Banks’ Risk Exposures – update

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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 portfolios 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:** \( F_{t}^{\text{int}} = \) return on 5 year safe (swap-quality) bond
- **credit risk:** \( F_{t}^{\text{credit}} = \) (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 \( \beta_{i}^{\text{int}} \) and \( \beta_{i}^{\text{credit}} \) recursively with data until \( t \), can downweight 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 \( \beta_{i}^{\text{int}} \) on 5-year swap bond, \( \beta_{i}^{\text{credit}} \) 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

interest rate risk
credit risk
cash

2006 2007 2008 2009 2010 2011 2012 2013 2014
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25