



Modelling Pre-Provision Net Revenue (PPNR)

1. Introduction

1.1 Background

The Comprehensive Capital Analysis and Review (CCAR) is an annual exercise organised by the Federal Reserve in order to help assessments of capital adequacy, planning and distributions. Participation is mandatory for the largest bank holding companies. Historic bank data has often been sourced from FR Y-9C regulatory reports.

Stress testing is well understood and is used to give an idea of the potential losses that might arise in an economic downturn. Less well known is Pre-Provision Net Revenue (PPNR) modelling, which is concerned with how variable bank earnings are, and how these could be affected in an economic downturn. PPNR measures net revenue from spreads and non-trading fees. Businesses with a trading mindset tend to look at losses generated by asset revaluation, whereas over a number of years, the loss of income revenues could be much more significant.

PPNR provides an analytical starting point for forecasts that can be easily challenged and refined. Accurate forecasting of PPNR is a critical component of holistic risk management for a bank.

1.2 PPNR components

PPNR captures the P&L from the loan book. The loan book earns P&L by writing loans at a higher rate than the bank pays on its deposits, other factors apply such as loan origination fees and associated costs and expenses.

The US Federal Reserve is pressing for improved modelling and analysis of PPNR

PPNR = (Loans * Yield) – (Deposits * Interest) + Additional Income – Expenses

Here is an example calculation:

	Average Balance	Average Rate	
Loans			Income
Mortgages	19,576	3.31%	648
Business Lending	7,339	3.78%	277
Unsecured personal lending	1,274	0.83%	138
Liquid assets	6,781	0.53%	36
Total interest-earning assets	4,970	3.14%	1,099(L)
Deposits			Cost
Current accounts	10,416	0.11%	11
Saving accounts	7,171	0.75%	54
Term deposits	5,500	2.35%	129
Wholesale deposits	96	0.85%	1
Bond and Notes	3,868	2.11%	82
Liquid liabilities	978	0.54%	5
Total interest-bearing liabilities	28,029	1.01%	282(D)
Loan Origination Fees	350 (F)		
Expenses	304 (E)		
Pre-Provision Net Revenue	867 (L - D + F - E)¹		

¹ PPNR = Total interest-earning assets – Total interest-bearing liabilities + Loan Origination Fees – Expenses

2. Challenges around PPNR

Previous attempts to model PPNR have faced a number of challenges:

2.1 Modelling Granularity (known as Segmentation within PPNR terminology)

Is it necessary to build separate regression models for each country and loan/deposit type?

Too much granularity would introduce spurious noise and create an unnecessarily large number of parameters to check. Too little granularity fails to identify the key risk drivers. It is necessary to create a balance by grouping similar countries together. This would improve the analysis as data errors could cancel out, or at least an erroneous amount would form a relatively smaller proportion of a larger aggregate total for a number of countries.

2.2 Modelled Components

Initially, banks simply modelled the changes in interest income less the cost of deposits. More recently, models look at the drivers of changes, eg loan/deposit maturities, pre-payments, the volume of new loans/deposits and credit defaults, loan/deposit spreads around base rates.

2.3 Model Choice

So far most banks have focussed on simple regression models of arithmetic returns, however these can have fairly poor R-squared statistics. The Fed would like to see more sophisticated modelling employed. For example, rather than use a regression model for a number of factors such as the overnight interest rate, the 2-year interest rate, the 5-year interest rate, the 10-year interest rate and the 30-year interest rate, we might use principal component analysis.

More complex techniques could be employed to supplement the current linear regression, such as auto regressive modelling, auto regressive integrated moving average modelling, quintile regression modelling. Given the current poor quality of the data, these do not seem to be currently very useful.

2.4 Quality of Historic Bank Data

To perform reliable regression analysis, it is essential to have good quality, reliable historic time series with a large number of observations. This is often unavailable and has to be synthesised. Large banks are subject to fairly frequent changes (business restructurings, market structural changes, pricing policy changes, client distribution changes, regulatory changes, etc). Often these changes haven't been well recorded as it seemed unnecessary at the time. New businesses and acquisitions are best modelled as separate items and added into the results. Systems changes may also restrict what data can be used. The data should cover at least one full economic cycle. We might determine this to be at least 14 years.

All practitioners report problems obtaining good historic bank data.

2.5 Statistical Checks

The Fed have indicated that they expect checks to be applied for variable distributions, stationarity, serial correlation and out-of-sample performance.

2.6 Expert Input and Overrides

The resulting models should be sanity checked to ensure data quality problems haven't led to obviously spurious regression coefficients. Any relationships that look odd, should be investigated and corrected as necessary.

Comparing the models for similar products across countries could be expected to give similar results. There should not be strong sensitivities for minor economic variables.

Where the statistical tests are failed, expert judgement should consider the overall importance and whether any adjustments can be applied to make corrections.

It is also necessary to ensure that the models are consistent with the historic data that is observed. This needs to be achieved by cleaning data and good modelling, rather than applying fudges on work onwards.

Automated overlays can be built into the model to apply corrections as necessary. For example, if a loan product balance increased historically due to extra hiring of sales staff rather than economic factors. Similarly, overlays can be used to prevent balance amounts going negative.

2.7 Poor Documentation

It is necessary to be honest and clearly document where data is poor and/or unreliable. Gaps need to be identified so they can be prioritised and improved in future.

All expert input and overrides should be clearly documented and justified.

3. June 2016 Federal Reserve Report

For the report "Dodd-Frank Act Stress Test 2016: Supervisory Stress Test Methodology and Results - June 2016," the Federal Reserve pooled historic data from 33 banks and built their own models. The resulting model parameters are the same for all banks. Pooling data in this way should reduce the effect of errors. We have the additional advantage that the resulting models exclude bank specific factors.

The Federal Reserve used a variety of models as appropriate. Structural models were used for individual large positions. Autoregressive models were used for revenue and expenses. Simple nonparametric models were employed, calibrated on recent bank-specific performance.

Separate models were built for 22 components of PPNR. Interest income was modelled as income on loans, income on Treasury securities, income on mortgage-

backed securities, income on federal funds and repo agreements, income on other securities, income on trading assets, and all other interest income. Interest expense was broken out and modelled as interest expense on deposits, interest expense on federal funds and repo agreements, interest expense on trading liabilities and other borrowed money, interest expense on subordinated debt, and all other interest expenses.

Non-interest income modelled included service charges on deposits, fiduciary income, income from insurance, investment banking and net servicing fees, and all other non-interest income. Expenses were modelled as staff compensation, fixed asset expenses and all other expenses.

These two scenarios were considered:

Adverse:

Domestic scenario – GDP growth falls to

- 2.8%, unemployment rises to 7.5%

International scenario – EUR area GDP growth falls to - 3.4%, Euro inflation falls to -0.8%, etc

Severely adverse

Domestic scenario – GDP growth falls to -6.1%, unemployment rises to 10%

International scenario – EUR area GDP growth falls - 5.4%, Euro inflation falls - 1.3%, etc

Over the 9 future quarters of the adverse scenario, the total losses of the 33 banks considered was projected to be USD 324B, of which, PPNR falls to USD 475B mainly due to lower long-term Treasury rates.

Over the 9 future quarters of the severely adverse scenario, the total losses of the 33 banks considered was projected to be USD 526B, of which, PPNR falls to USD 384B mainly due to negative short-term interest rates.

4. Summary

There is potential for significant PPNR losses. More focus needs to be given to PPNR modelling and loss mitigation.

Crude models don't give sufficient detailed information to perform useful analysis. Sophisticated, granular models tend to be

dominated by noise from poor quality data at individual bank level. So, we need to strike a balance in current analysis.

Banks need to collect detailed, granular data going forwards so they will be able to perform more useful analysis in the future. Governance and documentation of changes needs to be improved.

Rather than build a poor model for the entire business, it might be better to build a

number of models to be aggregated, for example, use good models for desks that have good information, use simpler modelling for desks where historic information is poor.

The Federal Reserve is pressing for improvements including more sophistication in PPNR modelling, this will be difficult to achieve until banks collect better quality data.

Getting in touch

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