Pre-Provision Net Revenue (PPNR): Research and Development

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Stress Test Modelling Symposium

October 10, 2018

Introduction

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1. Define PPNR as it pertains to stress tests
2. Describe the current modeling approach
3. Discuss a possible innovation to firm fixed effect calculations

Pre-Provision Net Revenue (PPNR)

- PPNR is the sum of:
  - Net interest income
  - Noninterest income less noninterest expense

- Overall PPNR includes losses from operational risk events and OREO expenses, but these are modeled separately

- PPNR does not include provisions for credit losses on loans or gains and losses on securities

PPNR is a significant portion of projections

Projected losses, revenue, and net income before taxes through 2020:Q1

Item	Billions of dollars	Percent of average assets[1]
Pre-provision net revenue[2]	492.3	3.0
Other revenue[3]	0.0	
less		
Provisions	481.7	
Realized losses/gains on securities (AFS/HTM)	10.0	
Trading and counterparty losses[4]	113.0	
Other losses/gains[5]	26.1	
equals		
Net income before taxes	-138.5	-0.8
Memo items		
Other comprehensive income[6]	-31.8	
Other effects on capital	*Actual 2017:Q4*	*2020:Q1*
AOCI included in capital (billions of dollars)[7]	-53.2	-88.8

PPNR above includes operational risk losses of $135bn

The PPNR models 24 components of revenue

- **Interest income:** Loans, interest bearing balances, UST, MBS, fed funds and repo, trading, securities, other
- **Interest expense:** Domestic time deposits, other domestic deposits, foreign deposits, fed funds and repo, trading and other borrowed money, subdebt, other
- **Noninterest income:** service charges on deposits, servicing fees, i-banking, fiduciary and insurance fees, other, trading
- **Noninterest expense**: Compensation, fixed assets, other

The PPNR model contains various approaches

Current modeling approaches differ among components:

1. **Autoregressive models** relate PPNR component ratios to historical ratios, BHC characteristics and macroeconomic variables

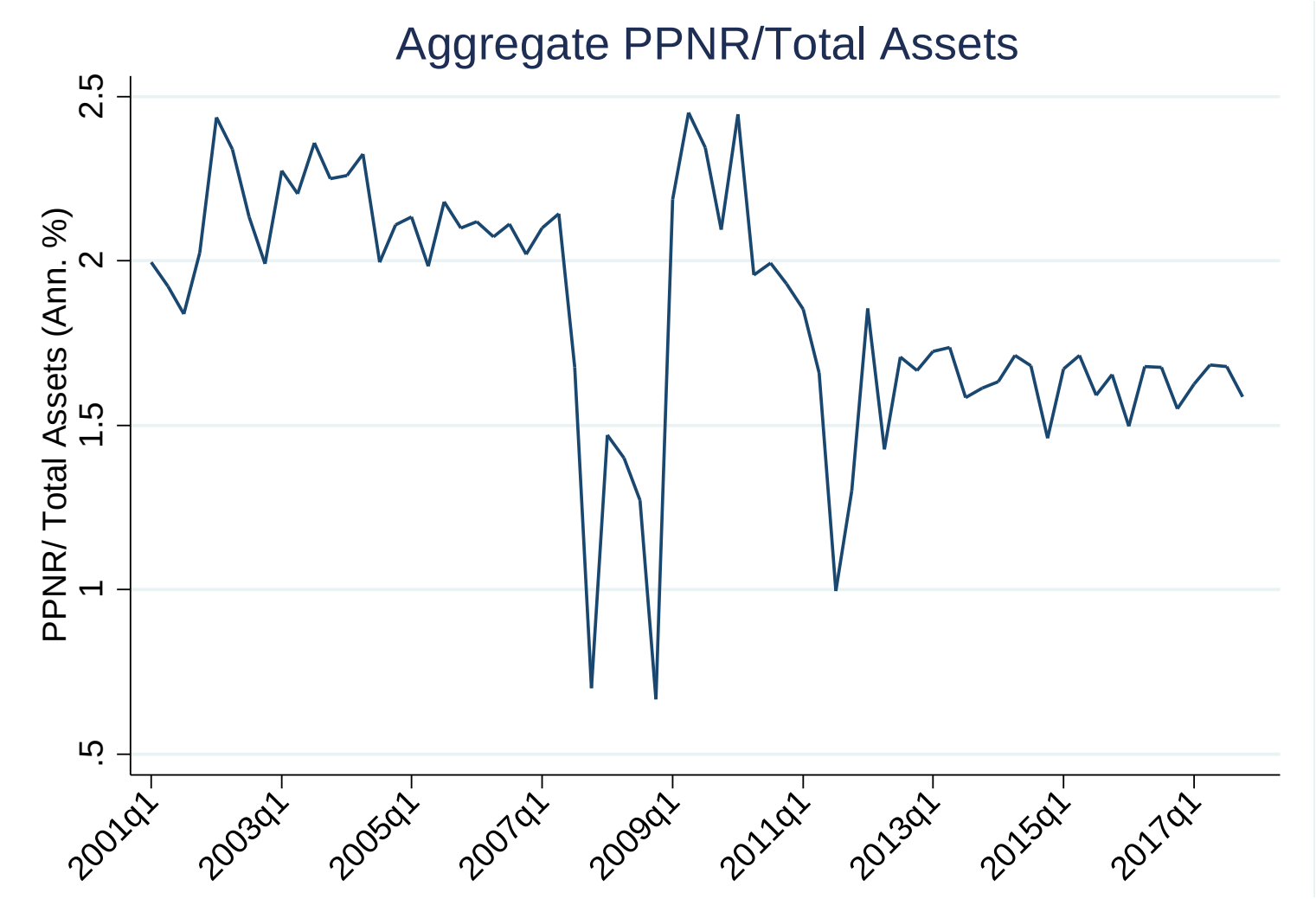
2. **Instrument level models** calculate expenses from granular information on yields and maturities (subordinated debt expense)

3. **Simple models** based on recent firm level performance

Estimation data is the panel of stress-tested banks

- Panel data constructed using public bank and regulatory filings (Y9C)
  - Critical advantage of this data is a long consistent time-series
- Estimation panel uses pro forma data which assumes merged entities are part of the ultimate acquirer as of the beginning of the sample (~1991Q1)
- Estimation and projections use a “top down” approach, rather than “bottoms up” approach
  - Emphasizes consistent treatment of components across banks

Pro Forma PPNR ratio over time



Pro forma Y-9C data including unbalanced panel of 38 DFAST BHCs excluding PPNR items modelled by other teams (op. risk, OREO) and DVA.

Autoregressive models with firm fixed effects

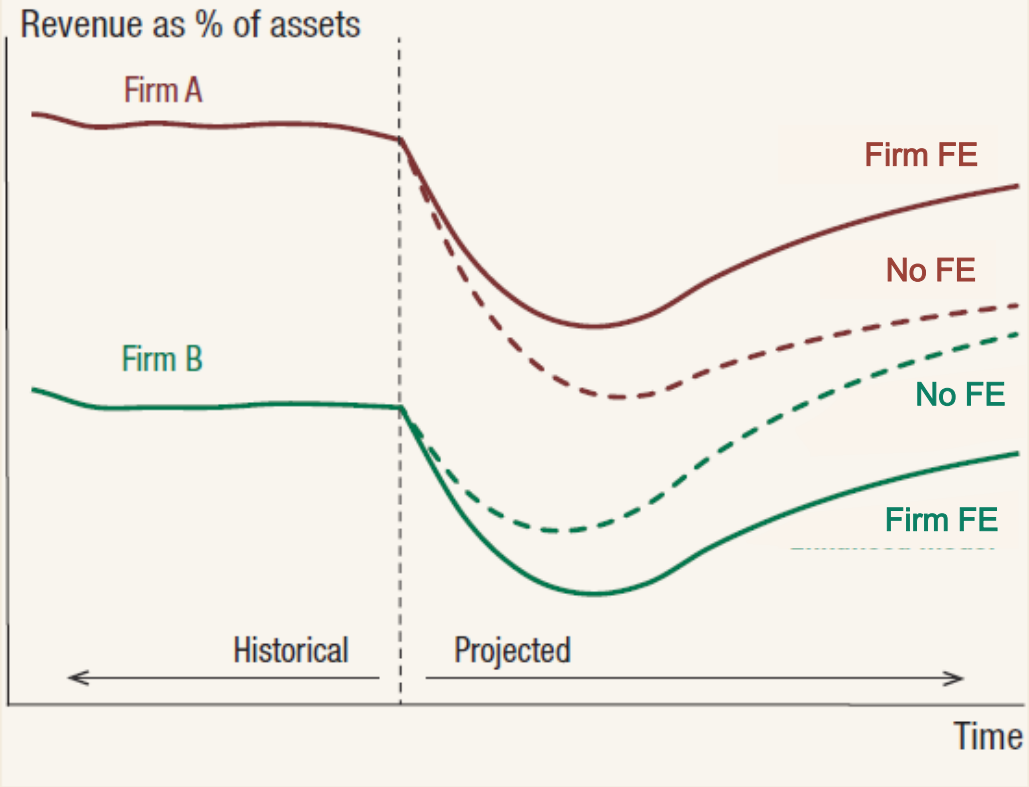
- PPNR components are modeled as ratios, expressed as a share of a relevant asset or liability balance
  - Projections converge towards the firm's own post-crisis average
  - The post-crisis period in here is 2009:Q4 onwards
  - Projections also vary in response to macroeconomic conditions

- The convergence to firm-specific post-crisis averages was phased-in during DFAST 2017 and fully implemented in DFAST 2018

- Some components are split into two groups of firms and sensitivities to macrovariables can vary across groups

The firm fixed effect model improves performance

Figure A. Hypothetical revenue projections from the original and enhanced PPNR models



Source: DFAST 2017 disclosure

Implications of the current fixed effect approach

- As more post-crisis data is added, historical firm performance is estimated over a longer time span
  - Improves stability
  - But new data becomes less impactful due to an ever larger estimation window

- Firm averages maybe less sensitive to recent developments in firm performance and underlying changes in business models

Alternative “Rolling-Window” fixed effect approach

Under a “rolling-window” approach, projections converge towards recent average performance (e.g. past 5 or 8 years) rather than the post-crisis average.

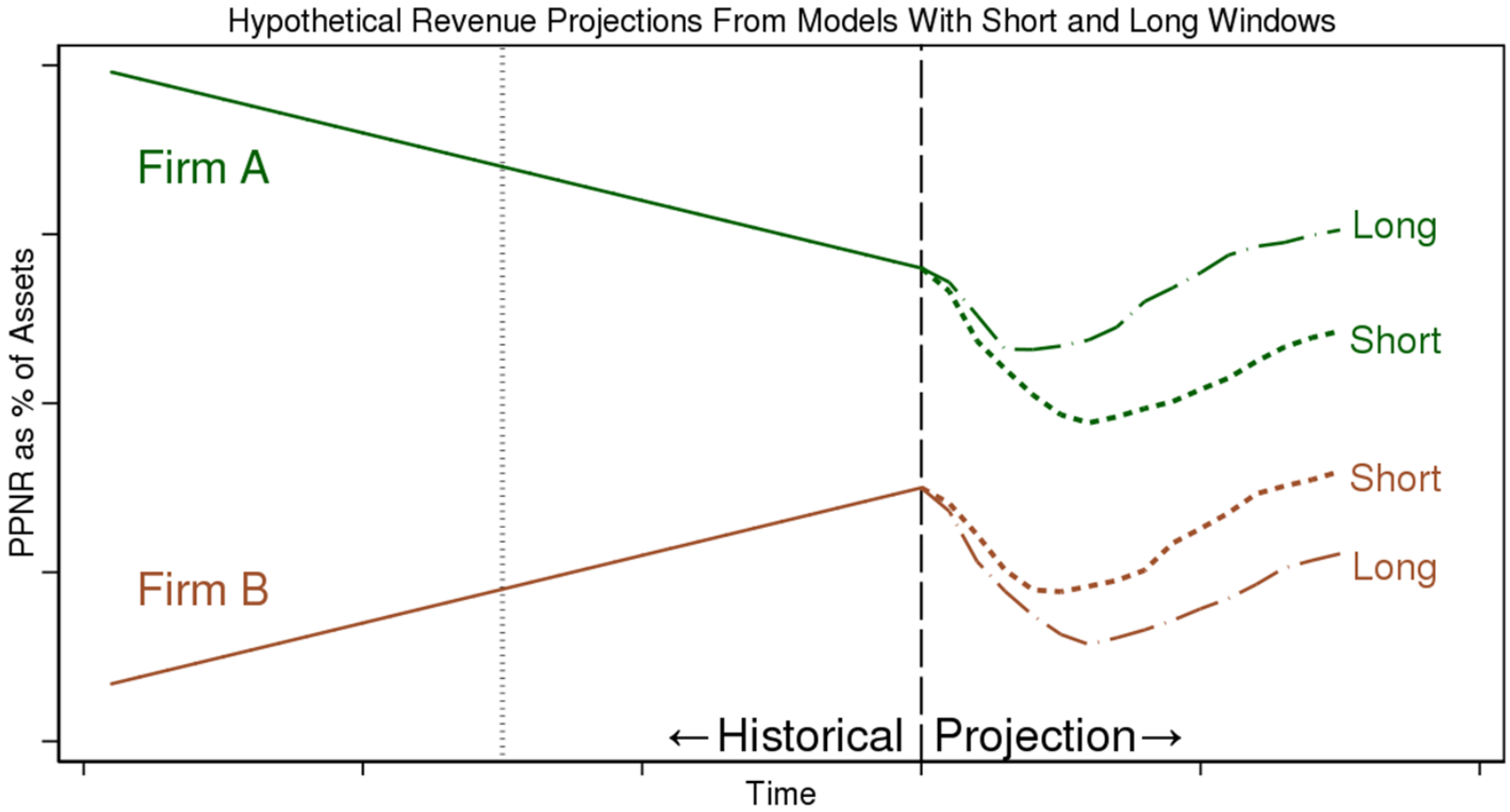
Advantages

- Increases sensitivity of results to recent performance
- Incorporates changes in business models more quickly

Disadvantages

- Increases year-to-year variability in projections
- May extrapolate more temporary changes in performance into projections
- Transition will impact projections for individual firms

Impact of long vs. short rolling windows



Dashed vertical line denotes separation between historical data and projection.
Dotted vertical line signifies end of short window informing projections

Evaluating the rolling-window approach

- Conduct performance testing to identify optimal window size and compare to current model
  - Out-of-sample errors
  - In-sample errors

- Respecify components models with the new structure to identify optimal specification
  - Bank characteristics
  - Lag structure
  - Macrovariables