

Bank Profitability during Recessions

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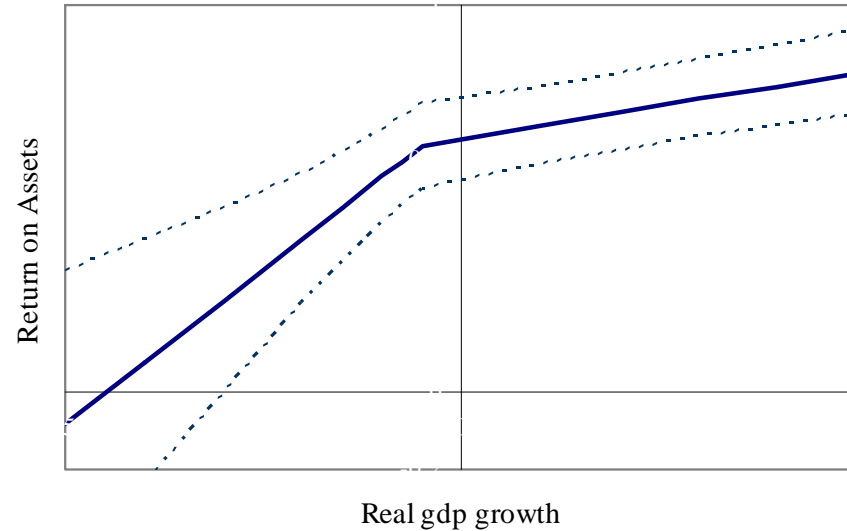
Outline

1. Introduction
2. Literature
3. Data
4. Methodology
 - (a) Model
 - (b) Estimation
5. Results
6. Conclusions

1. Introduction

Main Question:

How is Bank Profitability related to the Business Cycle?



2. Literature

General finding in the literature:

- *Positive relation* between bank profitability and the business cycle.
- Effect of economic activity on bank profitability is rather *small*.

Median return on assets (before tax): $\pm 0.7\%$

Given a 1% lower real gdp growth / output gap, the expected c.p. decline in current profit equals:

	<u>In terms of Assets:</u>
Bikker and Hu (2002)	0.06 %
Athanasoglou, Brissimis and Delis (2008)	0.077 %
Albertazzi and Gambacorta (2009)	0.025 %

2. Literature

Main channels for a traditional bank:

Worsening economic conditions

Fewer new loans

Credit losses

Berger and Udell (2004)
Calza et al. (2006),
Sorensen et al. (2009),
Jiménez et al. (2009).

Provisioning: Laeven & Majnoni (2003),
Bikker & Metzemakers (2005).
Credit losses: Salas & Saurina (2002),
(*asymmetric:*) Marcucci & Quagliariello (2009).

Changes in the yield curve, other...

2. Our Contribution

- 1) We assess whether the relation between the business cycle and bank profitability is stronger during deep recessions.
- 2) We derive our model from the bank's balance sheet and profit function. We improve other research by taking the bank's lending history into account.
- 3) We estimate a model for the three components which define bank profit: (a) net interest income, (b) other income and (c) provisioning plus all other costs.
- 4) We use both aggregated and individual bank data.

3. Data

Sources:

Aggregated bank data over countries:

OECD Banking Profitability Statistics

(unbalanced panel, 17 countries, 1980-2007, 355 country-year obs.)

Individual bank data:

BankScope

(unbalanced panel, 19 countries, 1991-2007, 16,851 bank-year obs.)

Macro economic data:

OECD Main Economic Indicators

4. Methodology

Starting point:

Bank balance sheet and profit function.

Goal:

Derive a model which can be estimated from the *available* data.

4(a). Model

Stylized bank balance sheet	
-Loans (L_t)	- Deposits (D_t)
- Non interest earning assets	- Other net interest bearing liabilities (R_t)
	- Bank capital
Total assets (A_t)	Total liabilities (A_t)

4(a). Model

Stylized Bank Income Statement

+/+	Net Interest Income		
+/+	Other Income		
-/-	Net Provisioning		} Put together
-/-	<u>All other costs</u>	+	
	Profit before Tax		

4(a). Model – Net Interest Income

Assumption:

Loans earn a fixed long term rate. Holders of deposits and (net) other interest bearing liabilities are paid a short term rate.

Consequences:

- The bank's lending history and historical lending rates do matter for current interest income.
- Interest income *to assets* is affected by the scope of the bank's activities (such as the ratio loans to assets).
- Several *cross-terms* appear in the empirical specification.

4(a). Model – Net Interest Income

Illustration of cross-terms:

$$NII_t \approx \sum_{i=0}^{\infty} r_{l,t-i} \cdot \omega_{t-i} \cdot L_t - r_{D,t} D_t - r_{R,t} R_t$$

Can be rewritten in the following form (see paper for details)

$$\frac{NII_t}{L_{t-1}} \approx r_{l,t} \frac{NL_t}{L_{t-1}} + \sum_{i=1}^{\infty} r_{l,t-i} \cdot \frac{NL_{t-i}}{L_{t-i-1}} \cdot \left(\prod_{j=1}^i (C_{t-j}) \right) - r_{D,t} D_t - r_{R,t} R_t$$

Note:

If the lending rate, $r_{l,t}$, depends on the *long term rate* and if new loan origination, NL_t/L_{t-1} , is related to *real gdp growth*, then their cross-term and lags will appear in the empirical specification.

4(a). Model – Bad Loan Losses

Bad loan losses (at time t) are modeled as fraction of the loan portfolio (at time $t-1$).

The fraction that is lost depends on real gdp growth (-) and unemployment (+).

Allow for a kinked relation with real gdp growth (Marcucci and Quagliariello, 2009)

- Slope is steeper if real gdp declines by at least 0.5% ».

4(b). Estimation

Aggregate data:

Dataset: Small number of units with relative large number of obs.

Method: GLS with heteroskedastic panels and unit-specific AR(1) disturbances.

Individual bank data:

Dataset: Gaps in the data. Large number of units with relative small number of observations.

Method: Fixed Effects with (common) AR(1) disturbances.

- (Baltagi-Wu LBI statistics of about 1.4)

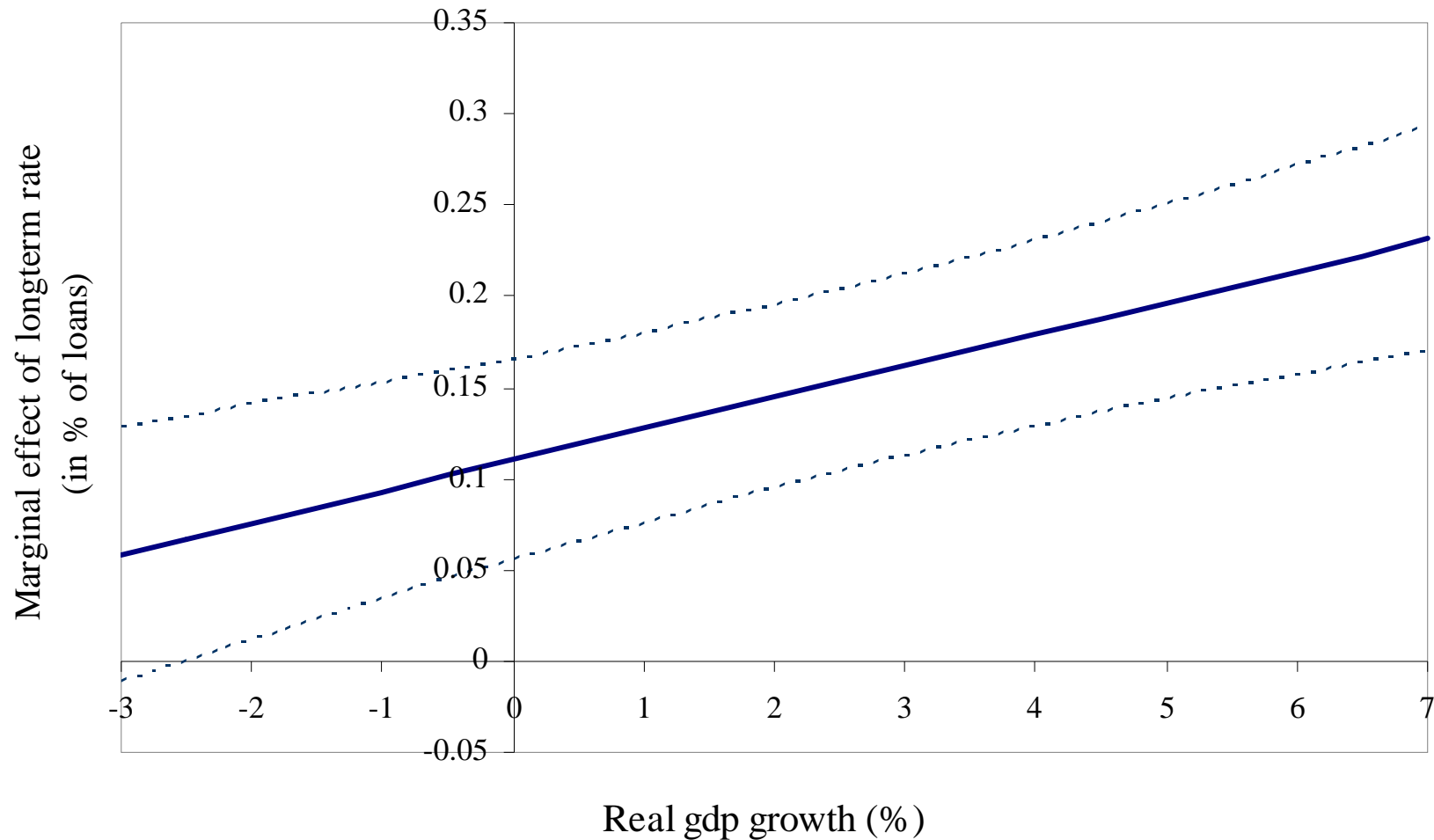
5. Results – Net Interest Income »

Overall: results are in accordance with our expectations for both datasets.

- Long (*short*) term rate with a positive (*neg.*) sign.
- Effect of long term rate is significant for a long period and declines over time (4 lags for individual data).
- As real gdp growth increases and the slope of the yield curve decreases, the long term rate becomes more important.

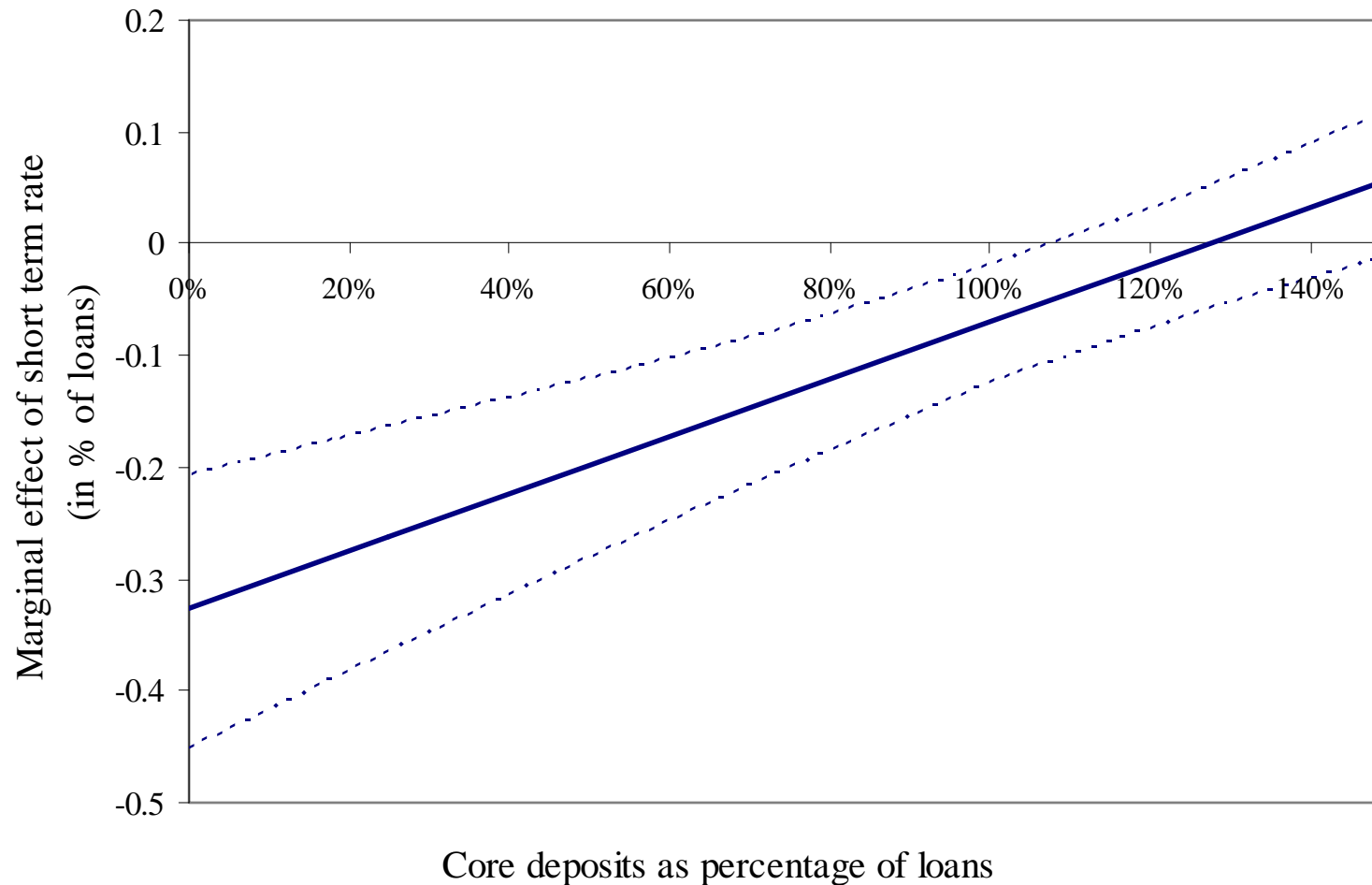
5. Results – Net Interest Income

Marginal Effect of the Long Term Rate (lagged)



5. Results – Net Interest Income

Deposit funding versus Wholesale funding



5. Results – Bad loan losses & Costs »

Unemployment and recession slope dummies increase bad loan losses and costs with the expected sign.

The increase in Bad Loan Losses due to less real economic growth is larger during severe recessions, than during 'normal' periods:

- If real activity decreases by 1% point during a severe recession: BLL & Costs to Assets increase by $\pm 0.4\% \times (\text{Loans to Assets})$

This asymmetry is significant up to 3 lags for the aggregate data.

5. Results – Return on Assets »

The effect of the business cycle is larger during severe recessions:

Fall in return on assets due to an additional 1% point decline in current real gdp growth during a severe recession:

$$\pm 0.4\% \times (\text{Loans to Assets})$$

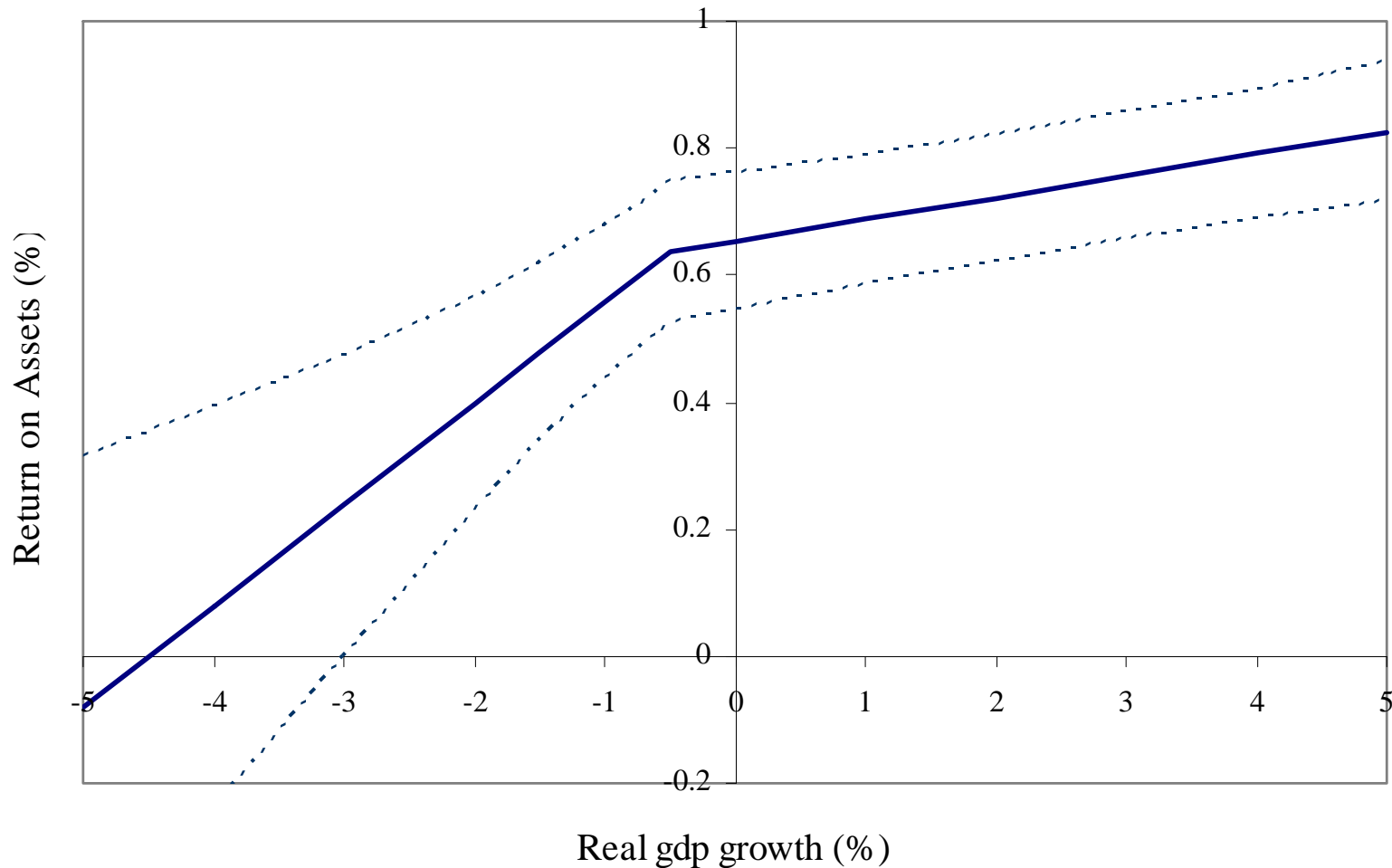
→ If a bank has an L/A ratio of 0.6*, then the effect during recessions is *± 3 - 10 times* the size of the effect in current empirical literature.

- Size of simultaneous effect is the same in both datasets.
- Delayed effect only in the aggregate data.

(*) Median loans to assets ratio in the individual bank data.

5. Results – Return on Assets

Real economic growth and Bank profitability



6. Conclusions

Negative relation recessions and bank profitability through:

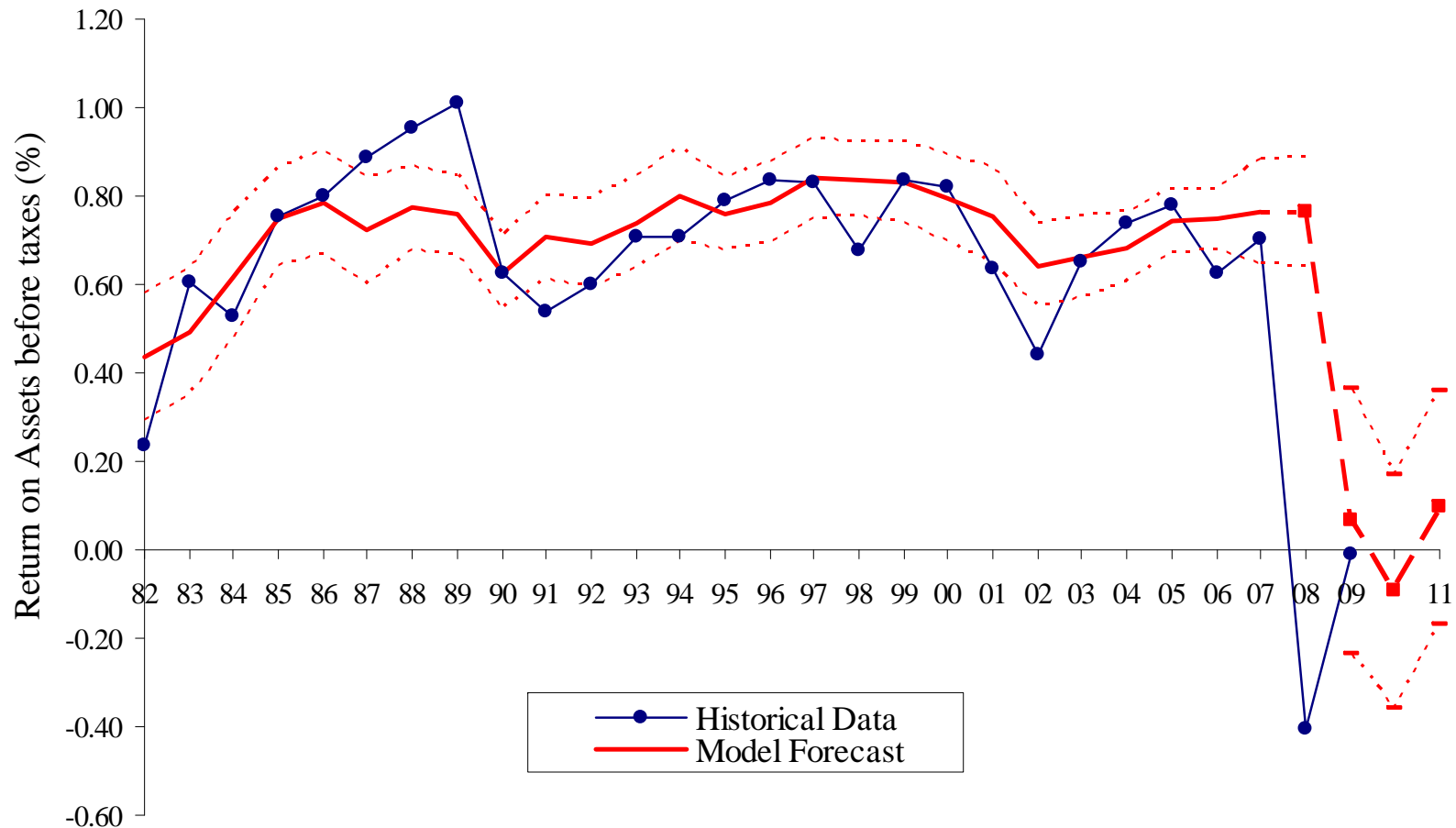
- 1) Net Interest Income: fewer new loans are originated.
 - Has a small, but long lasting effect on bank profitability.
- 2) Bad Loan Losses: recessions increase bad loan losses.
 - Bank profitability is more affected during severe recessions.
 - No decisive result on the duration of this effect.

The relation depends on:

- 1) Bank balance sheet characteristics.
- 2) Other macro economic variables, such as interest rates.

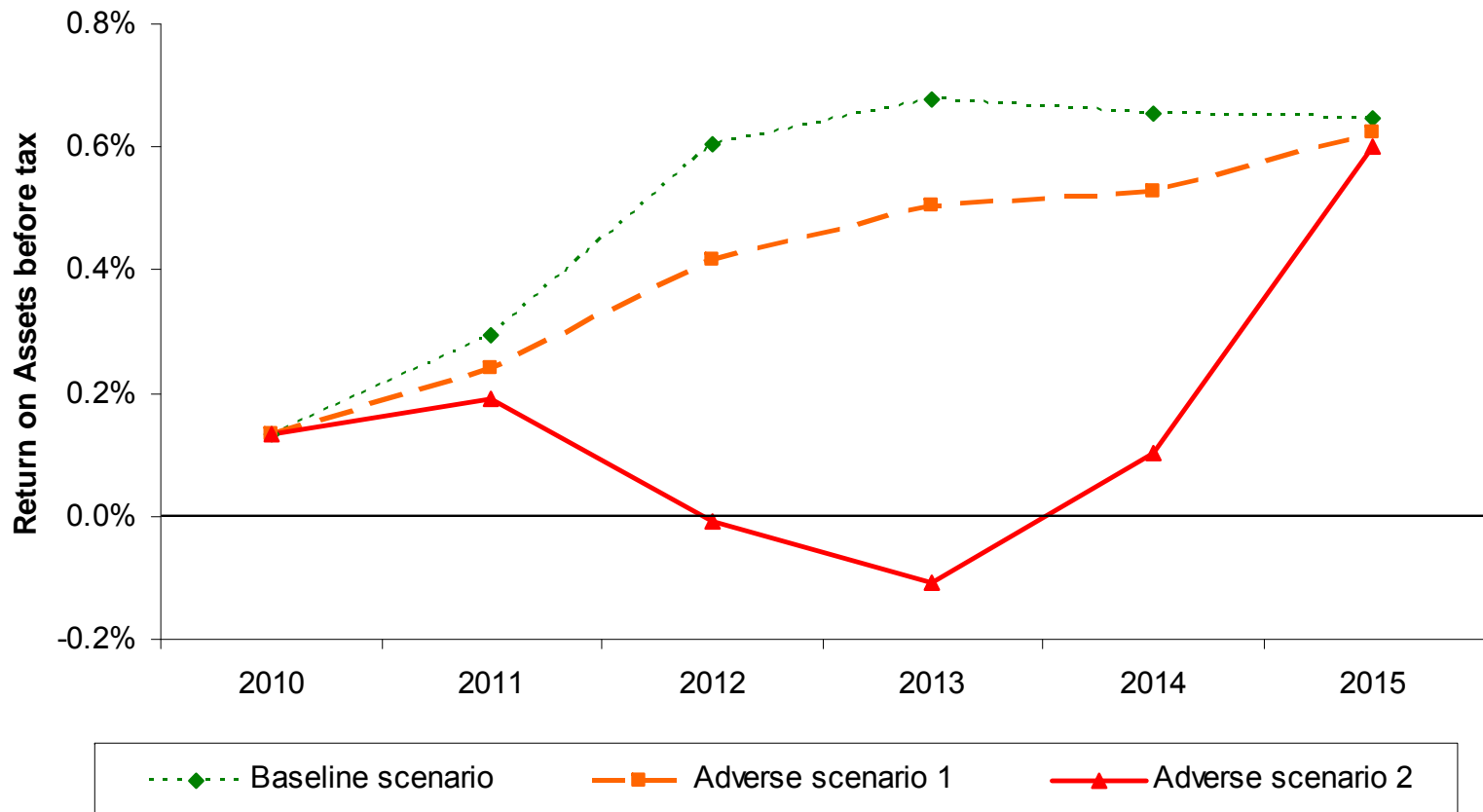
6. Conclusions – Forecasting

Forecasting profitability of Dutch banking sector using output from internal macro economic models



6. Conclusions – FSAP »

Stress Testing for Different Scenarios

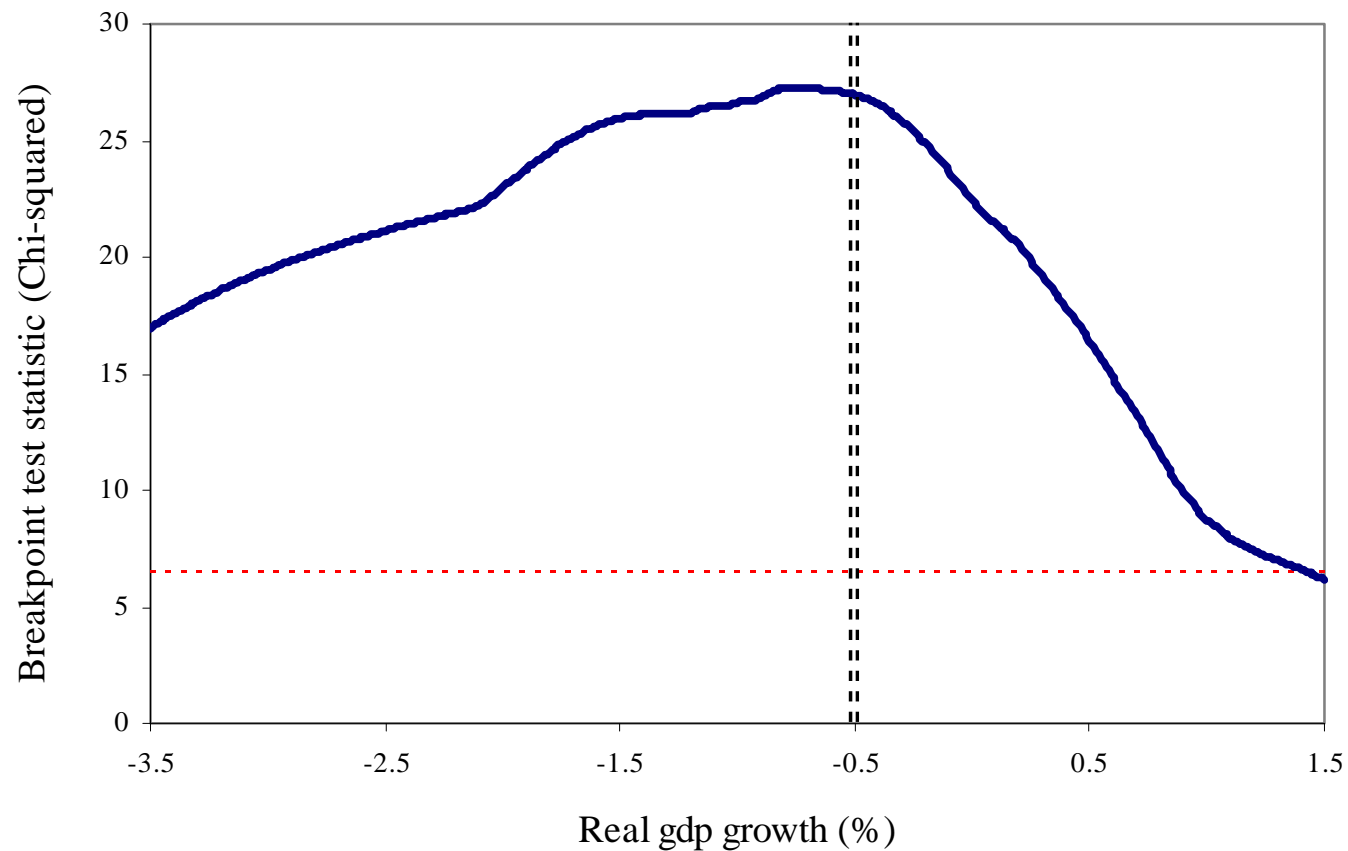


Thank you

Appendix: Breakpoint Selection «

Hypothesis testing: recession dummies are jointly insignificant.

Rejected for values above the horizontal dotted line (at a 1% sign. level)



Appendix: Net Interest Income

VARIABLES	<i>Aggregate data</i>		<i>Individual data</i>	
	(1)		(2)	
	<u>Net Interest Income_t</u>	(s.e.)	<u>Net Interest Income_t</u>	(s.e.)
	Loans _{t-1}		Loans _{t-1}	
Long-term interest rate _t	0.023	(0.036)	0.26***	(0.072)
Long-term interest rate _{t-1}	0.10***	(0.023)	0.13***	(0.027)
Long-term interest rate _{t-2}	0.06**	(0.030)	0.03	(0.024)
Long-term interest rate _{t-3}	0.08***	(0.026)	0.06***	(0.022)
Long-term interest rate _{t-4}			0.09***	(0.019)
(...)				
Long-term rate * Real GDP growth _t	2.14***	(0.563)	1.49***	(0.506)
Long-term rate * Real GDP growth _{t-1}	0.57	(0.452)	1.73***	(0.440)
Long-term rate * Real GDP growth _{t-2}	1.33***	(0.438)	0.78**	(0.380)
Long-term rate * Real GDP growth _{t-3}	0.70*	(0.417)	0.99***	(0.337)
Long-term rate * Real GDP growth _{t-4}			-0.12	(0.282)
(...)				
Number of observations	331		13294	
Number of countries; banks	17		1329	
Wald Chi ² [d.o.f.]	450.45***	[17]	-	
R ² (pseudo; overall)	0.48		0.30	

Appendix: Bad Loan Losses & Costs

VARIABLES	<i>Aggregate data</i>		<i>Individual data</i>	
	(1)		(2)	
	<u>Net provisions_t + Costs_t</u>	(s.e.)	<u>Net provisions_t + Costs_t</u>	(s.e.)
	Assets _{t-1}		Assets _{t-1}	
Real GDP growth _t	-0.07***	(0.024)	0.03	(0.022)
Real GDP growth _{t-1}	-0.03	(0.025)	0.07***	(0.020)
Real GDP growth _{t-2}	-0.04*	(0.023)	0.05***	(0.019)
[L _{t-1} /A _{t-1}] * Real GDP growth _t	0.10*	(0.056)	-0.04	(0.033)
[L _{t-1} /A _{t-1}] * Real GDP growth _{t-1}	0.05	(0.058)	-0.10***	(0.032)
[L _{t-1} /A _{t-1}] * Real GDP growth _{t-2}	0.08	(0.054)	-0.03	(0.030)
[L _{t-1} /A _{t-1}] * Recession slope dummy _t	-0.20*	(0.115)	-0.44***	(0.104)
[L _{t-1} /A _{t-1}] * Recession slope dummy _{t-1}	-0.48***	(0.122)	0.10	(0.101)
[L _{t-1} /A _{t-1}] * Recession slope dummy _{t-2}	-0.27**	(0.114)	-0.09	(0.070)
Unemployment rate _t	-0.0221	(0.033)	0.0778***	(0.019)
[L _{t-1} /A _{t-1}] * Unemployment rate _t	0.139*	(0.080)	0.0769**	(0.031)
(...)				
Number of observations	347		14061	
Number of countries; banks	17		1394	
Wald Chi ² [d.o.f.]	323.07***	[15]	-	

Appendix: Other Income

VARIABLES	<i>Aggregate data</i>		<i>Individual data</i>	
	(1)		(2)	
	<u>Other Income_t</u>	(s.e.)	<u>Other Income_t</u>	(s.e.)
	Assets _{t-1}		Assets _{t-1}	
Real GDP growth _t	-0.00	(0.007)	-0.01	(0.008)
Real GDP growth _{t-1}	0.01**	(0.007)	0.02***	(0.007)
Long-term interest rate _t	-0.06***	(0.015)	-0.00	(0.014)
Short-term interest rate _t	0.02*	(0.010)	0.00	(0.010)
Local stock market index return	0.002***	(0.000)	0.003***	(0.000)
Local stock market index volatility	0.000	(0.002)	0.002	(0.002)
L _{t-1} /A _{t-1}	0.010***	(0.002)	0.020***	(0.002)
D _{t-1} /A _{t-1}	---		-0.011***	(0.002)
R _{t-1} /A _{t-1}	-0.007***	(0.002)	-0.016***	(0.002)
Constant	0.008***	(0.001)	0.007***	(0.001)
Number of observations	354		14829	
Number of countries; banks	17		1398	
Wald Chi ² [d.o.f.]	64.36***	[8]	-	
R ² (pseudo; overall)	0.061		0.005	

Appendix: Return on Assets

VARIABLES	<i>Aggregate data</i>		<i>Individual data</i>	
	(1)		(2)	
	<u>Profit before tax_t</u> Assets _{t-1}	(s.e.)	<u>Profit before tax_t</u> Assets _{t-1}	(s.e.)
Real GDP growth _t	0.02	(0.0228)	0.03	(0.0197)
Real GDP growth _{t-1}	0.05**	(0.0230)	0.01	(0.0164)
Real GDP growth _{t-2}	0.02	(0.0220)	-0.02	(0.0142)
[L _{t-1} /A _{t-1}] * Real GDP growth _t	0.03	(0.0517)	-0.03	(0.0302)
[L _{t-1} /A _{t-1}] * Real GDP growth _{t-1}	-0.07	(0.0527)	0.05*	(0.0263)
[L _{t-1} /A _{t-1}] * Real GDP growth _{t-2}	-0.02	(0.0503)	0.03	(0.0230)
[L _{t-1} /A _{t-1}] * Recession slope dummy _t	0.31***	(0.115)	0.40***	(0.0813)
[L _{t-1} /A _{t-1}] * Recession slope dummy _{t-1}	0.57***	(0.116)	-0.02	(0.0781)
[L _{t-1} /A _{t-1}] * Recession slope dummy _{t-2}	0.38***	(0.111)	-0.04	(0.0531)
Unemployment rate _t	-0.00	(0.0244)	0.01	(0.0149)
[L _{t-1} /A _{t-1}] * Unemployment rate _t	0.06	(0.0609)	-0.05**	(0.0252)
(...)				
L _{t-1} /A _{t-1}	0.010	(0.0070)	0.008**	(0.0033)
D _{t-1} /A _{t-1}	---		0.000	(0.0022)
R _{t-1} /A _{t-1}	-0.005**	(0.0027)	-0.007***	(0.0020)
Constant	0.002	(0.0029)	0.004***	(0.0010)
Number of observations	347		14294	
Number of countries; banks	17		1403	
Wald Chi ² [d.o.f.]	154.38***	[16]	-	
R ² (pseudo; overall)	0.31		0.03	

Appendix: FSAP

Scenario		2010	2011	2012	2013	2014	2015
Baseline	Real GDP growth	-0.9%	1.9%	1.7%	1.7%	1.8%	1.9%
	Unemployment	3.9%	4.3%	4.3%	4.2%	4.1%	3.9%
	Longterm rate (10yr)	3.5%	3.4%	3.6%	4.0%	4.4%	4.6%
	Shortterm rate	0.9%	0.8%	1.1%	1.5%	1.9%	2.2%
Adverse 1	Real GDP growth	-0.9%	1.0%	-0.9%	0.7%	1.2%	1.9%
	Unemployment	3.9%	4.4%	5.3%	5.3%	4.4%	4.0%
	Longterm rate (10yr)	3.5%	3.9%	4.6%	4.0%	4.4%	4.6%
	Shortterm rate	0.9%	1.7%	2.3%	1.5%	1.9%	2.2%
Adverse 2	Real GDP growth	-0.9%	0.1%	-3.5%	-0.4%	0.6%	1.9%
	Unemployment	3.9%	4.5%	6.3%	6.4%	4.6%	4.1%
	Longterm rate (10yr)	3.5%	4.4%	5.6%	4.0%	4.4%	4.6%
	Shortterm rate	0.9%	1.7%	2.3%	1.5%	1.9%	2.2%