markus academy

# Quantitative Easing: What have we learned?

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PRINCETON

# Monetary Policy – (un)conventional

1. **Consumption demand** management
   (i) aggregate (ii) redistribute to high MPC HHs
2. **Portfolio choice** management
   (I Theory of Money: **risk premium** + redistributive)

- QE: Asset Purchase Programs
  - Gov. bond
    - Yield curve management — term premia
    - Interaction with DMO (at Treasuries)
  - Mortgages vs. corporate bonds — risk premia

- Negative Interest rate: ZLB vs. Reversal Interest Rate

# Central Bank vs. Treasury (DMO)

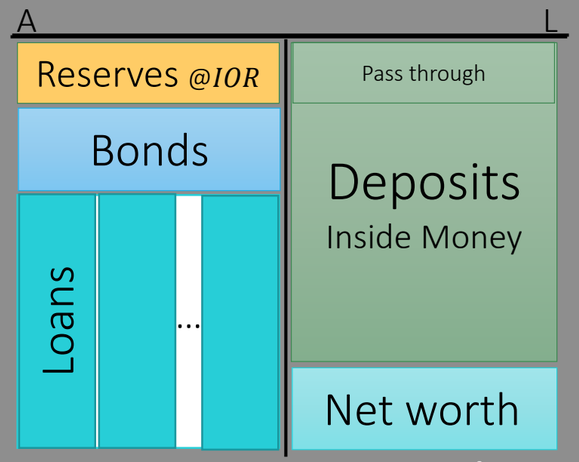
- **Central Bank**'s QE swaps
  fixed interest rate **gov. bonds** for floating **reserves**
- **Treasury** shortens debt maturity

- Is it simply a wash?
  Does QE only work if it involves risky assets?

- Political game between CB and Treasury:
  - Hiking interest rate after QE: CB suffers capital losses
  - Can CB sustain losses? Will Treasury recapitalize Central Bank?
  - Undercapitalized CB's can signal better

# QE: Effectiveness of interest rate policy, Sequencing

- QE = Swap Bonds for Reserves




Safe asset
- bond can be held by everyone
- reserves only held by banks

floating interest rate IOR

- Interest rate cut changes relative value btw Bond and Reserves/deposits ⇧
  - "stealth recapitalization"

1. QE: CB signals that rates will stay low for long
2. After QE: fewer bonds, less redistribution

- Optimal Sequencing:
  first $i$-cut, then QE -- first QT, then $i$-hike

# QE: Which assets?

- "Redistributive Monetary Policy" (2012 Jackson Hole)
- Bottleneck approach:
  - Redistribute wealth to sector with impaired balance sheet
    - 2008 GFC: Household sector ⟹ **MBS**
      Financial sector
    - 2020 Covid: Corporate sector ⟹ **Corporate Bonds**
  - Lowers "price of risk"/risk premia
  - Can be Pareto Improving (across all sectors)

# Poll

1. How much of a role did QE play in driving the asset price boom of the last decade?
   a. Little to none
   b. Moderate
   c. The central factor
2. How much of a role did QE play in supporting the recovery from the 2008 crisis?
   a. Little to none
   b. Moderate
   c. The central factor
3. What are the areas of QE research that are most understudied?
   a. Asset pricing work on QE
   b. Impact of QE on banks and firms
   c. Monetary aspects of QE
   d. Macro modeling that integrates QE

# QE: What have we learned?

Markus' Academy, 3/24/2022

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Stanford University GSB, SIEPR, and NBER

# What researchers and policymakers would like to know?

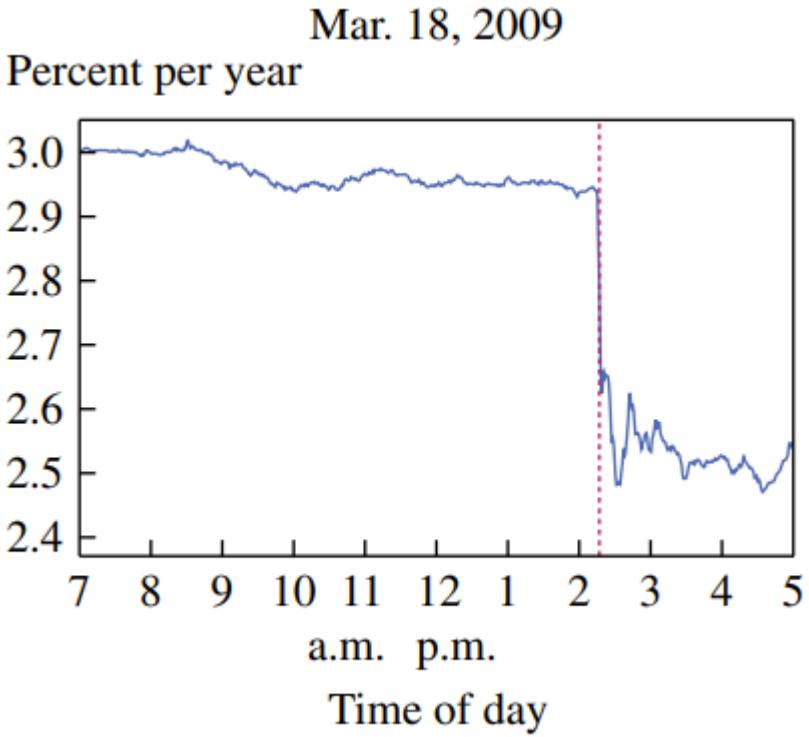
What is the impact of a given size of purchase/sale in a given asset market in a given economic state on the macroeconomy?

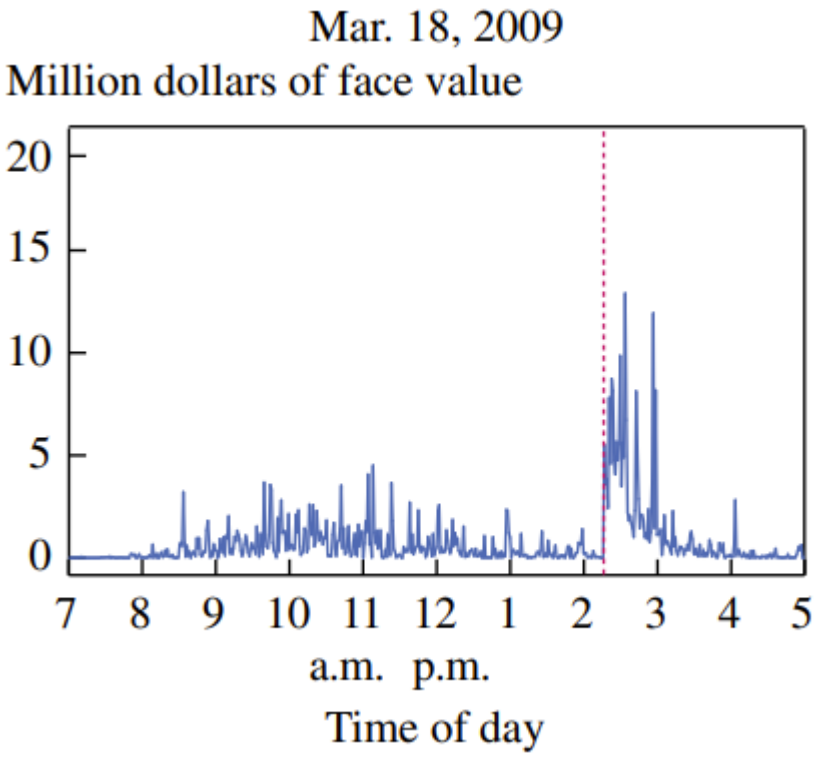
- What are impacts on output? Distributional consequences? International spillovers?
- Impact on inflation? Financial stability? Fiscal consequences?
- How do these impacts compare both in magnitude and extent to conventional monetary policy?

# Outline

- Selective review of research findings
- What we know more about and what we know less about?
- Where does research go from here?

# QE Event Studies




10 Year Treasury Yield (Left) and Trading Volume (Right)

Source: Krishnamurthy and Vissing-Jorgensen (2011)

# Identification challenges

- Tight event windows ⇒ unlikely that economic news cause QE and asset market reaction

- Identification challenge is around the channel(s) for QE

- "Conventional" broad channels:
  - Signaling path of policy rate; signaling policy marker preferences
  - Signaling news about economy

- "Unconventional" narrow channels:
  - Impacts on liquidity premia (QE increases reserve balances)
  - Impacts on risk premia (duration, credit, mortgage…)
  - Impacts on safety/scarcity premia (QE changes supply of safe assets)

# More on narrow channels

1. Impacts on safety/scarcity premia (QE changes supply of safe assets)

   - In the context of sovereign debt (U.S. Treasury, Bund, Gilt): Investors have mandates/special demands for safe bonds, sometimes of specific maturities

   - In the context of mortgage-backed securities: mortgage-specific funds have mandates to invest in the MBS market, track MBS index, etc.

2. Impacts on risk premia (duration, credit, mortgage…)

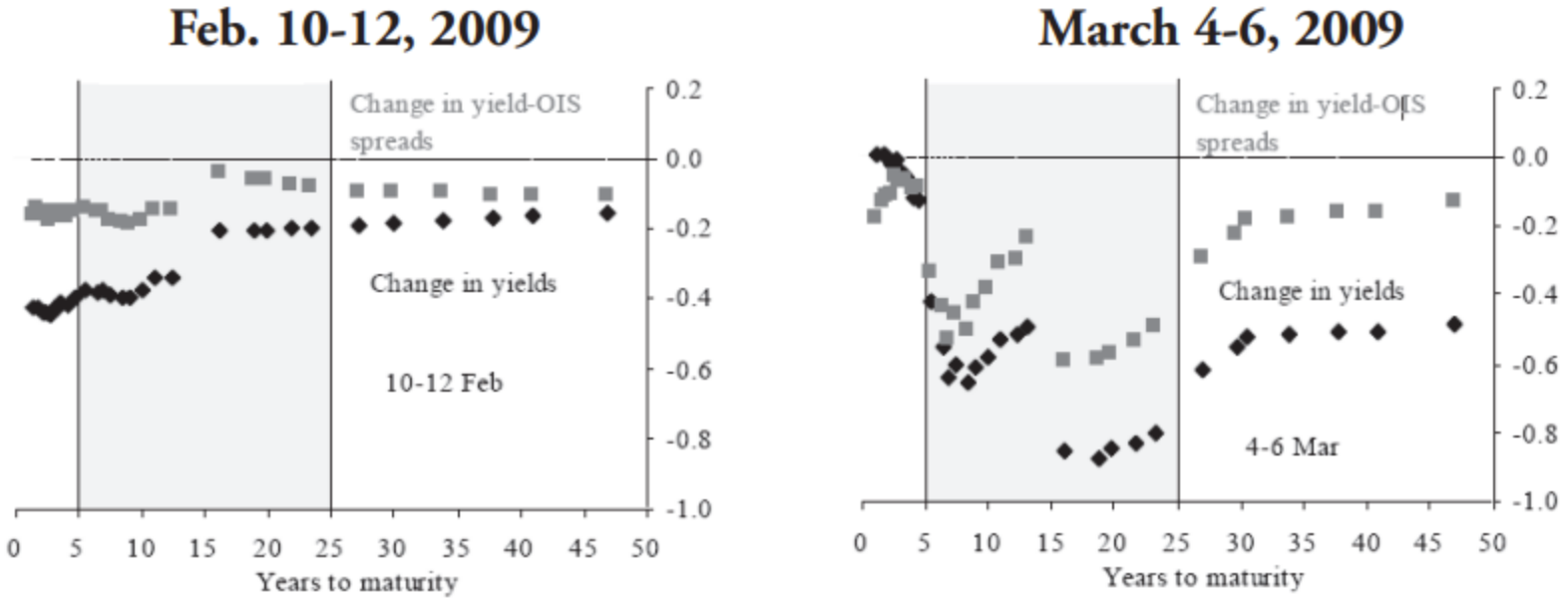
   - Investor SDF for a given risk is a function of the quantity of risk held by investor
   - For example,

$$\lambda^{risk} \propto \gamma\sigma_W, \qquad where, \qquad \sigma_w = f(quantity\ of\ risk)$$

   - The "how narrow" question: what else does this SDF price?

# Difference-in-Difference (OIS vs. Gilt yield)

**Yield Changes by Maturity from U.K. QE for U.K. Gilts and Gilt-OIS Spreads (percent)**




Source: Joyce, Lasaosa, Stevens and Tong (2011)

# More “narrow” channel evidence

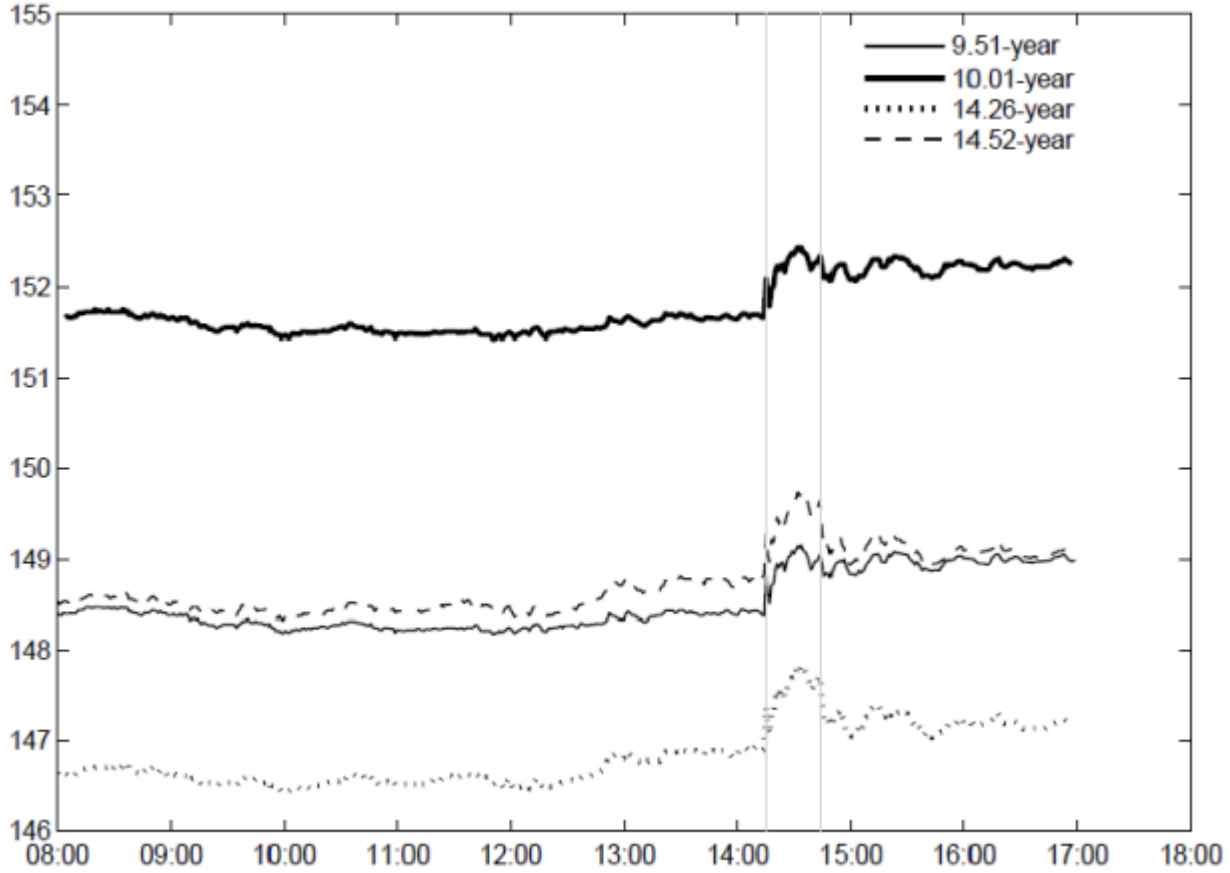



Figure 3: CUSIP-level intraday prices on August 10, 2010:

Source: D’Amico, English, Lopez-Salido and Nelson (2012)

# Many more [unconventional] narrow-channel studies

- Krishnamurthy and Vissing-Jorgensen (2011, 2013): MBS purchases moved MBS yields on current-coupon MBS particularly; and moved affected primary mortgage rates and loan originations (Di Maggio, Kermani, and Palmer, 2015)

- Eser and Schwab (2016): SMP announcements by ECB lowered particularly the target countries' sovereign yields during stress periods
  - Altavilla, Giannone and Lenza (2014): OMT announcements by ECB particularly compressed spreads of GIPS sovereigns to bunds
  - Similar evidence in Nagel, Krishnamurthy, and Vissing-Jorgensen (2018)

- Grosse-Rueschkamp, Steffen, and Streitz (2019), Todorov (2020): ECB CSPP lowered eligible bond yields

- Haddad, Muir and Moreira (2020): Fed IG Corporate bond purchase program and IG yields
  - Similar results in Gilchrist, Wei, Xu, Zakrajsek (2020) for corporate bonds and Moussawi (2022) for municipal bonds

# MBS quantity evidence from DiMaggio, Kermani and Palmer (2015)

- If it is narrow channel mechanism, then MBS purchases should particularly spur conforming (not jumbo) mortgage originations, because Fed purchased conforming

TABLE 3

*Effect of QE commencement on log refinance origination volumes by QE program*

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Program | QE1 | QE2 | MEP | QE3 | Tapering |
| Panel I. Without controls | | | | | |
| Program indicator | 1.019*** | 0.597*** | 0.544*** | 0.122 | −0.346** |
| | (0.279) | (0.164) | (0.075) | (0.080) | (0.139) |
| Jumbo indicator | −2.138*** | −2.169*** | −1.757*** | −1.543*** | −1.435*** |
| | (0.156) | (0.188) | (0.116) | (0.098) | (0.036) |
| Program × Jumbo | −0.831** | 0.067 | −0.057 | 0.060 | 0.416** |
| | (0.289) | (0.208) | (0.143) | (0.114) | (0.146) |
| Observations | 492 | 492 | 492 | 492 | 492 |
| R-squared | 0.637 | 0.560 | 0.466 | 0.355 | 0.292 |

# Rodnyansky and Darmouni (2017): MBS QE and bank lending

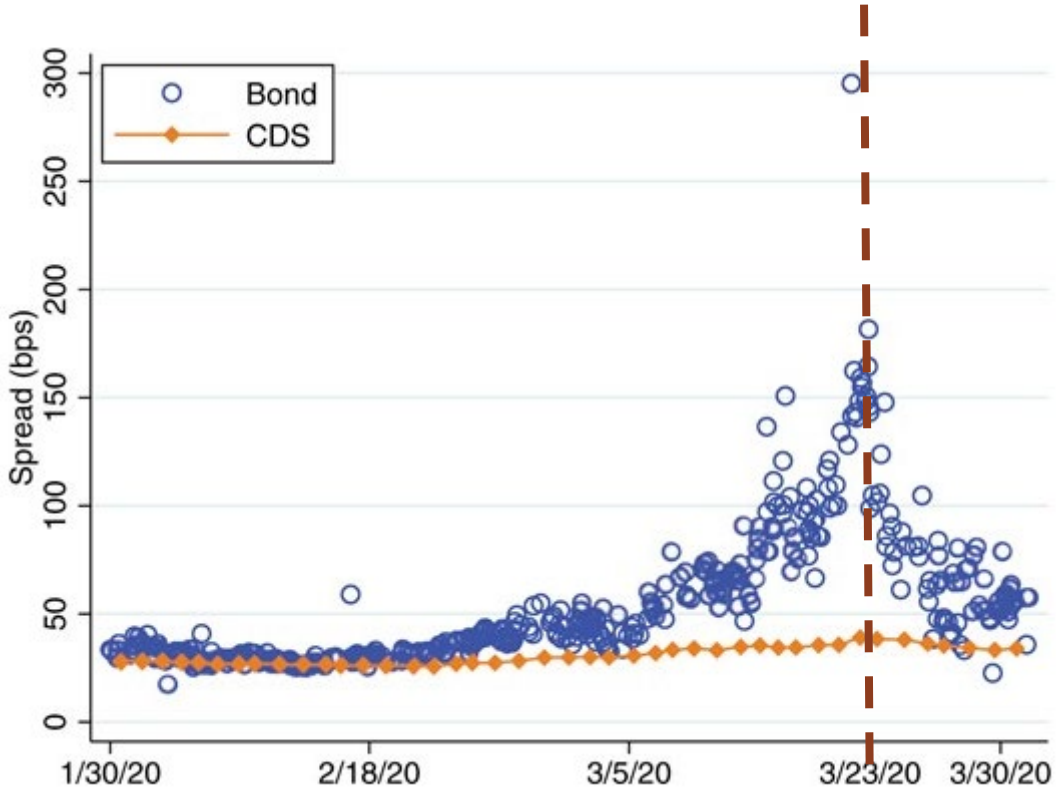
- If it is narrow channel, then MBS not Treasury purchases should drive lending
- Banks hold different amounts of MBS and Treasuries in 2008Q1 (pre-QE)

**Table 6**
**Pooled QE regression**

| | $\log(Lending_{it})$ | | $\log(RE\ Lending_{it})$ | | $\log(CI\ Lending_{it})$ | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $Treat_{M,i} \cdot QE1_t$ | 0.034*** | | 0.047*** | | 0.004 | |
| | [0.008] | | [0.009] | | [0.028] | |
| $Treat_{T,i} \cdot QE2_t$ | 0.028 | | −0.008 | | 0.034 | |
| | [0.018] | | [0.014] | | [0.037] | |
| $Treat_{M,i} \cdot QE3_t$ | 0.017** | | 0.021** | | 0.011 | |
| | [0.008] | | [0.010] | | [0.039] | |

- Spillovers to real estate lending, but less (none?) to C&I Lending

# QE in distressed states of the world




Google Bond Yield and CDS;
Fed Bond Purchase Program Announced 3/23

Source: Haddad, Muir and Moreira (2020)

# Asset Pricing Theory with Narrow Channels

- Any theory of QE must depart from a complete markets model and go towards segmented markets
  1. QE effects are “narrow” not “broad” --- they do not change the rep agent’s SDF. Instead, they must be changing the SDF of significant investors in the narrow market
  2. Macro-calibration of rep agent SDF will get a demand curve that is too elastic to be consistent with data

- Research needs to model the demand curves in the narrow market, and map out what “narrow” means

# Vayanos and Vila (2021)

- Model of the Treasury market yield curve delivering risk premia that are a function of supply

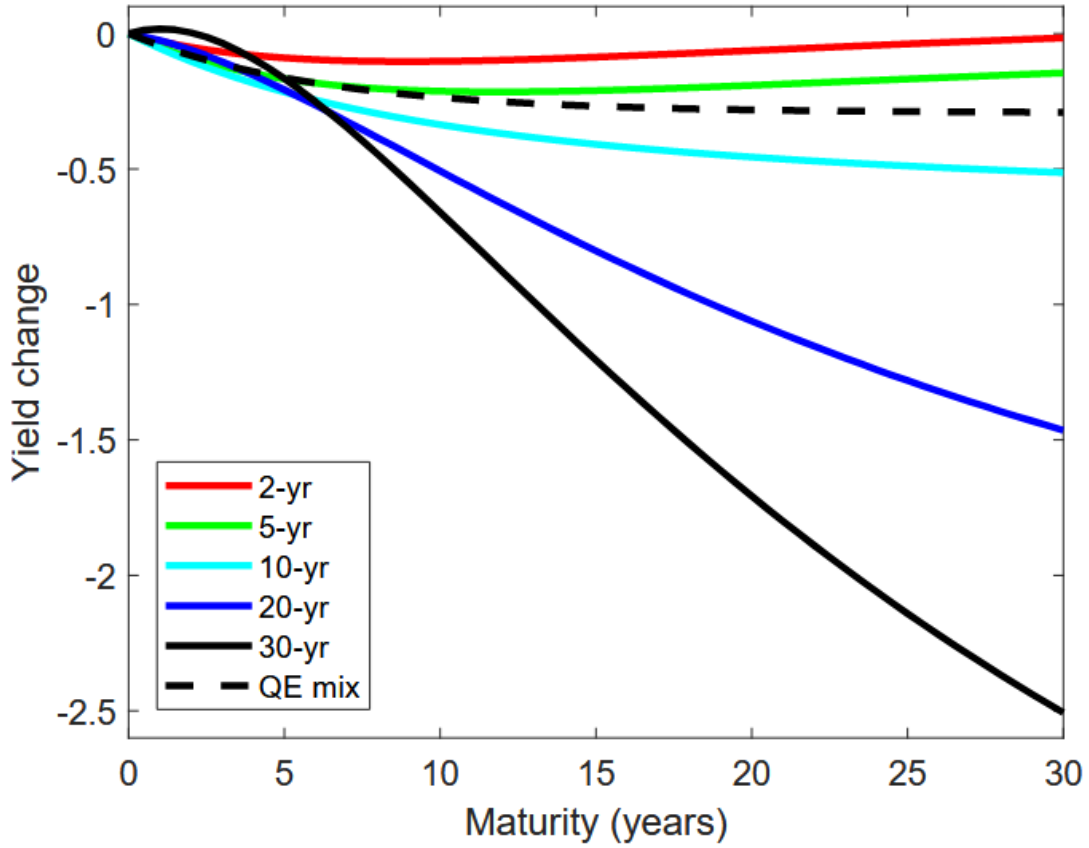
- Players:
  - Preferred habitat investors (pension funds, insurance companies, bond mutual funds)
  - Yield curve arbitrageurs (hedge funds, bond dealers/bond trading desks)

- Arbitrageurs integrate the yield curve, demanding risk premia as compensation for interest rate shocks and future supply shocks:

$$\lambda^{risk} \propto \gamma \sigma_W, \qquad where, \qquad \sigma_w = f(quantity\ of\ risk)$$

- Risk premium on interest rate shocks give a way of thinking about a duration risk premium
  - If arbitrageur risk aversion is high (e.g., balance sheet constraints) then risk premia are higher, and QE has a bigger impact
  - Duration local effects come from risk premia to future supply shocks

# Vayanos and Vila (2021): Model output




Effect on Treasury yield curve of announcement of purchase of $X of given maturity bond

# Duration Risk Premium and Spillovers

- Treasury yield also affected by safe asset demand effects.
  - If 10-year preferred habitat investors (e.g., insurance company demanding 10 year safe bonds) increase their demand for 10-year bonds … the 10-year yield will fall.

- What is a pure duration risk-premium effect?
  - Look at yield change on an asset not demanded by safe asset investors, but has duration risk, which the arbitrageur also prices

  - E.g., non-investment grade corporate debt?

- And this is related to spillovers: what else does the arbitrageur pricing kernel price?

$$\lambda^{risk} \propto \gamma \sigma_W, \qquad where, \qquad \sigma_w = f(quantity\ of\ risk)$$

# “Narrow” analysis from non-QE asset pricing research

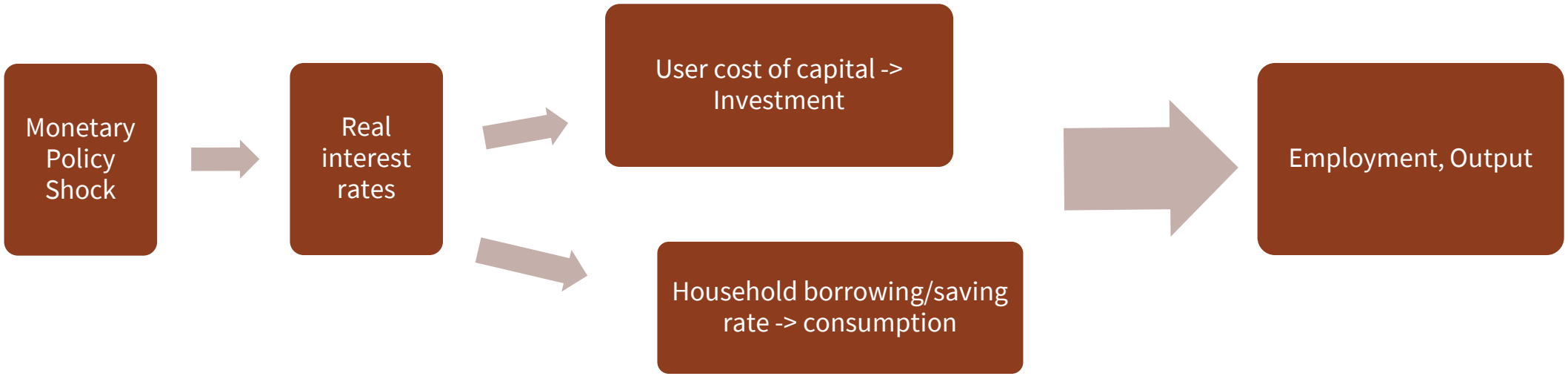
- We can learn from understanding the impact of (---) buying 10-year bonds, where (---) doesn’t have to be Fed

- Intermediary SDF, market segmentation, specialized demands
  - Intermediary asset pricing (He and Krishnamurthy, 2013)
  - Koijen and Yogo (2019) for equities
  - Bretscher, Schmid, Sen and Sharma (2022) for corporate bonds

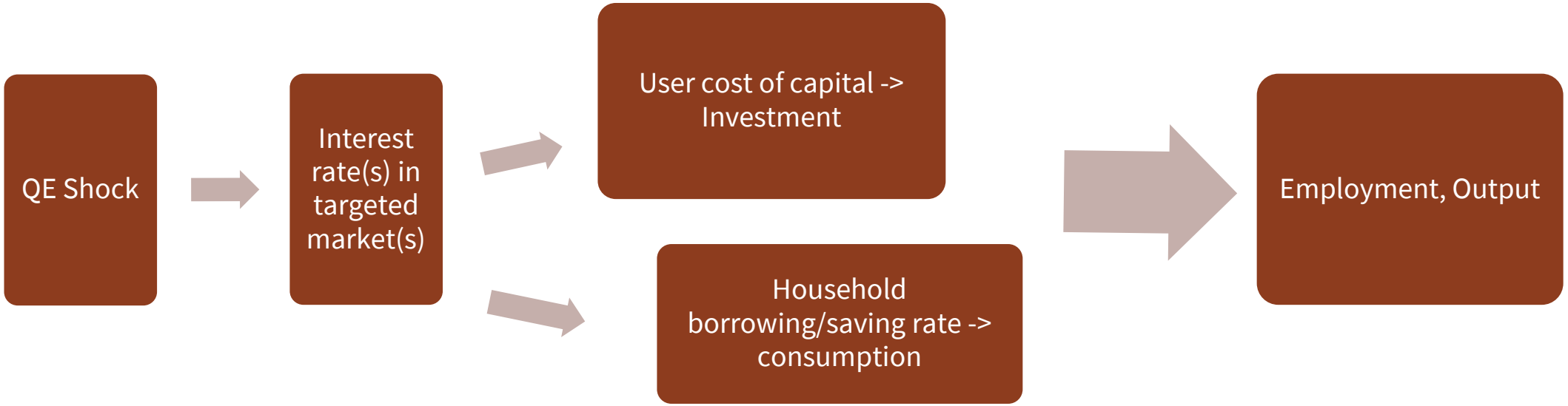
# Macro effects, conventional

Conventional monetary policy research has pursed VARs with *identified* monetary policy shocks

Here is a modeling way of understanding the steps in any identified mechanism



# Macro effects of QE



# User cost of capital and firm investment

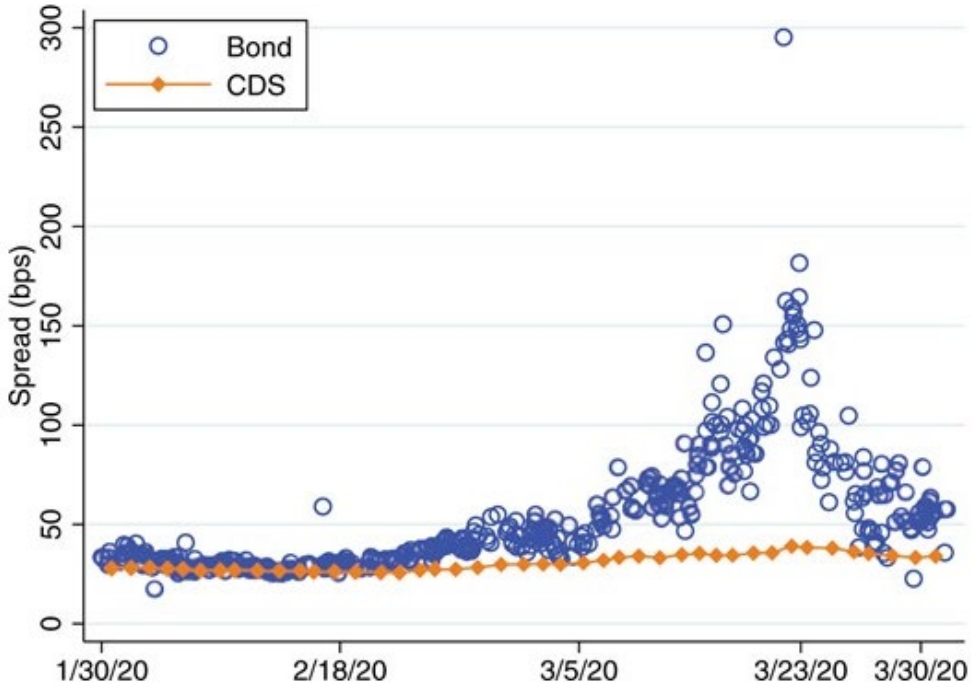
- Corporate expenditures will only respond to QE if QE affects the user cost of capital on the marginal unit of capital

- Suppose Google had two sources of capital
  - Cash (it has a lot…)
  - Corporate bond market

- The marginal source of capital is almost surely cash, where the user cost of capital is the nominal interest rate

- Corporate bond QE should be expected to have no effects on Google investment

- Evidence for the "no effect": Acharya and Steffen (2020), Darmouni and Siani (2022)




Google Bond Yield and CDS;
Fed Bond Purchase Program Announced 3/23

# Bonds, Loans and QE

- Take a firm with 5-year bonds and 5-year bank loans only
- Suppose suppliers of capital increase required returns
  - But bond investors more so than banks
- Since the firm will tap the lower cost source of capital at the margin
- *QE should target the financing with the lower yield (less fire-sold)*
  - That is, bank loans

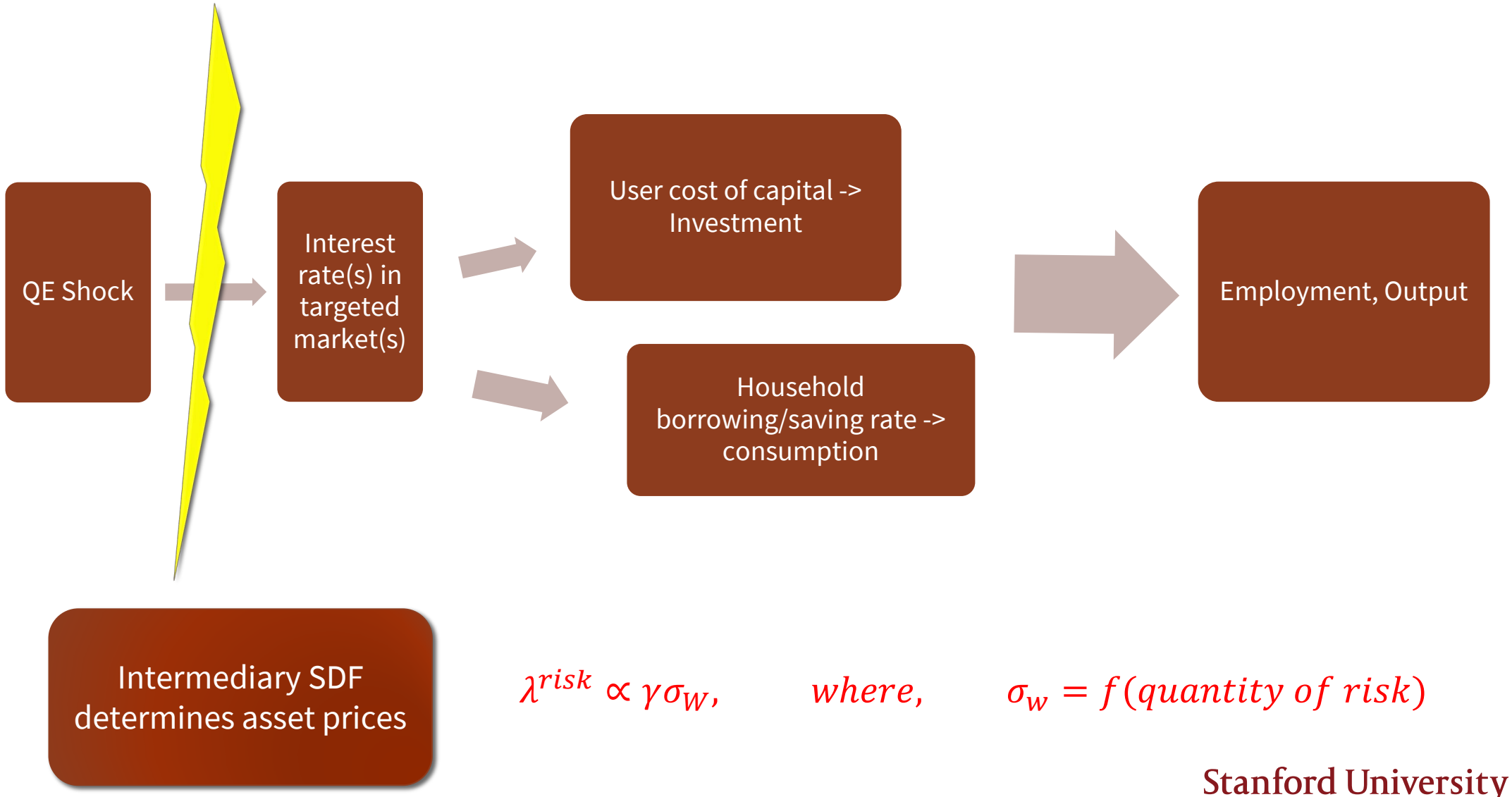
# QE and corporate finance

- Evidence for a pure cash hoarding effect from Fed 2020 COVID intervention in Acharya and Steffen (2020), Darmouni and Siani (2022)

- Grosse-Rueschkamp, Steffen, and Streitz (2019):
  - CSPP lowered bond yields, but had limited impact on treated firms' investment

  - But banks that were more exposed to treated firms increased lending to other firms; a spillover through a bank lending channel

# Macro effects via intermediation SDF




$$\lambda^{risk} \propto \gamma \sigma_W, \qquad where, \qquad \sigma_w = f(quantity\ of\ risk)$$

# Intermediation Channel

- Suppose instead that we considered a financial intermediation channel
  - The macro analog of He and Krishnamurthy (2013) and Vayanos and Vila (2021)
  - The SDF of these intermediaries prices both the narrow assets as well as related credit assets such as loans
  - Macro financial intermediation models (Gertler and Kiyotaki, 2010, Gertler and Karadi, 2011, Brunnermeier and Sannikov, 2014, He and Krishnamurthy, 2019, Papousi, Piazzesi and Schneider, 2021) build on this observation

1. *In this model, QE should purchase the low-price ("fire-sold") assets, to shore up the balance sheet of the intermediary, lowering risk prices and increasing lending*
2. *In this model, QE is particularly effective when constraints on financial intermediation is tight (e.g., distressed periods)*

# Further modeling?

- Suppose we mix corporate finance and intermediation:
  - Buy the expensive bonds in normal times and the cheapest bonds in distressed times?

- Modeling details matter for thinking about spillovers. Why did MBS purchases matter more than Treasury purchases? Why did real estate lending react more strongly than C&I lending?
  - There is ample room for more modeling work to interface with data patterns.

# Policy implications

- We are far from a compelling macro-finance model to study QE
  - Comparisons of conventional to unconventional within a single model is premature

- Research is still in the insights stage

1. The asset market targeted matters for transmission and design of optimal policy. It is more subtle than buy stuff … good things happen

2. Crisis interventions are more powerful than non-crisis interventions

3. Communication matters

# Communication and QT

- Financial markets infer reaction functions ("Taylor rules") over QE and conventional policy from QE actions and QE announcements
  - Is there a Fed "put"?  What is the strike?
  - Is the put for QE and/or conventional policy?
- In an environment where there is uncertainty over the reaction function, signal effects will be very strong
  - We saw this in 2013 with the taper tantrum
  - Likely important in today's environment

# Taking stock and a wishlist for research

1. Empirical evidence on the impact of asset purchases on asset prices
   - ➢ Many compelling studies. We have a pretty clear idea of the relevant channels

2. Asset pricing models that fit this evidence
   - ➢ Coherent models exist, but room for more work

3. Evidence on some of the macro consequences
   - ➢ Less compelling than the asset pricing work

4. Positive macro models of transmission mechanism
   - ➢ Many papers, but the weakest area of QE research thus far

5. Normative analyses to guide optimal policy and policy communication
   - ➢ Less work, and even less in the way of a compelling framework