around USD 4.5 trn, with US Treasuries holdings at USD 2.5 trn, and holdings of agency debt and agency MBS at USD 1.8 trn



Global liquidity

Per cent

USD trillion



Lhs:

- World real interest rate¹
- G7 nominal interest rate²
- G20 nominal interest rate³

Rhs:

- Official liquidity⁴



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Restricted

4

Debating the global impact of FRB QE

- View 1

- Primarily domestic policy, no major cross-border spillovers
- Cross-border consequences? If any, unintended
- What strengthens US economy is good for EVERYONE
- Promotes global macro and financial stability
- Obstfeld-Rogoff (2002) proposition: only small gains from policy coordination once individual central banks implement policies optimised to achieve domestic macro stability
- Ostry and Ghosh (2013): uncertainties and disagreement about the **cross-border effects of QE policies** a major obstacle to policy coordination



Debating the global impact of FRB QE

- View 2

- Depreciates USD: “currency war”
- Increases interest rate differentials vis-à-vis other economies
- Induces large and volatile capital flows in and out of EMEs
- Overheating and financial stability risks with increased risk-taking and asset market imbalances
- Rajan (2013): danger of “competitive asset price inflation”
- Taylor (2013): Obstfeld-Rogoff (2002) proposition may be true in normal times, but **substantial cross-border spillovers** seen in recent years may have significantly changed the cost-benefit analysis, particularly if QE measures represent “deviations from rules-based policy” which create incentives for other central banks to deviate from rules-based policies



Outline

- Announcement effects of US QE (LSAPs)
 - Responses in international financial markets
- Impact of US QE (LSAPs) on real and financial sectors
 - Term spread, corporate spread (and VIX)
 - Global VAR model and spillover effects
 - Domestic
 - Other advanced (euro area, Japan, UK)
 - 13 Emerging economies
- Conclusion



Federal Reserve large-scale asset purchases

	Announcement	Termination	Assets purchased	Amount ¹
LSAP1	November 2008		Agency mortgage-backed securities (MBS) and agency debt	\$600 billion
		March 2009	Agency securities	\$850 billion
		March 2010	Longer-term US Treasury securities	\$300 billion
LSAP2	November 2010	June 2011	Longer-term US Treasury securities	\$600 billion
Maturity extension programme (MEP)	September 2011		US Treasury securities with remaining maturities of six to 30 years	\$400 billion
	June 2012	December 2012	US Treasury securities with remaining maturities of six to 30 years	
LSAP3	September 2012	October 2014	Agency MBS	\$40 billion per month ²
		October 2014	Longer-term US Treasury securities	\$45 billion per month ²

¹ Initially announced amount of asset purchases for each programme or programme expansion. ² The purchases were open-ended when they were announced. The Federal Reserve started to taper the asset purchases in January 2014, and eventually halted the purchases altogether in October 2014.

Source: US Federal Reserve.



Transmission channels

- Domestic impact
 - ✓ Portfolio balance channel
 - ✓ Signalling or expectations channel
 - ✓ Interest rate channel
 - ✓ Credit channel
- International spillovers
 - ✓ Portfolio rebalancing channel
 - ✓ Combination of credit, asset price channel
 - ✓ Exchange rate channel
 - ✓ Trade channel
 - ✓ Endogenous monetary policy response



Announcement effects

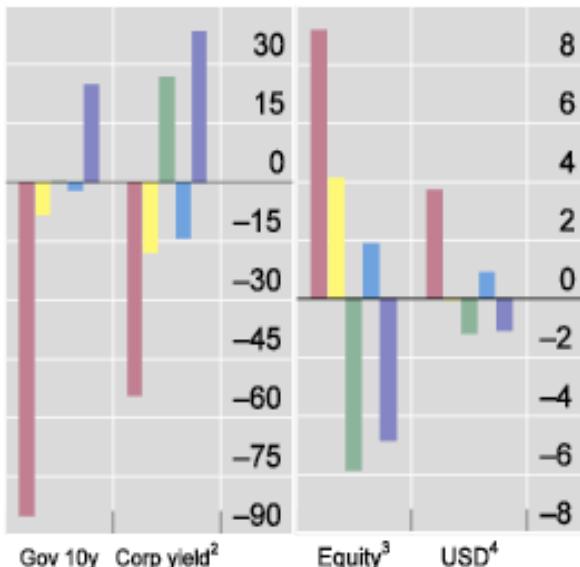
- Event study methodology
 - ✓ e.g. Meaning and Zhu (2011)
 - ✓ Global financial market reactions
 - ✓ One- and two-day event windows
- Cumulative 2-day percentage changes in
 - ✓ Government bond yields
 - ✓ Corporate bond yields
 - ✓ Sovereign CDS premia
 - ✓ Equity prices
 - ✓ USD bilateral exchange rates



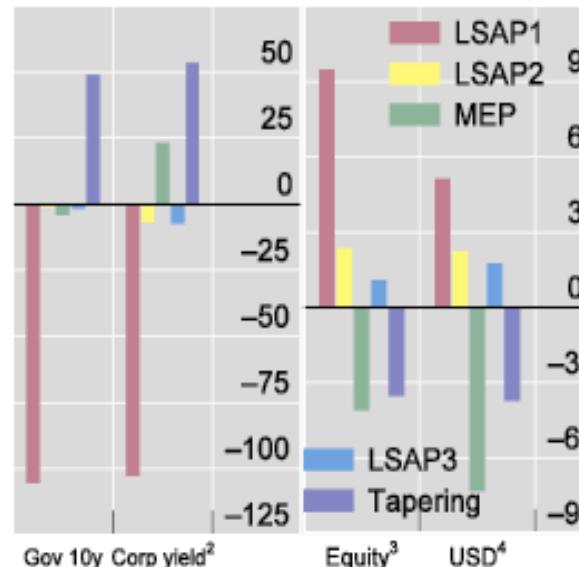
Spillover effects of FRB programmes

In basis points unless otherwise indicated

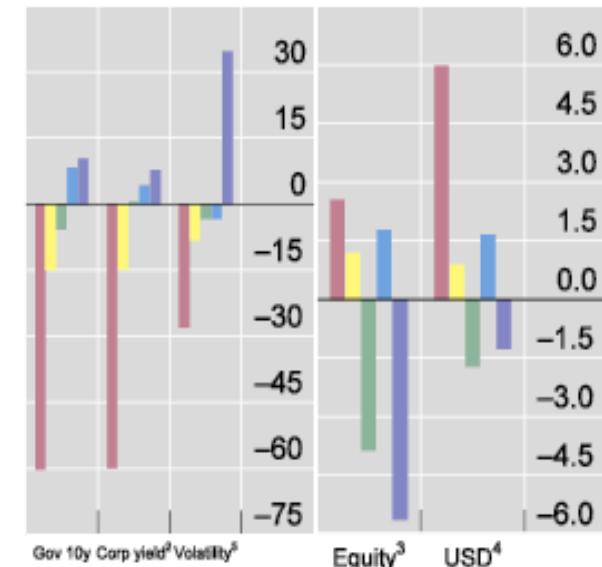
Emerging Asia



Latin America



Advanced economies



¹ Two-day event window. Simple averages based on a sample of countries. For emerging Asia: China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand; for Latin America: Brazil, Chile and Mexico; for the advanced economies: the euro area, Japan and the United Kingdom. ² CEMBI Broad yields for emerging Asia and Latin America. ³ In per cent. ⁴ In per cent; US dollar bilateral exchange rates: a positive change indicates depreciation. ⁵ In per cent, stock market volatility indices.

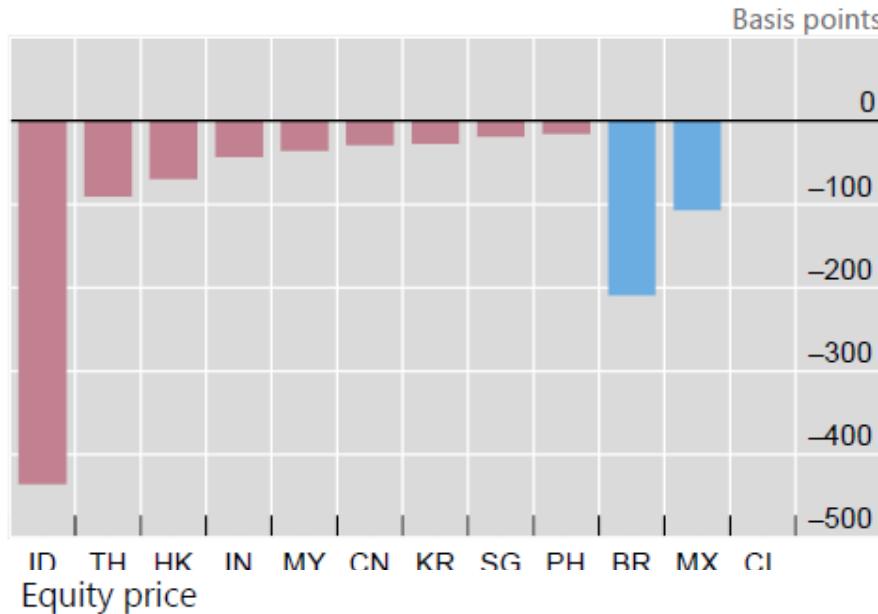
Sources: Bloomberg; Datastream; JPMorgan; national data; BIS calculations.

- LSAP1 far more effective, significant USD depreciation with LSAPs
- MEP behaves like Tapering except for impact on gov bond yields

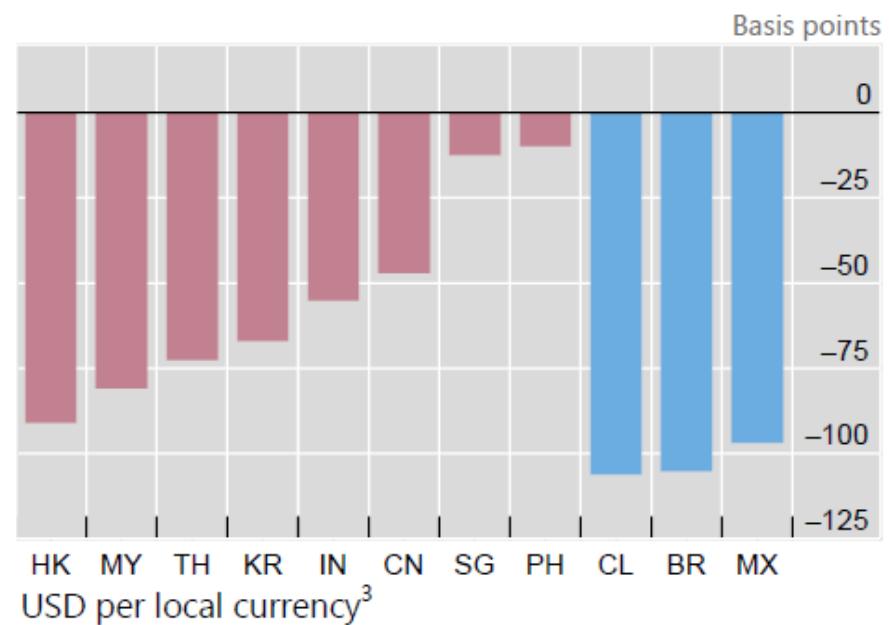


Spillover effects of FRB LSAP1

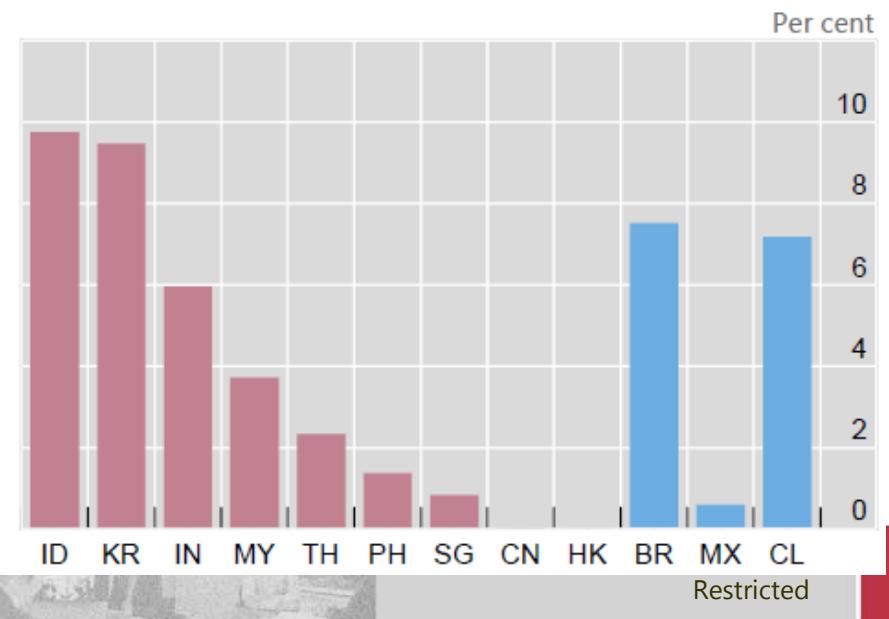
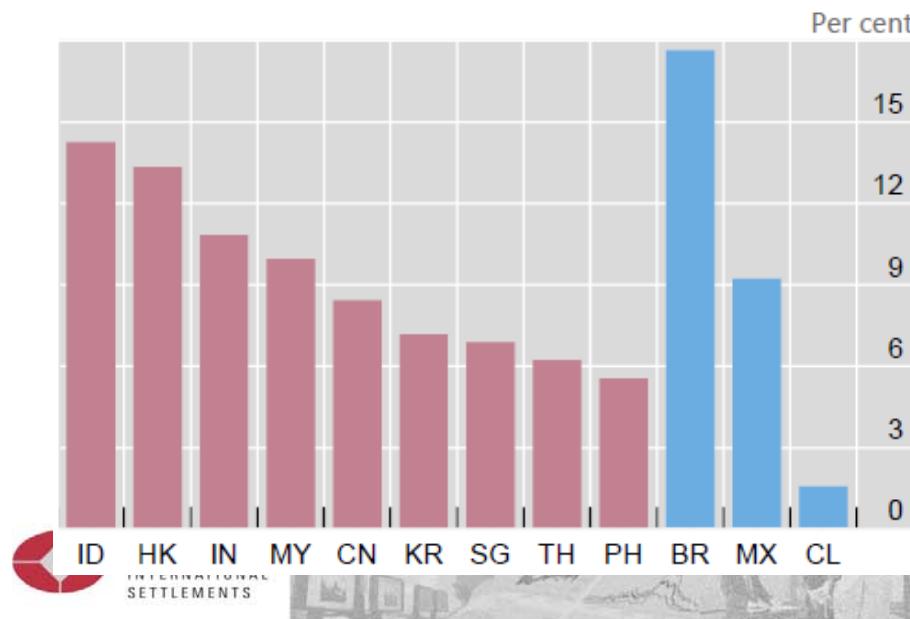
Ten-year sovereign bond yield



Corporate bond yield¹

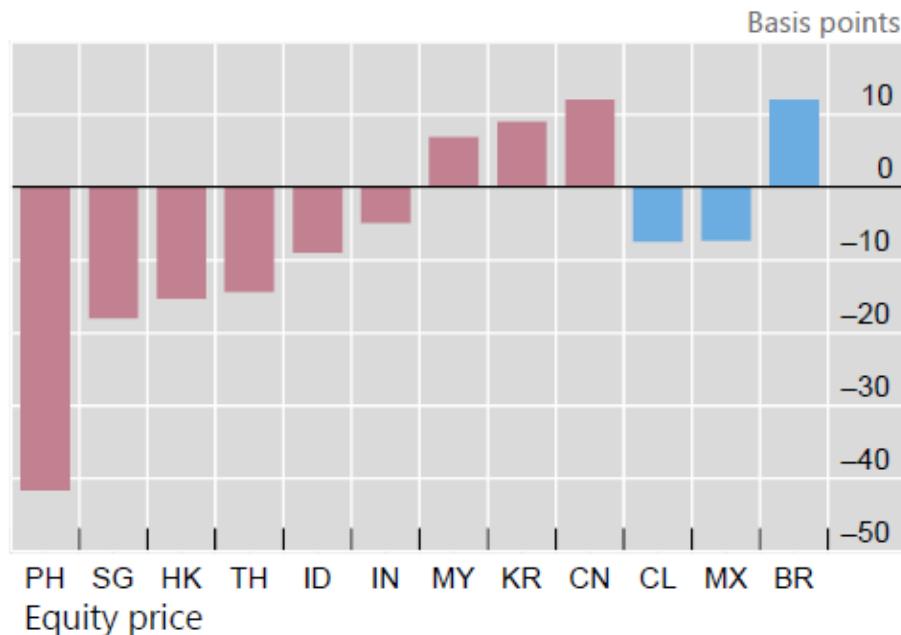


Per cent

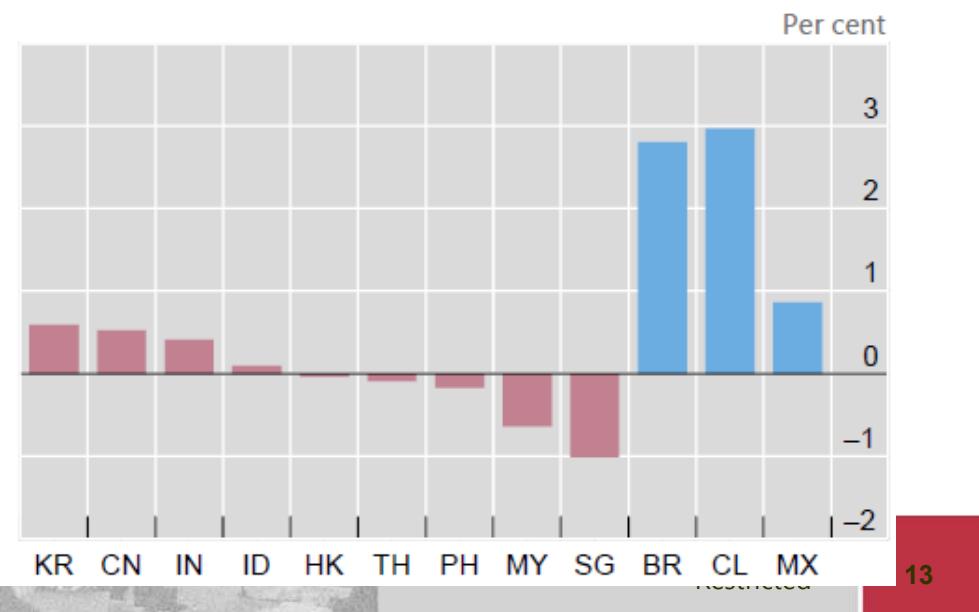
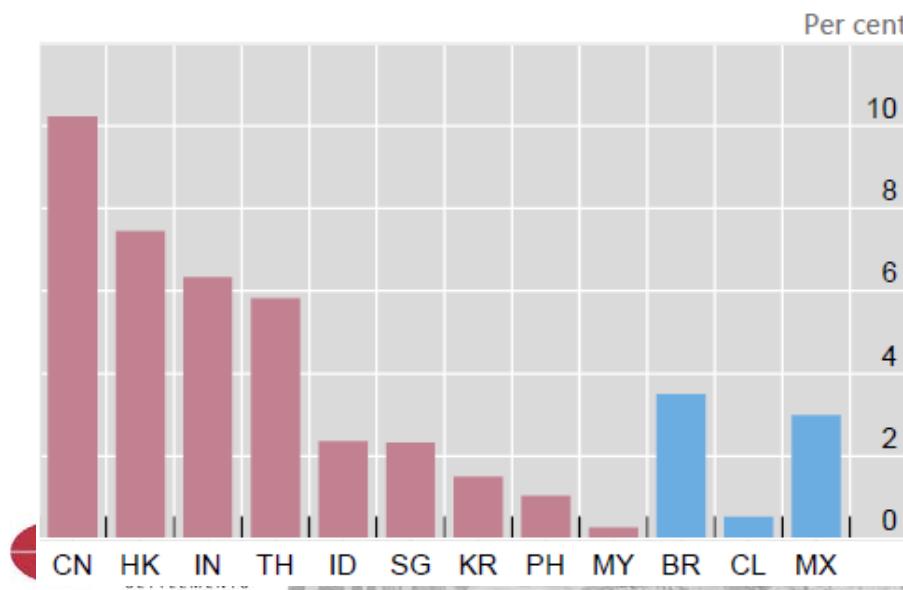
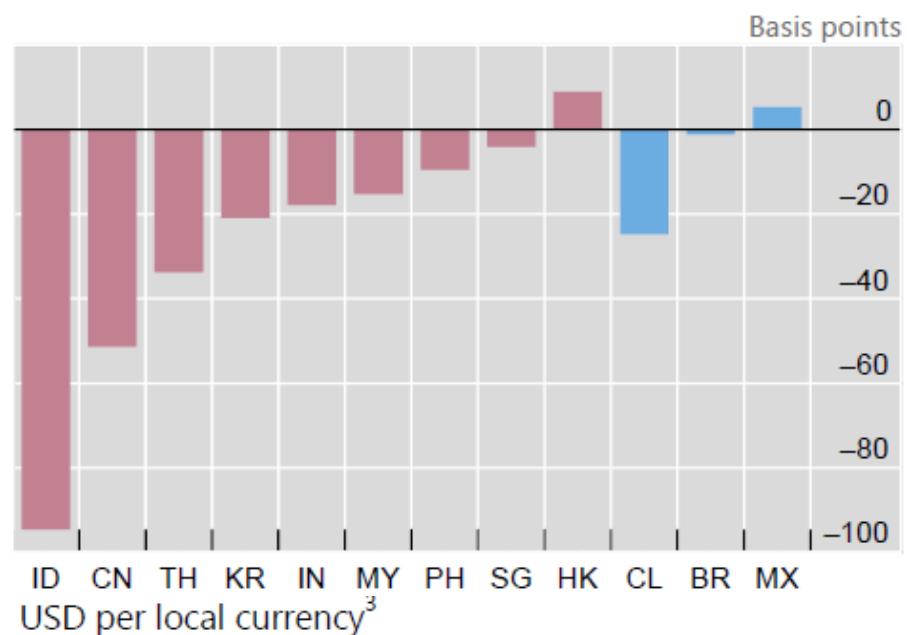


Spillover effects of FRB LSAP2

Ten-year sovereign bond yield

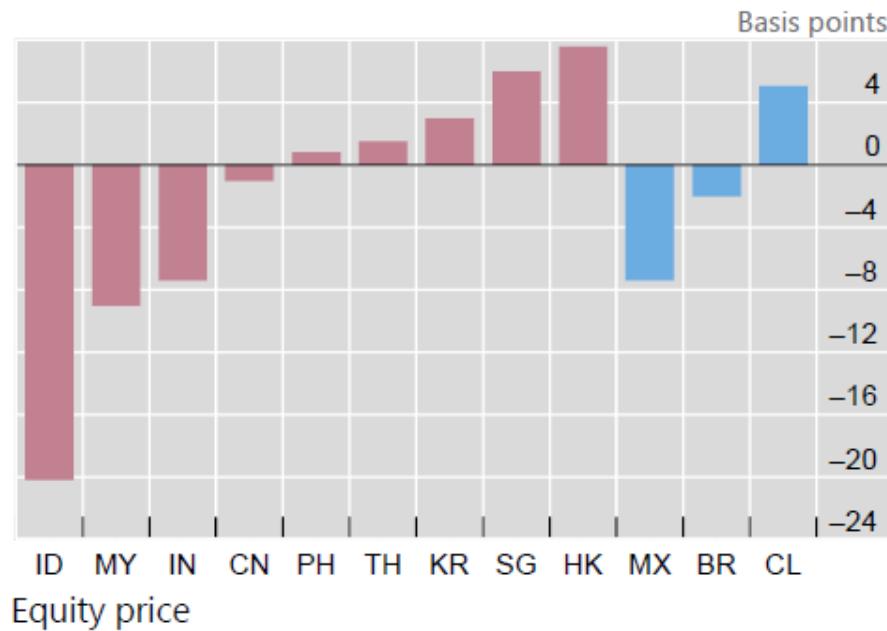


Corporate bond yield¹

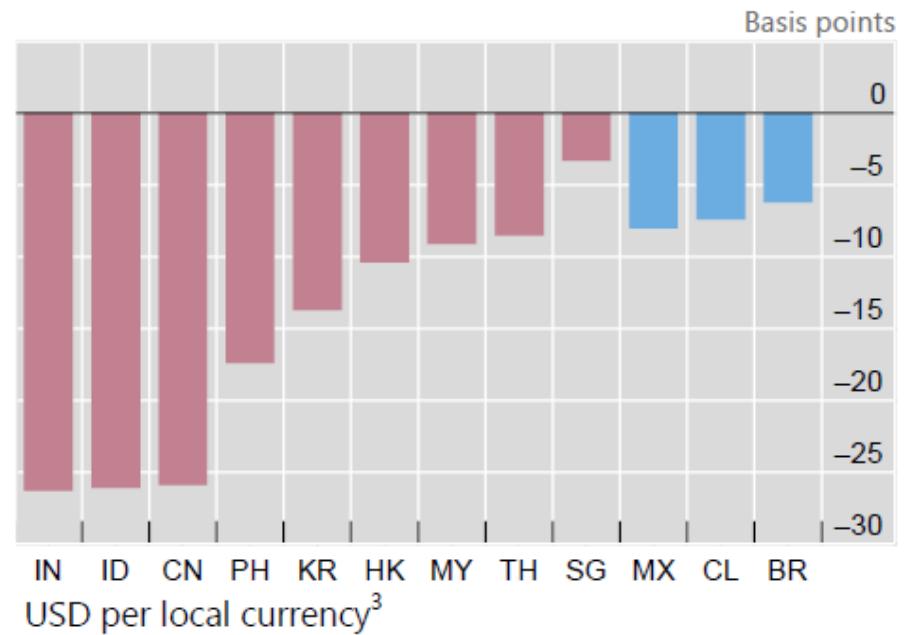


Spillover effects of FRB LSAP3

Ten-year sovereign bond yield

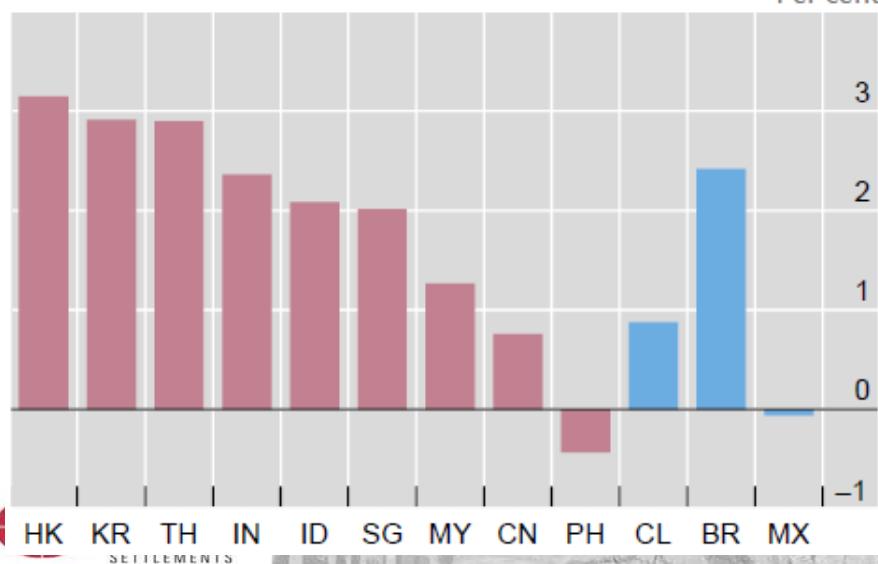


Corporate bond yield¹

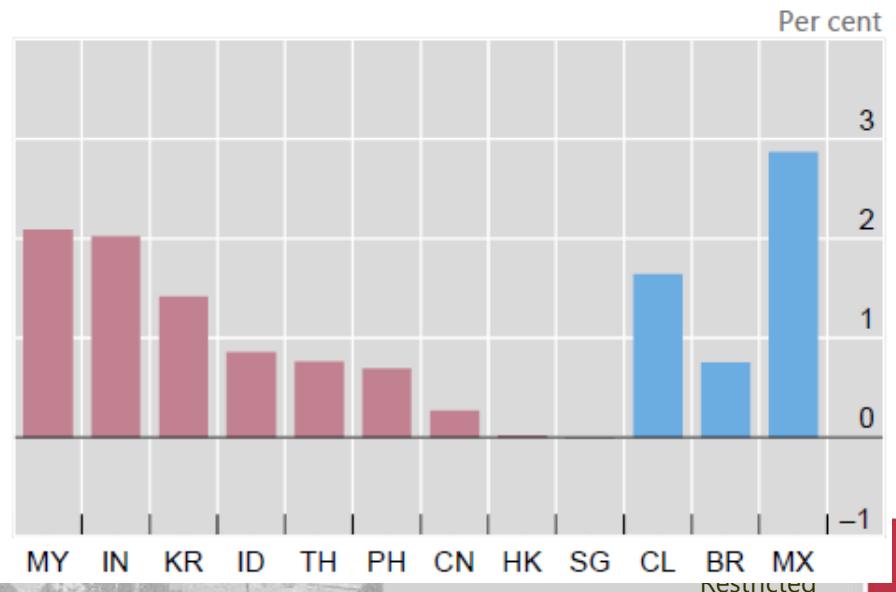


Equity price

Per cent



USD per local currency³

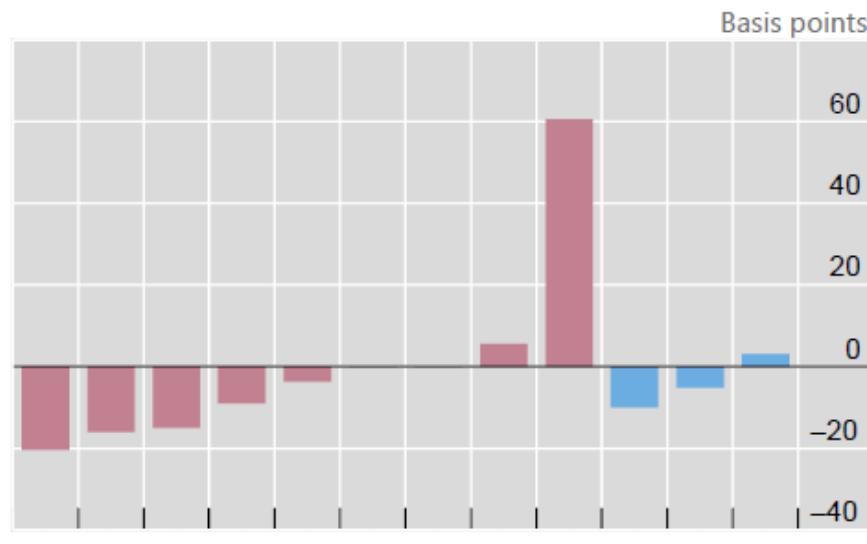


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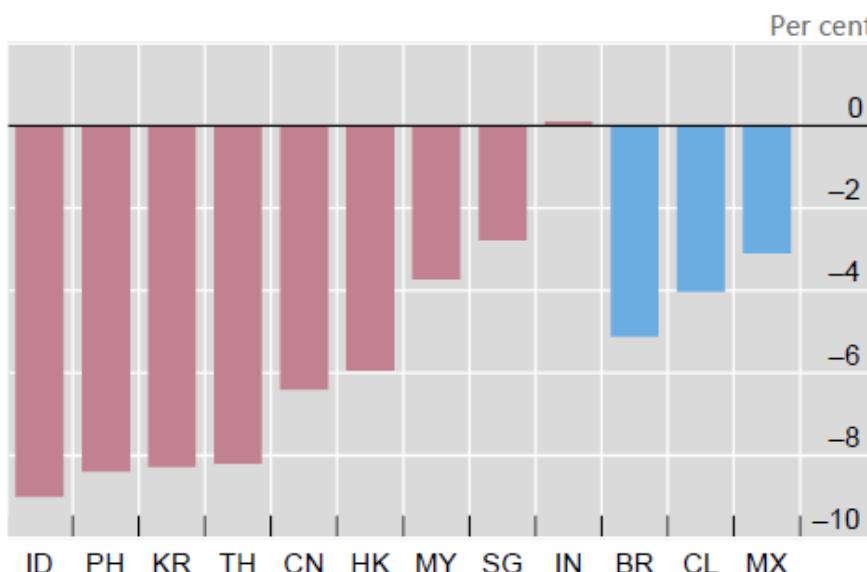
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Spillover effects of FRB MEP

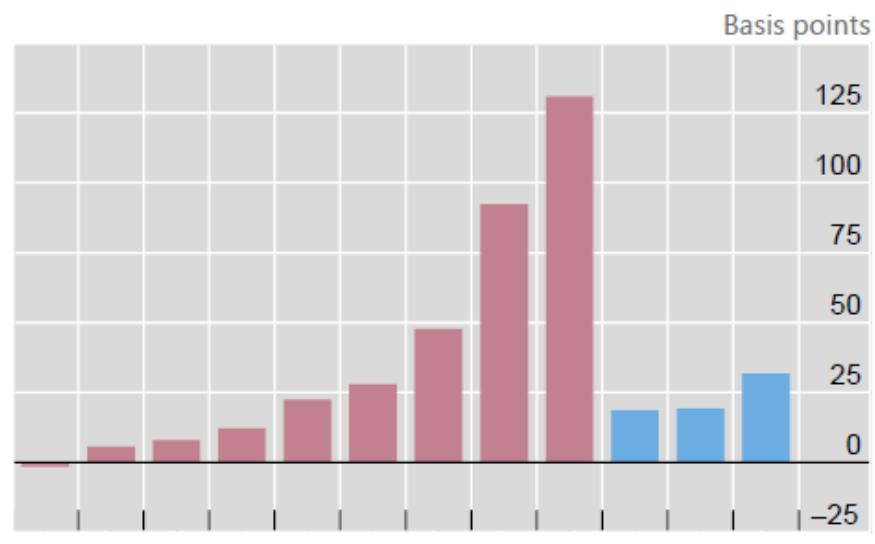
Ten-year sovereign bond yield



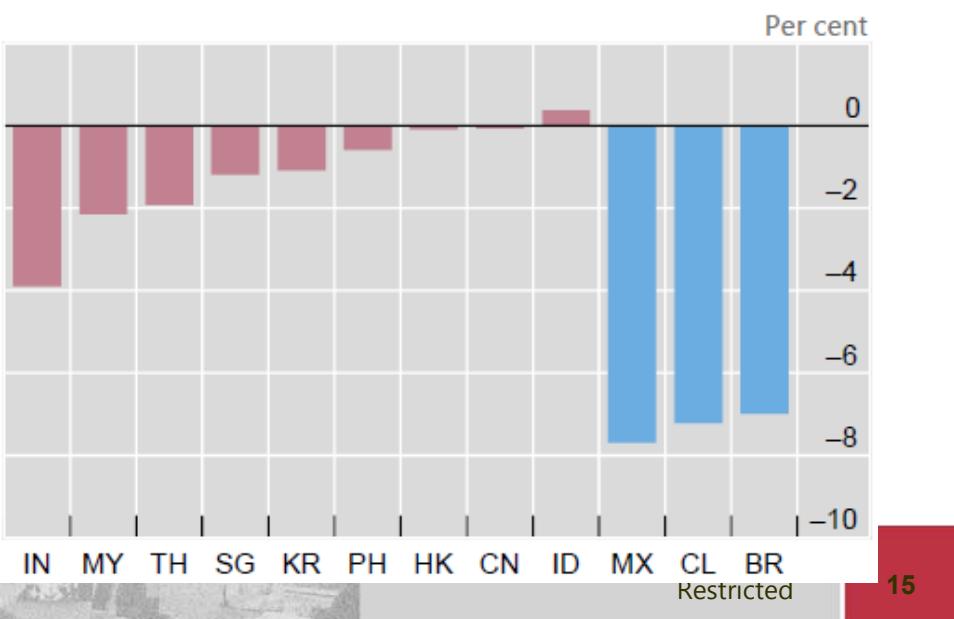
Equity price



Corporate bond yield¹



USD per local currency³



Cross-border announcement effects

- Sizeable and diverse
 - ✓ More uniform responses in advanced economies
 - ✓ Greater impact in some EMEs than domestically
 - ✓ LSAPs lower sovereign and corporate bond yields
 - ✓ Strong support for EM equity prices
 - ✓ But sizeable currency depreciation
 - ✓ Distinct exchange rate responses to LSAP2 (muted in Asia but USD depreciation in Latin America)
- Outright purchases vs Operation Twist
 - ✓ LSAP1 more “effective” than later programmes
 - ✓ “MEP puzzle”: MEP effects had “wrong” signs and behaved like Tapering
 - ✓ Size (more than composition) of asset holdings matter



Impact on global activity: GVECM model

- Cross-country dependence and transmission
 - Global vector error correction macroeconometric model
 - Pesaran et al 2004, Dees et al 2007
- Strength of cross-country linkages: weights based on
 - Bilateral trade
 - Financial transactions: cross-border bank lending
- Variables of interest
 - Real GDP, inflation, monetary policy, credit to private sector, FX pressure, equity prices
- Monthly data (1995-2013) and 17 economies
 - Pre-crisis sample: till June 2007
 - Crisis sample: from July 2007 to Feb 2013



Measuring US monetary policy at ZLB

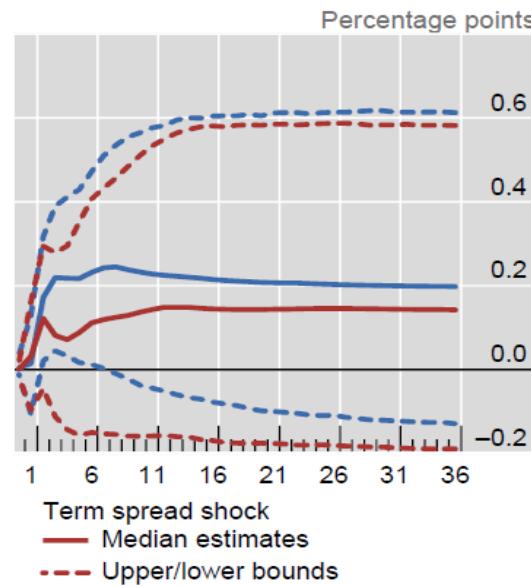
- FRB's extraordinary monetary stimulus
 - US term (10-year – 3-month Treasury yields) and corporate (Merrill-Lynch BBB-AAA) spreads, VIX
- Blinder (2010)
 - Central banks use unconventional tools to "*reduce interest rate spreads*" such as "*term premiums and/or risk premiums*", buying long-term Treasuries or using QE to target "risk or liquidity spreads"
 - Rationale: "*since private borrowing, lending, and spending decisions presumably depend on (risky) non-Treasury rates, reducing their spreads over (riskless) Treasuries reduces the interest rates that matter for actual transactions even if riskless rates are unchanged*"
- Chen, Filardo, He and Zhu (2012), Kapetanios, Mumtaz, Stevens and Theodoridis (2012) and Pesaran and Smith (2012)



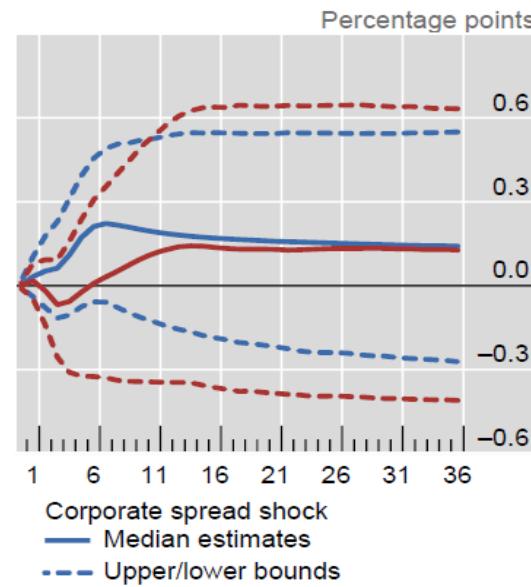
Impulse responses: domestic effects

Reduction in US term (14.2 bpts) and corporate (20.7 bpts) spreads

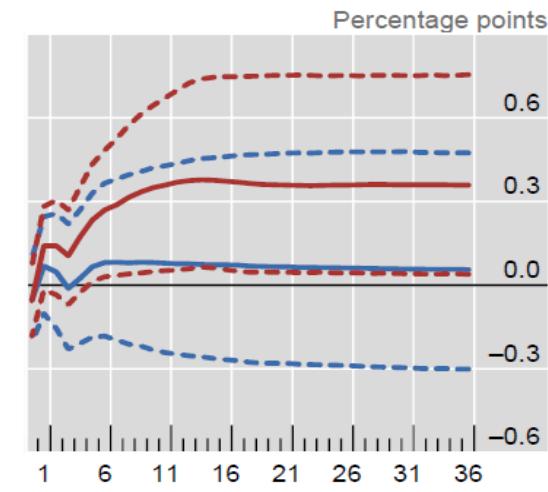
Real GDP growth



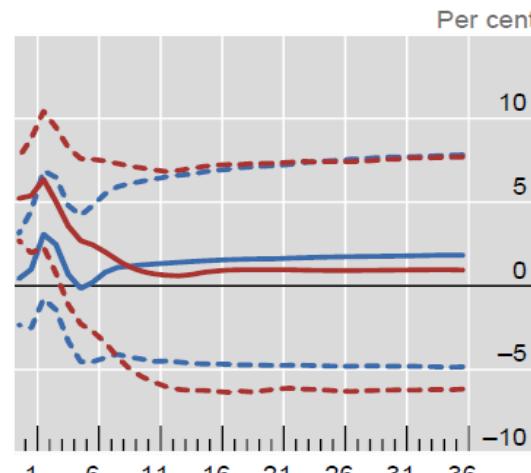
CPI inflation



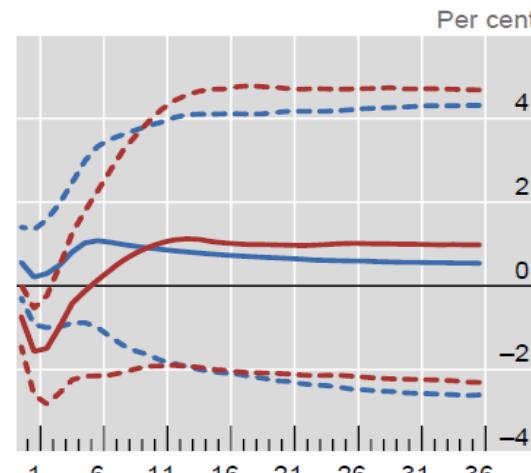
Growth of credit to private sector



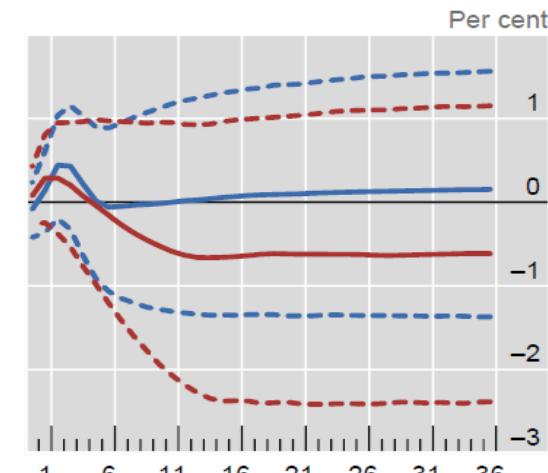
VIX



Equity price



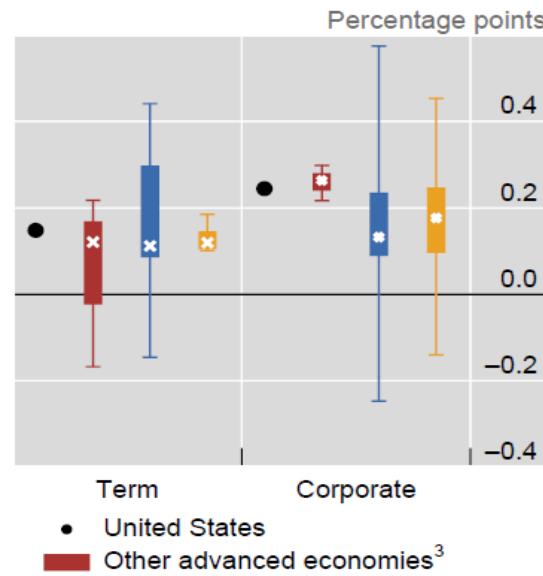
Foreign exchange pressure³



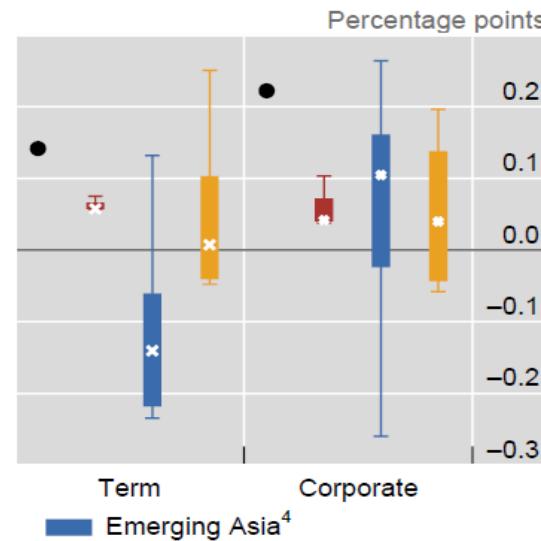
Maximum impulse responses

Reduction in US term (14.2 bpts) and corporate (20.7 bpts) spreads

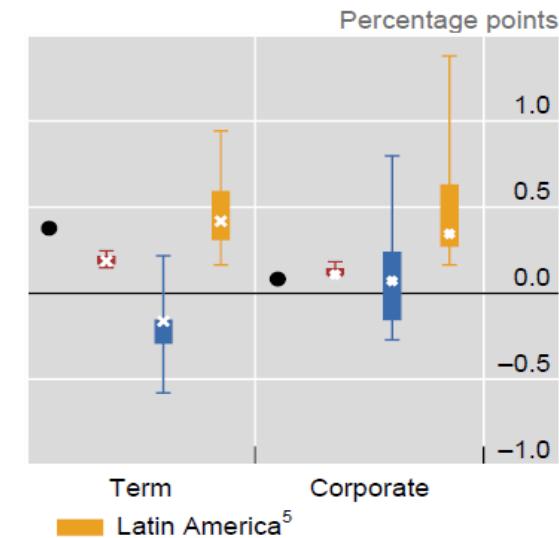
Real GDP growth



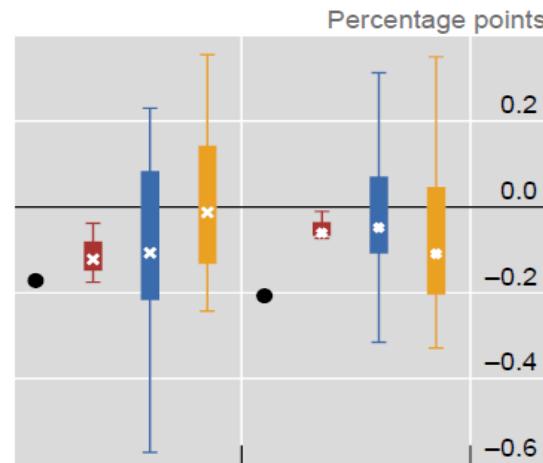
CPI inflation



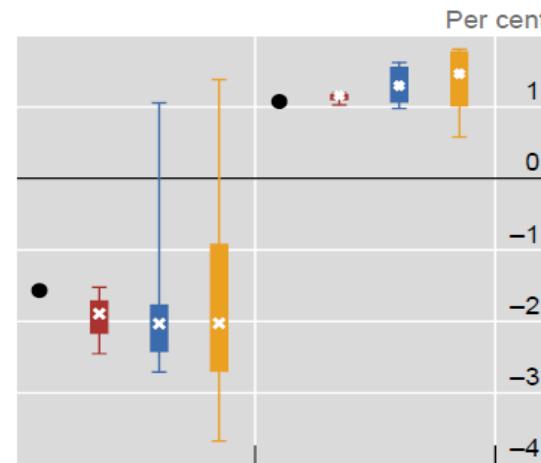
Credit to the private sector growth



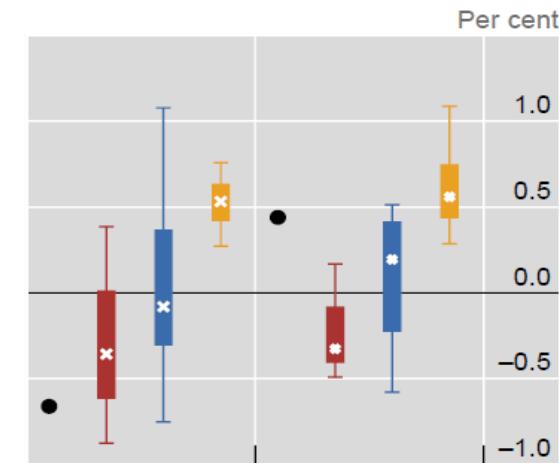
Monetary policy indicator⁶



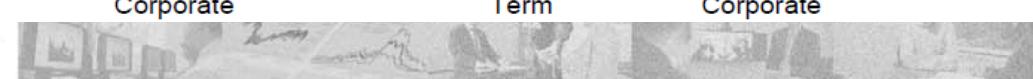
Equity price



Foreign exchange pressure⁷



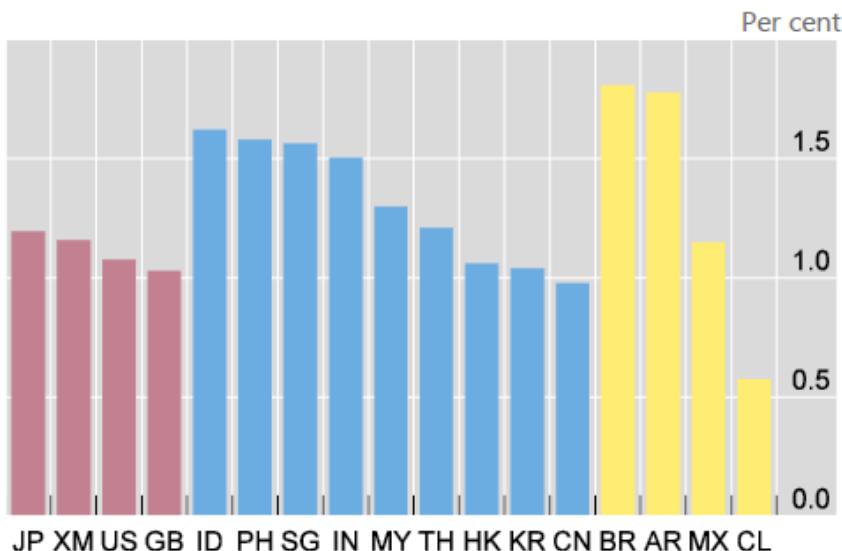
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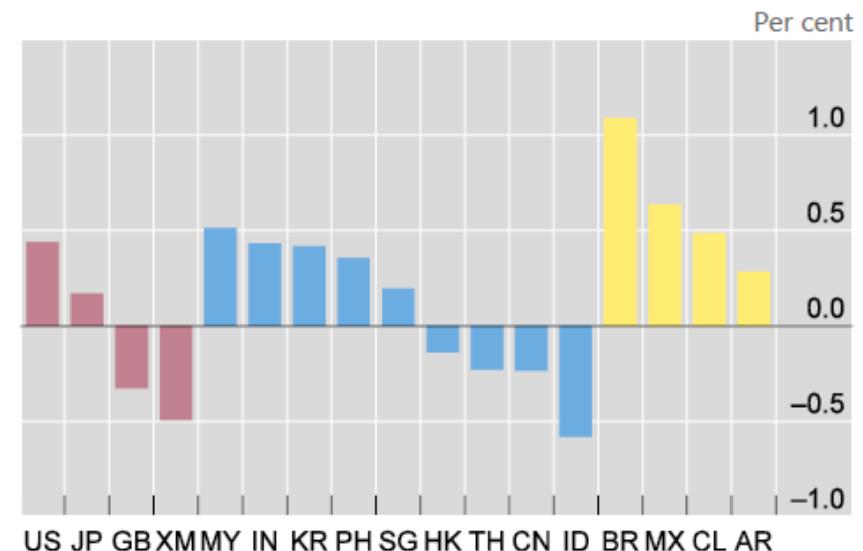
Maximum impulse responses

Reduction in US corporate (20.7 bpts) spreads

Equity price



Foreign exchange pressure³



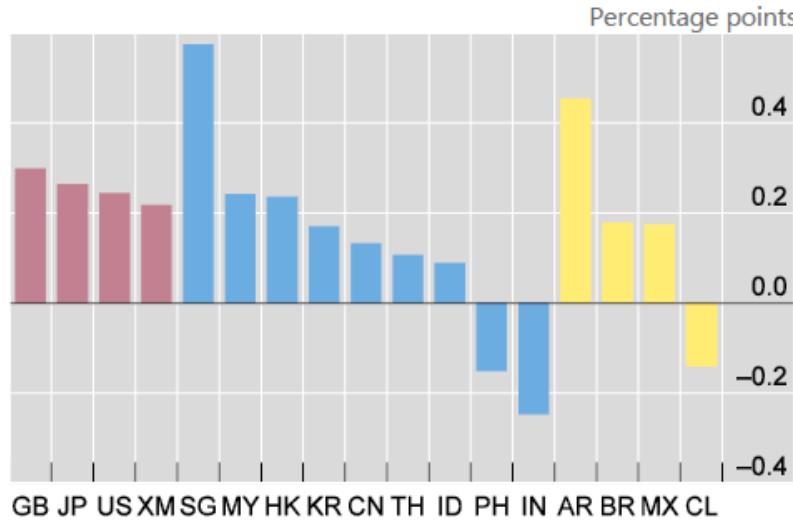
AR = Argentina; BR = Brazil; CL = Chile; CN = China; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MX = Mexico; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; XM = Euro area.

¹ The US corporate spread shock is a one-standard-deviation (ie 20.7 basis points) negative innovation to the corporate spread. ² For monetary policy indicators, we use corporate or term spreads for the advanced economies, and growth rates of a broad monetary aggregate for emerging economies. ³ A rise in the foreign exchange pressure index represents stronger appreciation pressure.

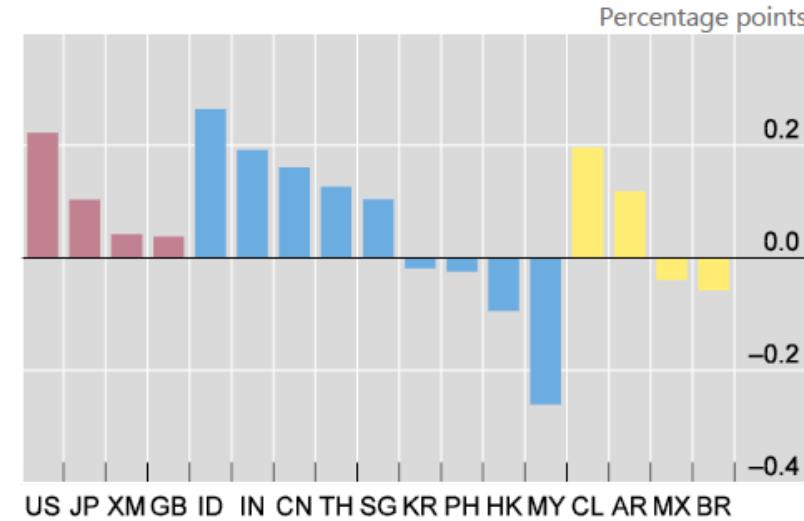
Maximum impulse responses

Reduction in US corporate (20.7 bpts) spreads

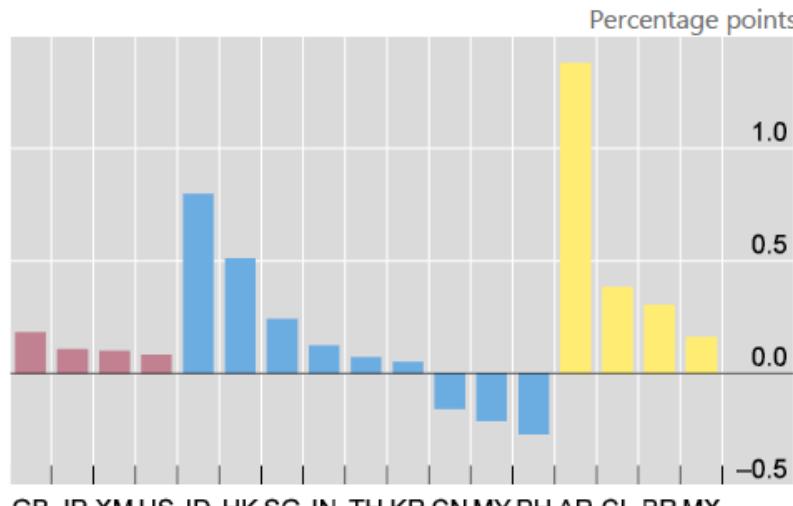
Real GDP growth



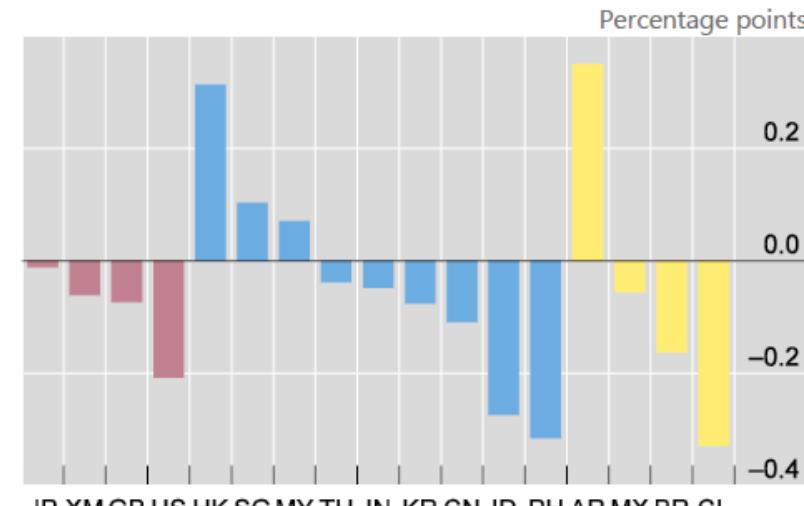
CPI inflation



Credit growth to the private sector



Monetary policy indicator²



Impulse responses

- Crisis-period impact of FRB QE: statistically significant
 - Domestic impact on credit (term) and output growth (VIX, corporate)
 - Impact on euro area output growth (corporate)
 - Early impact on Brazil's money growth, equity returns, FX pressure, credit & output growth (corporate)
 - Impact on China's FX pressure and credit & output growth (corporate)
- Impact varies across economies
 - Distinct monetary policy and FX responses
 - Positive on asset prices, generally more positive on credit growth and FX (corporate)
 - Greater & more diverse impact in many EMEs than in US & other advanced



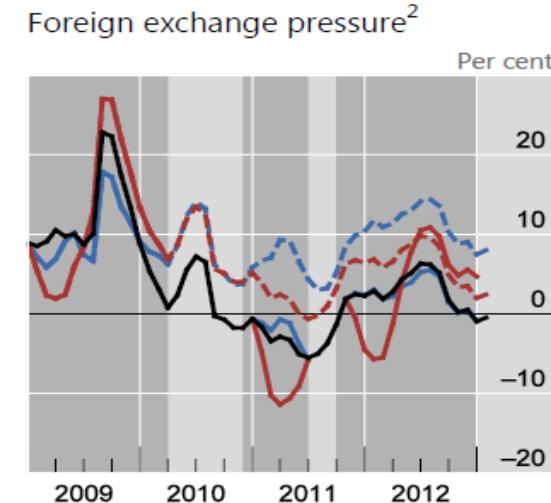
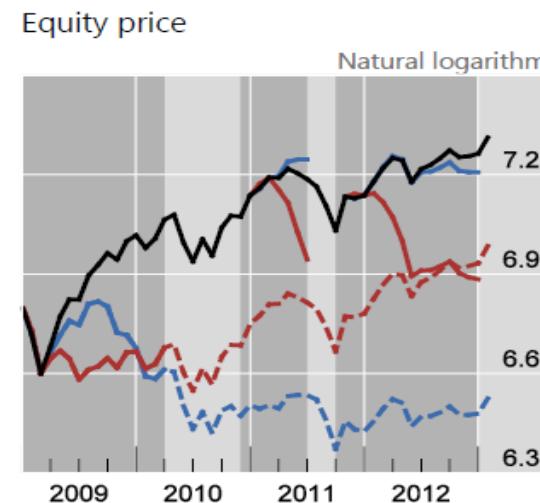
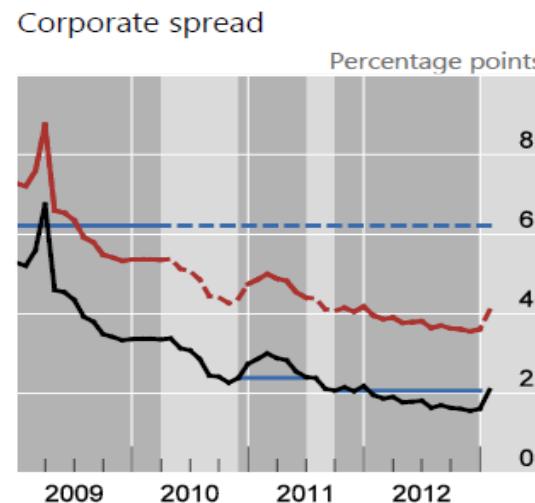
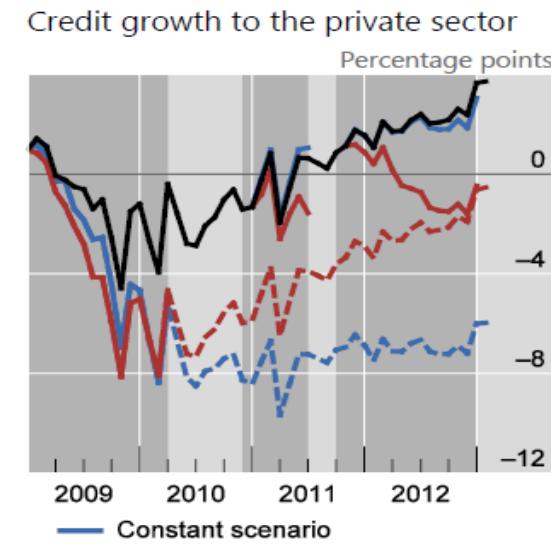
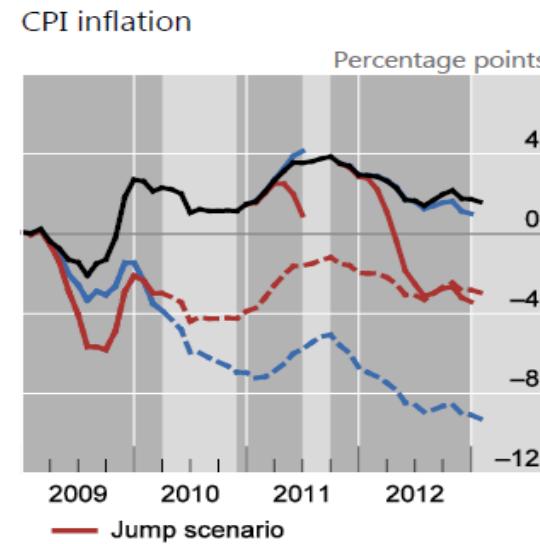
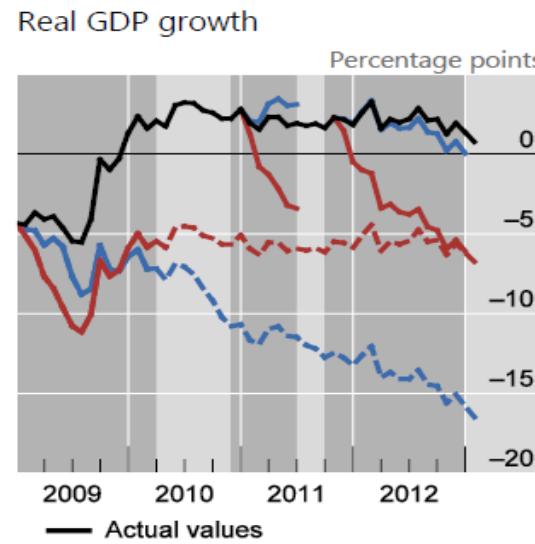
Counterfactual Analysis

- What would have happened without FRB QE?
 - Construct counterfactual scenarios based on different paths for US (term and) corporate for LSAP1, LSAP2 & MEP+LSAP3
- Scenario “constant”
 - Corporate spread constant within each QE period, at the value of the month before each programme
- Scenario “jump”
 - Corporate spread jumps by 200 basis points at beginning of each QE period and then stays 200 basis points above the actual path
- Scenario “increasing”
 - Corporate spread rises by 10 basis points in each & every month in each QE period



Counterfactual: US domestic impact

US corporate spread



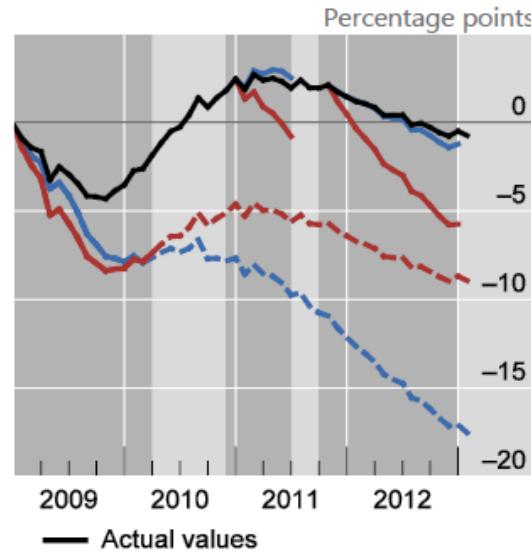
¹ The grey areas indicate the periods of implementation of LSAP1, LSAP2 and MEP. The black lines are actual values. The red lines are the values associated with the jump scenario where the US corporate spread jumps by 200 basis points and stays 200 basis points above the actual levels throughout the respective QE programme, and the blue lines depict the scenario where the US corporate spread stays equal to the actual level observed just before the QE programme. ² A rise in the foreign exchange pressure index represents stronger appreciation pressure.



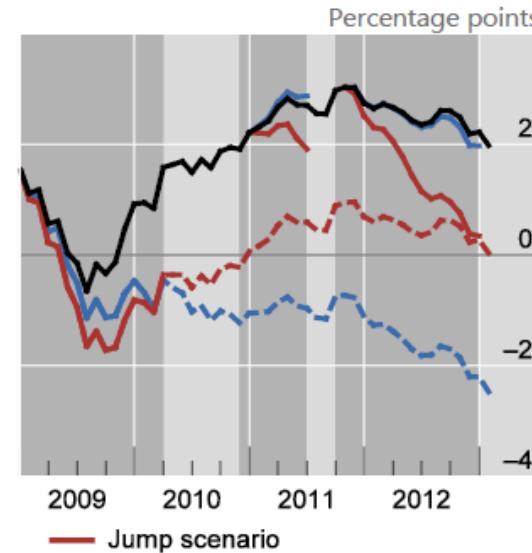
Counterfactual: spillover to euro area

US corporate spread

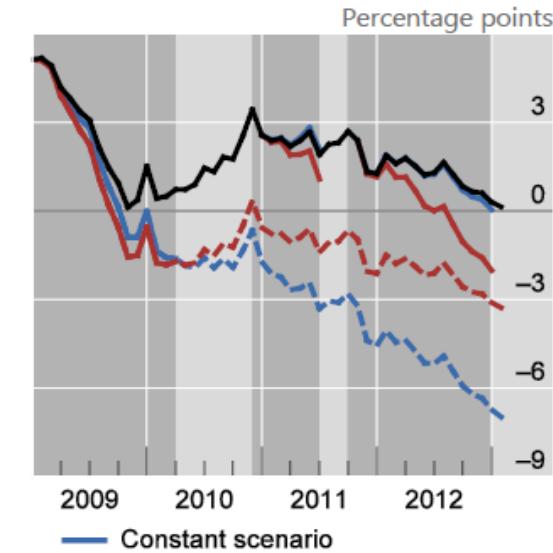
Real GDP growth



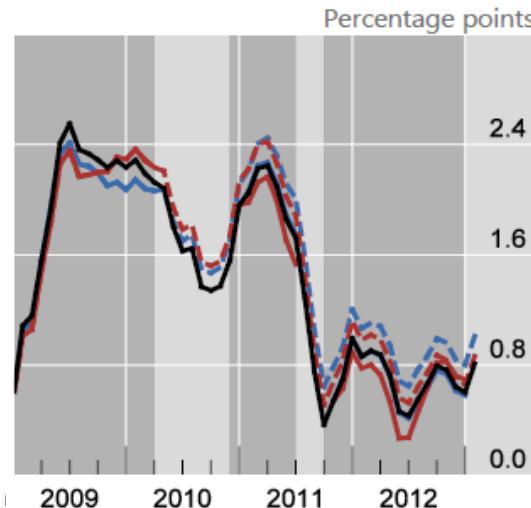
CPI inflation



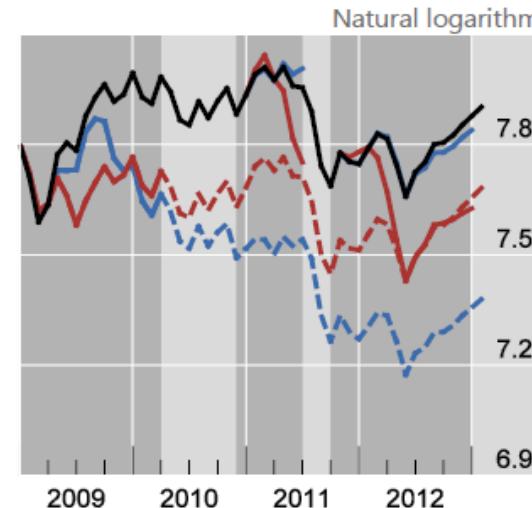
Credit growth to the private sector



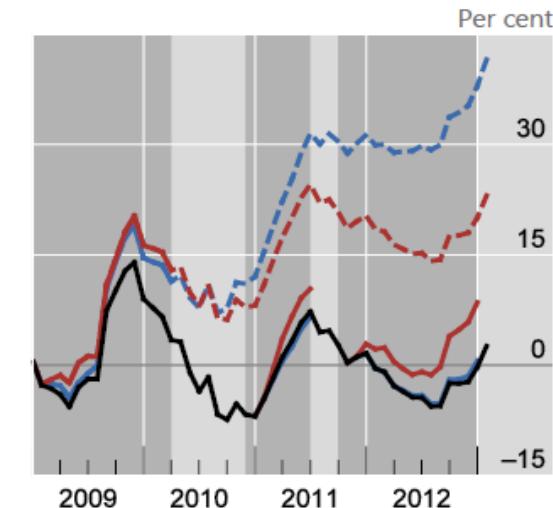
Term spread



Equity price



Foreign exchange pressure²



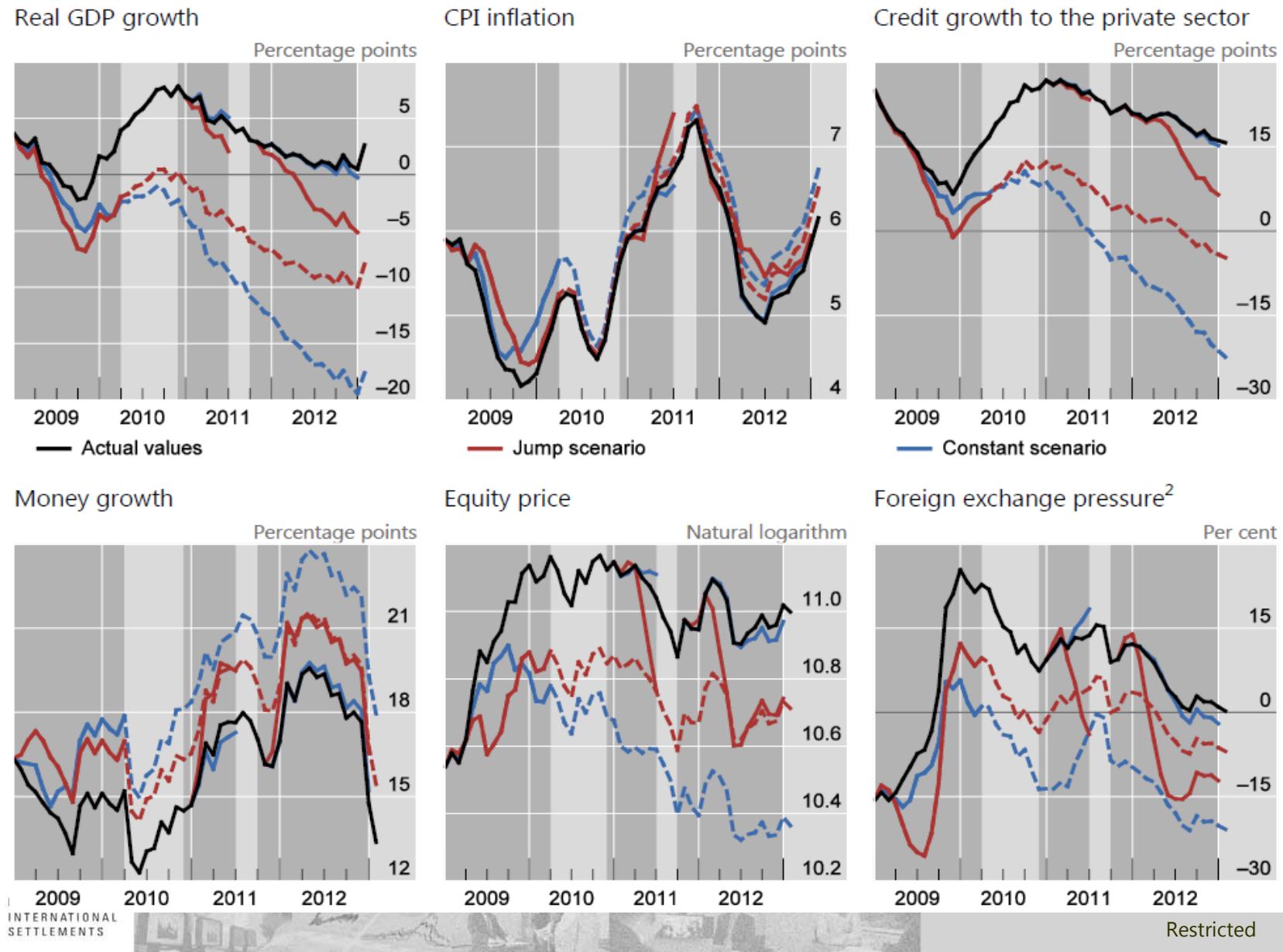
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Counterfactual: spillover to Brazil

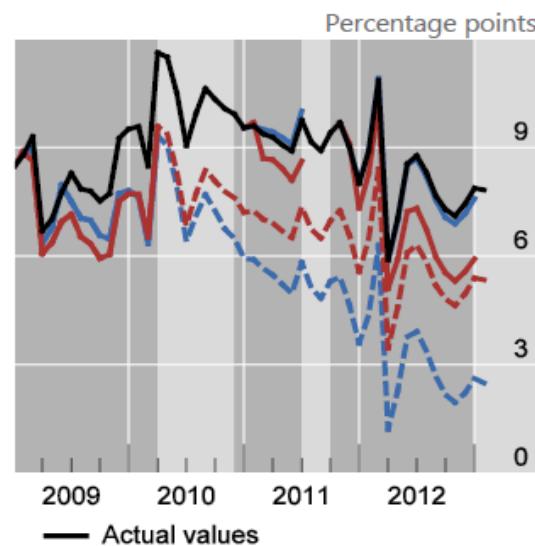
US corporate spread



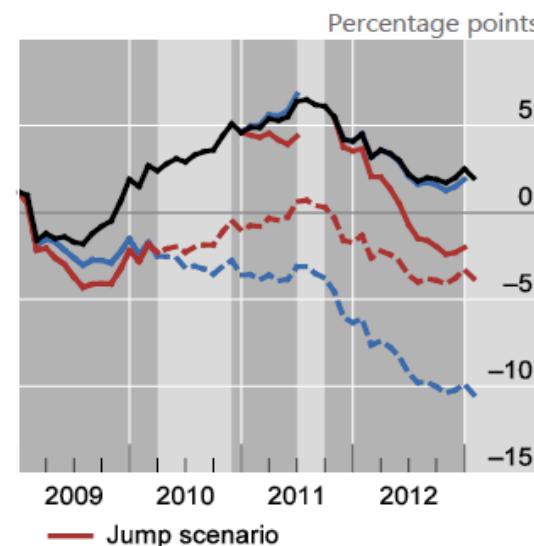
Counterfactual: spillover to China

US corporate spread

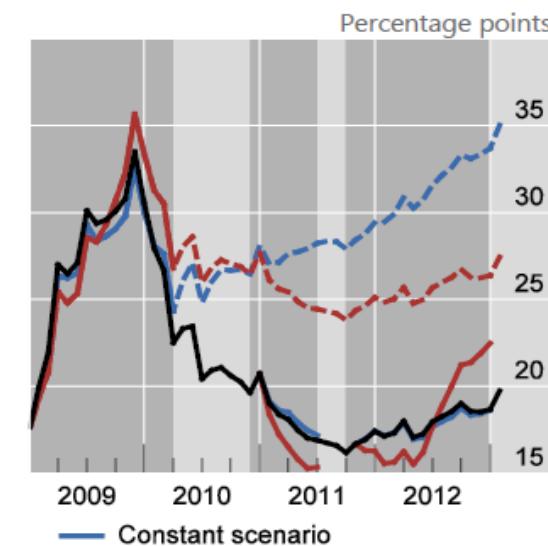
Real GDP growth



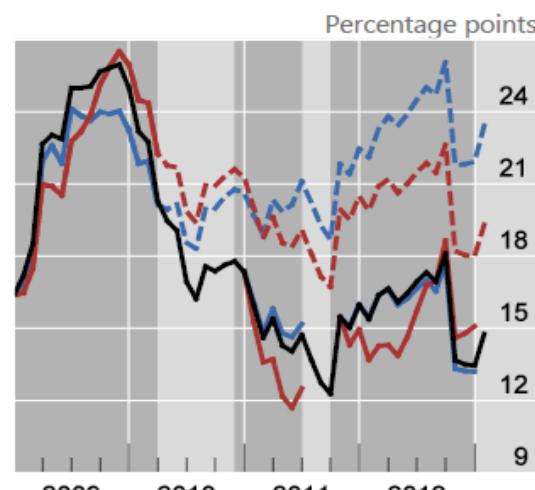
CPI inflation



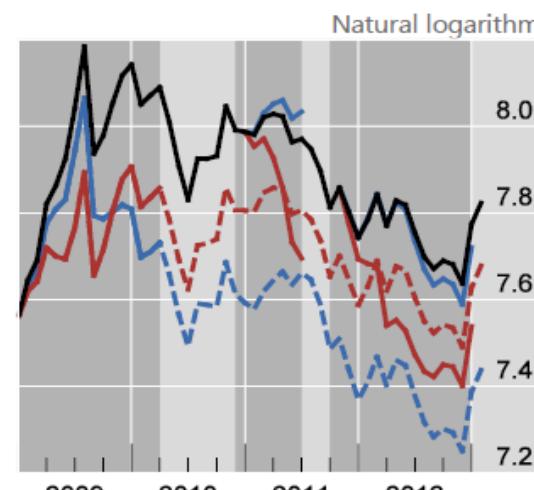
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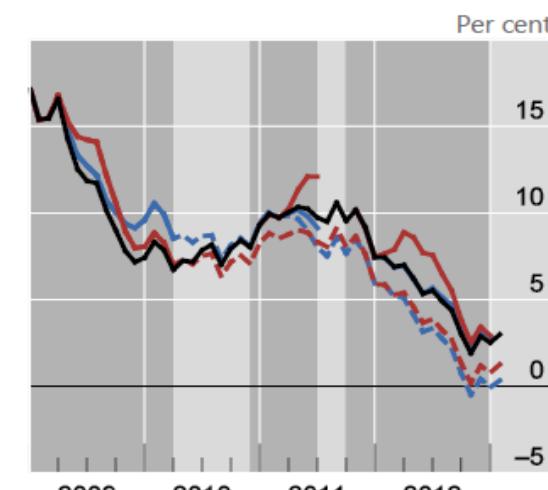
Money growth



Equity price



Foreign exchange pressure²



Conclusion

- Marked & varied announcement effects on global markets
 - US MEP “puzzle”
- QE helped stabilise US & global financial markets boosting asset prices and lowering borrowing costs
- US QE prevented prolonged recession & severe deflation in US & euro area
- US QE had greater impact when it managed to lower corporate spreads (and market volatility)
 - Buying government bonds just to lower term spread or twist yield curve may not be best option

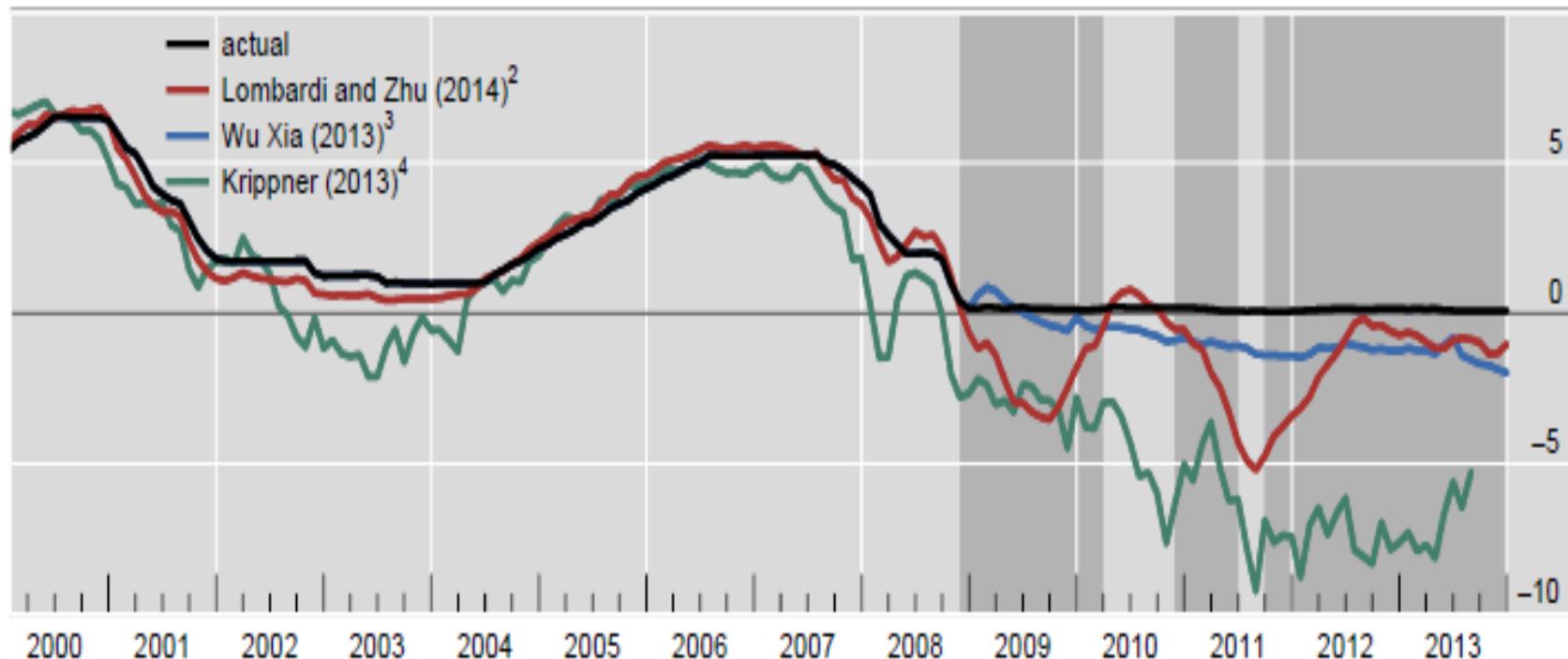


Conclusion

- Cross-border effects differed in EMEs depending on policy responses, but generally greater than in US
 - Whether QE effects are beneficial depends also on cyclical conditions of impacted economies
 - US QE supported recovery in 2009 & 2012
 - But contributed to overheating in Brazil, China & other EMEs in 2010-2011
 - Costs and benefits unevenly distributed
- QE can pose difficult policy challenges for EMEs
 - US monetary policy normalisation
 - But QE deepening in euro area and Japan?



Shadow and actual fed funds rate

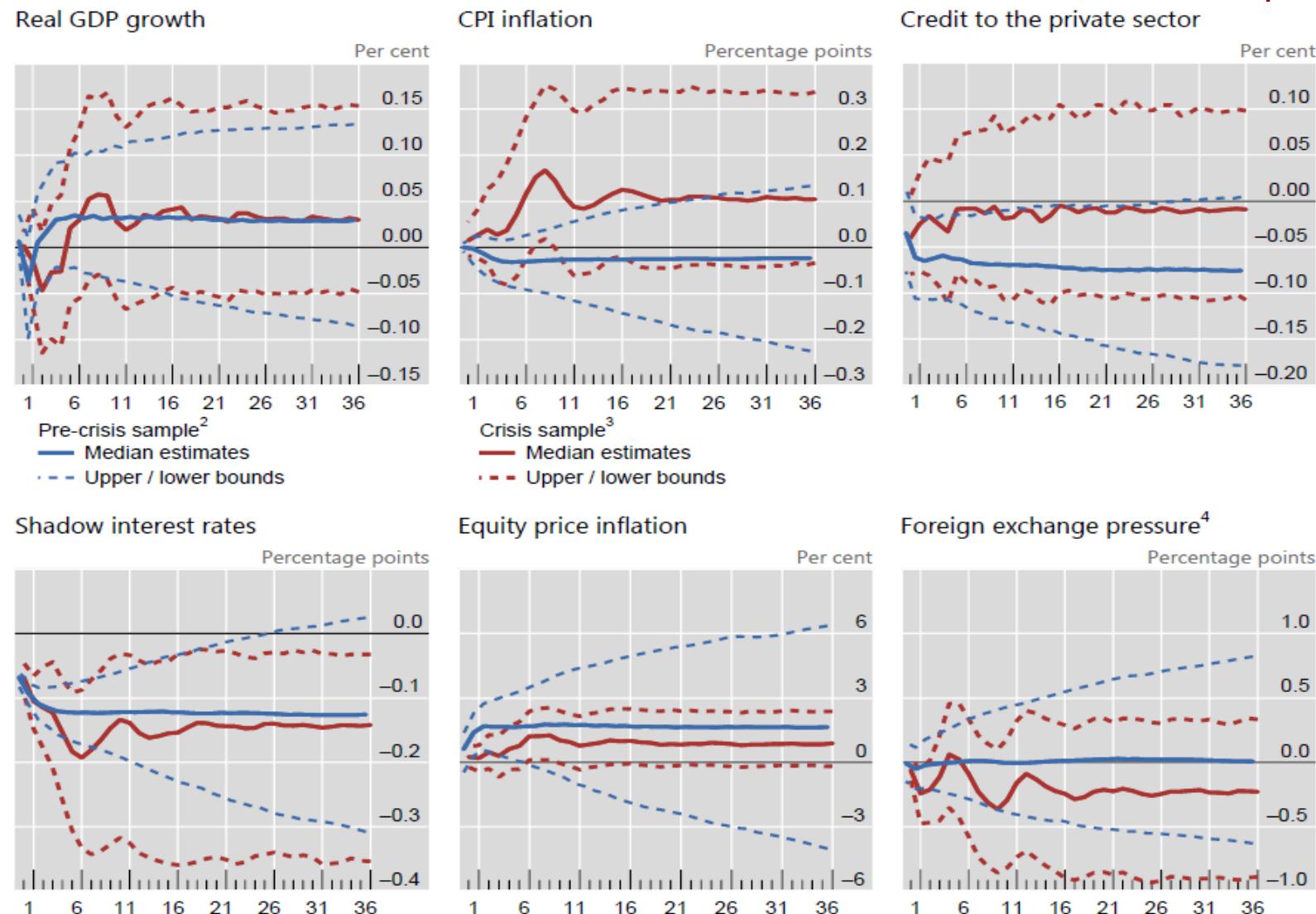


¹ The grey areas indicates the periods of implementation of LSAP1, LSAP2 and MEP plus LSAP3. ² M Lombardi and F Zhu, "Filling the gap: a factor-based shadow rate to gauge monetary policy", forthcoming working paper. ³ J Wu and F Xia, "Measuring the macroeconomic impact of monetary policy at the zero lower bound", working paper. ⁴ L Krippner, "A tractable framework for zero-lower-bound Gaussian term structure models", Reserve Bank of New Zealand discussion paper.



Impulse responses: United States

Reduction in Lombardi-Zhu (2014) US shadow funds rate (6.7 basis points)



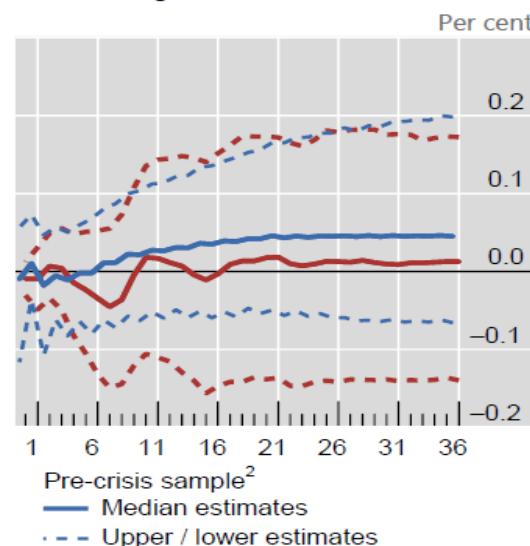
¹ The monetary policy shock is a one-standard deviation (i.e. 6.7 basis points) negative innovation to the US shadow federal funds rate. ² The pre-crisis sample ranges from February 1995 to June 2007. ³ The crisis or post-zero-lower-bound sample ranges from BIS October 2008 to February 2013. ⁴ A rise in the foreign exchange pressure index represents stronger appreciation pressure.



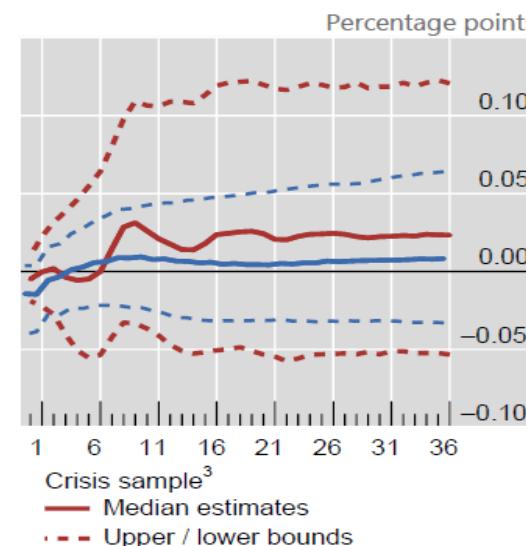
Impulse responses: euro area

Reduction in Lombardi-Zhu (2014) US shadow funds rate (6.7 basis points)

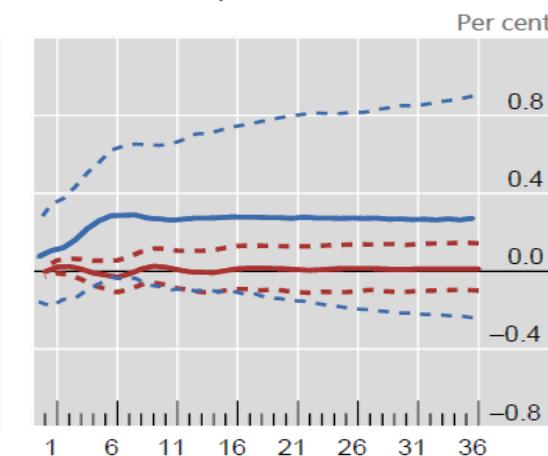
Real GDP growth



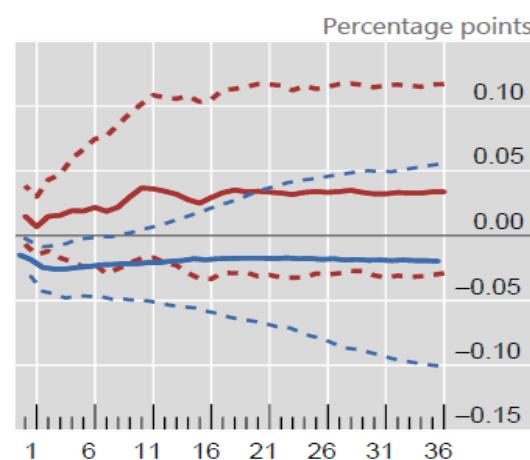
CPI inflation



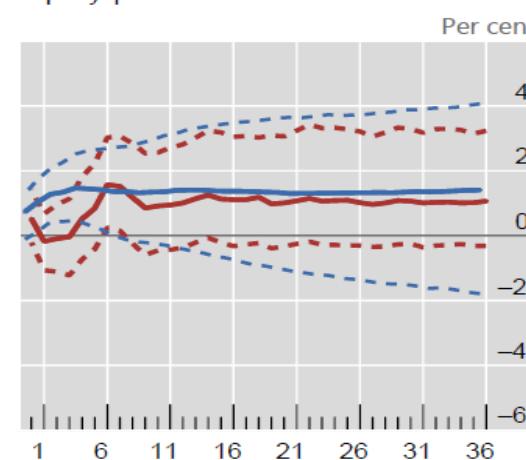
Credit to the private sector



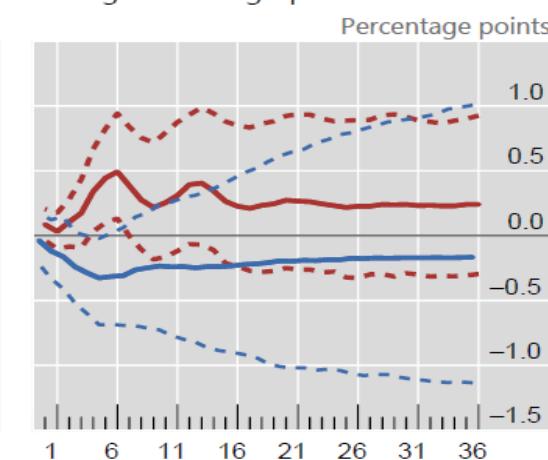
Shadow interest rates



Equity price inflation



Foreign exchange pressure⁴



¹ The monetary policy shock is a one-standard deviation (i.e. 6.7 basis points) negative innovation to the US shadow federal funds rate.

² The pre-crisis sample ranges from February 1995 to June 2007. ³ The crisis or post-zero-lower-bound sample ranges from October 2008 to February 2013. ⁴ A rise in the foreign exchange pressure index represents stronger appreciation pressure.

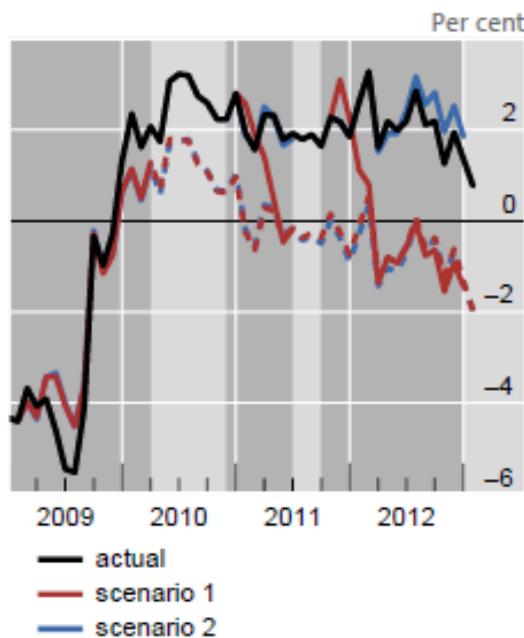


SETTLEMENTS

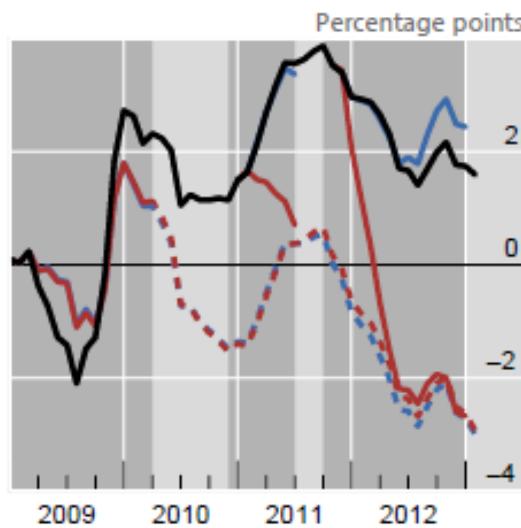
RESTRICTED

Counterfactual (shadow fed funds rate): US

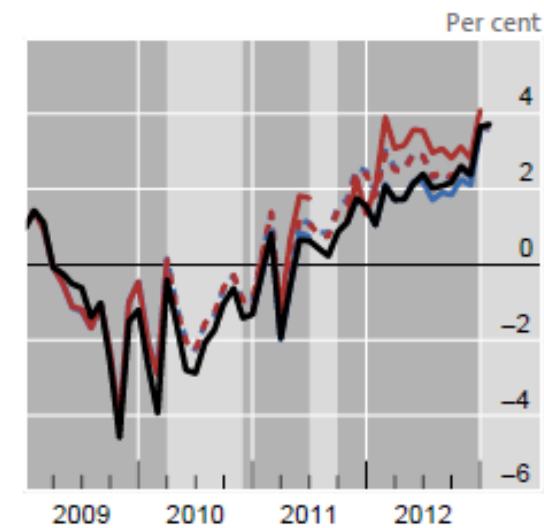
Real GDP growth



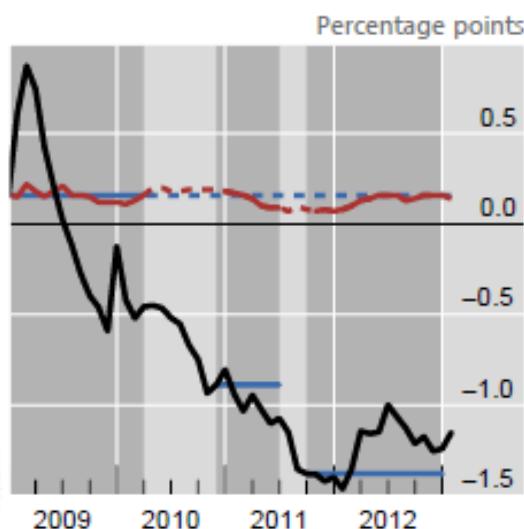
CPI Inflation



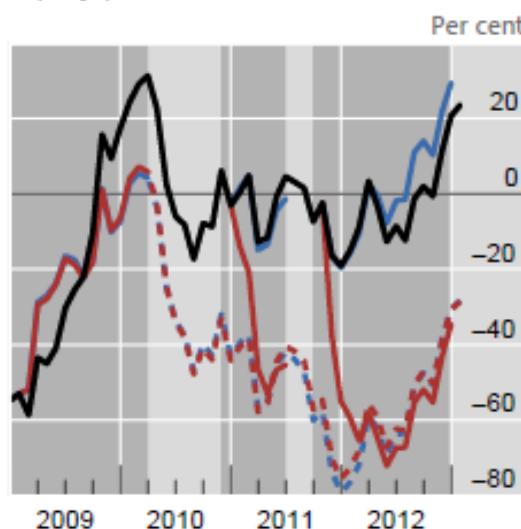
Credit to the private sector



Shadow interest rate



Equity price inflation



Foreign exchange pressure²

