



FEDERAL RESERVE BANK *of* NEW YORK

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

Argia M. Sbordon, Vice President
Research and Statistics Group

March 21, 2016

*The views expressed in this presentation are those of the
presenter and not necessarily those of the Federal Reserve
Bank of New York or The Federal Reserve System*

Monetary Policy

■ Formulation

- 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

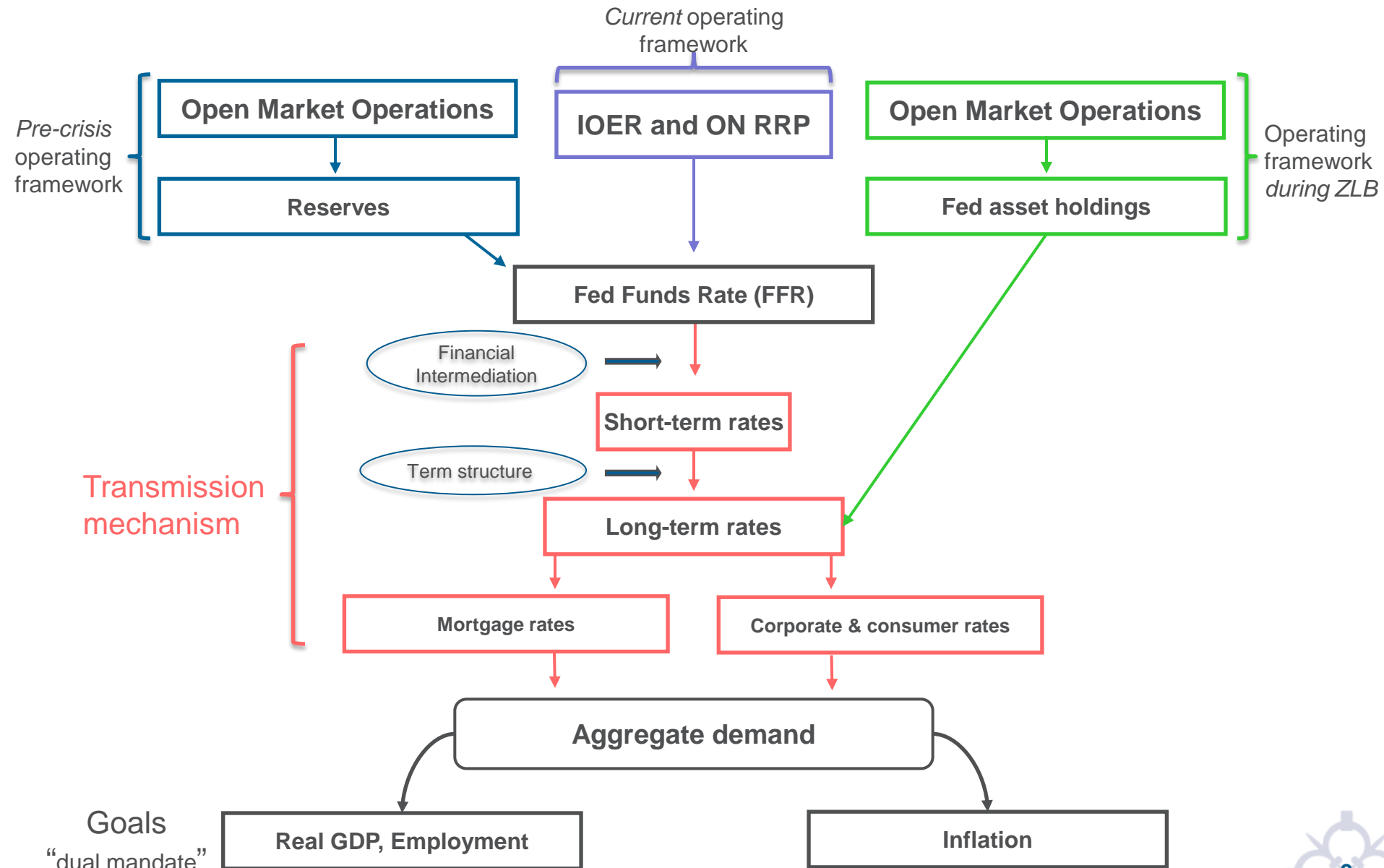
- The operating framework
 - What is (are) the operating target(s)
 - What are the *tools* to achieve the operating target(s)
 - Evolution of the operating framework since the crisis

■ Transmission

- The *channels* through which monetary policy affects the economy
 - From the operating targets to the Fed's objectives



At-a-glance: Operating Frameworks 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** is the percentage of their own deposits that banks must hold at the Fed
 - **Excess reserves** are reserves that banks hold in excess to the required ratio of deposits

■ 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

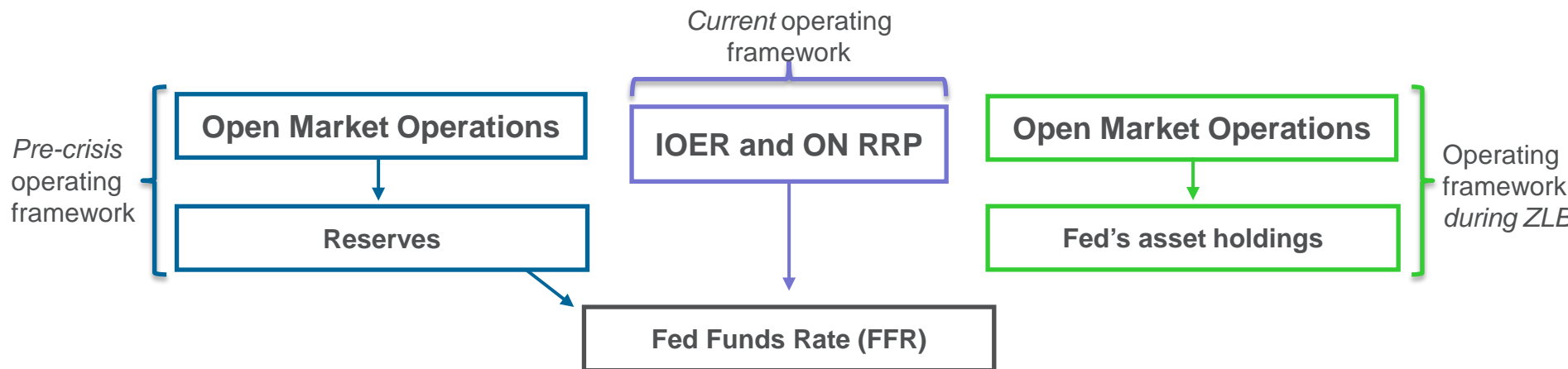
- **Interest on Excess Reserves (IOER)**

- 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 October 2008



Evolution of the Operating Framework

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



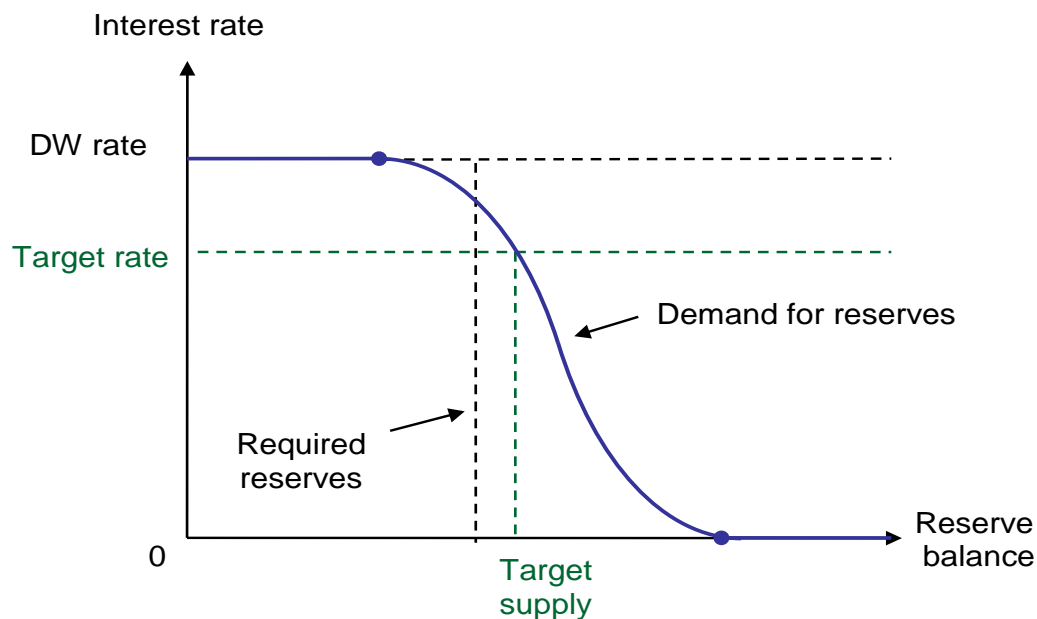
- **Pre-crisis framework:** FFR is **operating target**, managed through reserves
- **During the ZLB:** **Fed's asset holdings** is additional operating target
- **Current framework:** FFR main **operating target**, managed by IOER & ON RRP



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
 - Supply of reserves (by the Fed): provided to the banking system via OMO
- OMOs adjust supply of reserves to match demand at the **target rate**



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

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<i>Total assets</i>	<i>877.7</i>	<i>Total liabilities</i>	<i>877.7</i>

Monetary Policy Response to the Financial Crisis

Policies to alleviate problems in credit markets and stimulate the economy

- Traditional monetary policy
 - Progressive reduction of the FFR target → from 5¼ percent to effective zero
 - FFR target set at 0 to ¼ percent (ZLB) in Dec '08
 - 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
 - Asset purchases
 - *Agency debt, Agency MBS, long-term Treasuries*
- The size of the balance sheet increases → large amount of reserves
- With **no scarcity** of reserves → traditional framework no longer works

Change in the Operating Framework

- At ZLB policy implementation is through:
 - **Balance sheet policy** (aka LSAP or QE)
 - Changes in size and composition of the Fed's asset holdings
 - How it works*
 - Operate directly on long-term rates by reducing term premia
 - Support commitment to extended period of low rates
 - Increase in reserves is a byproduct of purchases, carrying implications for the federal funds market
 - **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

A variety of asset purchase programs were implemented since 2008

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

- Purchases of Agency MBS and Agency Debt (Nov '08) - predetermined *total* amount
- Purchases of long-term Treasury securities (Mar '09; Nov '10)
→ **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 '11-Dec '12)
→ **changes only the maturity composition of the balance sheet**

- **LSAP III: outcome-based program**

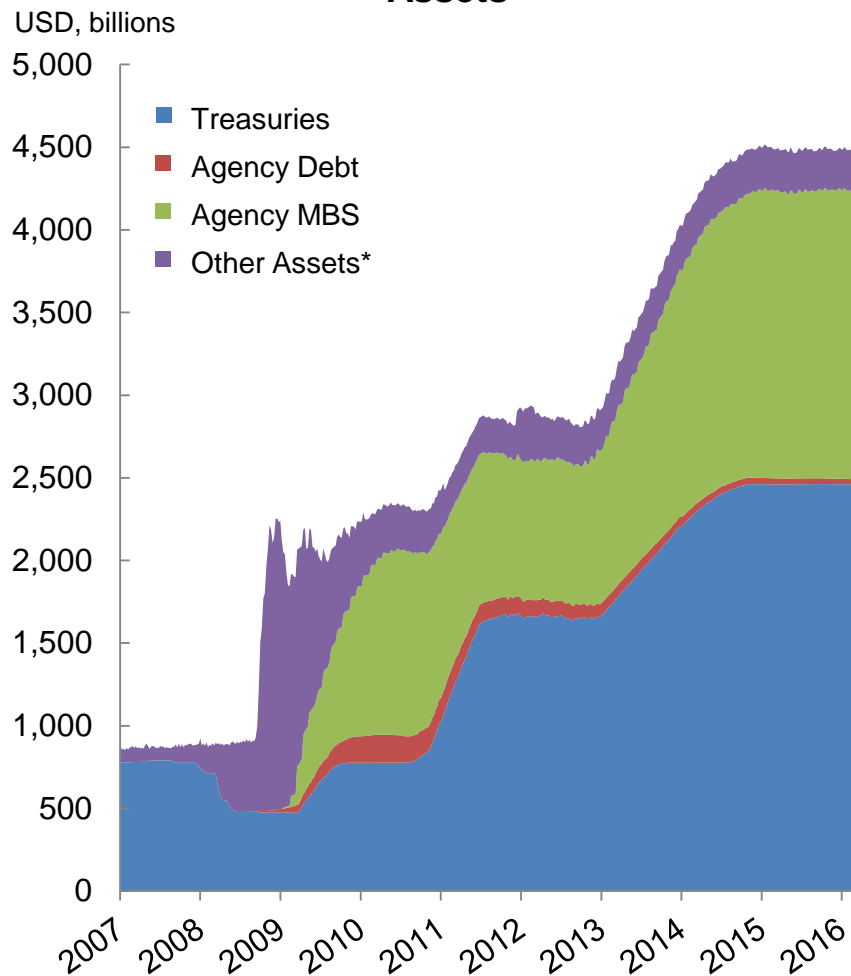
- Purchase of agency MBS (Sep '12) and long-term Treasuries (Jan '13) - fixed amount *per month*, until set objectives are reached
 - Incremental reduction in the pace of purchases (“tapering”) from Jan '14
 - Purchases ended in Oct '14
- **increases size and composition of the balance sheet**

Impact of LSAPs on the Fed's Balance Sheet

Assets		Liabilities	
Securities		Federal Reserve notes (currency)	1,385
U.S. Treasury Securities	2,461		
Agency Debt & MBS	1,792	Deposits of depository institutions (Reserve Balances)	2,771
Repurchase agreements (Repos)	0		
Loans to depository institutions	0.02	Reverse Repos	287
Other assets	237	Other (including capital)	47
<i>Total assets</i>	<i>4,490</i>	<i>Total liabilities</i>	<i>4,490</i>

Evolution of the Federal Reserve's Balance Sheet

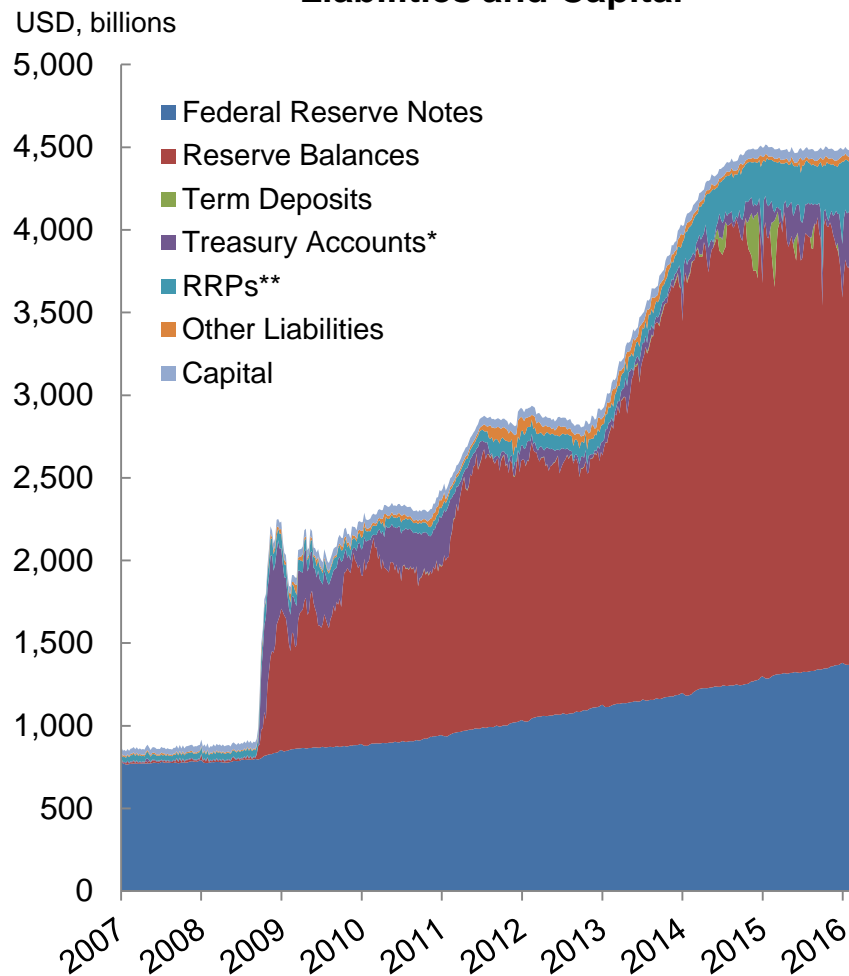
Assets



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

Source: Federal Reserve Board H.4.1, [February 25, 2016](#)
Release

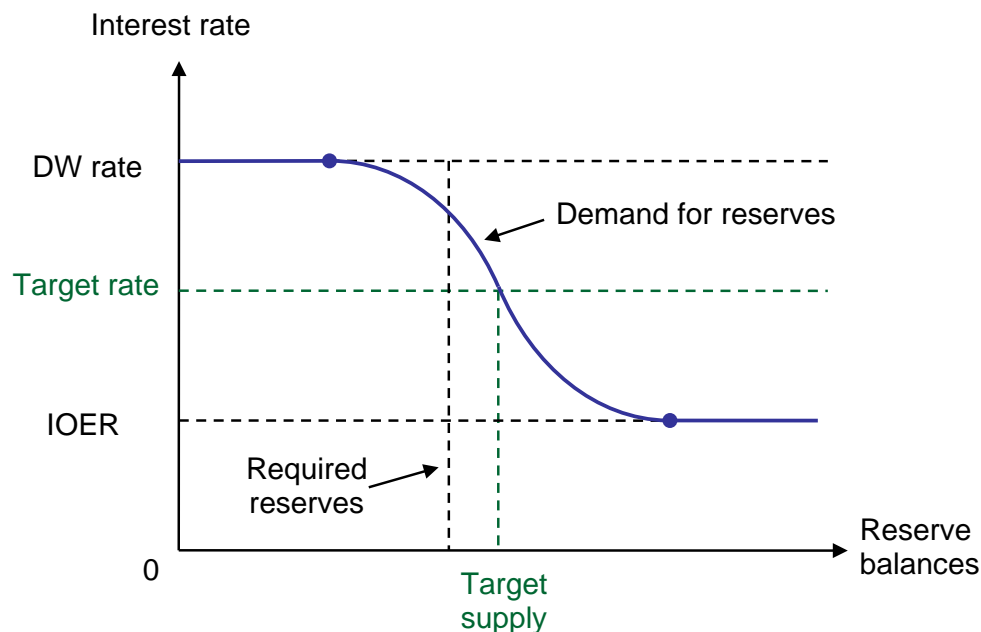
Liabilities and Capital



* Includes Treasury General Account and Supplementary Financing Account. ** Includes Foreign Repo Pool and RRP open market operations.

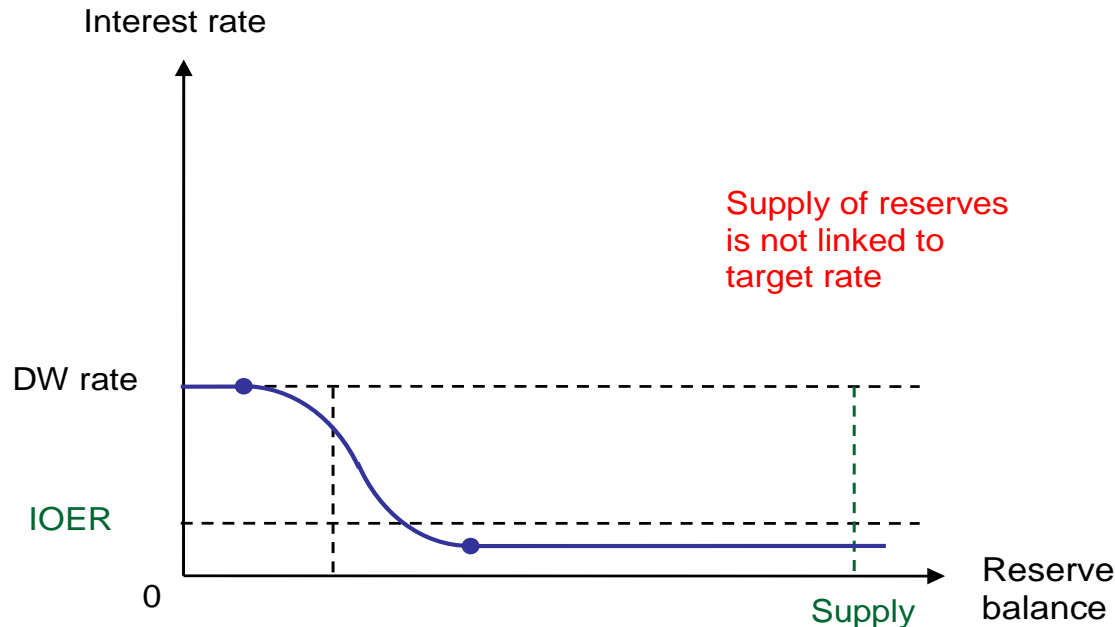
Interest On Excess Reserves (IOER)

- In 2008 the Fed is granted authority to pay **IOER** to banks (interest on the balances that they hold in their account with the Fed)
- IOER represent 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
- Supply and demand of reserves would again determine the equilibrium rate



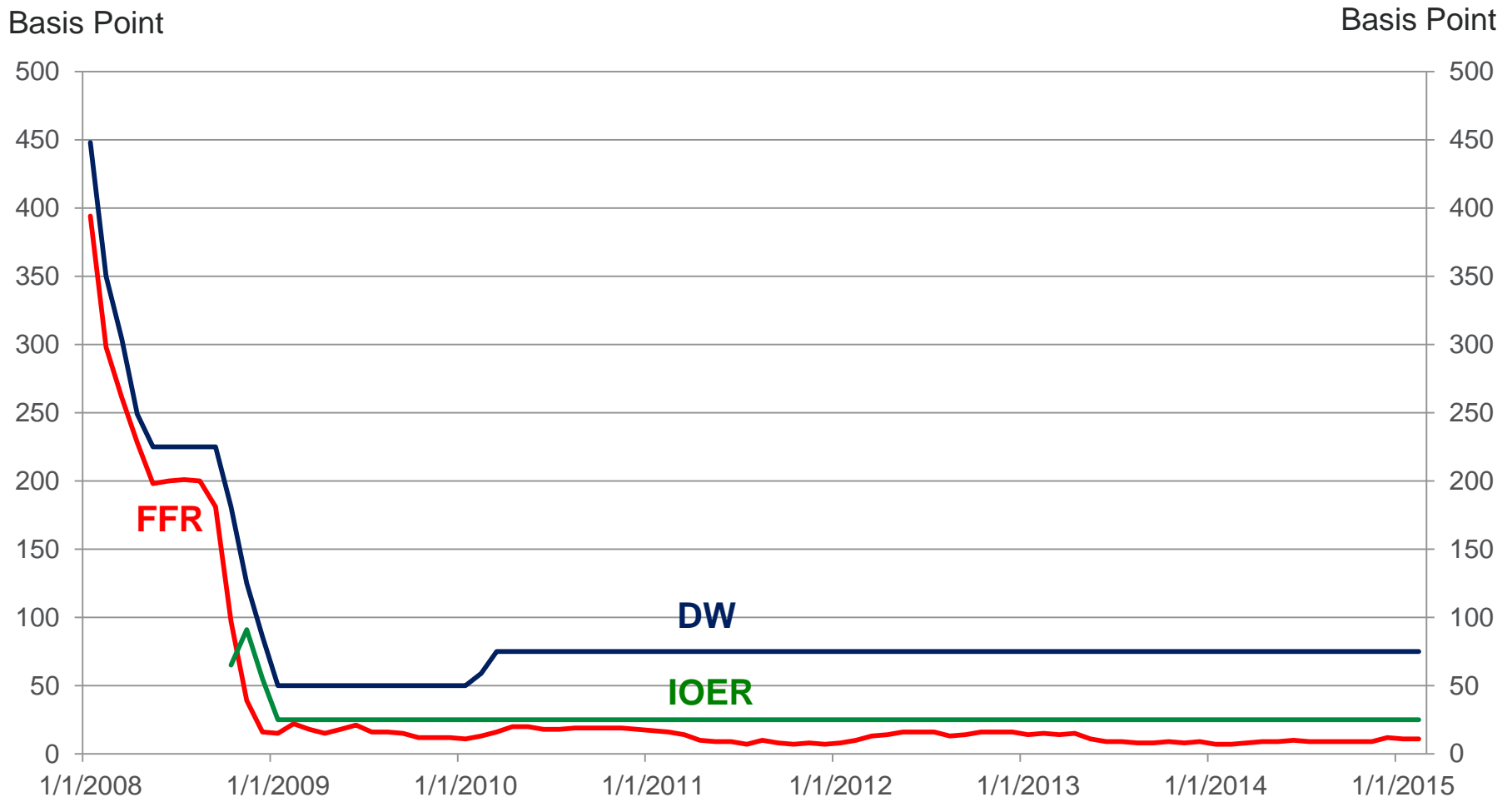
Impact of Large Amount of Reserves on FF Market

- With abundant reserves, no more link of reserves to the target rate
- Also, IOER has not set a floor beneath rates
 - Some institutions (GSEs and FHLBs) can trade in the FF market but cannot earn interest on reserves
 - Have an incentive to lend reserves at a lower rate than the IOER
 - Other features limit full arbitrage



A 'Leaky' Floor

- Market interest rates, including the fed funds rate, have been below IOER



Consequences for Monetary Policy Implementation

- Why is the 'leaky' floor a problem?
 - It may impair the Fed's ability to raise the FFR when policy accommodation needs to be reduced
- One solution: ON RRP (OverNight Reverse Repo)
 - Temporary exchange of cash for Treasury securities held by the Fed
 - A form of collateralized loan to the Fed (used in the past to drain reserves)
 - Investors give the Fed cash overnight -- Fed gives them Treasuries as collateral
 - Offered at a rate specified by the Fed
 - Engages a wide range of counterparties (MMFs, GSEs, PDs, banks)
 - Works because it goes beyond banks
 - Increases competition for funds among borrowers
- Supports a floor under rates

Changes in the Operating Regime

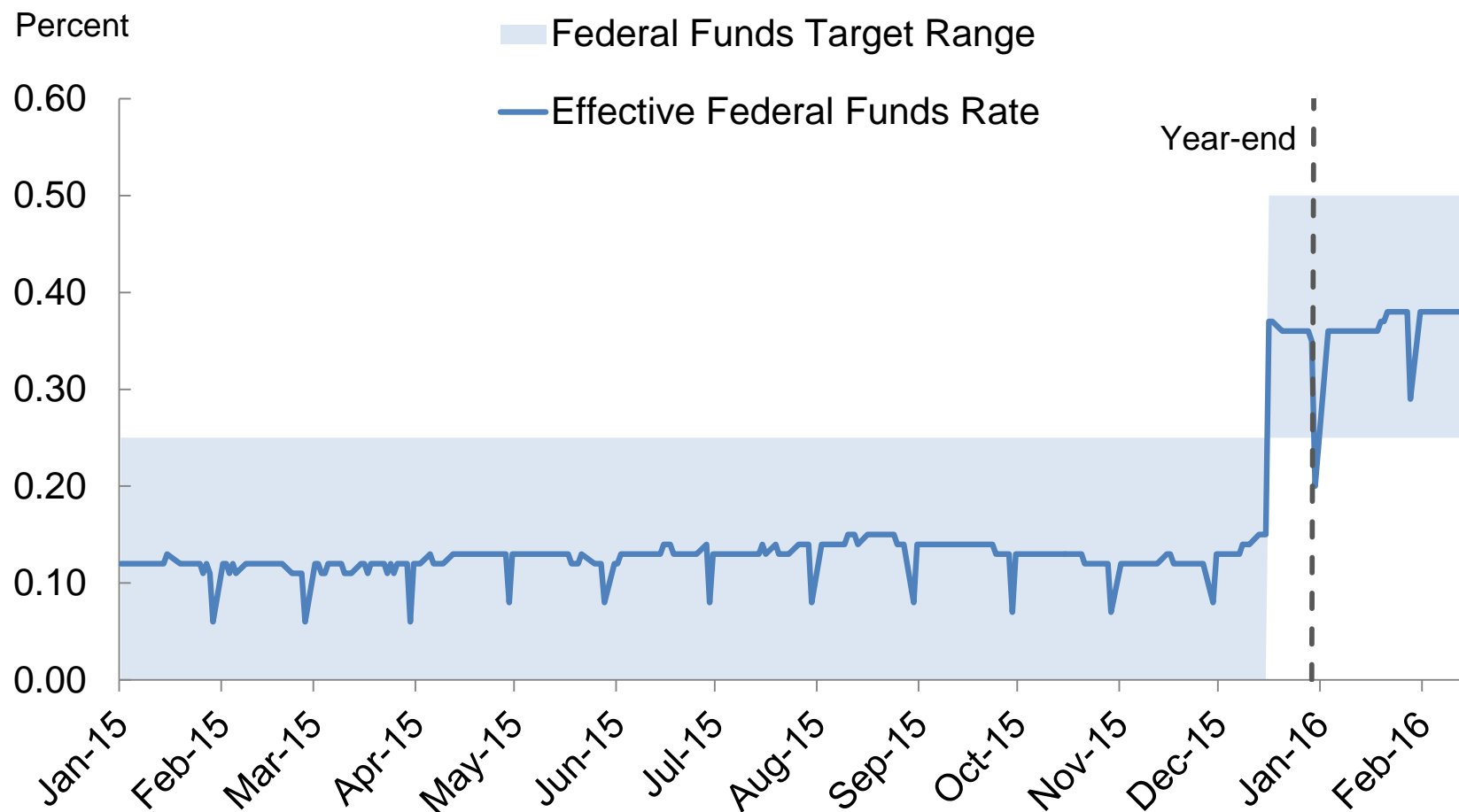
Policy Normalization Principles and Plans (September 11, 2014)

- 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: December 16, 2015

- FOMC raises target range for FF rate to $\frac{1}{4}$ to $\frac{1}{2}$ percent
 - Statement cites considerable improvement in labor market conditions and reasonable confidence inflation will rise, over the medium term, to its 2 percent objective
- Implementation decisions (effective December 17)
 - IOER rate raised to 0.50 percent
 - Desk directed to conduct ON RRP
 - offering rate of 0.25 percent
 - \$30 billion per-counterparty limit per day
 - Discount rate raised to 1.00 percent

Effective Federal Funds Rate



Sources: Federal Reserve Bank of New York, FOMC

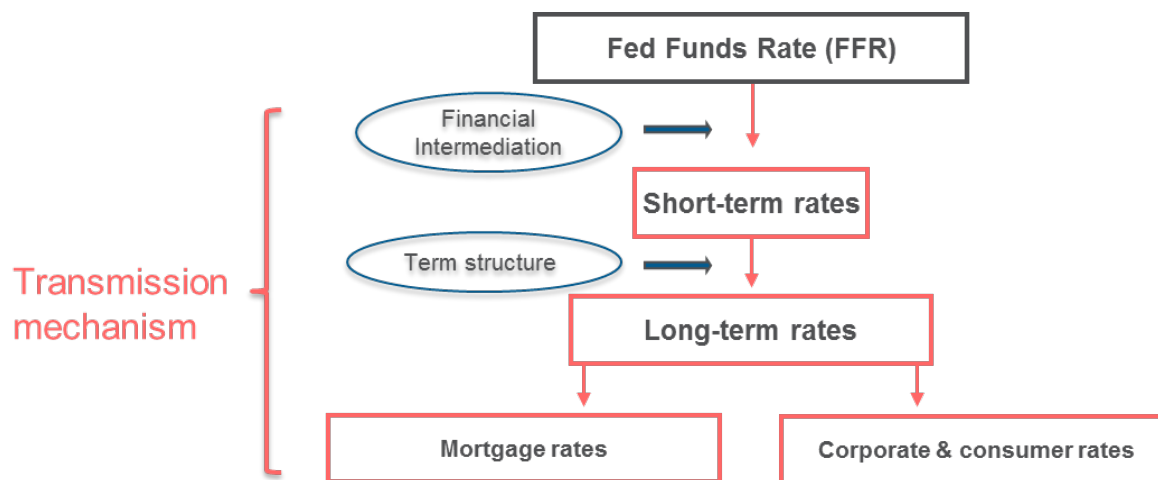
Key Takeaways on Policy Implementation

- 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 ZLB)**
 - Two operating targets
 - **FFR**: while at ZLB, 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; temporarily supported by ON RRP
 - Balance sheet expected to wind down gradually through redemptions and paydowns, once reinvestment is ceased

Understanding the Transmission Mechanism

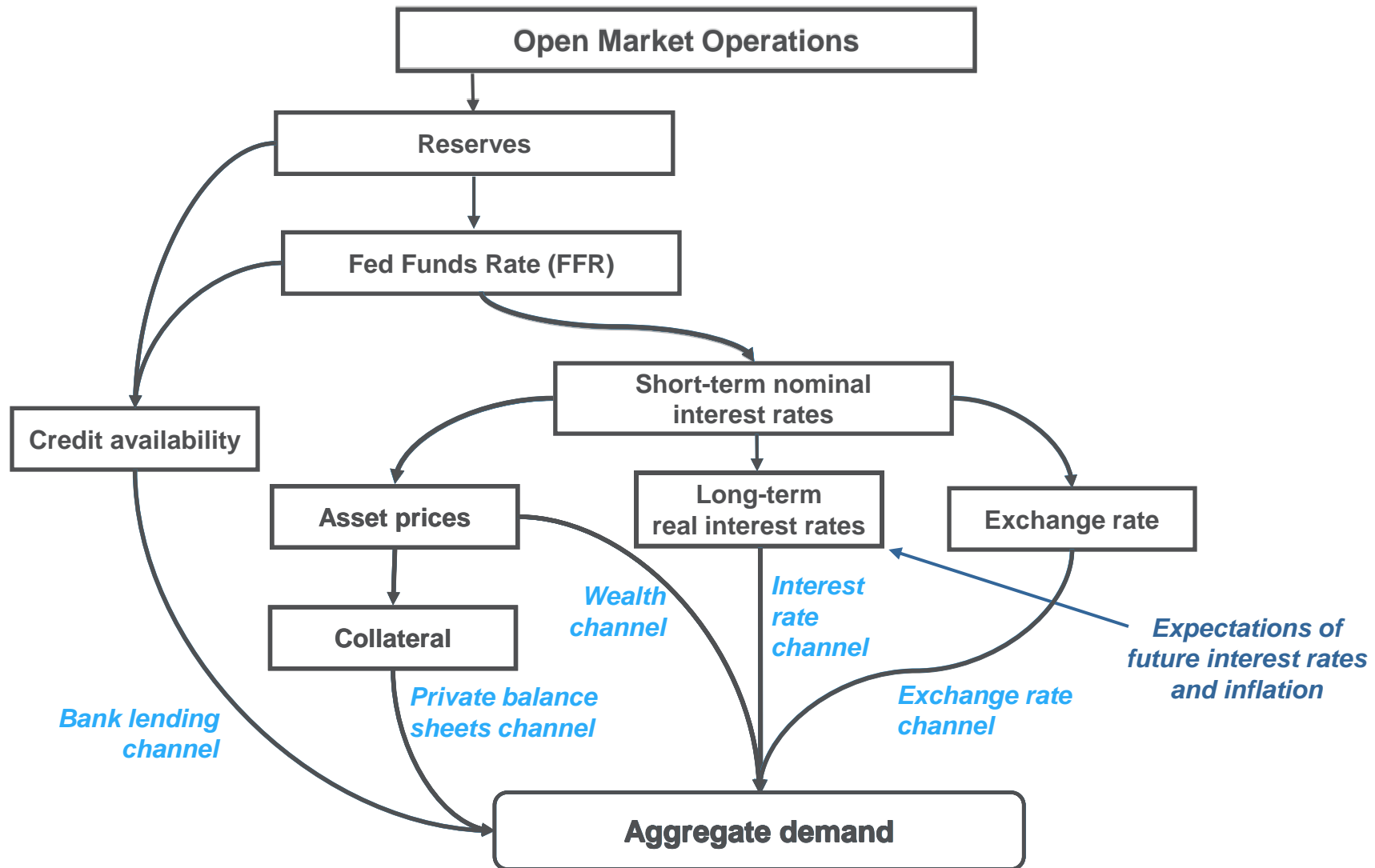
The Transmission Mechanism

- Intermediate targets have little *direct* impact on aggregate spending
 - They work through the *structure* of nominal interest rates and other financial prices



- ...which affect the economy through a variety of channels

Overview of 'Standard' Transmission Channels



The Channels of Transmission at Work

■ Interest rate channel

- Given inflation expectations, the nominal rate determines the *real* short-term interest rate; current and expected future real rates affect *longer-term* real rates, which influence interest-sensitive expenditures

■ Exchange rate channel

- Given expectations of future exchange rate levels, a higher interest rate implies a stronger currency (Uncovered Interest Rate Parity (UIP)). A stronger currency reduces net export demand.

■ Wealth channel

- A higher interest rate reduces the price of equities, reducing financial wealth
 - Effect on households: negative on consumption expenditures
 - Effect on firms: decline in market valuation of the firm relative to the cost of capital (Tobin's q) leads to a decline in investment spending

■ Balance sheet channel

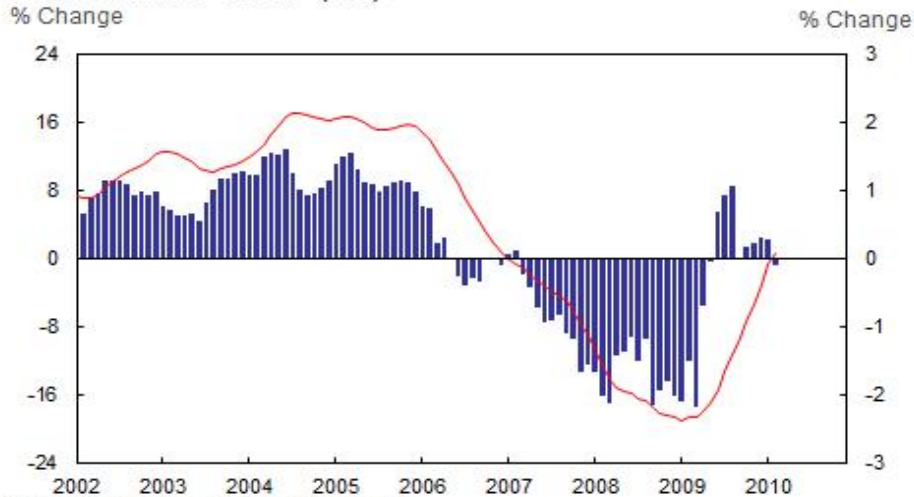
- A reduction in asset prices also reduces the collateral value of borrowers, reducing loans and aggregate demand

■ 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

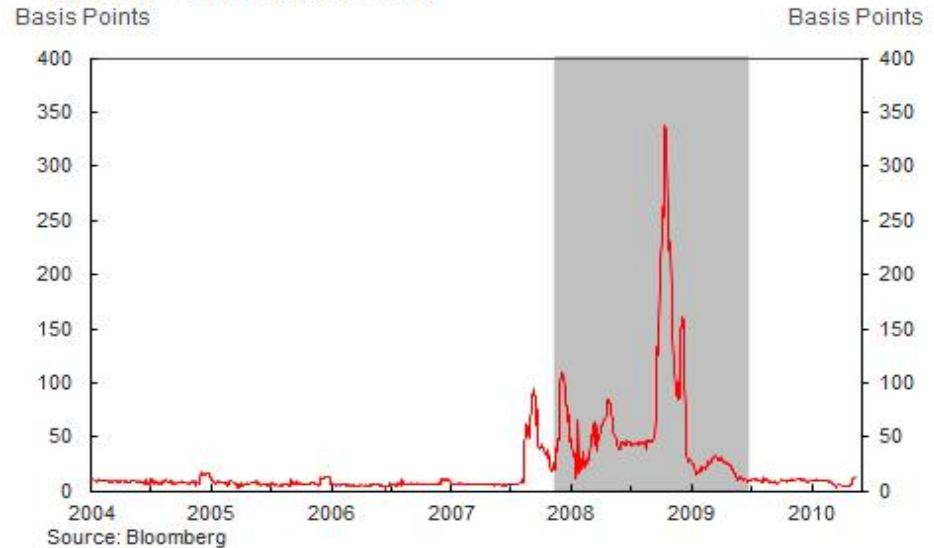
The Crisis: House Prices ↓ and Spreads ↑

Case-Shiller Index (SA)



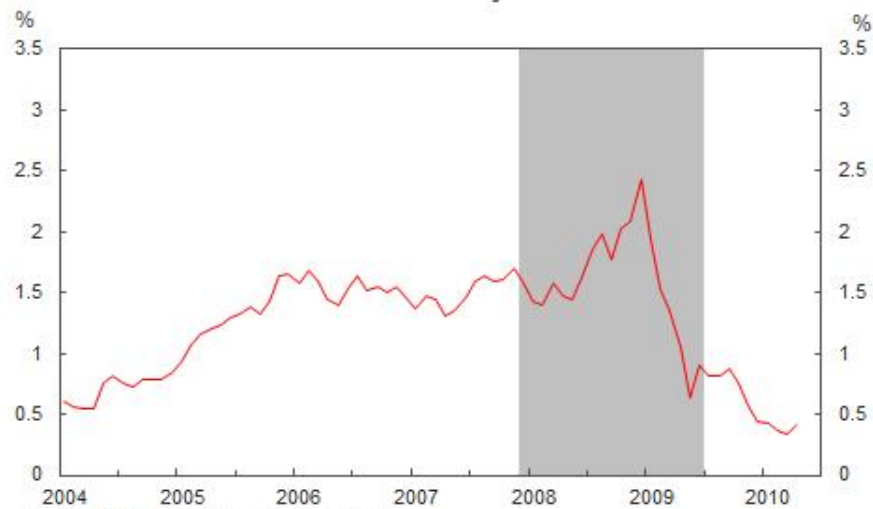
Source: S&P, Fiserv, and MacroMarkets LLC

1 Month USD Libor to OIS



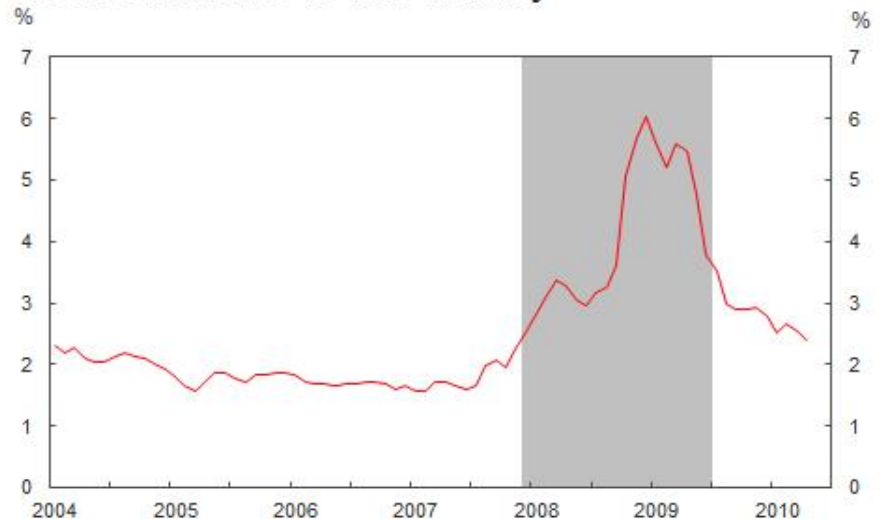
Source: Bloomberg

30-Year FRM to 10-Year Treasury



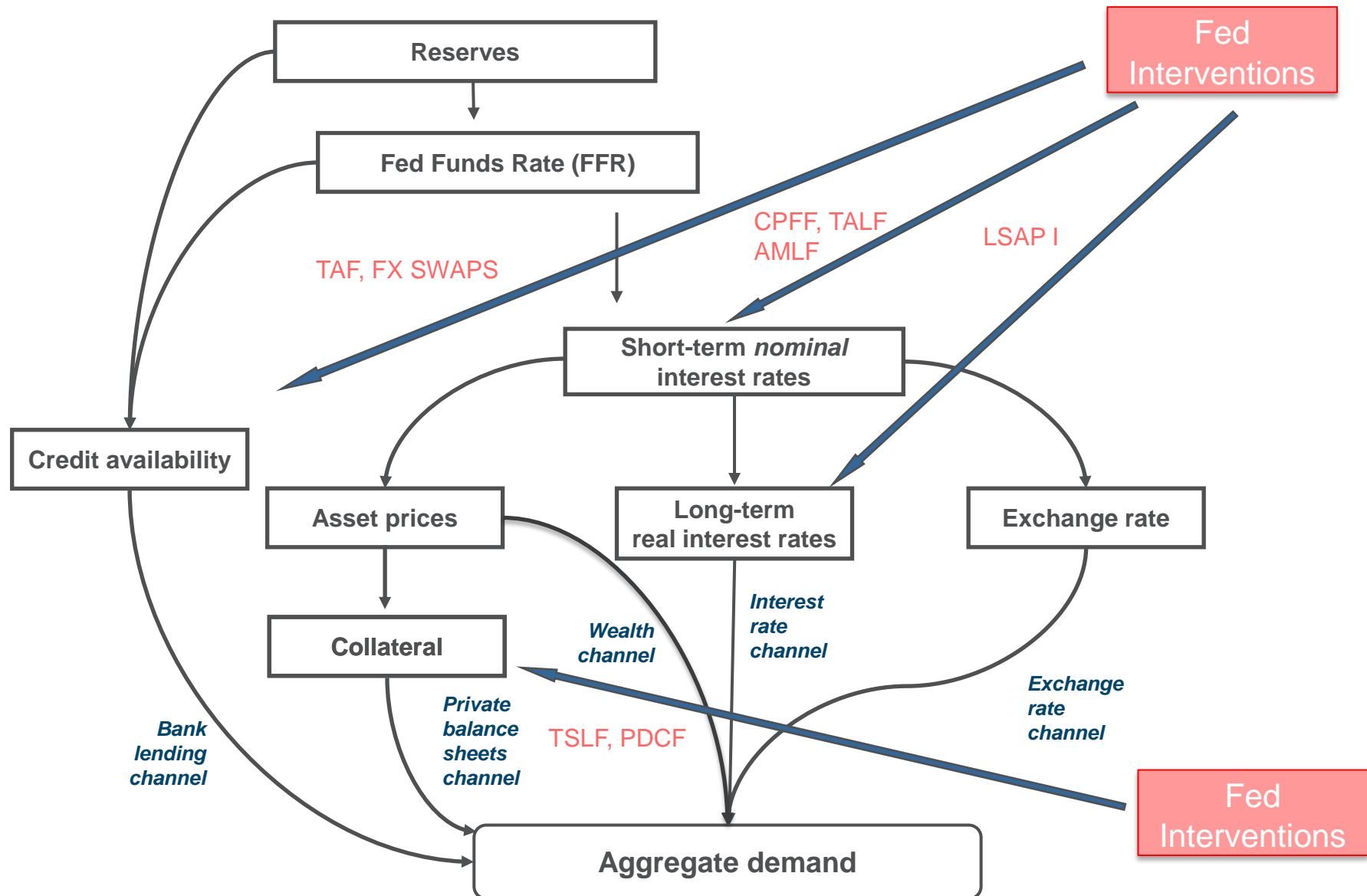
Source: HSH Associates and Datastream

BAA Bond Yield to 10-Year Treasury



Source: Federal Reserve Board

Transmission Channels and Crisis Interventions

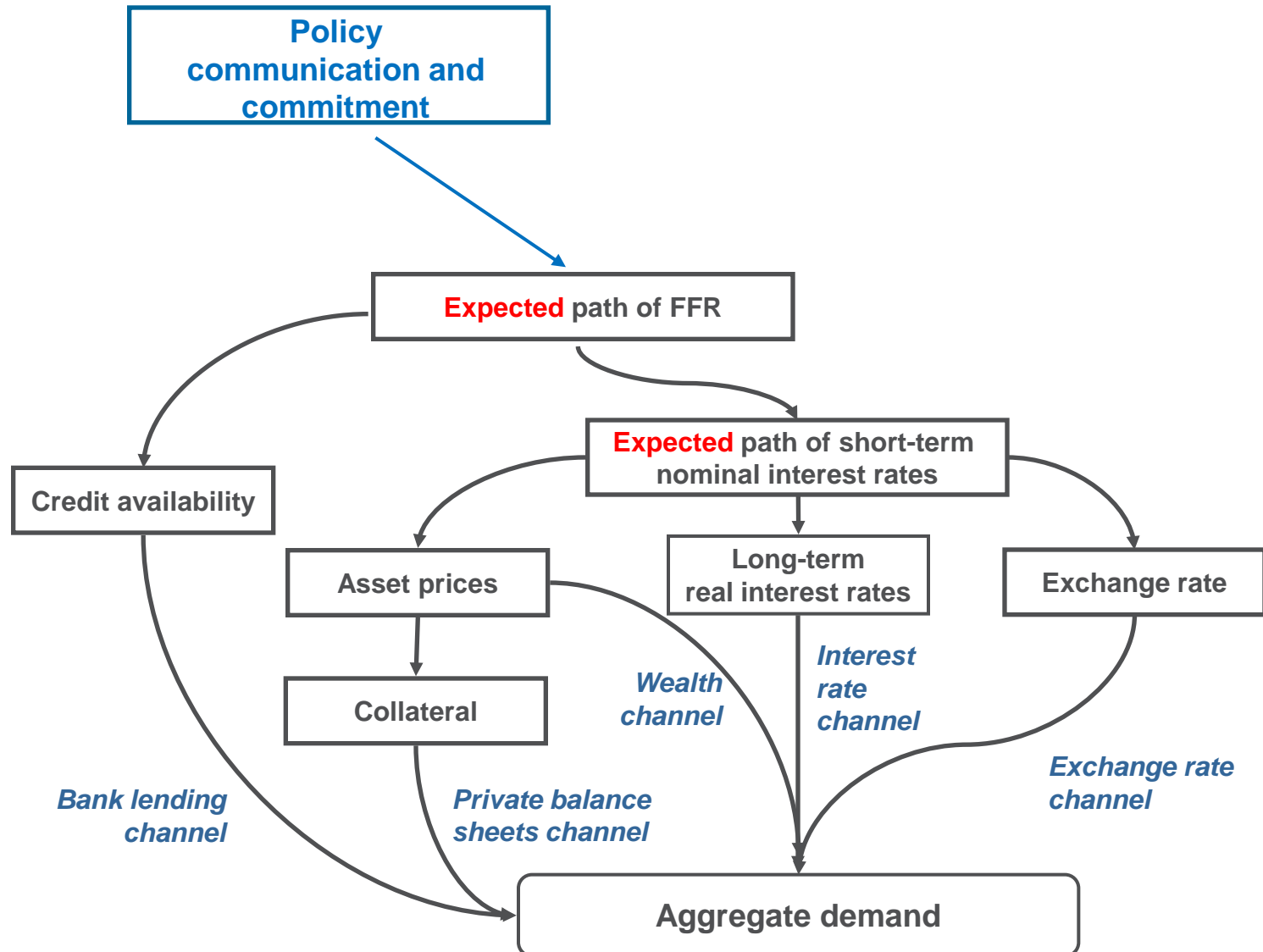


Transmission when at ZLB: Forward Guidance

How does Forward guidance work?

- At ZLB 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

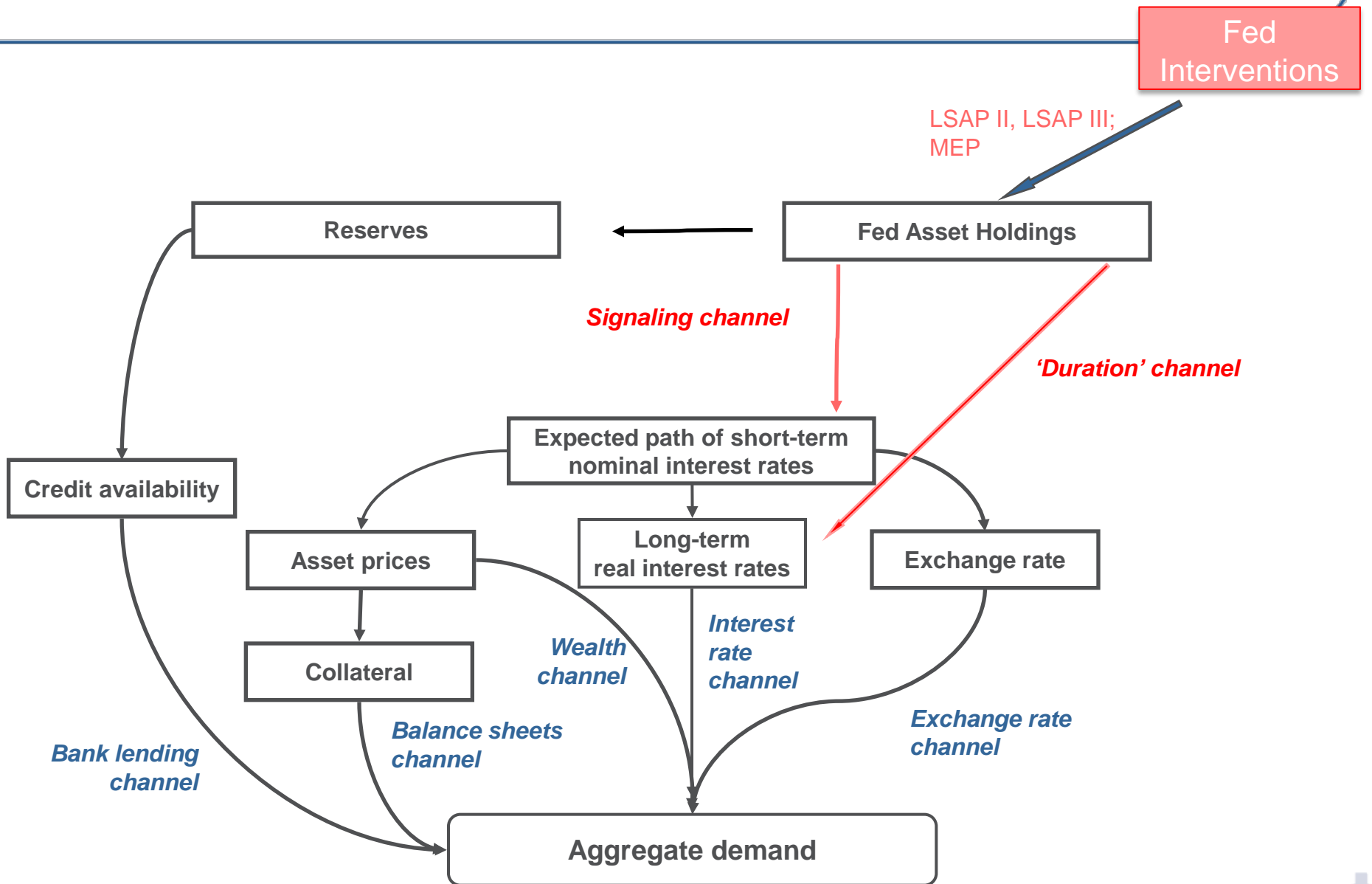


Transmission at ZLB: Asset Purchases

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

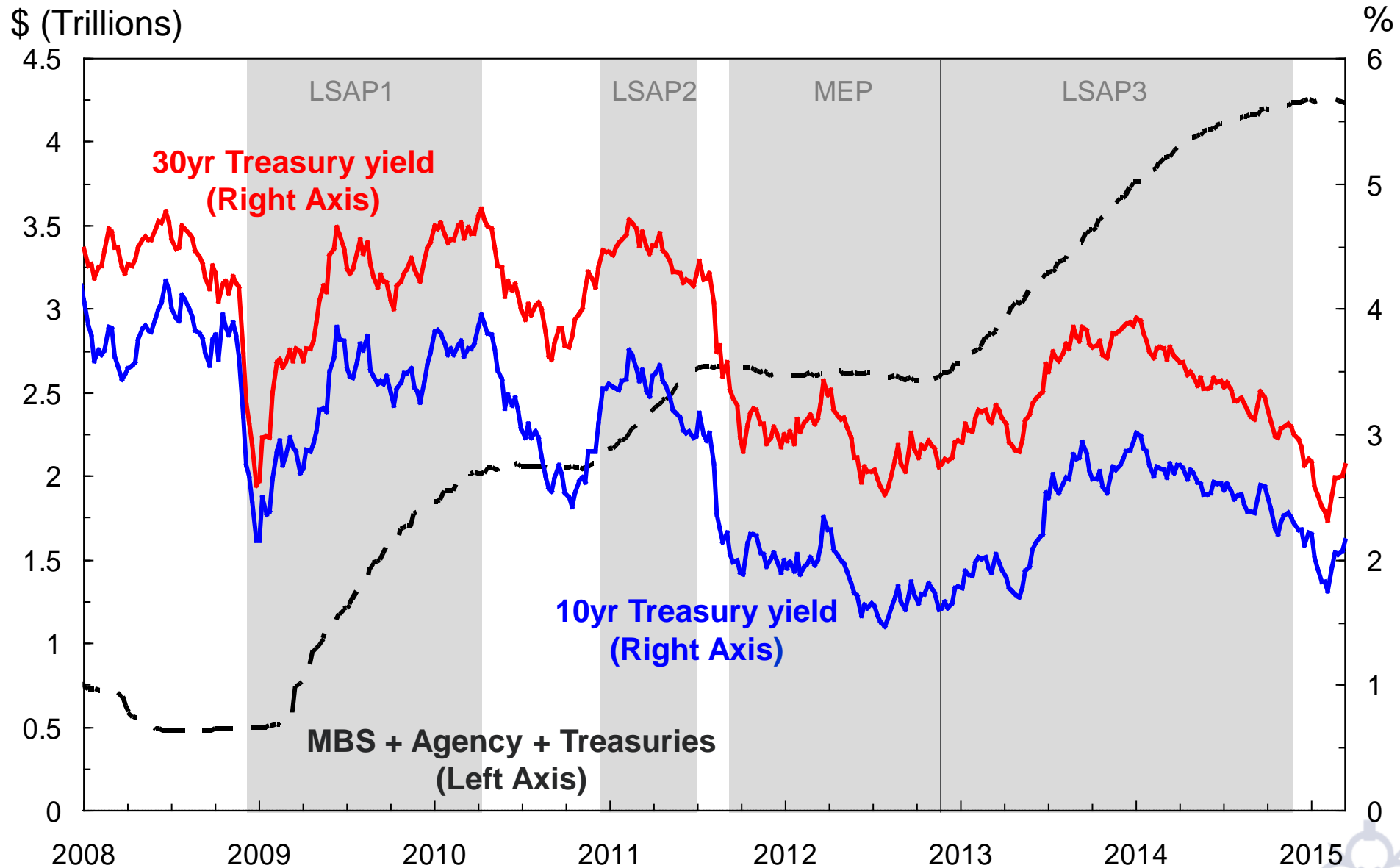
Asset Purchases



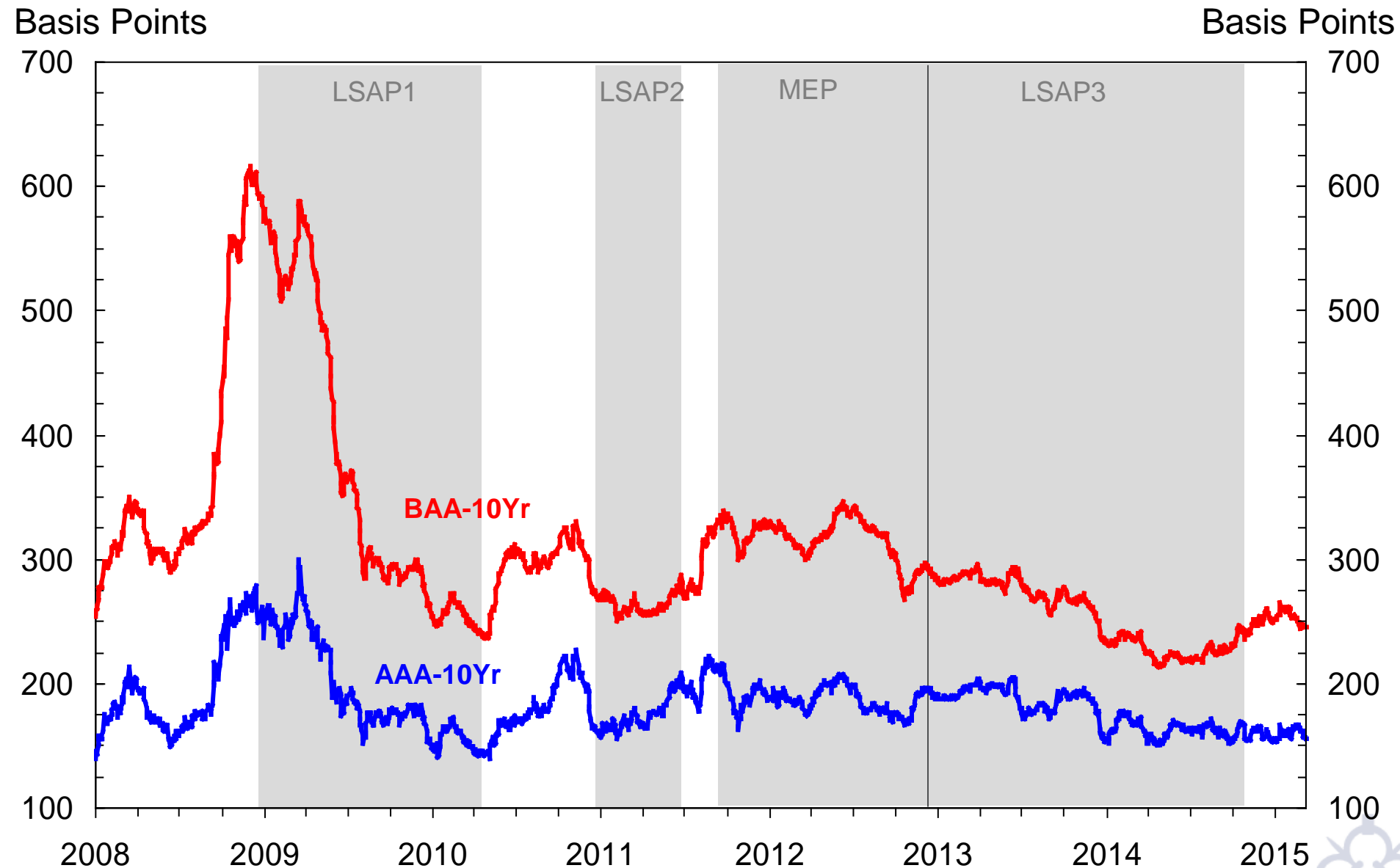
Did Asset Purchases Ease Financial Conditions?

- 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 Tr yield

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



Corporate Credit Spreads



Some 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 remains below objective
 - Unemployment rate has fallen faster than expected, particularly after the outcome-based program, but other labor market indicators have not recovered to pre-recession levels (low job-finding rate, low employment/population ratio, sluggish wages)
 - but counterfactual not observed!
- Some 'headwinds' have inhibited transmission
 - 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*

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 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 is the FFR, and it's level is achieved by setting the IOER 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,"
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- Potter, Simon (2015) "Money Markets and Monetary Policy Normalization" Remarks at the Money Marketeers of New York University, New York City, April 15.
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