Banks' Risk Exposures – update

Juliane Begenau, Monika Piazzesi and Martin Schneider

Stanford

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Motivation

- How can we measure the risk exposures of banks?
  - How can we compare the exposures of positions within banks?
    e.g. loans vs. securities, derivatives vs. other assets
  - How can we compare the exposures across banks?
    e.g., is JP Morgan more exposed than Wells Fargo?
- Replication approach with portfolio invested in few bonds
- Why useful?
  - well-functioning financial system and bank regulation
  - models with banks have few assets, confront data on many assets

Idea behind replicating portfolios

- express balance sheet positions of individual banks as "equivalents"
  - in 2013:Q4, JP Morgan has \$337.4 Billion worth of securities. These are 14% of its \$2.71 Trillion assets.
  - The security position is equivalent to a portfolio with \$216.9 Billion in "5 year swap-quality bonds", \$24.1 Billion in "5 year BB-rated bonds" and \$96.4 Billion in cash.
- replicating portfolios are constructed to match factor exposures
  - 2 risk factors: interest rate risk, credit risk
- replicating porfolios have same gains/losses

  in response to risk factor shock as the original positions.
  - (not duration matching, but maturities matter for factor exposures)

Construction of replicating portfolios

- interest rate risk: F_t^{int} = return on 5 year safe (swap-quality) bond
  credit risk: F_t^{credit} = (orthogonalized) return on 5 year BB-rated bond
- exploit strong factor structure, any other fixed-income instrument i

$$R_t^i = \alpha_i + \beta_i^{\text{int}} F_t^{\text{int}} + \beta_i^{\text{credit}} F_t^{\text{credit}} + u_t^i$$

  with u_t^i uncorrelated with risk factors
- estimate exposures β_i^{int} and β_i^{credit} recursively with data until t, can downweigh past, *cross sectional* fit for many instruments is key
- instrument i has certain maturity and credit-riskiness

  includes Treasuries, swap-quality bonds, MBS, and corporate bonds
- replicating portfolio puts weight β_i^{int} on 5-year swap bond, β_i^{credit} on 5-year BB-rated bond, $1 - \beta_i^{\text{int}} - \beta_t^{\text{credit}}$ on cash

Data on individual bank positions

- Quarterly Call Reports 1995:Q1 - now
- deposits & fed funds are mostly short term (= cash)
- securities: market values together with
  information about their maturities, credit ratings
- loans: face values together with
  information about their maturities, credit ratings

  $\rightarrow$ face values have to be translated into stream of payments
- derivatives: market values, notionals, maturities
  but not direction of the trade
  mostly swaps, which are linear combinations of bond prices

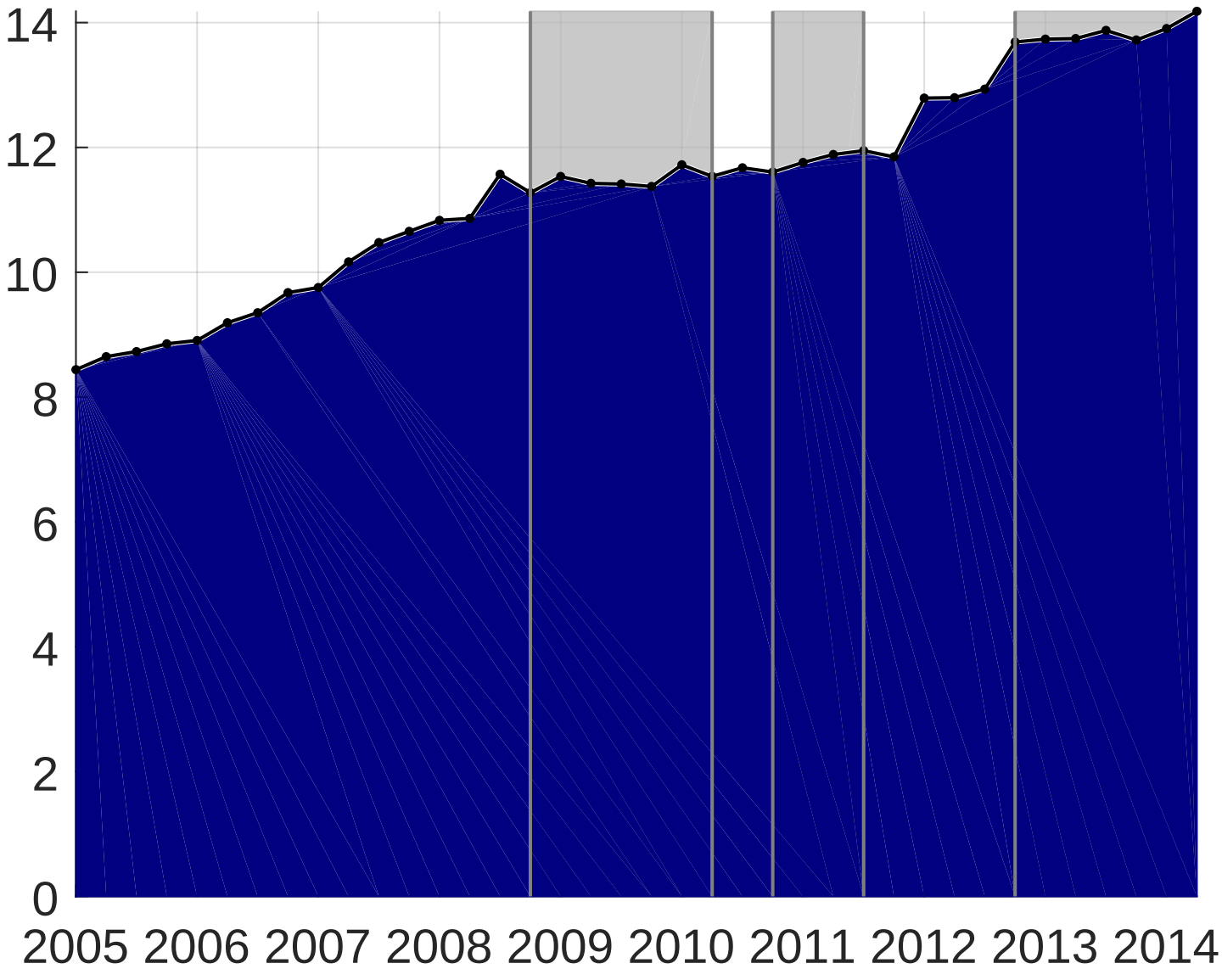
  $\rightarrow$ Bayesian estimation procedure to estimate direction

Update 1: Putting everything on a website

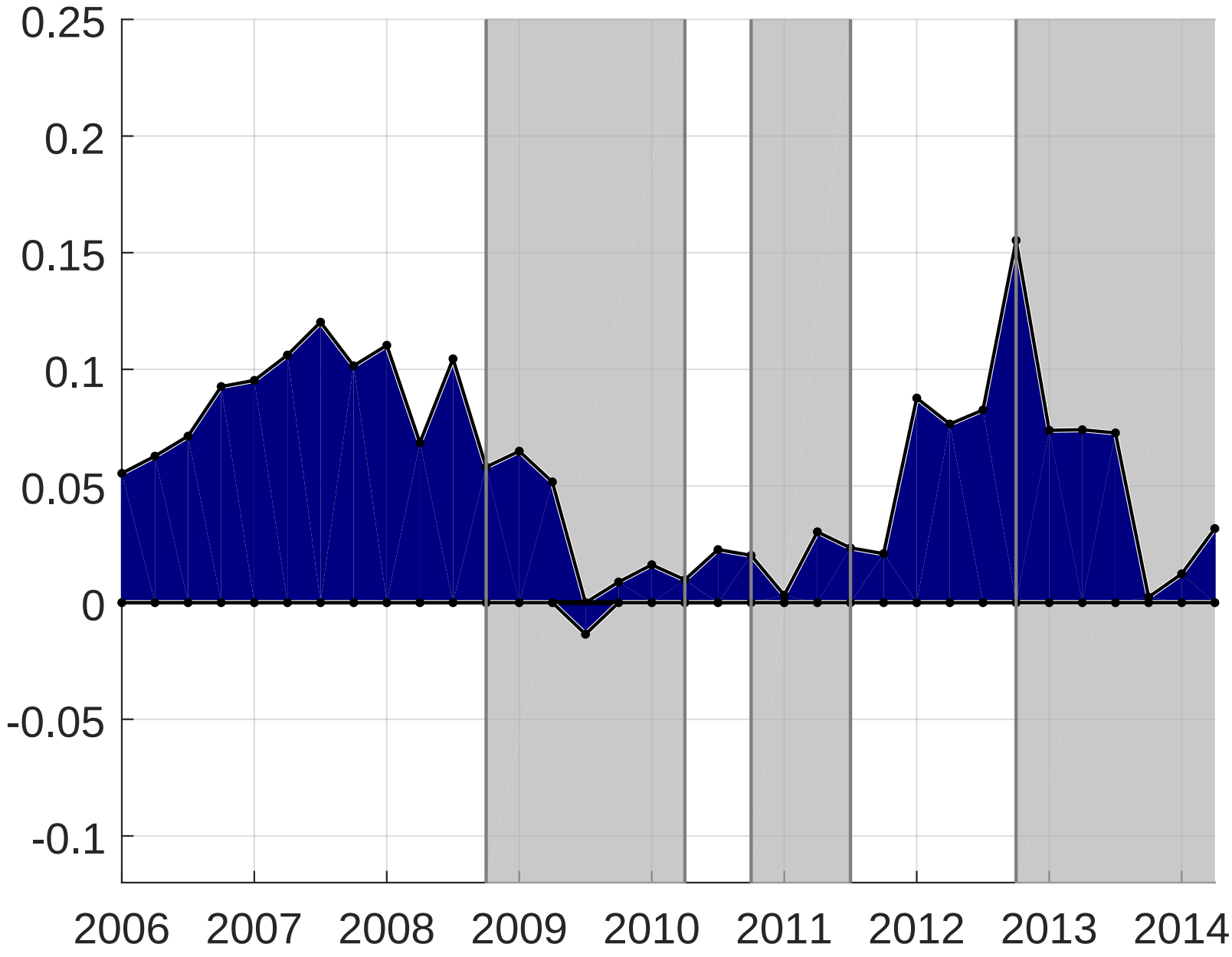
- for each individual U.S. bank, we compute replicating portfolios for every quarter from 1995:Q1 - 2017:Q3
- we put replicating portfolios for each bank on website
- we provide step-by-step instructions on how to update our sample
  - how to get balance sheet data from Call Reports on FDIC website
  - how to get prices and returns for fixed income instruments (Treasuries, swap-quality bonds, MBS, corporate bonds, etc.)
- website has our Stata and MATLAB codes to process updated sample
  - code allows user to choose method to estimate exposures
  - various options for Bayesian estimation that deals with derivatives
- website either at MFM or linked by MFM

Update 2: Bank risk exposures during QE

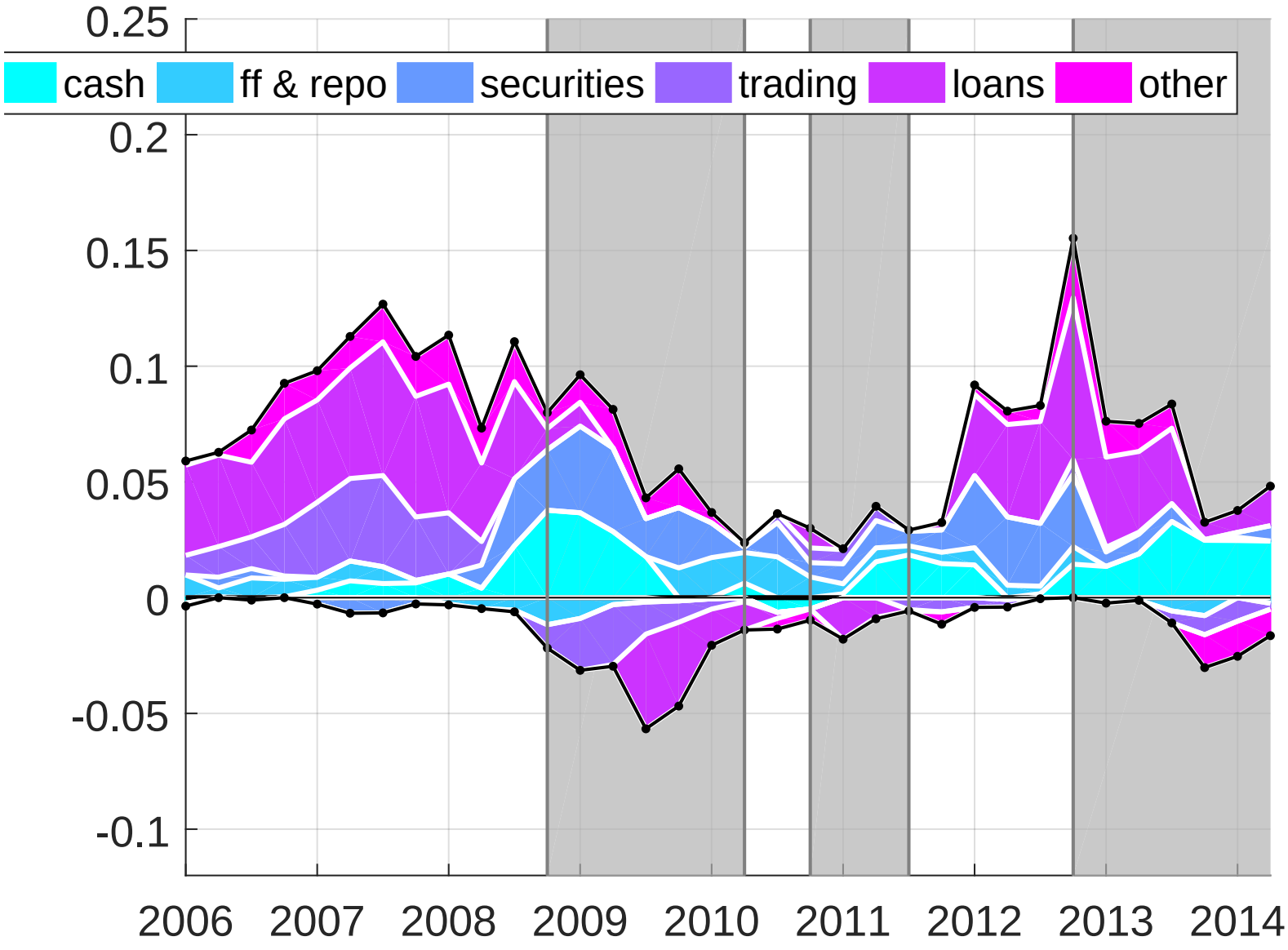
assets of U.S. banks, three QEs are shaded



Year-on-year growth of U.S. bank assets



Year-on-year growth of U.S. bank asset positions



Year-on-year growth of U.S. exposures