



FEDERAL RESERVE BANK *of* NEW YORK

The Federal Reserve in the 21st Century Implementation and Transmission of Monetary Policy

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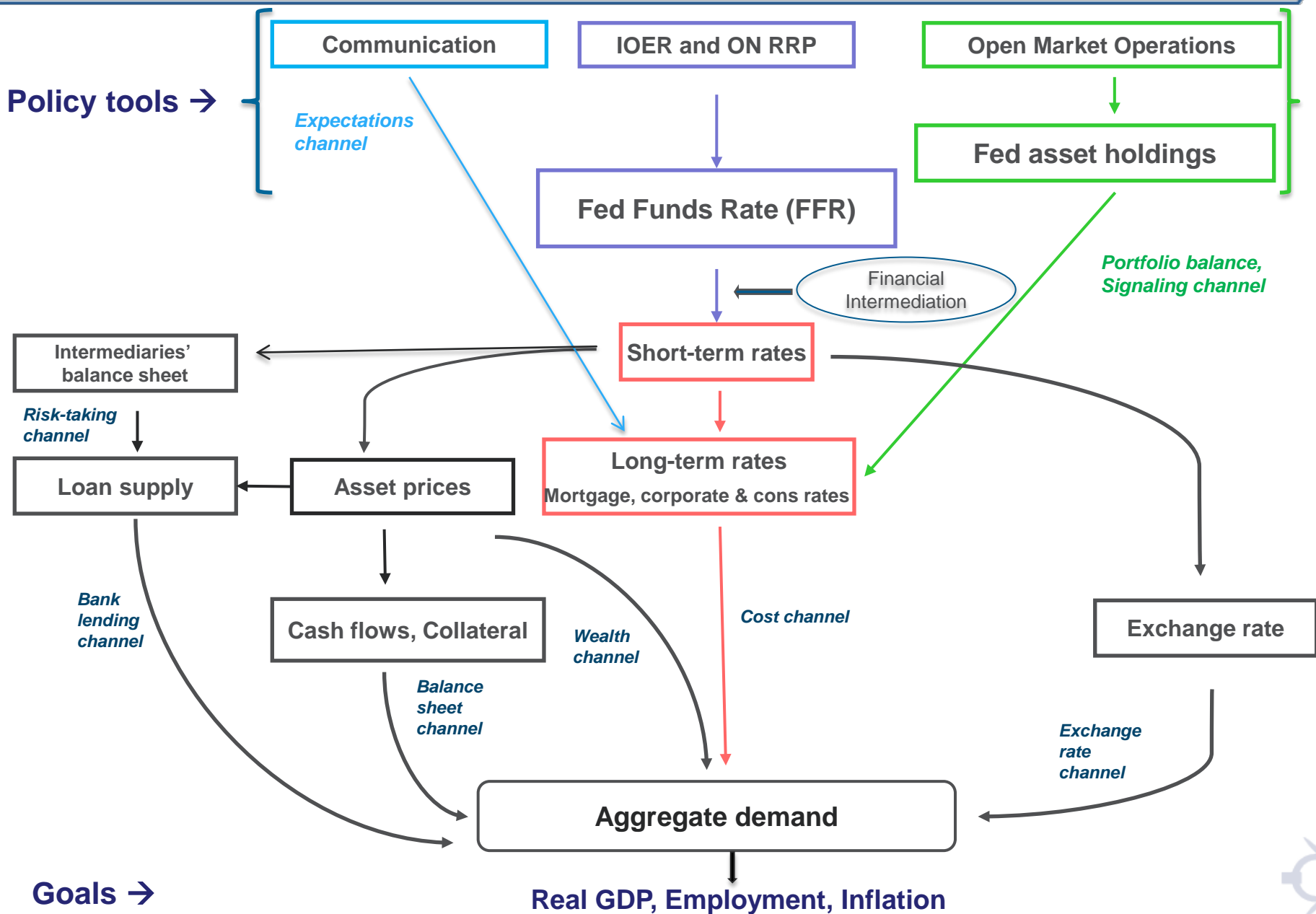
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Bank of New York or The Federal Reserve System*

Monetary Policy

- Strategy*
 - The decision making process
 - How the appropriate stance of policy is chosen
 - Determining the value of intermediate targets to achieve objectives
 - Giving directives for implementation
- Implementation
 - The operating framework
 - What is (are) the operating target(s)
 - What are the *tools* to achieve the operating target(s)
 - Evolution of the operating framework through the crisis to current
- Transmission
 - The *channels* through which monetary policy affects the broader financial conditions, which in turn affect the real economy
 - From the operating targets to the Fed's objectives



At-a-glance: Implementation and Transmission



Understanding Monetary Policy Implementation

First: Some Concepts

■ Reserves

- **Reserves** are deposits that banks hold in their accounts at the Federal Reserve (banks' *assets*, but Fed's *liabilities*)
 - **Reserve requirement ratio** → percentage of their own deposits that banks must hold at the Fed
 - **Excess reserves** → holding of reserve in excess to required reserves

■ Discount Window (DW)

- It's a credit facility administered by Reserve Banks
 - The Fed lends reserves to commercial banks
- It reflects the role of the Fed as “lender of last resort”
 - The lending rate is called **discount rate** (typically set above market rates to reflect a penalty for borrowing directly from the Fed)

■ Federal Funds Market

- An interbank market (largely overnight) where reserves are exchanged, without collateral requirement
 - Other institutions (GSEs and FHLBs) also participate in the FF market



Some Concepts, cont.

▪ **Open Market Operations (OMO)**

- Purchases or sales of government securities on the secondary market
 - Conducted by the NY Fed Desk
 - A *purchase* (sale) adds (drain) reserves to the banking system → its purpose is stimulating (restraining) an expansion of credit
- Repos and Reverse repos are temporary OMO

▪ **Interest on Excess Reserves (IOER)**

- Payment of interest to balances held in their Fed accounts
 - Payable only to depository institutions
- The Fed was authorized to pay interest on bank reserves starting in Oct. 2008

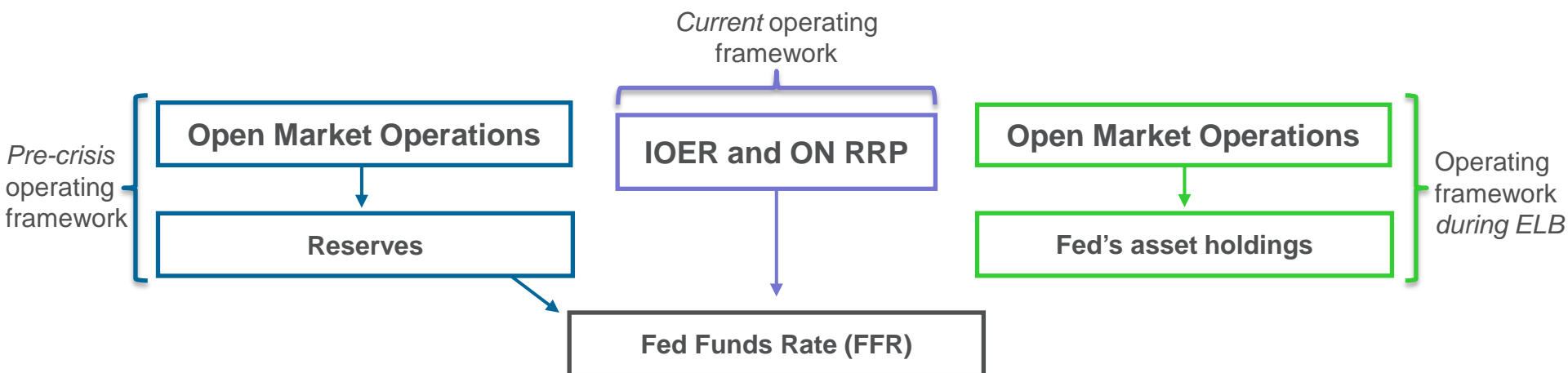
▪ **Term Deposit Facility (TDF)**

- Tool to manage aggregate quantity of reserves
 - Offered by Reserve Banks – funds in TDF are removed from reserve accounts of depository institutions



Evolution of the Operating Framework

- Operating framework: *operating target(s)* and *tools* to achieve them
 - Operating targets: *intermediate objectives* set by monetary policy
 - Need to be effective in influencing flow of credit and broad financial conditions
 - Should be controlled reasonably well by the central bank

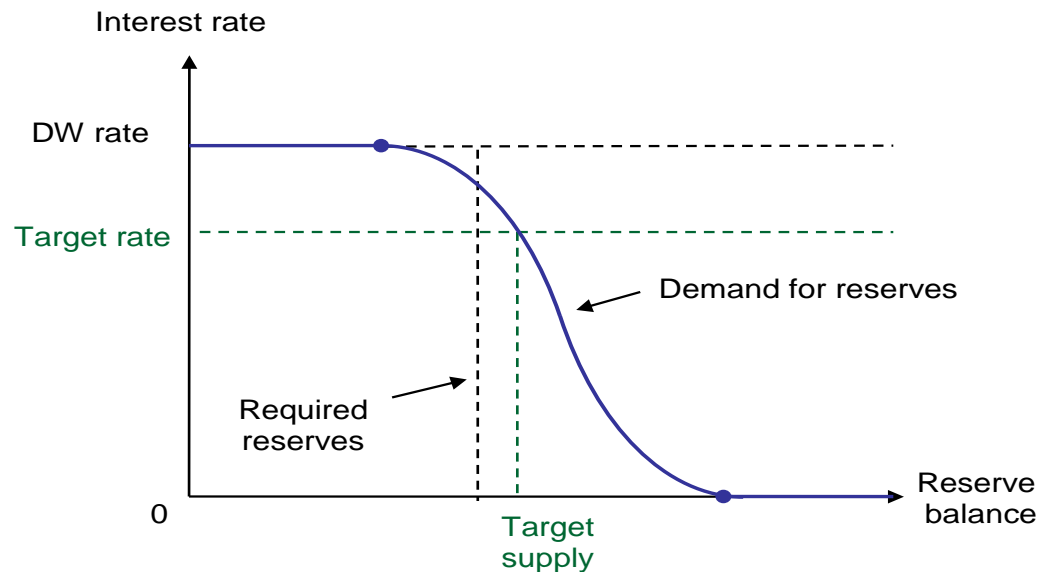


- Pre-crisis framework:** FFR is **operating target**, managed through reserves
- During the ELB (Effective Lower Bound):** **Fed's asset holdings** are an additional operating target
- Current framework:** FFR main **operating target**, managed by IOER & ON RRP

Pre-Crisis Operating Framework

The FFR and the Market for Reserves

- Corridor-like system, unremunerated reserves
 - Demand for reserves (by banks): inversely related to the interest rate
 - Influenced by the reserve requirement
 - DW rate generally prevented FFR from spiking up
 - Supply of reserves (by the Fed): provided to the banking system via OMO
 - OMOs adjust supply of reserves to match the demand at the **target rate**
 - Crucial: scarcity of reserves



Reserve Balances in the Fed's (stylized) Balance Sheet

Assets		Liabilities	
U.S. Treasury securities	790.7	Federal Reserve notes (currency)	776.5
Repurchase agreements (Repos)	18.8	Deposits of depository institutions (Reserve balances)	12.6
Loans to depository institutions (Discount Window loans)	0.2	Other (including capital)	78.6
Other assets	58.0		
<i>Total assets</i>	<i>867.7</i>	<i>Total liabilities</i>	<i>867.7</i>

Impact of OMOs on the Fed's Balance Sheet

Assets		Liabilities	
U.S. Treasury securities	790.7 +10	Federal Reserve notes (currency)	776.5
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Impact of OMOs on the Fed's Balance Sheet

Assets		Liabilities	
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Repurchase agreements (Repos)	18.8	Deposits of depository institutions (Reserve balances)	22.6
Loans to depository institutions (Discount Window loans)	0.2	Other (including capital)	78.6
Other assets	58.0		
<i>Total assets</i>	<i>877.7</i>	<i>Total liabilities</i>	<i>877.7</i>

Monetary Policy Response to the Financial Crisis

To alleviate problems in credit markets and stimulate the economy, in turn:

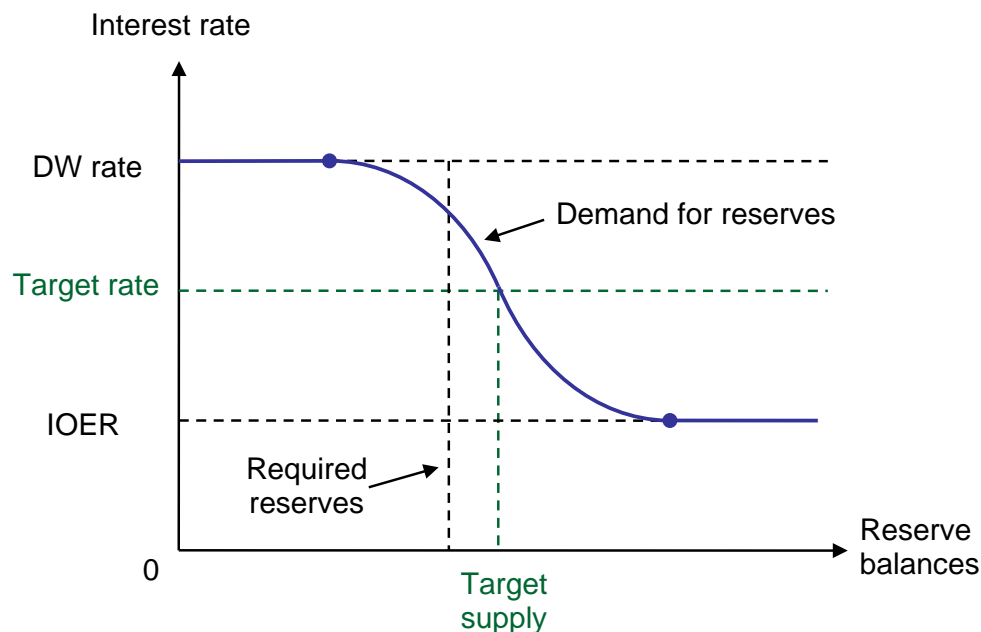
- Traditional monetary policy
 - Progressive reduction of the FFR target → from 5¼ percent to effective zero
 - FFR target set at 0 to ¼ percent (ELB) in Dec 2008
- Liquidity provision
 - Increases in loans and lengthening of term of loans
 - Provision of liquidity to *commercial banks* and *primary dealers* (TAF, TSLF, PDCF), then to other market participants (CPFF, AMLF, TALF)
 - Opening of *currency swap lines* (address dollar borrowing costs overseas)
- Accelerated plans to pay interest on reserves (IOER)
- Asset purchase programs
 - *Agency debt, Agency MBS, long-term Treasuries*

➤ Consequences?

- The size of the balance sheet increases → large amount of reserves are created
- With abundant reserves → traditional operating framework no longer works

What is the Interest On Excess Reserves (IOER)?

- **IOER** is interest on the balances that the banks hold in their account at the Fed
 - Authority to pay IOER to banks granted to the Fed in 2008
- IOER represents a risk-free overnight rate → should put a ‘floor’ on rates
 - It’s opportunity cost of holding reserves vs. alternative assets
 - There should be no incentive to lend below IOER rate
- With scarce reserves, supply and demand would determine equilibrium rate



The ELB Changed the Operating Framework

- At the ELB, two type of policies to affect financial conditions
 - **Balance sheet policy** (LSAPs, aka QE)
 - Changes in size and composition of the Fed's asset holdings
 - How it works***
 - Reduces *long-term rates* by reducing term premia
 - Supports commitment to extended period of low rates
 - As a byproduct, reserves increase --> reduced control of the FFR
 - **Forward guidance** on the future path of the FFR
 - FOMC set expected time/conditions for liftoff and path afterwards
 - How it works***
 - Expected low path of short term rates puts downward pressure on longer-term interest rates and makes financial conditions more accommodative.



The Fed's Balance Sheet Policy

Variety of asset purchase programs implemented since 2008

▪ Large-Scale Asset Purchases (LSAPs) I and II

- Purchases of Agency MBS and Agency Debt (Nov 2008)
 - Purchases of long-term Treasury securities (Mar 2009; Nov 2010)
 - Predetermined *total amounts*, purchased over a period of months
- **increase size and composition of the balance sheet**

▪ Maturity Extension Program (MEP)

- Purchase of long-term Treasury securities and sale of an *equal amount* of short-term Treasury securities (Sept 2011-Dec 2012)
- **changes only the maturity composition of the balance sheet**

▪ LSAP III: outcome-based program

- Purchase of agency MBS (Sep 2012) and long-term Treasuries (Jan 2013)
 - Fixed amount *per month*, until set objectives are reached
 - Incremental reduction in the pace of purchases (“tapering”) from Jan 2014
 - Purchases ended in Oct 2014

→ **increases size and composition of the balance sheet**

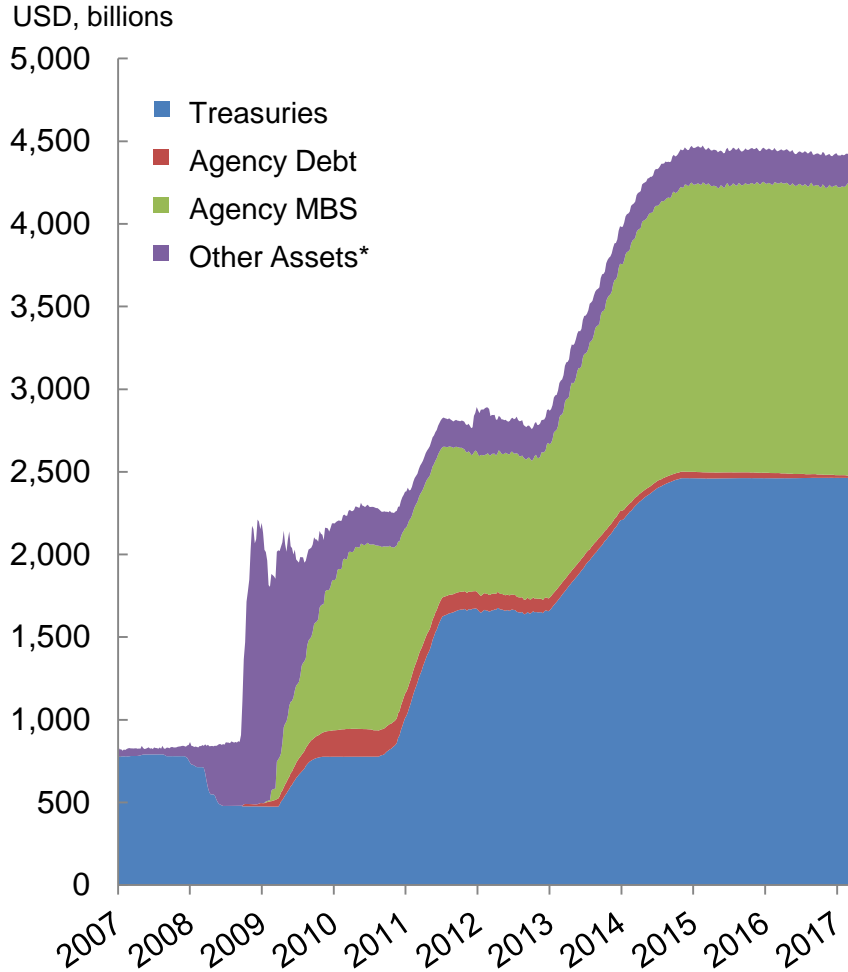


Impact of LSAPs on the Fed's Balance Sheet

Assets		Liabilities	
Securities held outright		Federal Reserve notes (currency)	1,484
U.S. Treasury Securities	2,464		
Agency Debt & MBS	1,784	Deposits of depository institutions (Reserve Balances)	2,460
Repurchase agreements (Repos)	0	Reverse Repos	477
Loans to depository institutions	0.01	Other	8
Other assets	222		
<i>Total assets</i>	<i>4,470</i>	<i>Total liabilities</i>	<i>4,470</i>

Evolution of the Federal Reserve's Balance Sheet

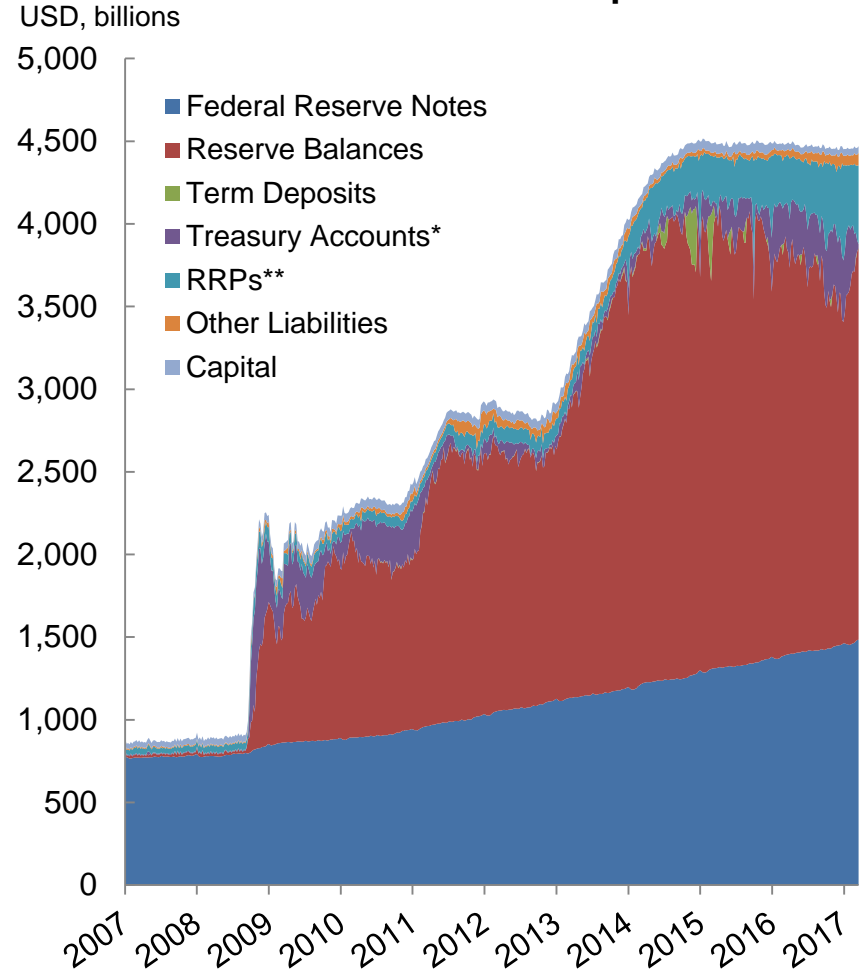
Assets



* Includes DW, crisis facilities, central bank liquidity swaps, foreign portfolio, and unamortized premiums and discounts.

Source: Federal Reserve Board H.4.1, March 16, 2017 Release

Liabilities and Capital



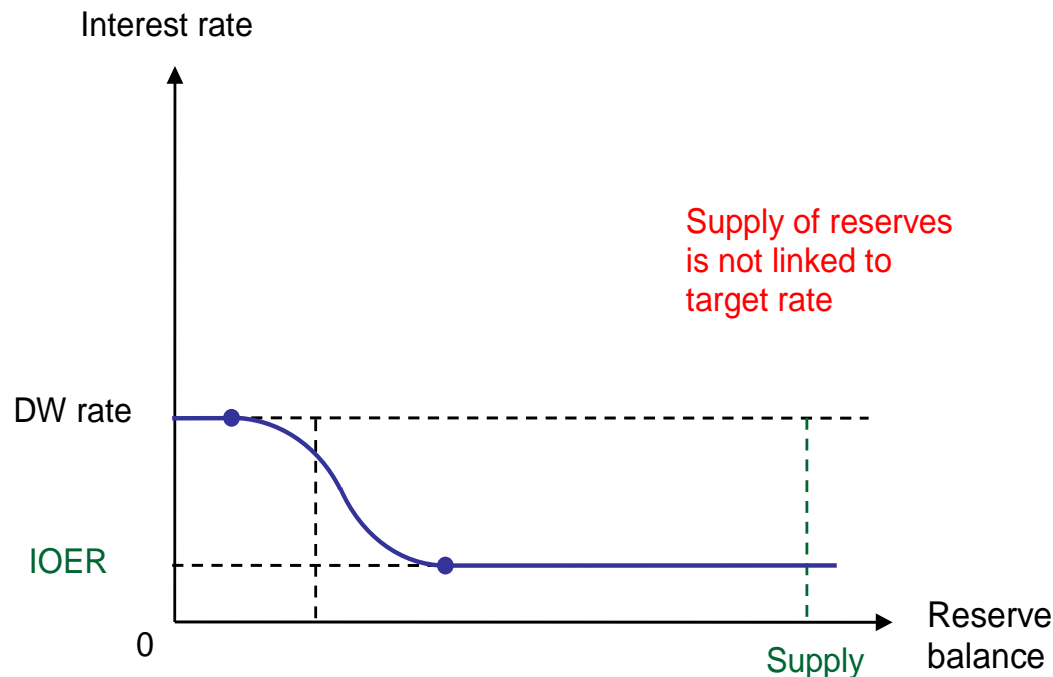
* Includes Treasury General Account and Supplementary Financing Account.

** Includes Foreign Repo Pool and RRP open market operations.



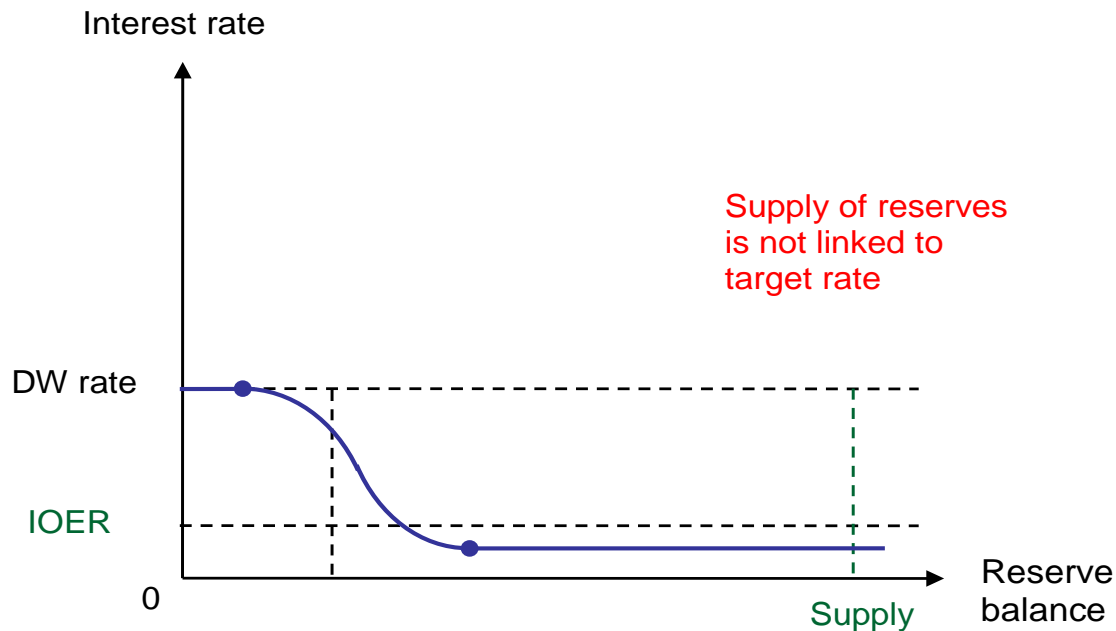
Impact of Large Amount of Reserves on FF Market

- With large amount of reserves
 - No more need to forecast reserve demand and adjust accordingly the supply
 - Small adjustments of reserves via OMO, as in pre-crisis framework, would not impact the federal funds rate
- With abundant reserves, the IOER could be used to control the target rate



A “leaky” floor

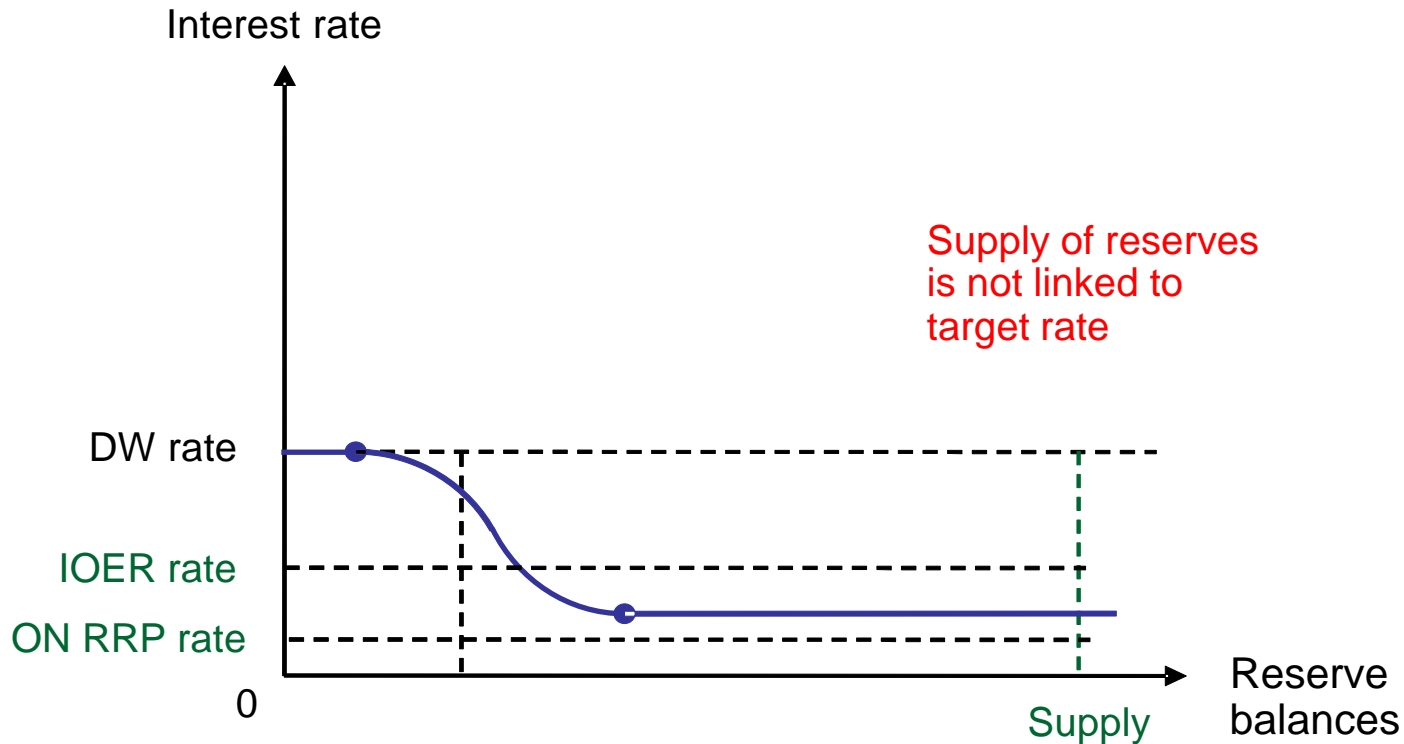
- IOER should set a floor beneath interbank rates
 - If banks can earn 1% leaving money in their Fed account, they won't have an incentive to lend it out below that rate
- However, some institutions (GSEs and FHLBs) can trade in the FF market but cannot earn interest on reserves
 - Hence they have an incentive to lend reserves at a lower rate than the IOER
 - Interbank trades occur at rates above IOER but non-bank to bank trades occur at rates below IOER



Addressing the 'leaky' floor problem

OverNight Reverse Repos (ON RRP)

- Temporary exchange of cash for Treasury securities held by the Fed
- Engages a wide range of counterparties (MMFs, GSEs, PDs, banks)
 - Supports a floor under rates



Towards a New Operating Framework

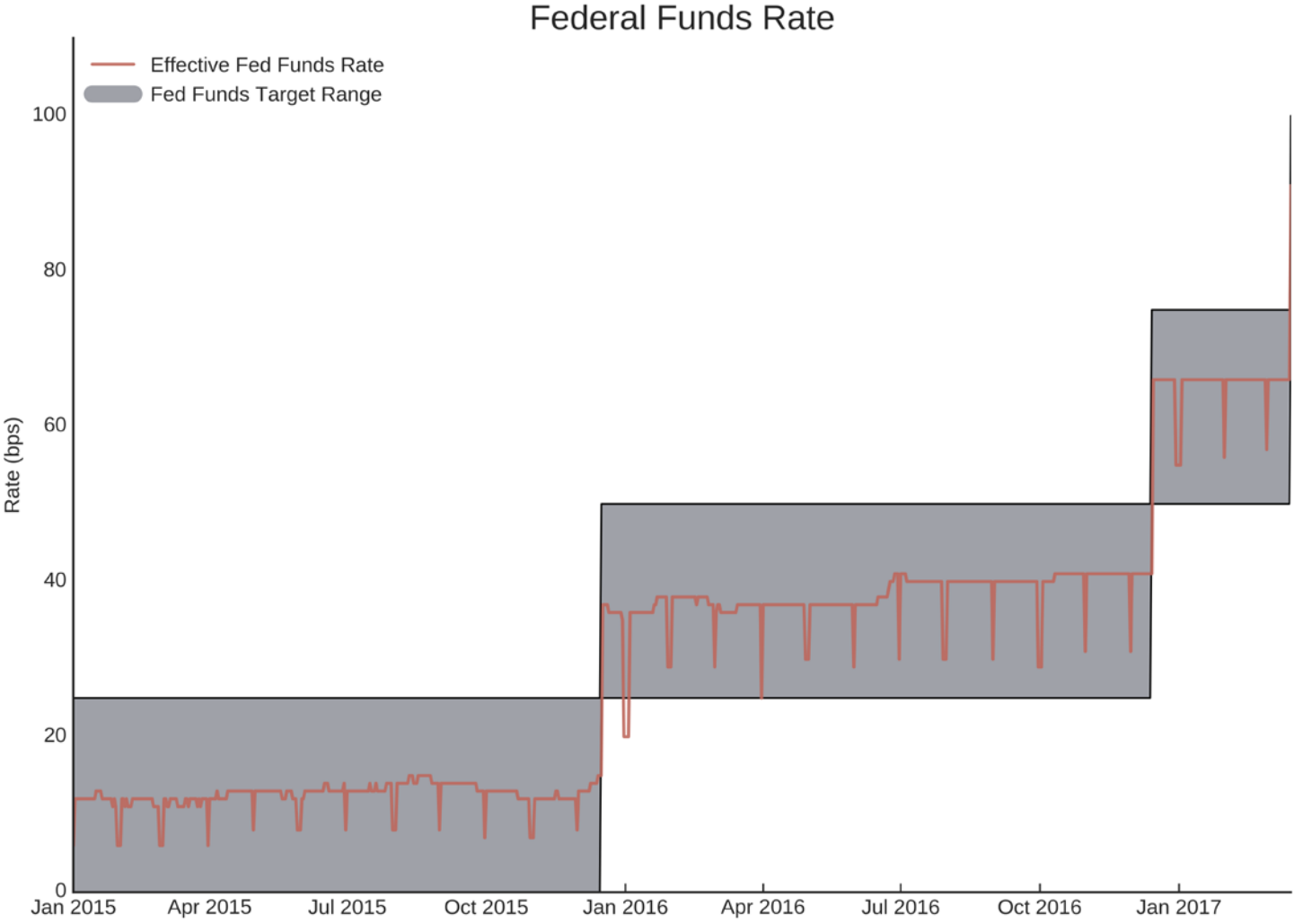
Policy Normalization Principles and Plans (September 16, 2014)

- During normalization: **FFR primary operating target**
 - IOER: “the Federal Reserve intends to move the federal funds rate into the target range set by the FOMC *primarily* by adjusting the **interest rate it pays on excess reserve balances**.”
 - ON RRP: “the Federal Reserve intends to use an **overnight reverse repurchase agreement facility** and other *supplementary* tools as needed to help control the federal funds rate. The Committee will use an overnight reverse repurchase agreement facility only to the extent necessary and will phase it out when it is no longer needed to help control the federal funds rate.”
- During normalization: **Balance sheet policy**
 - No active balance sheet policy: “The Committee expects to cease or commence phasing out reinvestments after it begins increasing the target range for the federal funds rate.”
 - No sizeable sales of MBS expected: “The Committee currently does not anticipate selling agency mortgage-backed securities as part of the normalization process.”

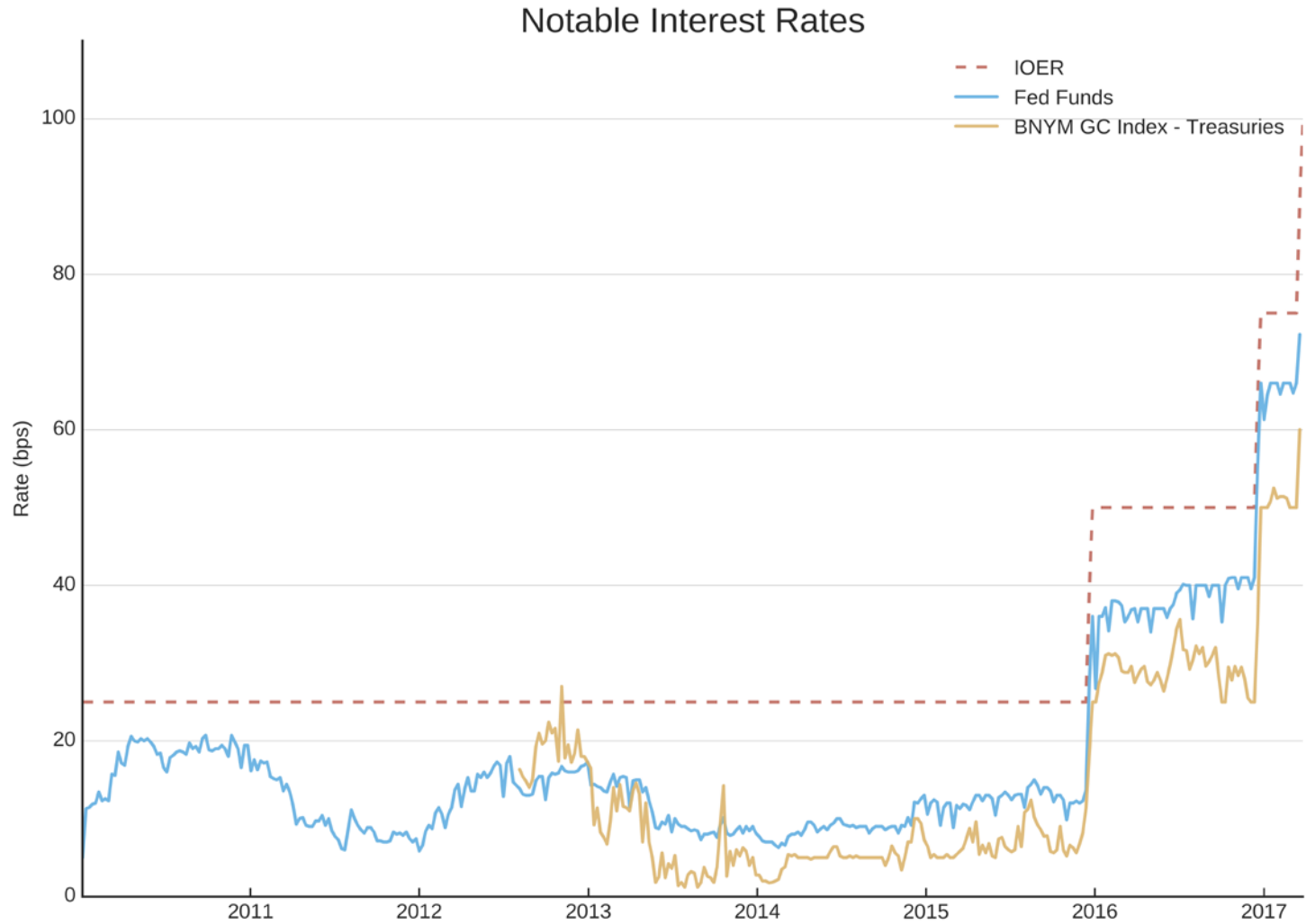
Lift-off and Current Stance

- FOMC raised target range for the first time (lift-off) on December 16, 2015 to a range of $\frac{1}{4}$ to $\frac{1}{2}$ percent
- Range raised again on December 2016 and March 2017
- FOMC post-meeting communication
 - Statement
 - Announces the FOMC decision about the target range for the FFR (target range currently at $\frac{3}{4}$ to 1 percent)
 - Implementation Note
 - Announces Board of Governors' decision about the level of the IOER (currently 1.00 percent)
 - Gives the FOMC directives to the Desk to conduct OMO, including ON RRP, as necessary to maintain the federal funds rate in the set target range
 - Announces Board's decision about requests submitted by regional Feds about the discount rate (currently 1.50 percent)

Effective Fed Funds Rate Is Up



Money Market Rates Are Up



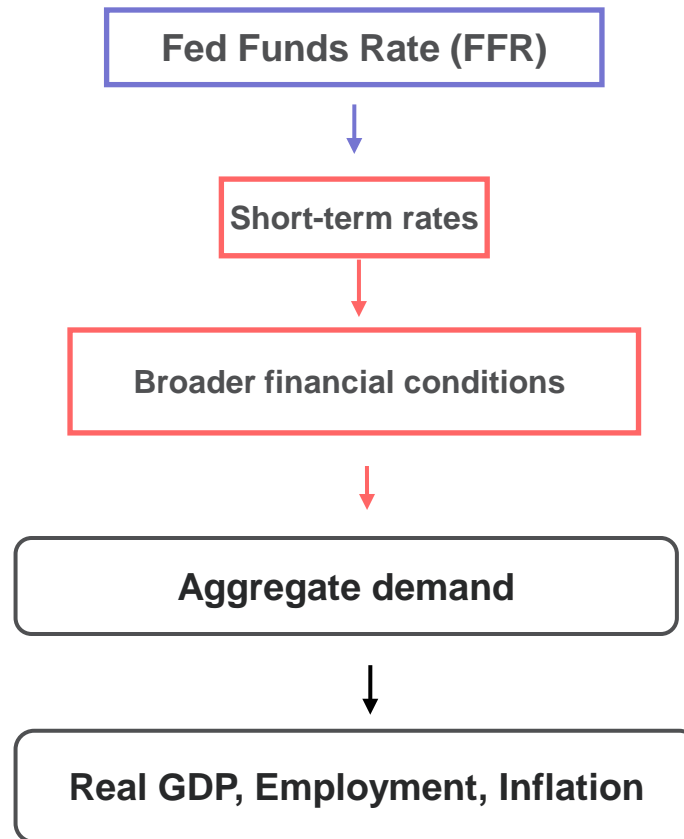
Key Takeaways on Policy Implementation

- Policy implementation **‘pre-crisis’**
 - FFR as operating target
 - OMOs manage the supply of reserve to maintain FFR near target
- Policy implementation **during the crisis (at ELB)**
 - Two operating targets
 - **FFR:** while at ELB, expectations managed via forward guidance
 - **Balance sheet policy:** active management of the asset side
- Policy implementation **during normalization**
 - FFR main operating target
 - Achieved by setting IOER; supported by ON RRP
 - Balance sheet expected to wind down gradually through redemptions and paydowns, once reinvestment is ceased
- **Long-run Framework**
 - Is still under discussion
 - Issues: floor versus corridor, abundant vs scarce reserves

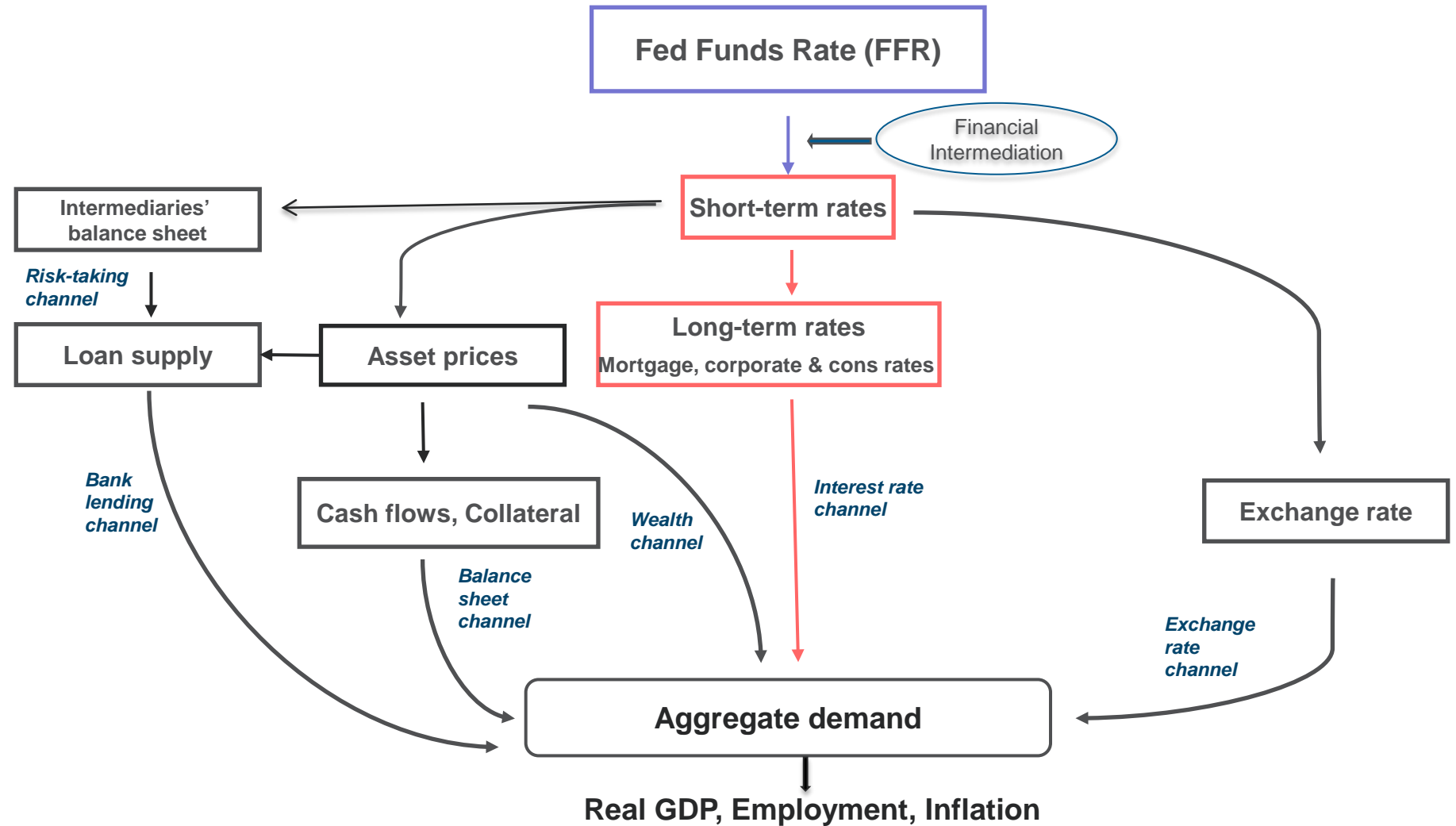
Understanding the Transmission Mechanism

What is the Transmission Mechanism?

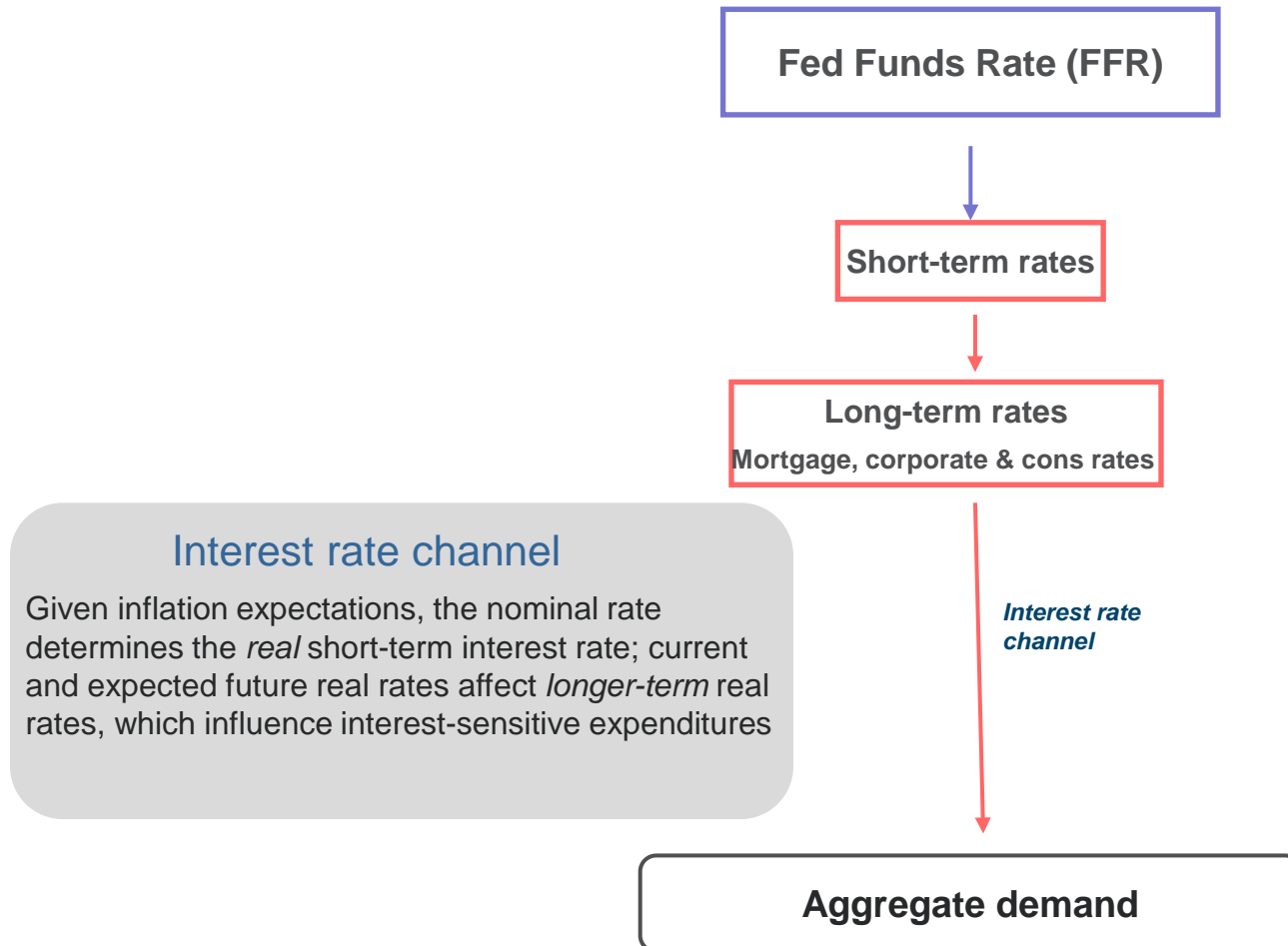
- Intermediate targets have little *direct* impact on aggregate spending
- They work by affecting the broad financial conditions



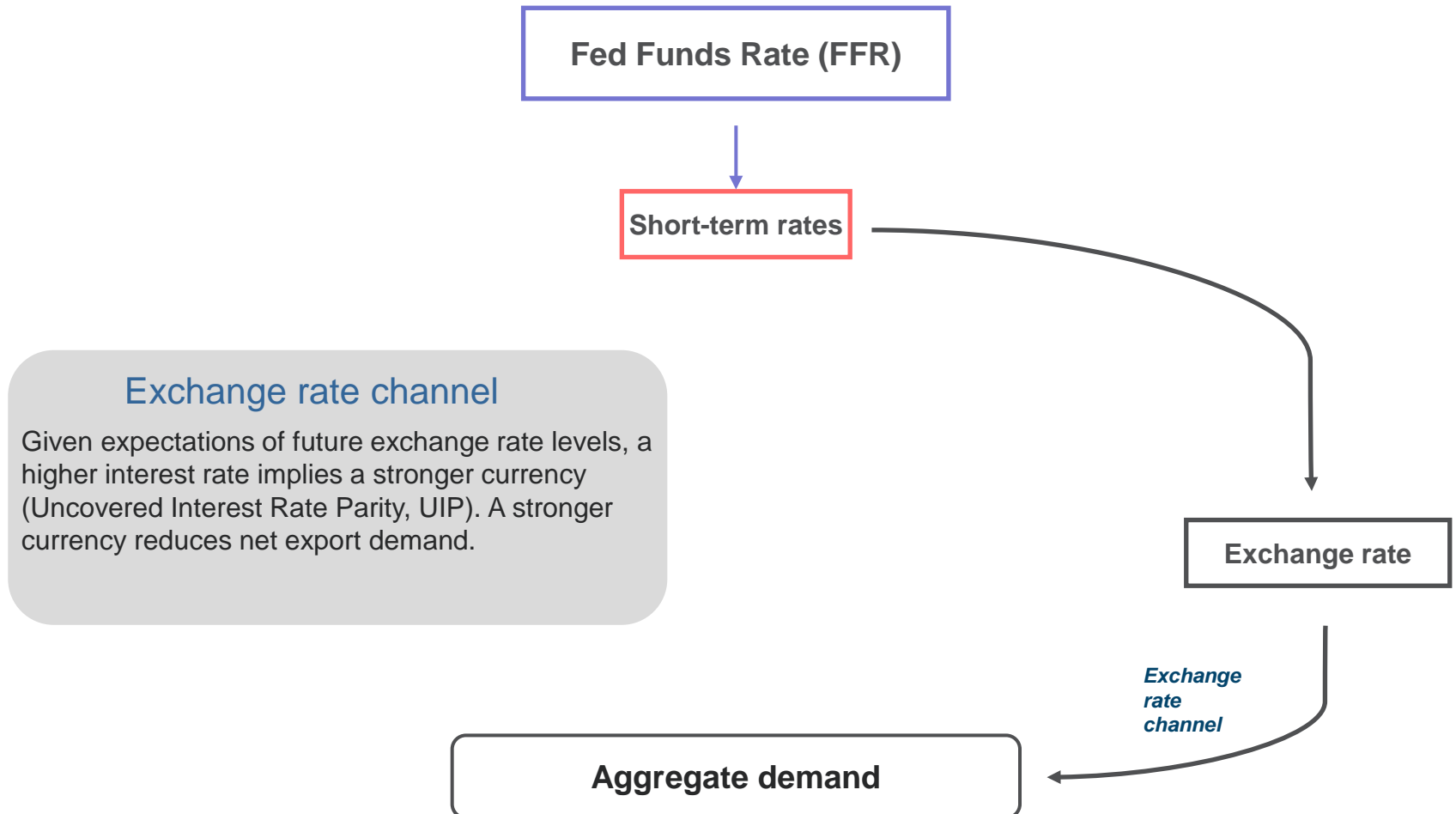
Channels of Monetary Policy Transmission



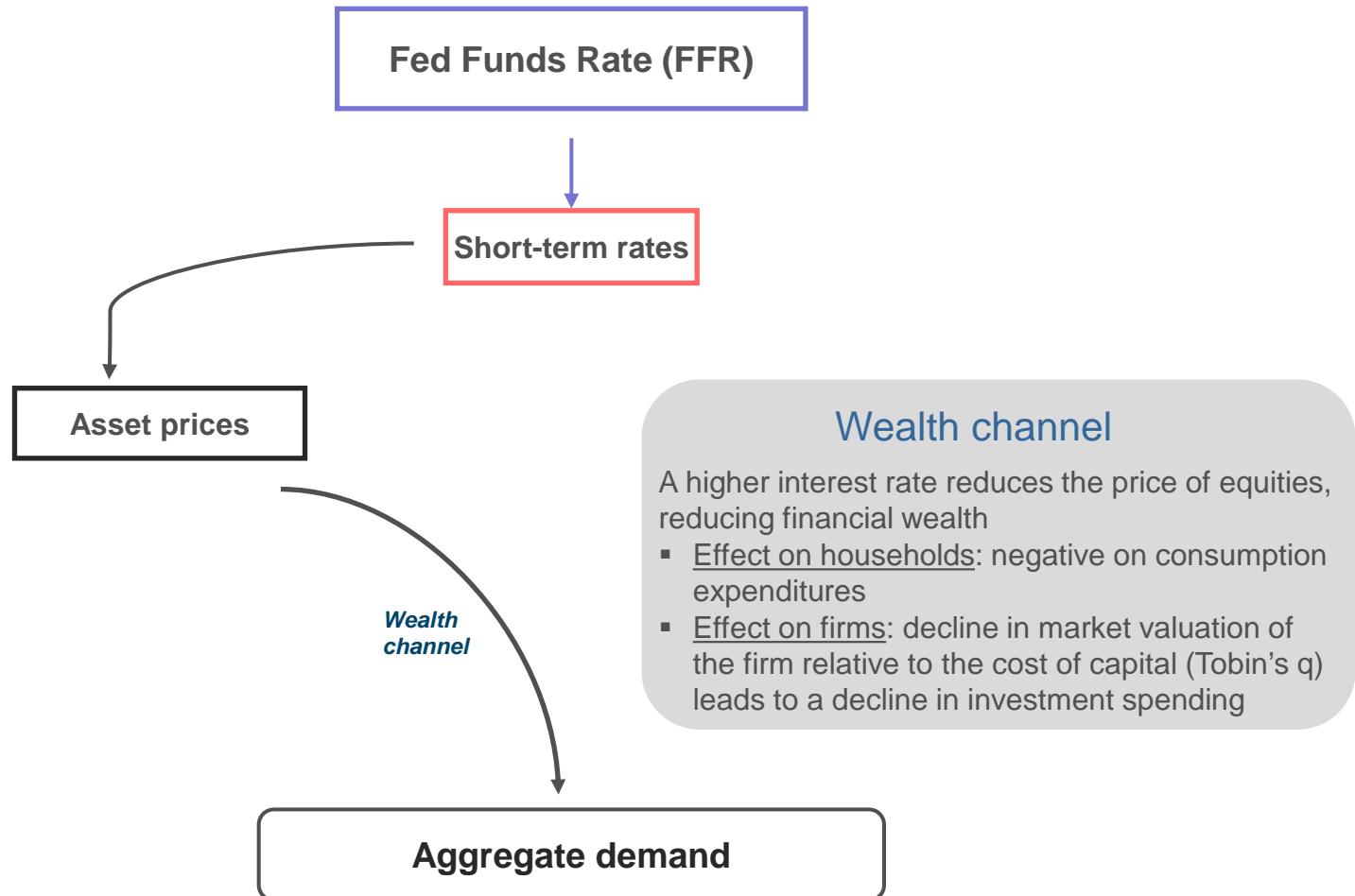
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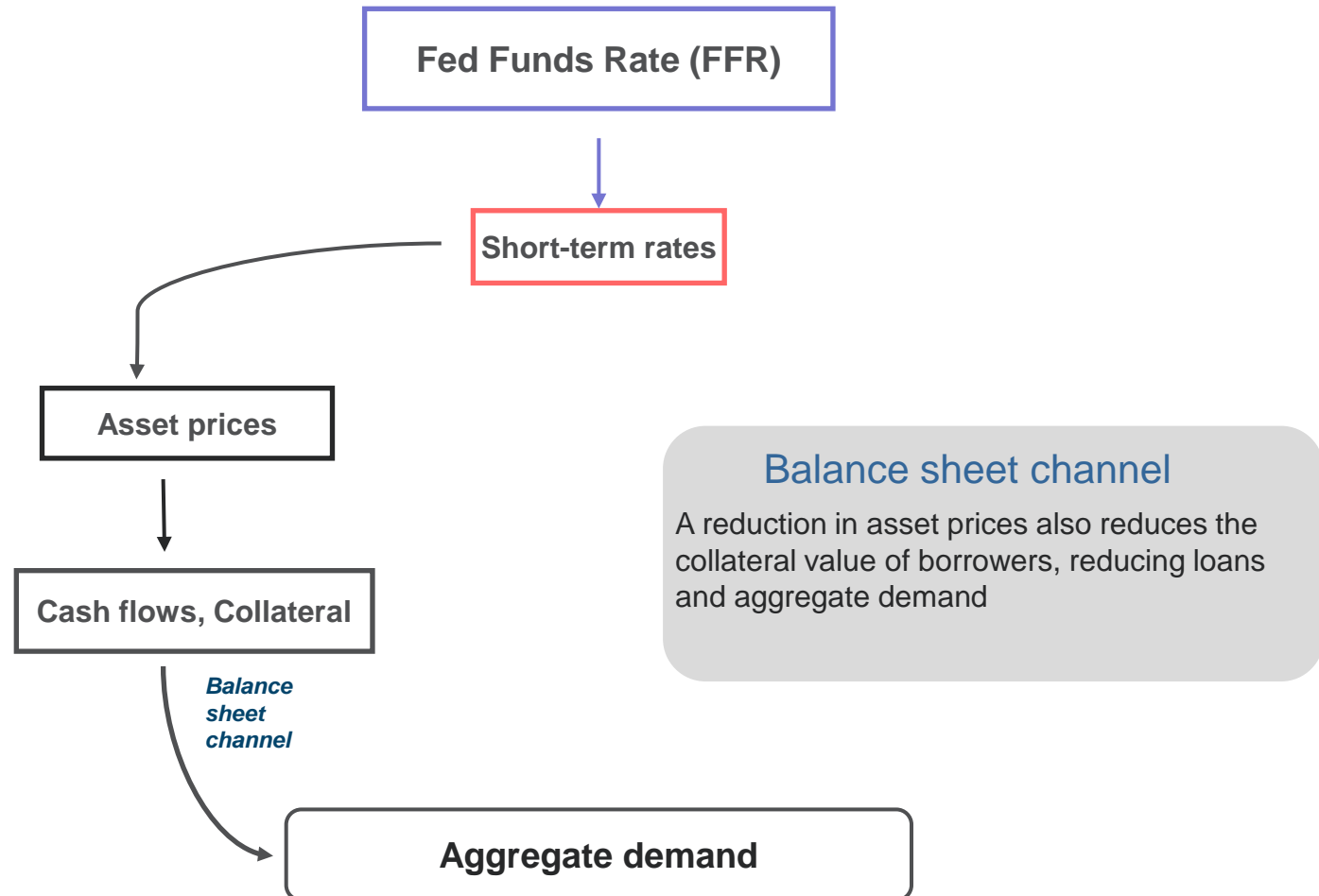
Channels of Monetary Policy Transmission



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Channels of Monetary Policy Transmission



Channels of Monetary Policy Transmission

Fed Funds Rate (FFR)

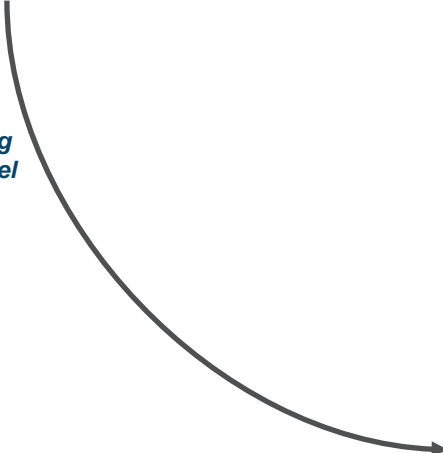


Short-term rates



Loan supply

*Bank
lending
channel*



Aggregate demand

Bank lending channel
A reduction in reserves and/or a higher cost of reserves lead to an inward shift in the supply of bank loans, a decline in loans and a decline in spending by bank-dependent firms and consumers

Channels of Monetary Policy Transmission

Fed Funds Rate (FFR)



Short-term rates

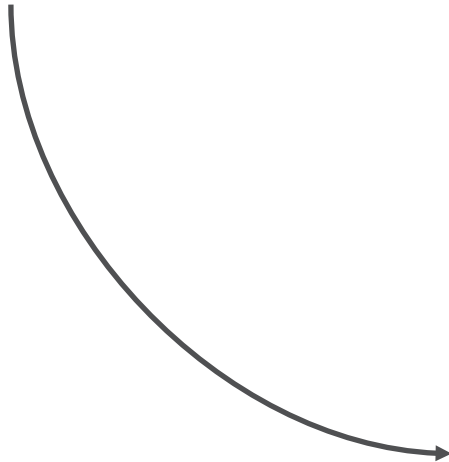


Intermediaries' balance sheet

Risk-taking channel



Loan supply

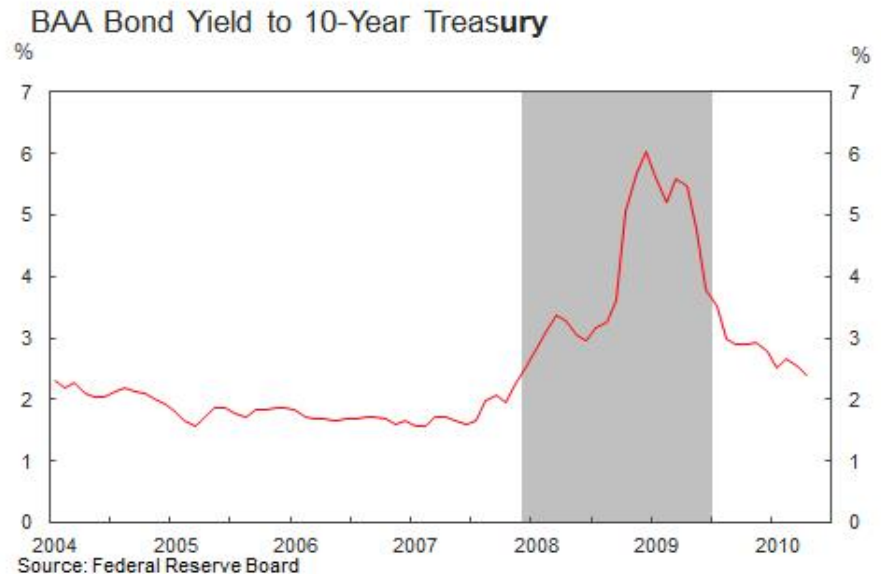
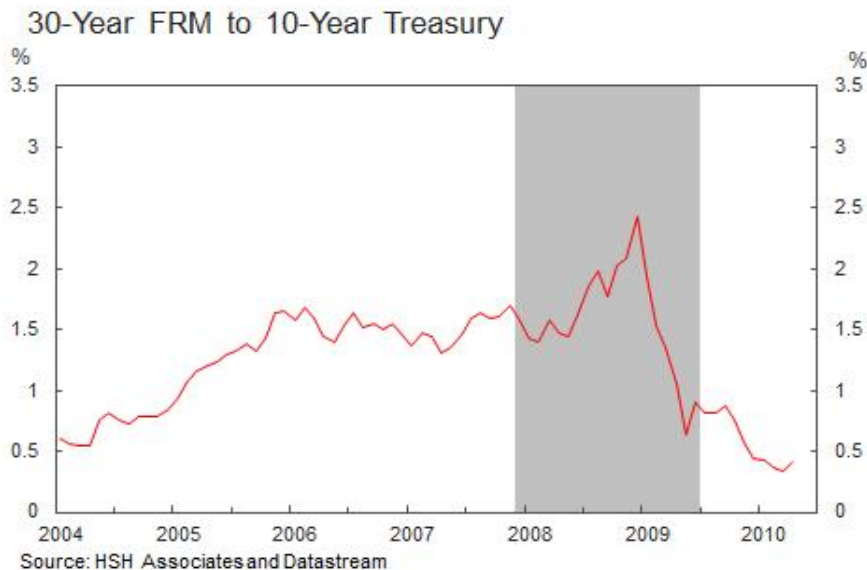
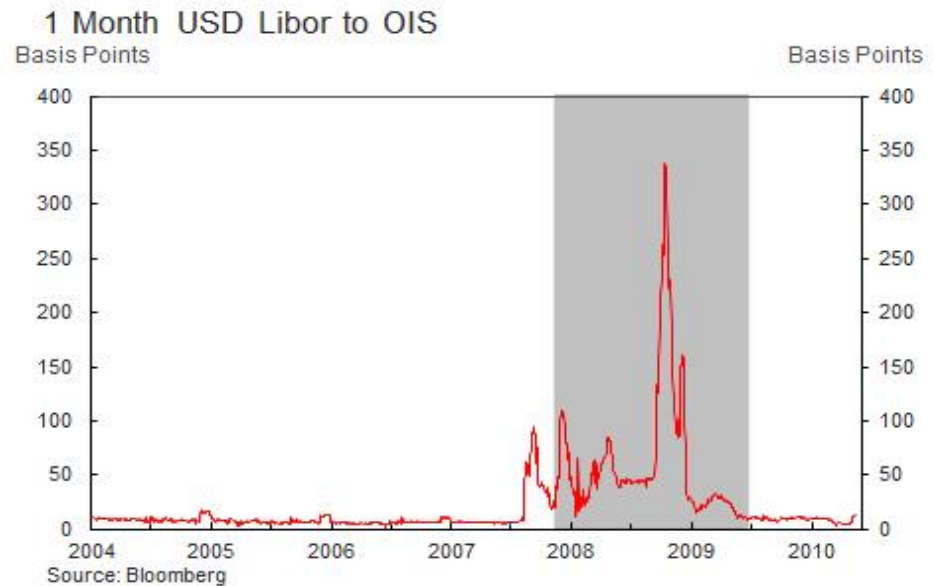
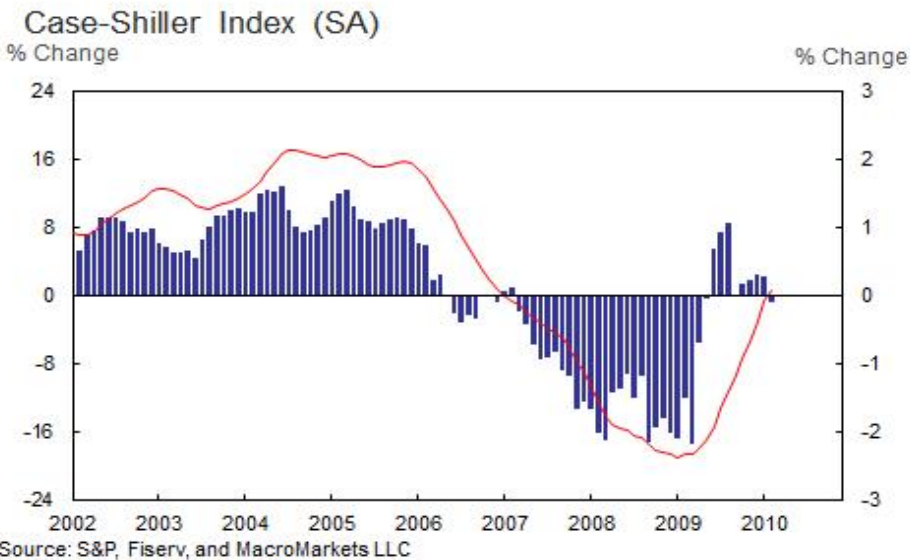


Aggregate demand

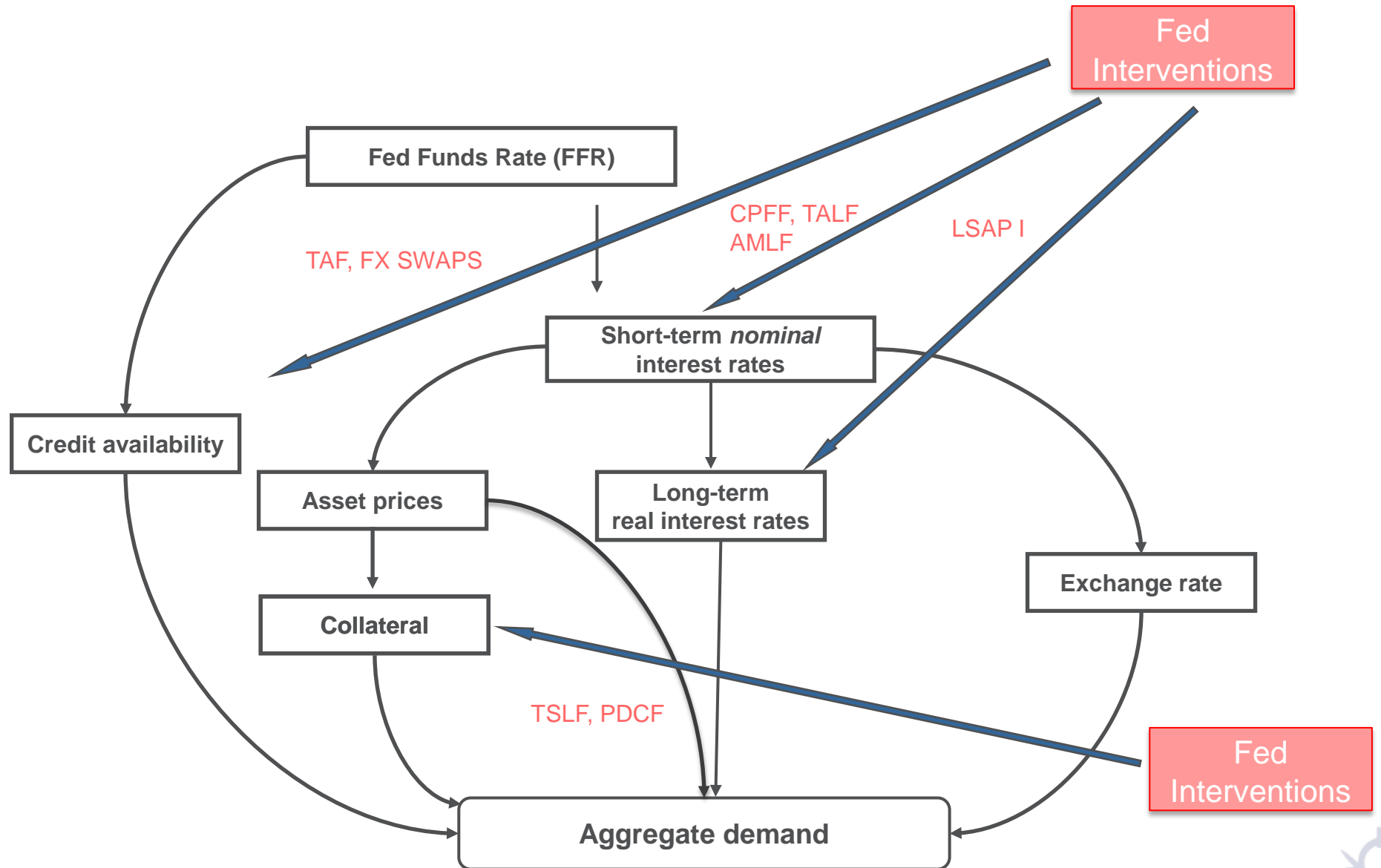
Risk-taking channel

The policy rate directly influences bank profitability and risk appetite:
lower rate → higher risk-taking capacity → higher credit supply
→ reduced risk premia

The Crisis: House Prices ↓ and Spreads ↑



Fed Interventions to Restore Transmission



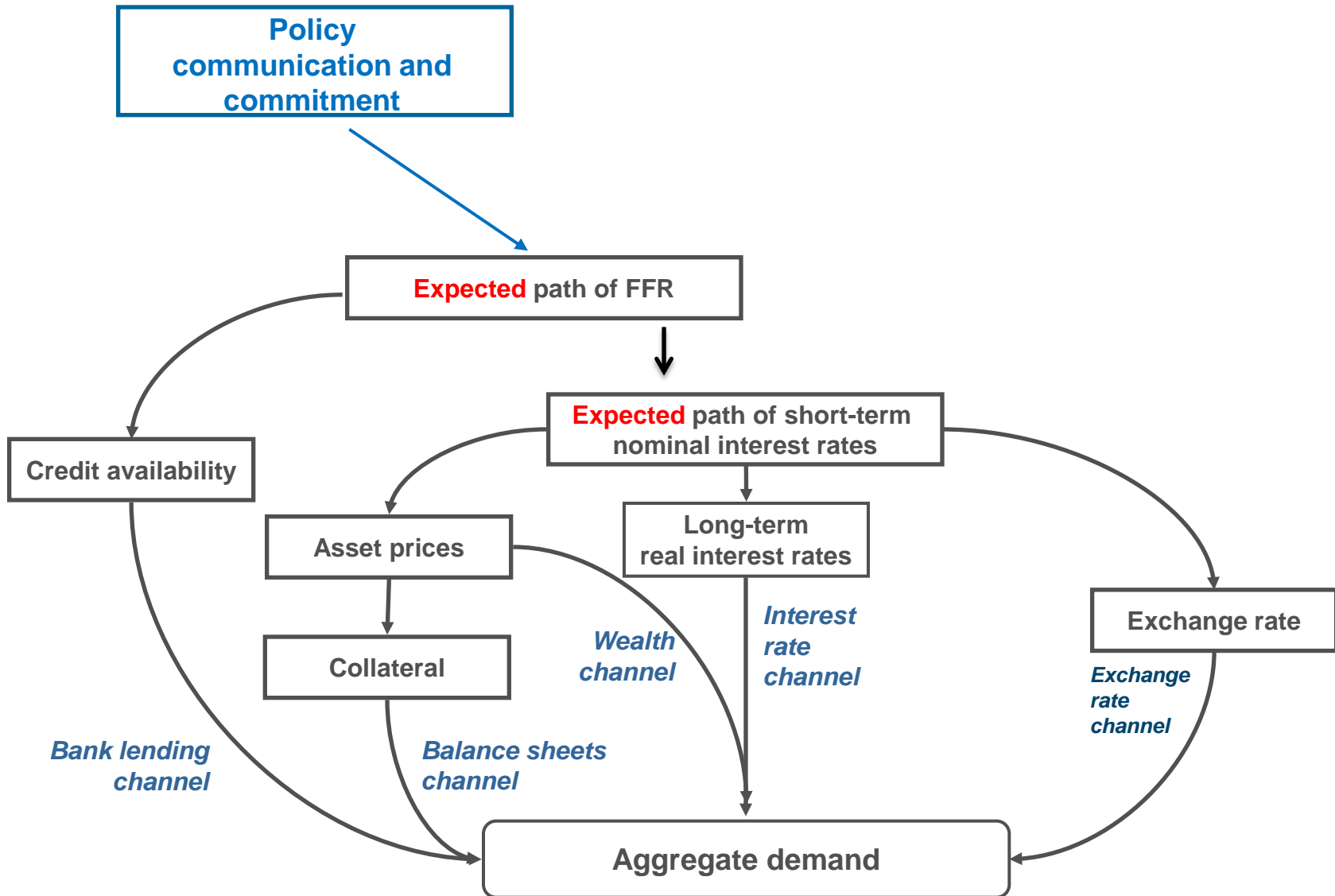
Transmission at ELB: Forward Guidance

❖ How does Forward guidance work?

- At the ELB stimulus cannot be provided by lowering the *current* FFR
- FOMC set expected time/conditions for liftoff and path afterwards
- Monetary transmission works via *expectations* of the future path of the FFR
 - Expected low path of short term rates puts downward pressure on longer-term interest rates and makes financial conditions more accommodative



Forward Guidance



Transmission at ELB: Asset Purchases

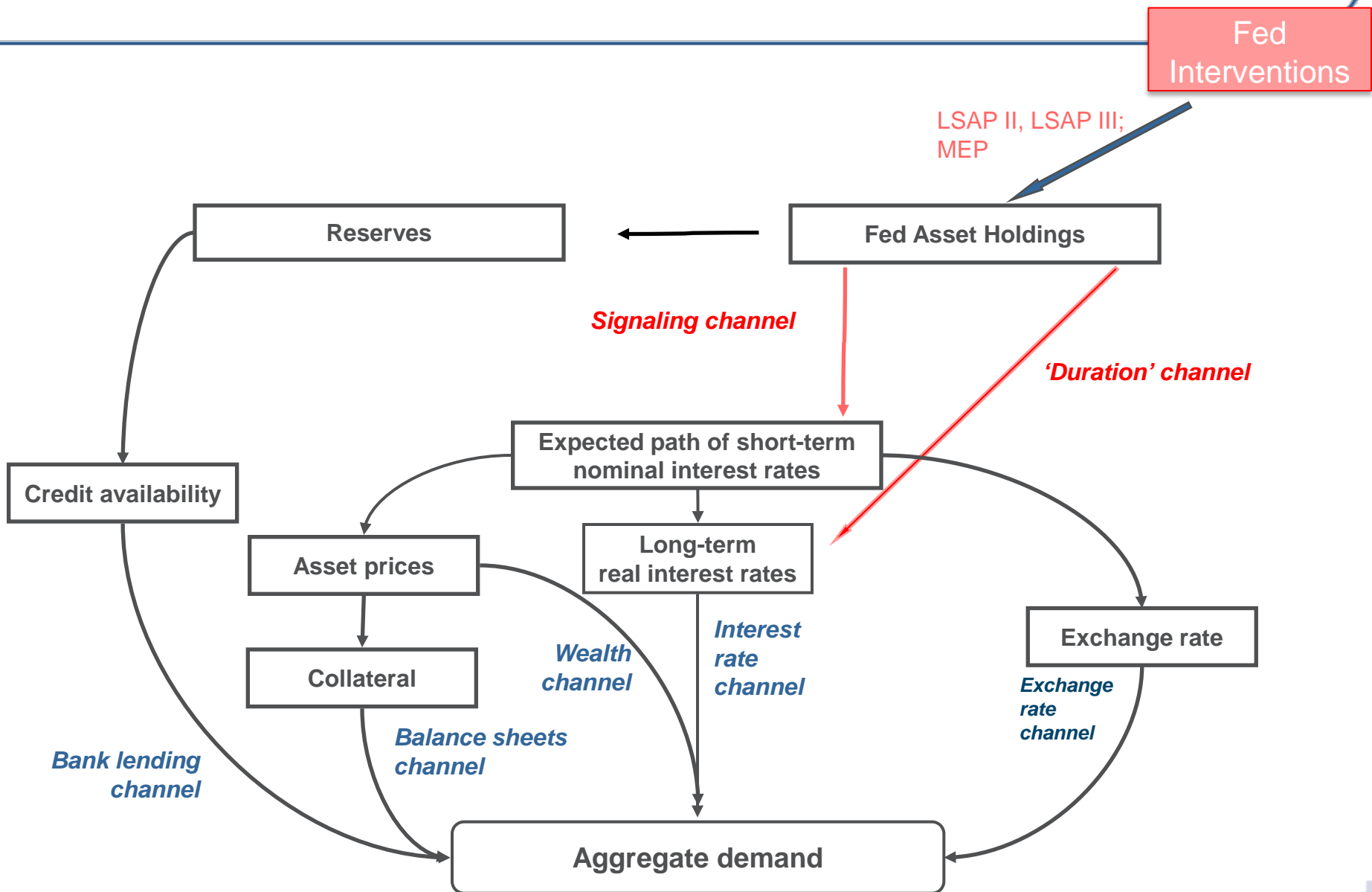
❖ How do asset purchases work?

- **Duration channel** (or term premium effect)
 - Asset purchases work primarily by reducing risk premia
 - Purchases transfer duration risk from the private sector to the central bank's balance sheet.
 - The reduction in risk premia prompts private sector investors to move into riskier assets
 - Financial market conditions ease, supporting wealth and aggregate demand.”

- **Signaling channel**
 - Works through FFR path expectations
 - Purchasing long-term assets serves as a credible commitment to keep interest rates low (as the CB incurs a loss when raising rates)

- **Other channels** (not in the figure)
 - Liquidity channel: by increasing reserves (most liquid asset)
 - Inflation expectations channel: by reducing real rates

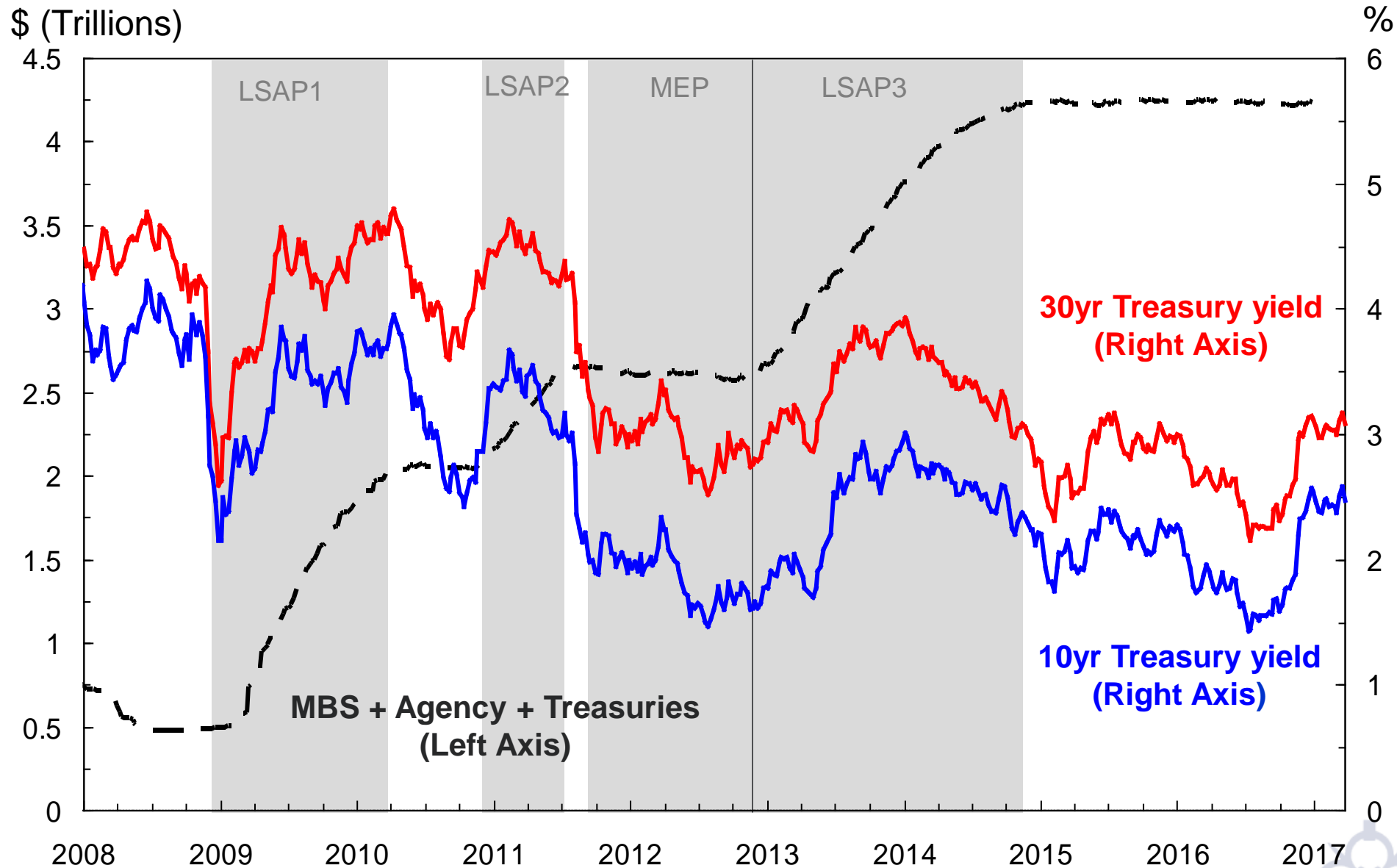
Asset Purchases



Did Asset Purchases Ease Financial Conditions?

- Efficacy of **asset purchases** is difficult to quantify
 - Financial market responses seem consistent with expected effects
 - General downward trend in 10-yr Treasury yield since 2008
 - MBS yields, mortgage rates lower
 - Equity prices up
 - Corporate bond spreads narrower
 - Effects vary across programs and asset classes
 - Treasury purchases appear to affect significantly long-term Treasury rates and highly-rated corporate bonds rates; but affect less low-rated corporate bonds and mortgages
 - MBS purchases appear to have significant effects on mortgage rates
 - Empirical assessments based primarily on ‘announcement effects’
 - event studies focus on narrow windows around the time of announcements to measure changes in a variety of long-term rates
 - Hard to establish ‘causation’ since there may be other concurrent events
 - Market reaction depends on the dynamics of expectations, hard to measure
 - Average estimate: \$100 billion purchases → -5bp in 10-yr Treasury yield

Fed's Securities Holdings, 10y & 30y Treasury Yields

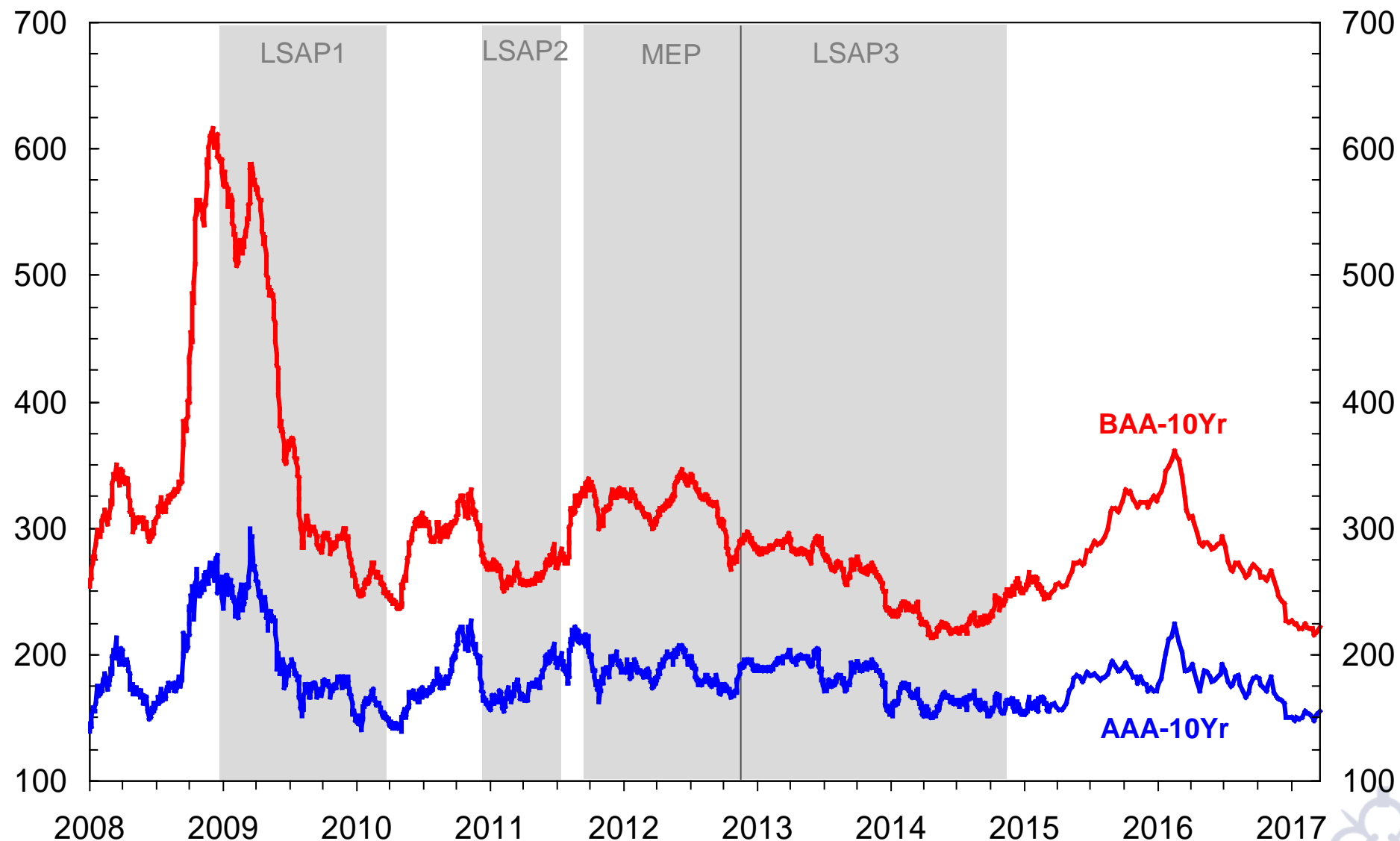


Source: Federal Reserve Bank of St. Louis, Federal Reserve Board, H.4.1 release of March 16, 2017

Corporate Credit Spreads

Basis Points

Basis Points



Source: Federal Reserve Economic Data (FRED)

Selected Estimates of LSAPs' Impact on Yields

Estimated Impact of LSAPs on the 10-Year Treasury Yield

Research Paper	Estimated Decline in 10Yr Treasury Yield (bp)	Impact per \$100Bn (bp)
LSAP1: 12/5/2008 - 3/31/2010		
(\$1.25 Trillion MBS purchases, \$300 Billion Treasury security purchases, \$172 Billion agency debt security purchases)		
D'Amico and King (2013) [Treasury only]	20 to 30	7-10
D'amico et al. (2012) [Treasury only]	35	12
Krishnamurthy and Vissing-Jorgensen (2011)	100	6
Gagnon et al. (2011) [Events] & [Regression]	91 & 36 to 82	5 & 2-5
LSAP2: 11/2/2010 - 6/30/2011		
(\$600 Billion Treasury security purchases)		
D'amico et al. (2012)	55	9
Krishnamurthy and Vissing-Jorgensen (2011)	25	4
Meaning and Zhu (2011)	21	4
Swanson (2011)	15	3
Maturity Extension Program: 10/3/2011 - 12/30/2012		
(\$667 Billion Treasury security purchases, \$667 Billion Treasury security sales/maturities)		
Hamilton and Wu (2012)	22	2
Meaning and Zhu (2012)	17	1
LSAP3: 9/14/2012 - 10/31/2014		
(\$823 Billion MBS purchases, \$790 Billion Treasury security purchases)		
Engen, Laubach, and Reifschneider (2015)	60	4

Did Asset Purchases Improve Economic Conditions?

- Effects of purchases on aggregate demand are harder to assess
 - Simulations from structural models suggest *positive*, but relatively small, macroeconomic effects
 - Economic recovery remained fragile despite large purchases
 - Inflation moving only slowly towards objective
 - Unemployment rate fell faster than expected, particularly after the outcome-based program, but other labor market indicators slower to recover (low job-finding rate, low employment/population ratio, sluggish wages)
 - but counterfactual not observed!
- Some ‘headwinds’ inhibited transmission of LSAPs
 - Contractionary fiscal policy
 - Tighter lending standards/private deleveraging
 - European sovereign debt crisis
 - Low global growth
- Benefits/costs assessment of nontraditional tools still subject to *considerable uncertainty*
- Debate continues over their role when away from the ELB

Some Estimates of LSAPs' Macroeconomic Impact

Macroeconomic Impact

Estimated Impact of LSAPs on Various Macroeconomic Variables

Investigator	Variable of Interest	Assumptions (approx)	Total Effect
Macro Advisers [MA Model]	Real GDP (effect after 8 qtrs)	\$600 Bil LSAP → -20 bp in 10Y Treasury	+ 0.4%
Boston Fed [BF Model]	Real GDP (effect after 8 qtrs)	N/A	+ 0.8%
" "	Unemployment (effect after 8 qtrs)	N/A	- 0.5%
SF Fed [FRBUS]	Real GDP (effect after 8 qtrs)	\$600 Bil LSAP → -20 bp in 10Y Treasury	+ 0.6%
Chan, Curdia and Ferrero [DSGE Model]	Real GDP (effect after 8 qtrs)	\$600 Bil LSAP → -10 to -20 bp in 10Y Treasury	+ 0.1% to + 0.3%
" "	Inflation (effect after 8 qtrs)	" "	+ 0.02% to + 0.05%
Baumeister and Benati [SVAR]	Real GDP growth (effect after 1 qtr)	Shock of 60 bp to Treasury spread	≈ + 3.5%
" "	Inflation (effect after 1 qtr)	" "	≈ + 1.0%
Board staff's study: Chung et al (2012) [FRB/US model]	Unemployment	\$600 Bil LSAP	- 0.25 %

Key Takeaways on Policy Transmission

- Monetary policy affects the economy by influencing broad financial conditions
 - Operating targets affect the *structure* of nominal interest rates and other financial prices
 - These in turn affect the economy through a variety of channels, involving movements in long-term interest rates, the exchange rate, asset prices and changes in the broad supply of credit
- When the federal funds rate is near the zero bound, expectations of the future path of the FFR and size and composition of asset holdings play an important role in the transmission of monetary policy
- During normalization, monetary policy primary operating target is the FFR
 - Target range for the FFR is achieved by setting the IOER rate and terms of ON RRP transactions



Some useful references

- Ihring, J.E., E. E. Meade and G.C Weinbach. (2015) Monetary Policy 101: A Primer on the Fed's Changing Approach to Policy Implementation,"
<http://www.federalreserve.gov/econresdata/feds/2015/files/2015047pap.pdf>
- Potter, Simon (2016) "Implementing Monetary Policy Post-Crisis: What Have We Learned? What Do We Need to Know?" Speech at Columbia University SIPA, New York City, May 4.
<https://www.newyorkfed.org/newsevents/speeches/2016/pot160504>