

# Simple bank model

Document prepared by  
BSM Unit

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## 1. Summary of functional relationships

Impairments =  $f(\text{Debt service cost}(t); \text{average real house price growth}(t); \text{average USDZAR}(t))$

Endowment =  $f(\text{rate sensitivity}(t); \text{change in rates}(t))$

Fee and commission income =  $f(\text{Nominal GDP}(t-2))$

Opex =  $\text{cpi infl} + 4\%$

Margin = 4.14%

Balance sheet growth for margin income = credit extension growth

Margin income =  $(\text{balance} \times \text{margin})$

Advance growth = credit extension growth

## 2.1. FRBG estimation model output

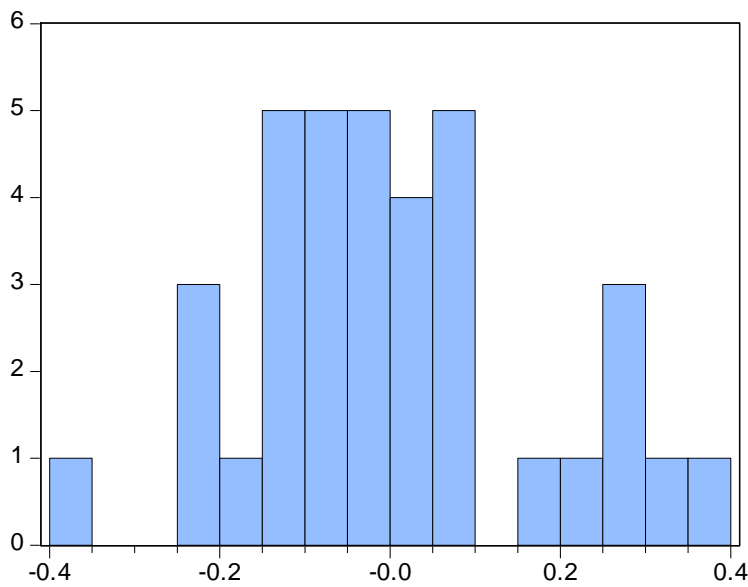
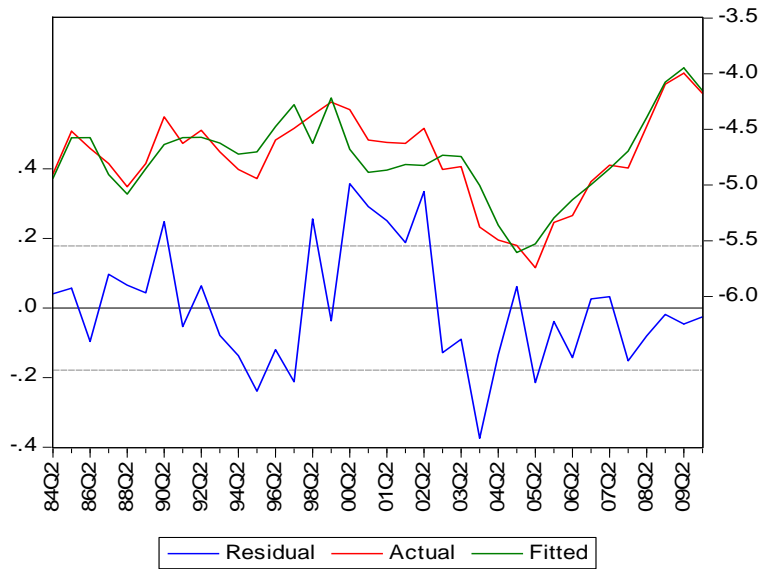
Current impairment rate = 93bps as at 201012

Change in impairment rate is modelled through the following function.

Advances growth is assumed to be static in line with endowment balances

Variable description for FRB Model		
Debt servicing cost	Average debt service charge for quarter ended	$aver\_debtch=(debt servch+debt servch(-1)+debt servch(-2)+debt servch(-3))/4$
Growth in House Price Index	average annual growth rate in real ASAHPI (defaulted by ECPI)	
USD/ZAR	annual average USD/ZAR rate	$aver\_usdzar=(usdzar+usdzar(-1)+usdzar(-2)+usdzar(-3))/4$
		$debt servch=rpor*nhddis(-1)/100$
Dum94	Dummy variable = 1 from 1994	

Dependent Variable: LOG(ODDS_FSR)				
Method: Least Squares				
Date: 08/05/10 Time: 14:35				
Sample (adjusted): 1984Q2 2009Q4				
Included observations: 36 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(AVER_DEBTCH(-2))	0.732388	0.177696	4.121573	0.0002
LOG(AVER_USDZAR)	0.217476	0.057313	3.794555	0.0006
C	-6.558712	0.407727	-16.08602	0.0000
DUM94*LOG(AVER_RASAHPI/AVER_RASAHPI(-4))	-3.074283	0.496042	-6.197629	0.0000
R-squared	0.826599	Mean dependent var		-4.747708
Adjusted R-squared	0.810342	S.D. dependent var		0.409419
S.E. of regression	0.178301	Akaike info criterion		-0.506249
Sum squared resid	1.017319	Schwarz criterion		-0.330302
Log likelihood	13.11248	Hannan-Quinn criter.		-0.444839
F-statistic	50.84762	Prob(F-statistic)		0.000000



Series: Residuals  
 Sample 1984Q2 2009Q4  
 Observations 36

Mean -3.07e-16  
 Median -0.031301  
 Maximum 0.356818  
 Minimum -0.373865  
 Std. Dev. 0.170488  
 Skewness 0.355785  
 Kurtosis 2.738493

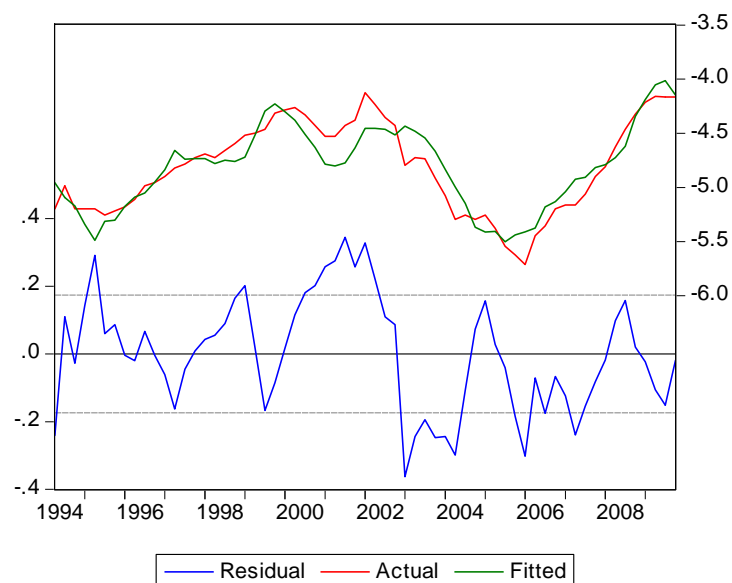
Jarque-Bera 0.862077  
 Probability 0.649834

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.882298	Prob. F(3,32)	0.1524
Obs*R-squared	5.399866	Prob. Chi-Square(3)	0.1448
Scaled explained SS	3.708693	Prob. Chi-Square(3)	0.2947

## 2.2. Industry estimation model output - not used in model

Variable description for Industry Model	
Debt servicing cost	$\text{debt servch} = \text{rpor} * \text{nhddis}(-1) / 100$
Growth in House Price Index	Annual growth in ASAHPI deflated by ECPI
Growth in real GDP	Real GDP growth (annualised GDP)
USD/ZAR	annual average USD/ZAR rate

Dependent Variable: LOG(ODDS)				
Method: Least Squares				
Date: 08/03/10 Time: 09:42				
Sample (adjusted): 1994Q2 2009Q4				
Included observations: 63 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(DEBTSERVCH(-4))	0.749829	0.141457	5.300744	0.0000
C	-8.156214	0.356806	-22.85895	0.0000
LOG(RASAHPI(-4)/RASAHPI(-8))	-1.756976	0.390782	-4.496057	0.0000
LOG(RGDPA(-6)/RGDPA(-10))	-5.065471	1.312687	-3.858857	0.0003
LOG(AVER_USDZAR)	1.068462	0.079406	13.45575	0.0000
R-squared	0.840653	Mean dependent var	-4.813513	
Adjusted R-squared	0.829664	S.D. dependent var	0.421096	
S.E. of regression	0.173794	Akaike info criterion	-0.585854	
Sum squared resid	1.751852	Schwarz criterion	-0.415764	
Log likelihood	23.45439	Hannan-Quinn criter.	-0.518956	
F-statistic	76.49654	Durbin-Watson stat	0.560654	
Prob(F-statistic)	0.000000			



## 2.3. Model comparisons

Fundamental factors	Fundamental determinants: FRB		Fundamental determinants: Industry		Relative coefficient size
	Coefficient size	Lagged impact in months	Coefficient size	Lagged impact in months	
Debt servicing cost	0.92	6	0.75	12	1.22
Collateral values *	-2.54	0	-1.76	12	1.45
Real GDP growth	NA		-5.07	18	
USDZAR	0.20	0	1.07	0	0.19
Overall macro factor sensitivity (R <sup>2</sup> )	80%		84%		

Fundamental factors	Beta estimate for positive movements in fundamental factor		Beta estimate for negative movements in fundamental factor	
	FirstRand	Industry	FirstRand	Industry
Debt servicing cost	0.039%	0.032%	-0.041%	-0.033%
Collateral values *	-0.118%	-0.080%	0.079%	0.074%
Real GDP growth	NA	-0.249%	NA	0.198%
USDZAR	0.009%	0.046%	-0.009%	-0.048%

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### 3. Endowment estimate outline

#### 3.1. Income statement

##### 3.1.1. Current method – this method is used because of the fact that the BS size is not observable on a regular basis:

- Income statement charge in quarter = (cumulative change in interest rates since beginning of financial year)\*(T/4)\*(annual rate sensitivity of 100bps rate movement).
  - Where T = quarters remaining in the financial year.
- Rate sensitivity = 650 000 (as per Dec 2010 results presentation ).

(similarly, quarterly change in endowment = quarterly change in rates\*(annual rate sensitivity/4)\*time to end of the year measured in quarters as per model)

- **Growth rate in underlying asset is assumed to be directly related to credit extension growth.**

##### 3.1.2. Alternative method used previously – uses rate sensitive BS size and rate change:

$$56*0.8=45*i \quad (1)$$

$$\begin{aligned} 56*i-56(i*0.2) &= 56(i-i*0.2) \\ &= 56(i-i*0.2) \\ &= 56(i-i*0.2) \\ &=56(i(1-0.2)) \\ &=56*i*0.8 \\ &=45*i \\ &=(1) \end{aligned}$$

$$\text{Cap}+30i-30*0$$

$$\text{NMD}+56i+56i*0.2$$

$$\text{NRA}+10*0-10*i$$

$$=65*i$$

Then, income statement charge = change in above from t to t+1.

### 3.2. Balance sheet - not used currently

Shareholder's capital and reserves / Total Equity

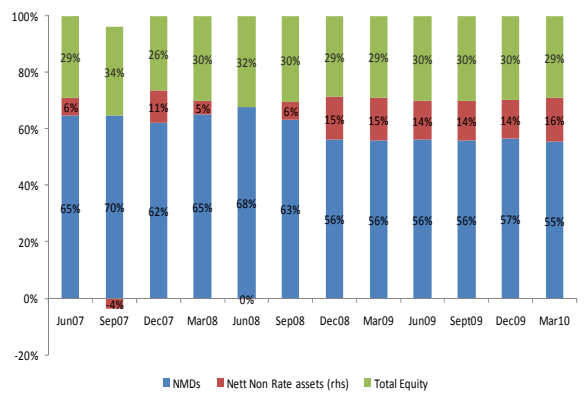
+Non maturity deposits (current savings and transmission accounts)\*Beta

-Non rate assets

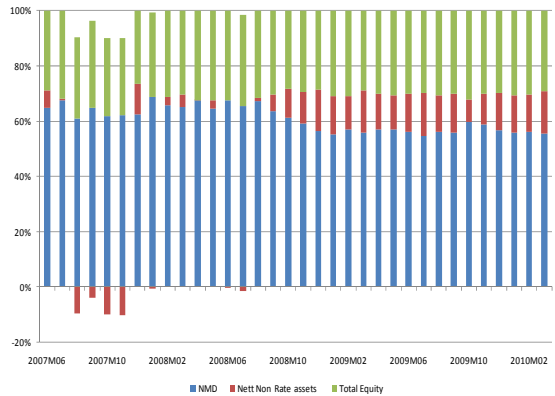
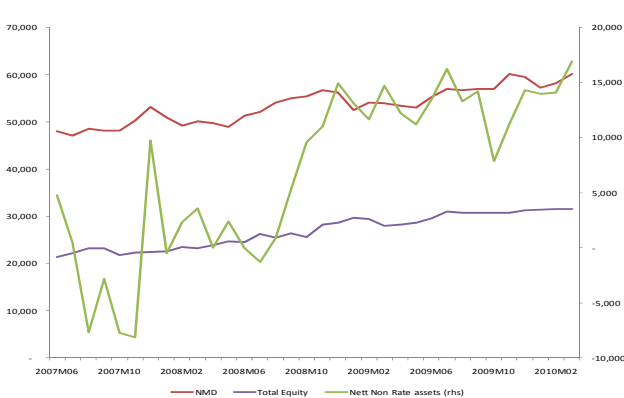
=Endowment assets

Beta = rate sensitive portion of NMD

#### Component analysis - quarterly

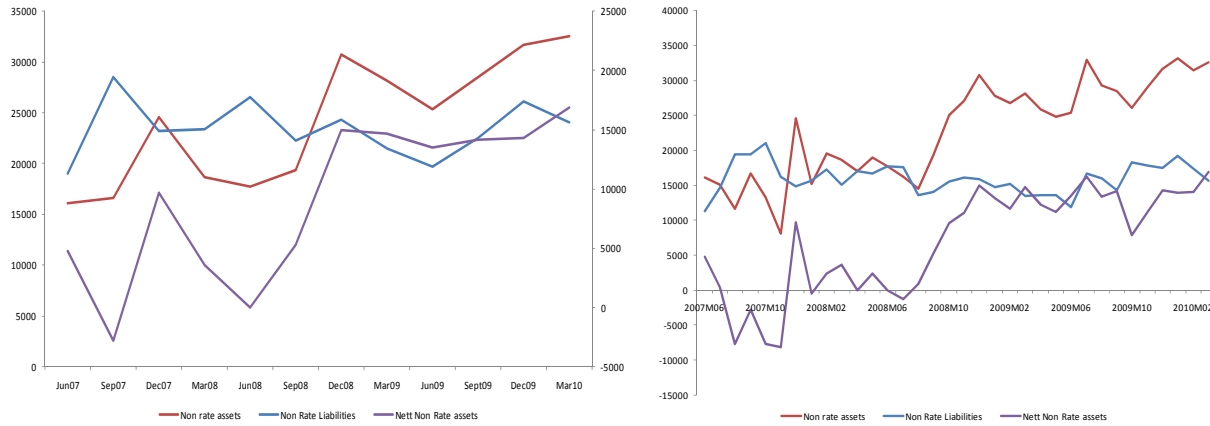


#### Component analysis - monthly





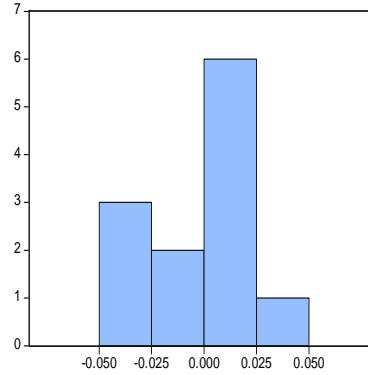
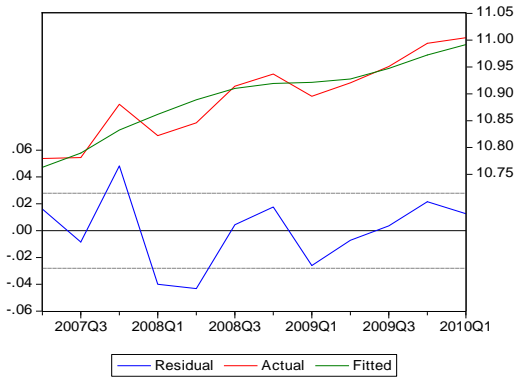
## Component analysis – focus on non rate assets and liabilities



## Examples of model to get NMD – not used currently

### Non maturity deposits – quarterly 1

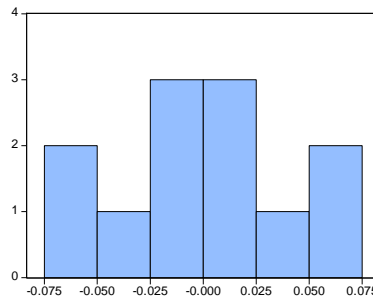
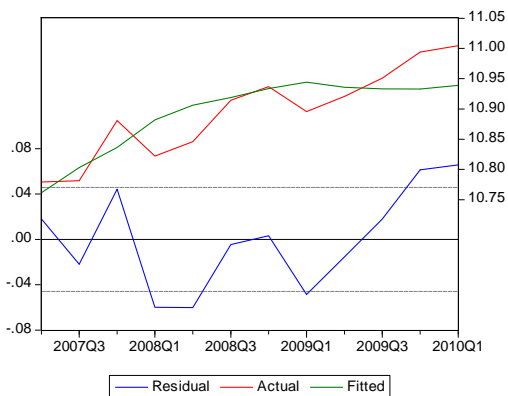
Dependent Variable: LOG(NMD)				
Method: Least Squares				
Date: 08/26/10 Time: 17:08				
Sample (adjusted): 2007Q2 2010Q1				
Included observations: 12 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	0.892548	0.107206	8.325540	0.0000
C	-2.172794	1.569487	-1.384398	0.1963
R-squared	0.873920	Mean dependent var		10.89386
Adjusted R-squared	0.861312	S.D. dependent var		0.075093
S.E. of regression	0.027965	Akaike info criterion		-4.164698
Sum squared resid	0.007821	Schwarz criterion		-4.083880
Log likelihood	26.98819	Hannan-Quinn criter.		-4.194619
F-statistic	69.31462	Durbin-Watson stat		2.153130
Prob(F-statistic)	0.000008			



Series: Residuals	
Sample 2007Q2 2010Q1	
Observations 12	
Mean	0.000000
Median	0.004013
Maximum	0.048260
Minimum	-0.043162
Std. Dev.	0.026664
Skewness	-0.139822
Kurtosis	2.415587
Jarque-Bera	0.209870
Probability	0.900383

### Non maturity deposits – quarterly 2

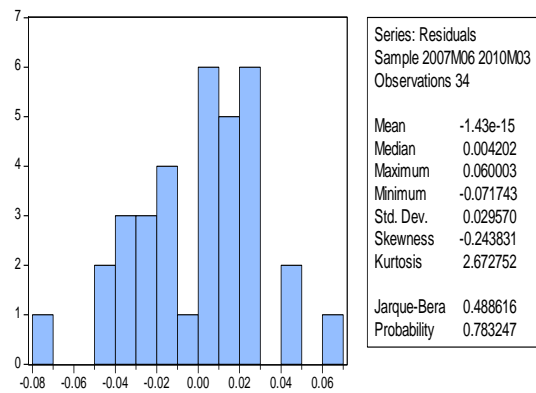
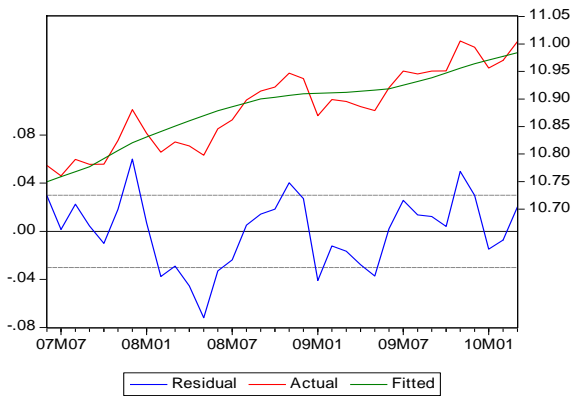
Dependent Variable: LOG(NMD)				
Method: Least Squares				
Date: 08/26/10 Time: 17:24				
Sample (adjusted): 2007Q2 2010Q1				
Included observations: 12 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TOTAL_PSCE)	0.763916	0.172901	4.418228	0.0013
C	-0.142332	2.497912	-0.056980	0.9557
R-squared	0.661255	Mean dependent var		10.89386
Adjusted R-squared	0.627381	S.D. dependent var		0.075093
S.E. of regression	0.045839	Akaike info criterion		-3.176368
Sum squared resid	0.021012	Schwarz criterion		-3.095550
Log likelihood	21.05821	Hannan-Quinn criter.		-3.206290
F-statistic	19.52074	Durbin-Watson stat		1.274942
Prob(F-statistic)	0.001298			



Series: Residuals	
Sample 2007Q2 2010Q1	
Observations 12	
Mean	1.54e-15
Median	-0.000646
Maximum	0.065770
Minimum	-0.060226
Std. Dev.	0.043705
Skewness	0.059428
Kurtosis	1.869079
Jarque-Bera	0.646555
Probability	0.723773

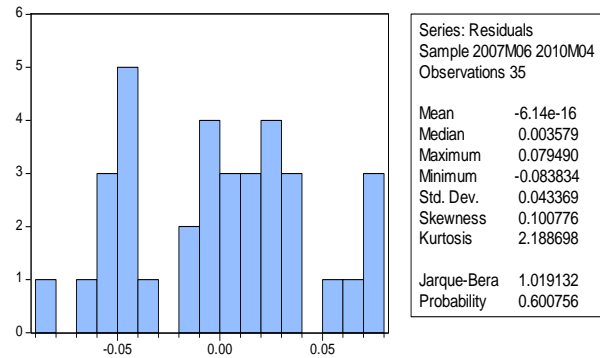
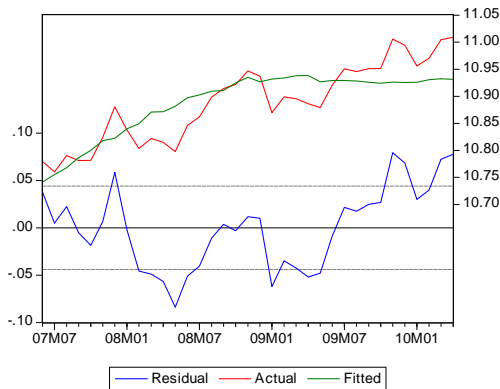
Non maturity deposits – monthly 1

Dependent Variable: LOG(NMD)				
Method: Least Squares				
Date: 08/26/10 Time: 09:33				
Sample (adjusted): 2007M06 2010M03				
Included observations: 34 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	0.915416	0.073467	12.46027	0.0000
C	-2.517748	1.075629	-2.340723	0.0256
R-squared	0.829113	Mean dependent var	10.88472	
Adjusted R-squared	0.823773	S.D. dependent var	0.071531	
S.E. of regression	0.030028	Akaike info criterion	-4.116322	
Sum squared resid	0.028855	Schwarz criterion	-4.026536	
Log likelihood	71.97748	Hannan-Quinn criter.	-4.085703	
F-statistic	155.2583	Durbin-Watson stat	0.923552	
Prob(F-statistic)	0.000000			



Non maturity deposits – monthly 2

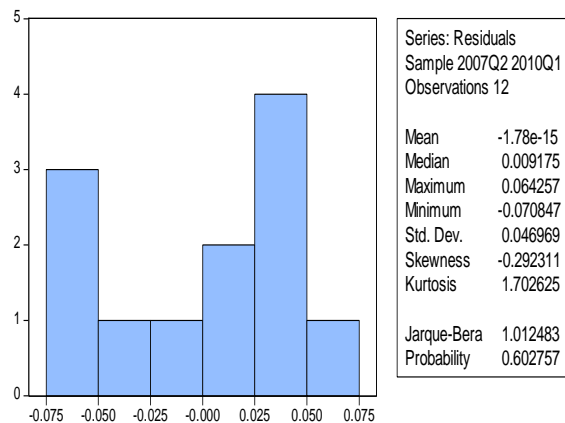
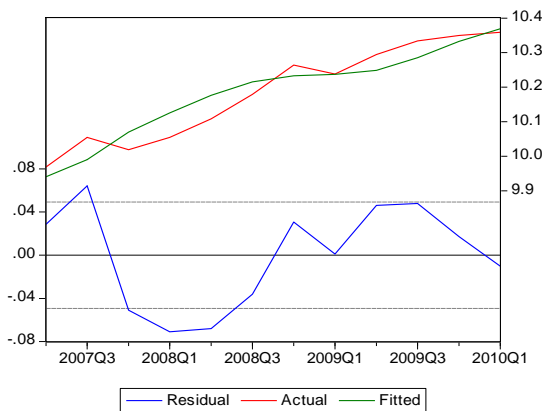
Dependent Variable: LOG(NMD)				
Method: Least Squares				
Date: 08/26/10 Time: 19:02				
Sample (adjusted): 2007M06 2010M04				
Included observations: 35 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TOT_PSCE)	0.820859	0.104368	7.865026	0.0000
C	-0.974897	1.508362	-0.646328	0.5225
R-squared	0.652114	Mean dependent var	10.88827	
Adjusted R-squared	0.641572	S.D. dependent var	0.073530	
S.E. of regression	0.044021	Akaike info criterion	-3.352838	
Sum squared resid	0.063950	Schwarz criterion	-3.263961	
Log likelihood	60.67466	Hannan-Quinn criter.	-3.322157	
F-statistic	61.85864	Durbin-Watson stat	0.449454	
Prob(F-statistic)	0.000000			



## Examples of model to get equity - not used currently

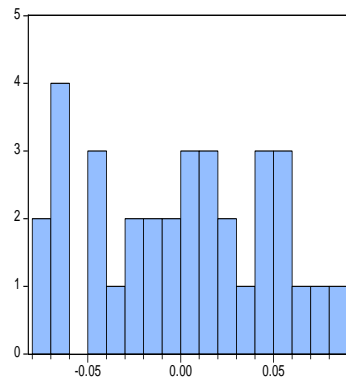
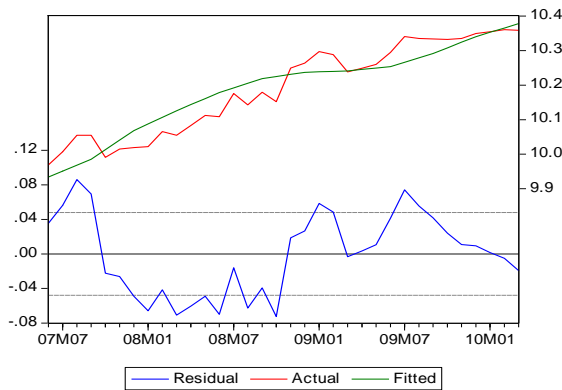
Total equity – quarterly

Dependent Variable: LOG(TOT_EQ)				
Method: Least Squares				
Date: 08/26/10 Time: 19:09				
Sample (adjusted): 2007Q2 2010Q1				
Included observations: 12 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	1.670864	0.188846	8.847750	0.0000
C	-14.27551	2.764692	-5.163510	0.0004
R-squared	0.886728	Mean dependent var	10.18547	
Adjusted R-squared	0.875400	S.D. dependent var	0.139556	
S.E. of regression	0.049261	Akaike info criterion	-3.032336	
Sum squared resid	0.024267	Schwarz criterion	-2.951519	
Log likelihood	20.19402	Hannan-Quinn criter.	-3.062258	
F-statistic	78.28269	Durbin-Watson stat	1.031909	
Prob(F-statistic)	0.000005			



Total equity – monthly

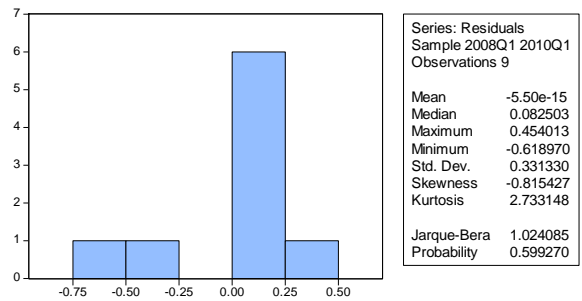
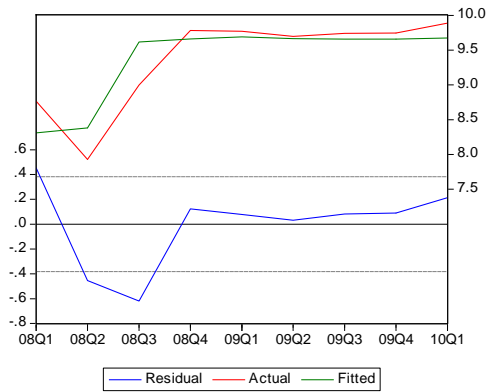
Dependent Variable: LOG(TOTEQ)				
Method: Least Squares				
Date: 08/26/10 Time: 19:13				
Sample (adjusted): 2007M06 2010M03				
Included observations: 34 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	1.733669	0.117291	14.78097	0.0000
C	-15.19271	1.717253	-8.847103	0.0000
R-squared	0.872244	Mean dependent var	10.18967	
Adjusted R-squared	0.868251	S.D. dependent var	0.132078	
S.E. of regression	0.047941	Akaike info criterion	-3.180681	
Sum squared resid	0.073546	Schwarz criterion	-3.090895	
Log likelihood	56.07158	Hannan-Quinn criter.	-3.150062	
F-statistic	218.4772	Durbin-Watson stat	0.480134	
Prob(F-statistic)	0.000000			



Series: Residuals	
Sample 2007M06 2010M03	
Observations 34	
Mean	7.89e-16
Median	0.002578
Maximum	0.086116
Minimum	-0.072550
Std. Dev.	0.047209
Skewness	0.011544
Kurtosis	1.864149
Jarque-Bera	1.828477
Probability	0.400822

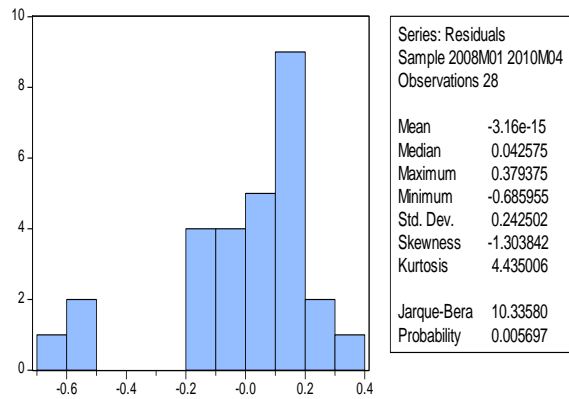
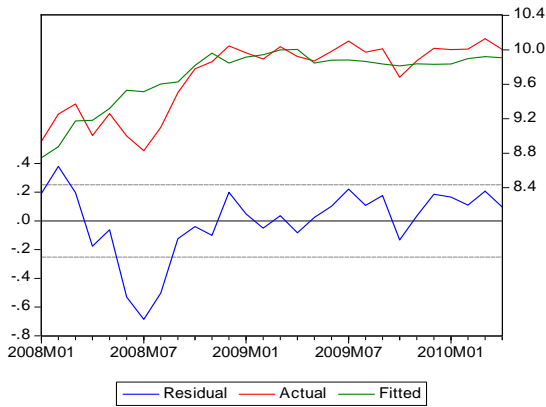
Net non-rate assets – quarterly 1

Dependent Variable: LOG(NNRA_ADJ)				
Method: Least Squares				
Date: 08/26/10 Time: 19:30				
Sample (adjusted): 2008Q1 2010Q1				
Included observations: 9 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TOTAL_PSCE)	2.278393	11.39188	0.200001	0.8481
C	-24.56952	164.5791	-0.149287	0.8862
DUM1	1.194893	0.669991	1.783447	0.1248
R-squared	0.753996	Mean dependent var	9.368506	
Adjusted R-squared	0.671994	S.D. dependent var	0.668019	
S.E. of regression	0.382587	Akaike info criterion	1.177478	
Sum squared resid	0.878235	Schwarz criterion	1.243219	
Log likelihood	-2.298650	Hannan-Quinn criter.	1.035608	
F-statistic	9.194912	Durbin-Watson stat	1.622694	
Prob(F-statistic)	0.014888			



Net non-rate assets – monthly 1

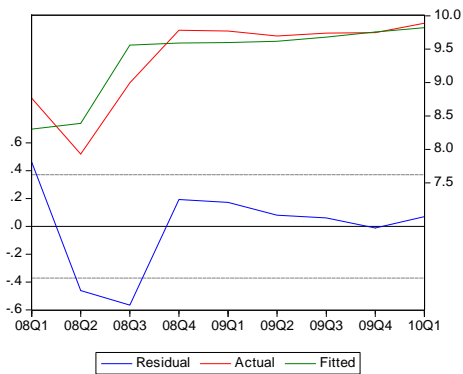
Dependent Variable: LOG(NNRA_ADJ)				
Method: Least Squares				
Date: 08/26/10 Time: 19:25				
Sample (adjusted): 2008M01 2010M04				
Included observations: 28 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(TOT_PSCE)	11.26377	3.334744	3.377702	0.0024
C	-153.3760	48.11375	-3.187779	0.0038
DUM1	-0.091990	0.263621	-0.348950	0.7300
R-squared	0.660153	Mean dependent var	9.693399	
Adjusted R-squared	0.632965	S.D. dependent var	0.415981	
S.E. of regression	0.252016	Akaike info criterion	0.182307	
Sum squared resid	1.587799	Schwarz criterion	0.325043	
Log likelihood	0.447698	Hannan-Quinn criter.	0.225943	
F-statistic	24.28122	Durbin-Watson stat	0.641921	
Prob(F-statistic)	0.000001			





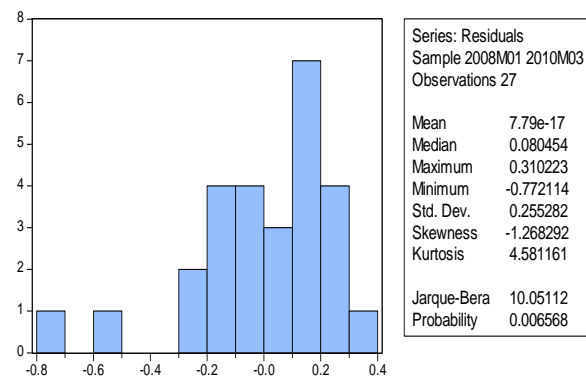
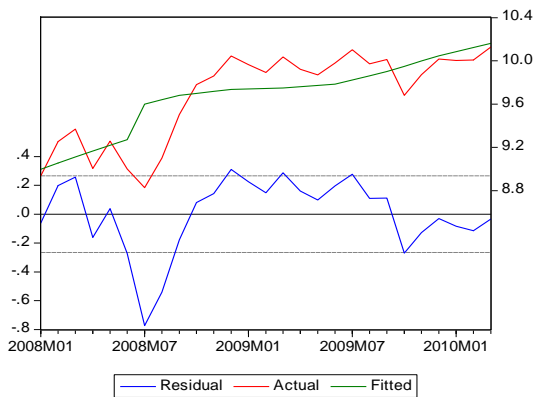
Net non-rate assets – quarterly 2

Dependent Variable: LOG(NNRA_ADJ)				
Method: Least Squares				
Date: 08/27/10 Time: 13:51				
Sample (adjusted): 2008Q1 2010Q1				
Included observations: 9 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	2.808190	4.279252	0.656234	0.5360
C	-32.70692	62.55967	-0.522812	0.6198
DUM1	1.106649	0.433867	2.550665	0.0435
R-squared	0.768940	Mean dependent var	9.368506	
Adjusted R-squared	0.691920	S.D. dependent var	0.668019	
S.E. of regression	0.370784	Akaike info criterion	1.114807	
Sum squared resid	0.824885	Schwarz criterion	1.180549	
Log likelihood	-2.016633	Hannan-Quinn criter.	0.972937	
F-statistic	9.983628	Durbin-Watson stat	1.762099	
Prob(F-statistic)	0.012336			



Net non-rate assets – monthly 2

Dependent Variable: LOG(NNRA_ADJ)				
Method: Least Squares				
Date: 08/27/10 Time: 13:53				
Sample (adjusted): 2008M01 2010M03				
Included observations: 27 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDPA)	5.235129	1.808798	2.894258	0.0080
C	-67.34071	26.42434	-2.548435	0.0176
DUM1	0.286852	0.188403	1.522546	0.1409
R-squared	0.629382	Mean dependent var	9.681882	
Adjusted R-squared	0.598497	S.D. dependent var	0.419331	
S.E. of regression	0.265706	Akaike info criterion	0.291588	
Sum squared resid	1.694395	Schwarz criterion	0.435570	
Log likelihood	-0.936444	Hannan-Quinn criter.	0.334402	
F-statistic	20.37834	Durbin-Watson stat	0.707698	
Prob(F-statistic)	0.000007			



## 4. Non-interest revenue

Note: Currently only the fee and commissions income portion of Non-interest revenue is assumed to be macro driven i.e. Fee and commission income is modeled with the function below and assume to impact the income statement while the residual change income from other non interest revenue is assumed to be constant or macro insensitive.

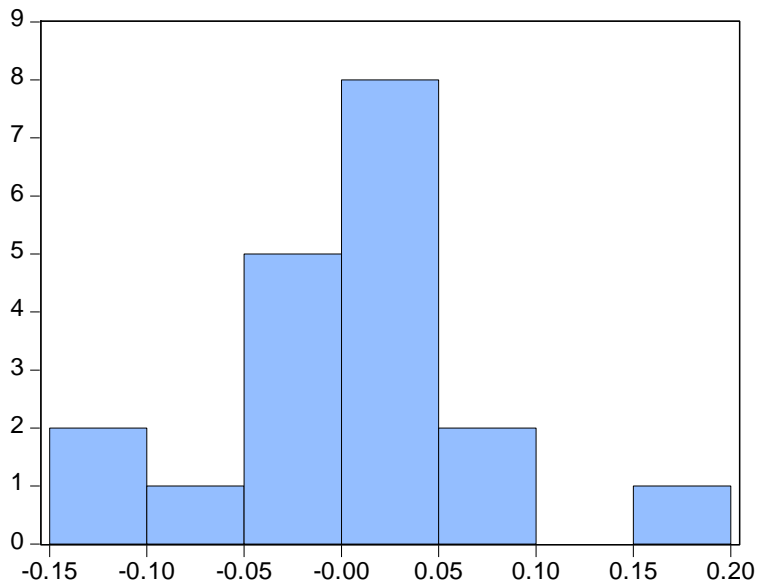
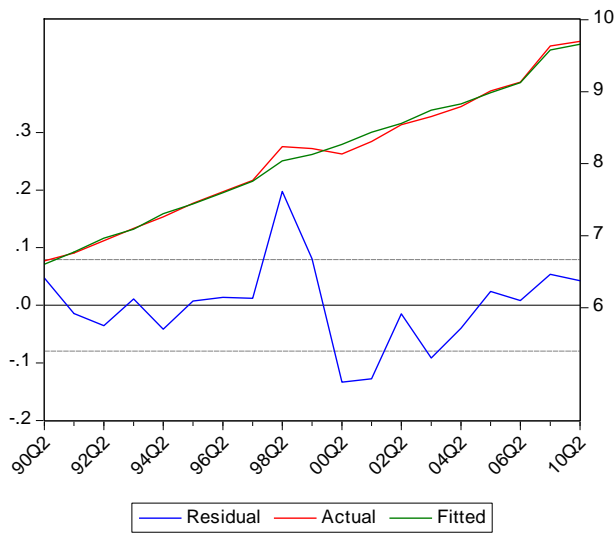
### 4.1. Fee and commission income

Current balance 201006 = R 16 269 million

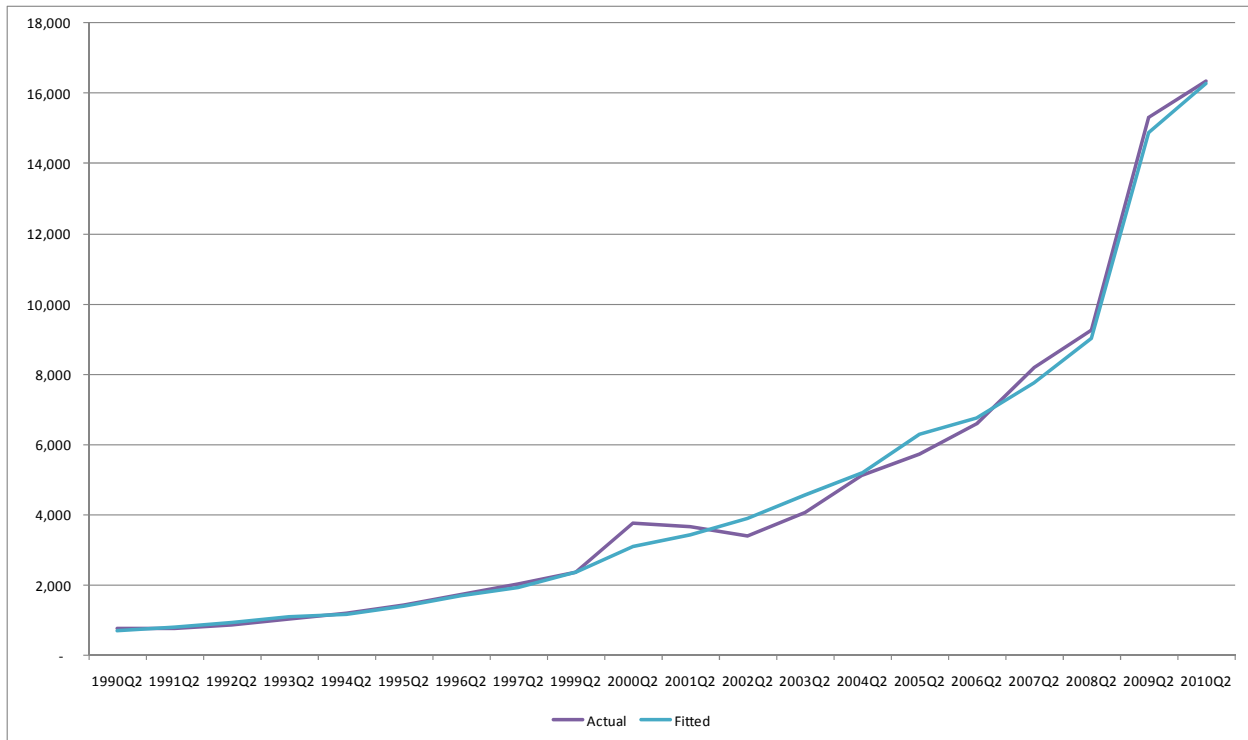
Current balance 201012 = R 19 086 million

Level in fee and comm. income is modelled through the following function;

Dependent Variable: LOG(FEE_COMM_INC)				
Method: Least Squares				
Date: 02/28/11 Time: 13:49				
Sample (adjusted): 1990Q2 2010Q2				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(NGDP(-2))	1.290639	0.050519	25.54749	0.0000
DUM98	0.155238	0.066492	2.334689	0.0329
C	-9.504895	0.654172	-14.52966	0.0000
R-squared	0.993530	Mean dependent var	8.099973	
Adjusted R-squared	0.992721	S.D. dependent var	0.931223	
S.E. of regression	0.079450	Akaike info criterion	-2.083439	
Sum squared resid	0.100997	Schwarz criterion	-1.934317	
Log likelihood	22.79267	Hannan-Quinn criter.	-2.058201	
F-statistic	1228.408	Prob(F-statistic)	0.000000	



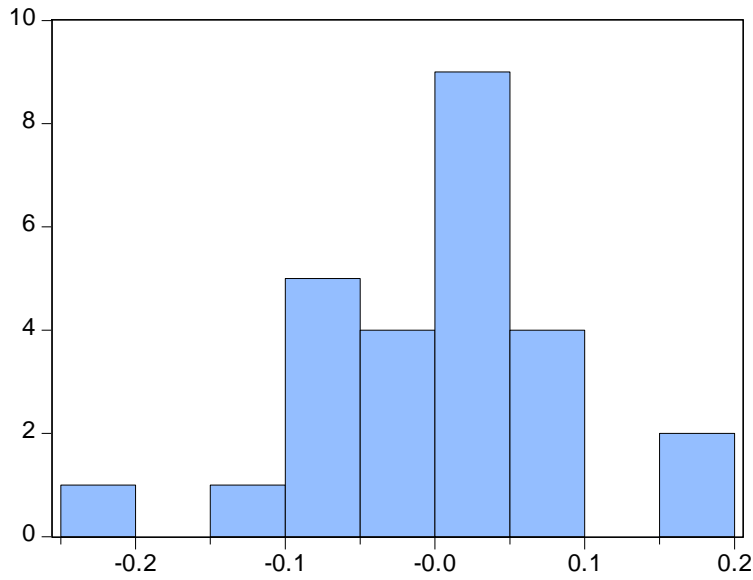
Series: Residuals	
Sample 1990Q2 2010Q2	
Observations 19	
Mean	2.24e-15
Median	0.008227
Maximum	0.197417
Minimum	-0.133458
Std. Dev.	0.074906
Skewness	0.433102
Kurtosis	4.166456
Jarque-Bera	1.671154
Probability	0.433624



## 4.2. Total Non-interest income – not used currently pls see note above

Current balance 2010Q6 = R 26 140 million

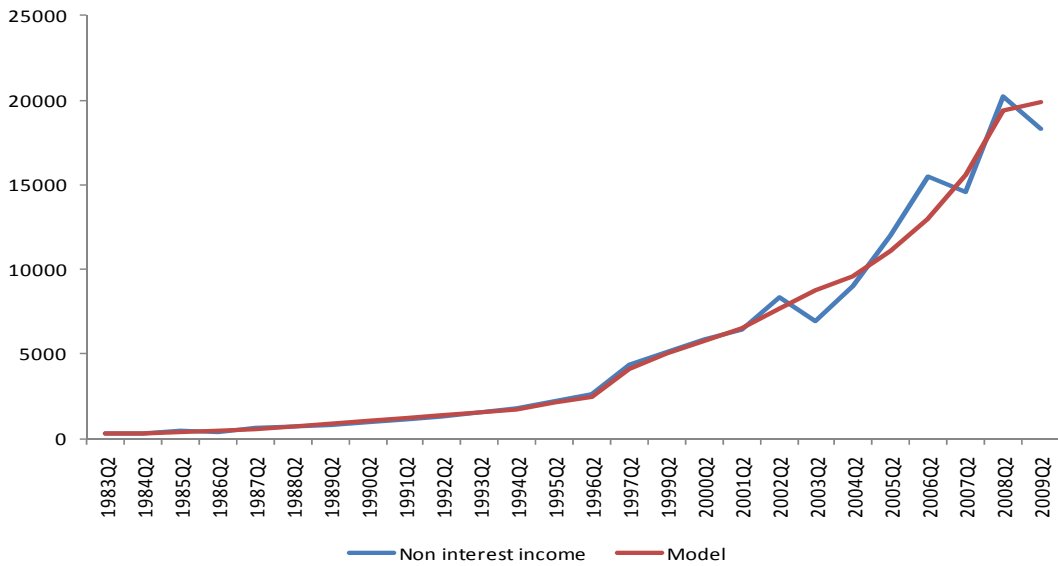
Dependent Variable: LOG(NIR)				
Method: Least Squares				
Date: 08/12/10 Time: 12:09				
Sample (adjusted): 1983Q2 2009Q2				
Included observations: 26 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
LOG(RGDPA)	1.981893	0.237584	8.341874	0.0000
LOG(ECPI)	1.160274	0.059367	19.54404	0.0000
DUM97	0.373502	0.075108	4.972897	0.0001
C	-24.41336	3.182035	-7.672248	0.0000
R-squared	0.995771	Mean dependent var	7.856617	
Adjusted R-squared	0.995194	S.D. dependent var	1.364143	
S.E. of regression	0.094572	Akaike info criterion	-1.738280	
Sum squared resid	0.196763	Schwarz criterion	-1.544727	
Log likelihood	26.59765	Hannan-Quinn criter.	-1.682544	
F-statistic	1726.538	Prob(F-statistic)	0.000000	



Series: Residuals  
 Sample 1983Q2 2009Q2  
 Observations 26

Mean -2.32e-15  
 Median 0.012395  
 Maximum 0.179249  
 Minimum -0.237666  
 Std. Dev. 0.088716  
 Skewness -0.286069  
 Kurtosis 3.775651

Jarque-Bera 1.006390  
 Probability 0.604596



## 5. Margin income

Assumed to be 4.14% of balance sheet as per the Dec 2012 results presentation

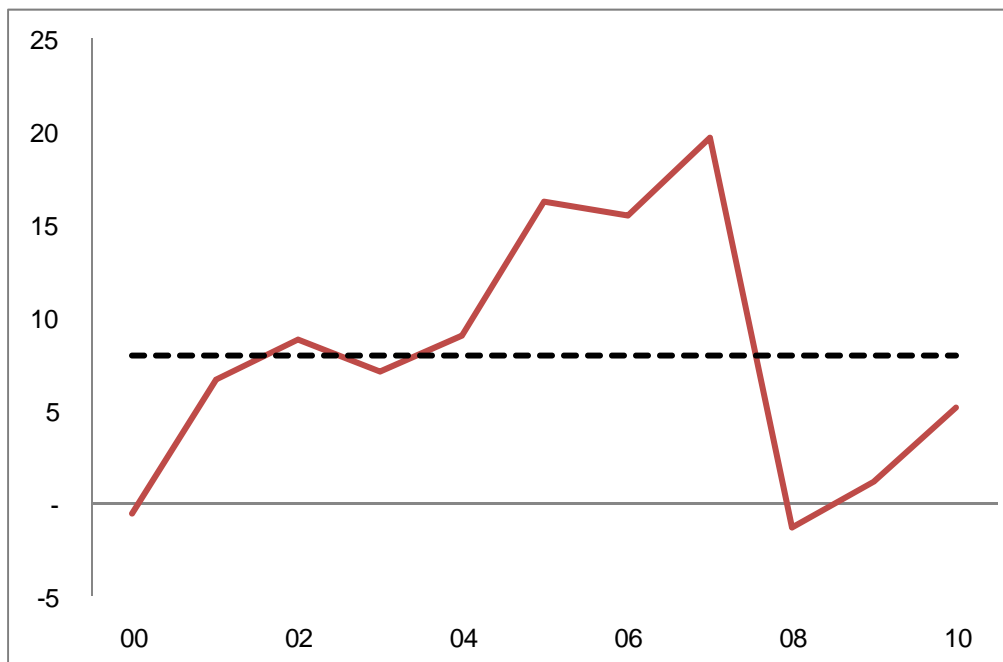
Current BS size as per Dec 2012 results = R461 503 bill

BS growth = private sector credit extension growth

## 6. Operating expenditure

Opex growth =inflation+4% - this is already low with respect to historical real growth rates (see graph below out of 10 yr review data)

Current opex = R26 848 as per Dec 2010 result presentation



## 7. Advances

Advances are modeled as a function of private sector credit extension growth.

Current balance = 461 503