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**Empirical study of Indonesian Banks Group 1 based on Core Capital  
(KBMI 1):  
The Impact of Bank Internal Factors on Non-Performing Loan  
Moderated by BOPO**

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***Abstract***

*This research explores the NPL of Indonesian banks which are categorized in the Core Capital group of up to IDR 6 trillion or KBMI 1. The research sample is 25 conventional KBMI 1 banks that are on the Indonesia Stock Exchange from 2016 -2021. Analysis based on panel data consists of 4 independent variables (CAR, LDR, NIM, CASA); a moderating variable (BOPO) and dependent variable (NPL); and run by multiple linear regression and moderating regression analysis. Statistical results show that all independent variables have no significant direct effect on the dependent variable, while BOPO only strengthens the effect of CAR and CASA on NPL. These findings mean that the moderating variable is taken into consideration in future research to pursue substantive results.*

*Key words: CAR, LDR, NIM, CASA, BOPO*

***Abstrak***

Penelitian ini mendalami NPL institusi perbankan Indonesia yang masuk dalam kelompok Modal Inti sampai dengan Rp 6 triliun atau disebut KBMI 1. Sampel penelitian adalah 25 bank konvensional KBMI 1 yang terdaftar di Bursa Efek Indonesia pada tahun 2016 -2021. Analisis terfokus pada 4 variabel independen (CAR, LDR, NIM, CASA); variabel moderasi (BOPO) dan variabel dependen (NPL). Data yang dianalisis dalam bentuk data panel; kemudian dilakukan regresi linier berganda dan analisis regresi moderasi. Hasil statistik menunjukkan bahwa seluruh variabel independen tidak mempunyai pengaruh langsung yang signifikan terhadap variabel dependen, sedangkan BOPO hanya memperkuat pengaruh CAR dan CASA terhadap NPL. Temuan ini berarti bahwa variabel moderasi dipertimbangkan dalam penelitian selanjutnya untuk mencapai hasil substantif.

Kata kunci: CAR, LDR, NIM, CASA, BOPO

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## 1. INTRODUCTION

### 1.1. Background

National economic development is driven by the banking industry which is widespread in aggregate economic activities at home and abroad. So, the challenging part is to keep the banking industry stable in strong quality and resilience. Basically, simple banking operations are required to carry out the financing and funding functions properly in accordance with government regulations. Meanwhile, in an expanded function, it will become a government agent to maintain economic stability from a macroeconomic and microeconomic perspective. From a commercial perspective, banking operations are supported by net profit which depends on internal operational performance such as; credit quality proxied by non-performing loan ratio (NPL), capital resilience

to risk proxied by capital adequacy requirements (CAR), funding ability proxied by loans by loan to deposit ratio (LDR), margin of interest income to interest expense net of interest income (NIM), Low Cost Funding proxied by Current Account Saving Account (CASA), Operational Cost Efficiency Proxied by Operational Income and Operational Costs (BOPO), Management Capability Proxied by Good Corporate Governance (GCG), Return Achievement Proxied by Return On Equity (ROE), with return on Assets (ROA), and other financial measurements. Substantially, bank operations also refer to net income as common sense in business practices.

## 1.2. Business Phenomena

Most of the bank's income is contributed by interest income which is very dependent on credit collection, both principal and interest, which is represented by NPL. Credit collectibility must be closely monitored and maintained so that it is always in good standing with a maximum ratio of 5%. If it is more than 5%, the bank will be placed under intensive supervision by the Financial Services Authority, because NPL is an indicator of banking health (Bank Indonesia, 2013). Of course, NPL performance is sensitively influenced by many internal factors in banking operations; this raises curiosity to conduct research on the effect of CAR, LDR, NIM, CASA as independent variables on NPL as the dependent variable, then these independent variables are moderated by BOPO. The research was conducted on the Indonesian banking industry, where these banks are included in the group of bank core capital 1 (KBMI 1), with the smallest core capital category of up to IDR 6 trillion (OJK, 2021). The objective of this research is to analyze whether the independent variable has an effect on NPL, then the moderator variable strengthens the effect of the independent variable. It is hoped that the results of this research can contribute to the practice of the banking industry, especially for banks that are included in the group of bank core capital 1 (KBMI 1).

## 1.3. Literature review

Referring to the research objectives, the framework is based on Schumpeter's Profit Innovation Theory as grand theory, then the middle theory is Resources Based View Theory (RBV). Finally to discuss the findings, is referring to the application theory of each variable.

### 1.3.1. The Schumpeter's Innovation Theory of Profit

Basic theory as foundation of this research is The Schumpeter's Innovation Theory of Profit, which substantively explains that corporations achieve sustainable profits through innovation (Schumpeter, 2015). It leads to build the research mapping, where explaining that entrepreneurs can achieve economic benefits through innovation in order to pursue performance targets, especially profits; with 2 main activities namely 1) achieving economical production costs; 2) increase the demand or sales quantity (Elliott,1983). The substance of this theory has been applied by institutions in the banking industry, through various innovative strategies to launch public fundraising products with the lowest possible interest costs and launch various loan products that attract bank debtors, by utilizing resources that can create investment opportunities and business growth (Śledzik, 2013; Hanush & Pyka, 2007).

### 1.3.2. Resource Based View (RBV) Theory

The theory used as a bridge between Grand theory and the theory of the application of each variable is the Resource Based View (RBV) Theory (Barney, 1991) which acts as the middle referring to the substance of the RBV; explained that strategic elements, both tangible and intangible, were able to support company performance, which in this study explored allegations that bank credit performance was influenced by several factors, namely CAR; LDRs; NIMs; CASA and BOPO. Based on this understanding, researcher implementing RBV as a middle theory is relevant theory serves to explain that a company is able to achieve a position of competitive advantage, since it is able to utilize and develop available strategic resources in tangible and intangible forms; represented by the dependent variable, independent variables and moderator variable. In practice, there are some critics who say that the RBV is not fundamentally a theory, because the axioms underlying the RBV are heterogeneous resources with a high degree of mobility, requiring additional development and re-evaluation to meet the requirements of the theory (Priem and Butler, 2001).

### 1.3.3. Hypothesis

Referring to the substance of the Innovation theory and RBV theory, the research hypothesis was built on the effect of CAR, LDR, NIM and CASA on NPL, as well the influence of independent variables was moderated by BOPO. The description of all variables is as follows:

#### 1.3.3. a. NPL (Non-Performing Loan)

Non-Performing Loans are loans that are constrained in the payment of principal and or loan interest. NPL quality is measured by the ratio of Total NPL to total credit. The formula is:

$$\text{NPL} = \frac{\text{Total NPL}}{\text{Total Credit}} \times 100\%$$

Source: Bank Indonesia (2004)

In practically, interest income from loans is the main source of income, so that the quantity of loans is a target that is inseparable from NPL risk and is influenced by several internal bank conditions, such as CAR; LDR; NIM; CASA and BOPO.

#### 1.3.3.1. CAR (Capital Adequacy Requirement)

CAR shows the obligation of banking financial institutions to provide minimum capital according to the profile of operational risk, market risk, and credit risk (OJK, 2016). The substance of CAR is the bank's financial ability to address risks holistically. CAR formula is:

$$\text{CAR} = \frac{\text{Total Capital}}{\text{Risk weighted assets}} \times 100\%$$

Source: OJK (2016)

The CAR ratio means protecting customers and maintaining overall financial system stability in the banking industry. CAR reflects the weight of a bank's ability to face potential risk of loss which is interpreted as CAR affecting NPL. As is the case with research findings

on banking in Indonesia by Yam (2016); Sarita & Zubaidi (2018) and Suryani & Afrika (2021) state that CAR has an effect on NPL. The same findings were conveyed in the research by Radivojevic & Jovovic (2017) which examined the banking industry in 25 developing countries in Eastern Europe, South America, East Asia, West Asia and Africa in; Wood & Skinner (2018) examines the banking industry in Barbados.; Ozili's research (2019) in 96 countries based on world bank data; in Taiwan by research by Cheng et al (2016) and Rahman et al (2017) in Bangladesh. Based on the theoretical review presented and the findings of previous similar studies, temporary conclusions are drawn:

Hypothesis 1 (H<sub>1</sub>): CAR has an effect on NPL

#### 1.3.3.2. LDR (Loan to Deposit Ratio)

LDR is the ratio between the amount of loans provided by the bank and the amount of third party funds deposited in the bank. Loans granted are funds channeled to customers; does not include interbank loans; while third party funds include demand deposits, savings and time deposits but do not include interbank funds (Bank Indonesia, 2013b). LDR is an indicator to assess a bank's ability to channel third party funds to the public in the form of loans (credit). The LDR calculation formula is:

$$\text{LDR} = \frac{\text{Total Credit}}{\text{Total Third party Funds}} \times 100\%$$

Source: Bank Indonesia (2015)

In practice, banks take a safe position with the principle of prudence in issuing credit which refers to the LDR ratio because it is directly related to financial performance; especially NPL. The effect of LDR on NPL was found from research in the banking sector in various countries; such as in Indonesia by Permana & Mulyati (2021) and Ruslim & Bengawan (2019); in Taiwan by Cheng et al (2016); in Bangladesh by Rahman et al (2017) and in Albania by Gabeshi (2016). Based on the theoretical studies presented and findings from previous similar studies, temporary conclusion are drawn:

Hypothesis 2 (H<sub>2</sub>): LDR has an effect on NPL

#### 1.3.3.3. Net Interest Margin (NIM)

NIM is net interest income divided by total assets or earning assets (Bank Indonesia, 2004). The NIM's understanding in general relates to interest income from loans with interest costs from the funds raised. The calculation method can be done with the following formula:

$$\text{NIM} = \frac{\text{Net Interest Income}}{\text{Average Productive Assets}} \times 100\%$$

Source: Bank Indonesia (2004)

In essence, NIM has an indirect correlation with NPL; because a high NIM can mean that the interest rate charged to debtors is relatively high and has the potential to disrupt loan repayments and interest payments; then the effect on bad loans increases. This understanding was found in research by Juliani (2022) in Indonesia, Malimi (2017) in Tanzania, Rahman et al (2017) in Bangladesh, Radivojevic & Jovovic (2017) in 25 developing countries, Ghosh et al (2019) in Bangladesh and Kumar et al. (2018) in Fiji; Based on the

theoretical review presented and the findings of previous similar studies, temporary conclusions are drawn: Hypothesis 3 (H<sub>3</sub>): NIM has an effect on NPL

#### 1.3.3.4. Current Account and Saving Account (CASA)

CASA is a comparison of the amount of low-cost funds collected by banks from savings and current accounts compared to the total amount of third party funds. (www.investopedia.com & www.Business-standard.com). Called low-cost funds because the interest given is much smaller than deposit interest. In practice, the bank's expectation is to achieve a high CASA ratio; this means that the majority of funding comes from low-cost sources so that it can reduce the cost of funds which increases competitiveness (www.cnbc.indonesia.com) The CASA ratio can be calculated by the formula:

$$\text{CASA} = \left( \frac{\text{Current accounts} + \text{Savings}}{\text{Total Third party funds}} \right) \times 100\%$$

Source: Banks annual report

The availability of low-cost funds certainly increases the competitiveness of lending which has an impact primarily on debtors' repayment as well reduces the potential for non-performing loans.

The term CASA is only better known in the West Asia and Southeast Asia regions (Tuovila, 2020; The Economic Times, 2023), so research related to the effect of CASA on NPLs is still difficult to find. However, CASA can increase the amount of credit extended by banks, this was found in research in Indonesia by Yulianto & Yusniar (2011). Thus, CASA is thought to have an impact on the banking NPL level. Then the temporary conclusions are drawn:

Hypothesis 4 (H<sub>4</sub>): CASA has an effect on NPL

#### 1.3.3.5. BOPO (Operation expenses and Operation Income)

BOPO is a comparison between operating expenses and operating income. Which is to determine the level of bank operational efficiency. This ratio is very meaningful for measuring the operational efficiency of a bank (Bank Indonesia, 2011).

BOPO plays a role in measuring the level of efficiency as well the ability of bank management in carrying out its operational activities. The BOPO ratio can be calculated using the following formula:

$$\text{BOPO} = \left( \frac{\text{Total Operation expenses}}{\text{Total Operation income}} \right) \times 100\%$$

Source: Bank Indonesia (2001)

BOPO is related to the cost of human resources and supporting facilities that contribute to income and expenses, so it can be understood that BOPO plays a role in moderating other elements directly related to NPL. Referring to the thoughts above, a temporary conclusion is drawn that:

Hypothesis 5 (H<sub>5</sub>): BOPO moderates the effect of CAR on NPL

Hypothesis 6 (H<sub>6</sub>): BOPO moderates the effect of LDR on NPL

Hypothesis 7 (H<sub>7</sub>): BOPO moderates the effect of NIM on NPL

Hypothesis 8 (H<sub>8</sub>): BOPO moderates the effect of CASA on NPL

## 2. RESEARCH METHOD

This study uses a quantitative-causal-comparative/quasi-experimental research method, which aims to measure the level of influence of the independent variable (X) on the dependent variable (Y), then an impact estimate is developed by including a moderating variable (confounding variable) to test the hypothesis of the theory. The objectives are to find a comprehensive and dynamic implementation of the theory (Leavy, 2023; Creswell & Creswell, 2018). The research population is all banks in Indonesia that are included in group 1 of the Core Capital Bank Group (KBMI 1) with a capital of up to Rp. 6 trillion, total has 73 banks as of August 2022 (www.katadata.co.id, 2022). To optimize results, the study took samples based on the purposive sampling method with the criteria of banks in the KBMI-1 group has been listed on the Indonesia Stock Exchange (IDX) for the period 2016 to 2021. The sample selected was 25 banks (see appendix 1). The research data was processed in the form of panel data consisting of 25 cross sections and 6 time series (Baltagi, 2021; Gujarati, 2014). The statistics used are inferential which aims to perform data processing with multiple linear regression, moderation regression, hypothesis testing and data analysis, as well as to draw conclusions on the population (Bungin, 2013; Cooper & Schindler, 2014; Abdullah, 2015; Yam, 2020).

### 2.1. Modelling

Panel data analysis model selection runs in several stages using the STATA application; starting from the Common Effect method; Fixed Effect; Random Effect and Lagrange Multiplier, through Chow test, Breusch & Pagan Lagrangian Multiplier test and Hausman test. The most effective and selected method is the Random Effect model (see appendix 2, 3, 4, 5, 6)

### 2.2. Empirical model

There are 2 empirical models (see figure 1. Modelling chart) in this study consists of:

- a) The direct effect of independent variables (CAR, LDR, NIM and CASA) on the dependent variable (NPL); equation (Ghauri et al, 2020):

$$Y_1 = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e \dots \dots \dots (1)$$

Note:

$$Y_1 = \text{NPL}; X_1 = \text{CAR}; X_2 = \text{LDR}; X_3 = \text{NIM}; X_4 = \text{CASA}; e = \text{error}$$

- b) BOPO moderation on the influence of independent variables (CAR, LDR, NIM and CASA)

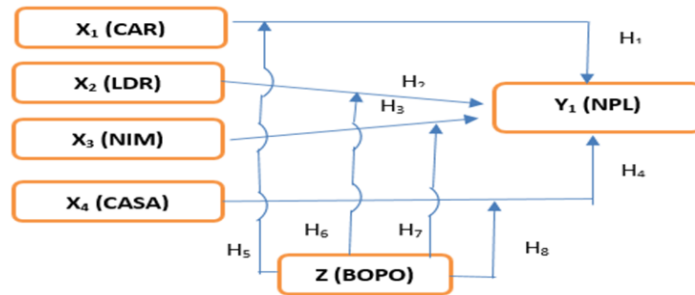
to the dependent variable (NPL), equation (Lie, 2009):

$$Y_2 = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_6 X_1 Z + \beta_7 X_2 Z + \beta_8 X_3 Z + \beta_9 X_4 Z + e \dots \dots \dots (2)$$

Note:

$$Y_2 = \text{NPL}; X_1 = \text{CAR}; X_2 = \text{LDR}; X_3 = \text{NIM}; X_4 = \text{CASA}; Z = \text{BOPO}; X_1 Z = \text{interaction CAR with BOPO}; X_2 Z = \text{interaction LDR with BOPO}; X_3 Z = \text{interaction NIM with BOPO}; X_4 Z = \text{interaction CASA with BOPO}; e = \text{error}$$

Figure 1 - Modeling Chart



### 3. RESULT & DISCUSSION

#### 3.1. Statistical Result

The results of empirical data processing (attachment) show that:

- The direct effect of the independent variables (CAR, LDR, NIM and CASA) on the dependent variable (NPL); all independent variables have no effect on the dependent variable (see table 2.1.) the equation is:  $NPL = 2.680 + 0.370_{CAR} + 0.455_{LDR} - 0.129_{NIM} - 0.424_{CASA} + e \dots (1)$
- The BOPO moderating variable only strengthens several independent variables; namely CAR has a positive effect and CASA has a negative effect on NPL (see table 2.2.), the equation is:  $NPL = 3.311 + 4.979_{CAR} + 0.806_{LDR} - 0.977_{NIM} - 3.881_{CASA} + e \dots (2)$

Table 2.1. Model 1 test (multiple linear regression  $\alpha$  0.05)

Variable	Coefficient	Prob.	Remarks
CAR	0.370	0.468	Prob > 0.05 (Insignificant)
LDR	0.455	0.495	Prob > 0.05 (Insignificant)
NIM	-0.129	0.343	Prob > 0.05 (Insignificant)
CASA	-0.424	0.406	Prob > 0.05 (Insignificant)
Constanta	2.680		

Source: STATA test output (see appendix 4)

Table 2.2. Model 2 test (moderating regression analysis;  $\alpha$  0.05)

Variable * M	Coefficient	Prob.	Remarks
CAR M	4.979	0.001	Prob < 0.05 (significant)
LDR M	0.806	0.575	Prob > 0.05 (Insignificant)
NIM M	-0.977	0.058	Prob > 0.05 (Insignificant)
CASA M	-3.881	0.023	Prob < 0.05 (significant)
Constanta	3.311		

Source: STATA test output (see appendix 7)

Note: CAR M; LDR M; NIM M; CASA M interaction between the independent variables and the moderating variable (BOPO)

#### 3.2. Discussion

Statistical tests show that the direct effect of the independent variables CAR, LDR, NIM, CASA on the dependent variable NPL is contrary to the hypothesis and after there is interaction between the independent variables and the moderating variable BOPO;



Statistical test results show that CAR and CASA have an effect on NPL. Interpretation of the findings of this study are as follows:

- a) CAR has no direct effect on NPL,  $H_1$  is rejected. This finding is in line with the results of Juliani's research (2022); Wulandari et al (2021); Ruslim & Bengawan (2019) in Indonesia, EL-Maude, et al. (2017) in Nigeria and Koju et al (2018) in Nepal. It is interpreted that the company's capital status which relates to operational and credit risk (CAR) does not encourage management to relax the policy of granting safe credit; because in essence the technical processes of CAR and NPL are different and not directly related.
- b) LDR has no direct effect on NPL,  $H_2$  is rejected. This finding is in line with the results of Yam (2016); Beni et al (2023); Wulandari et al (2021); Juliani (2022). It is interpreted that the Released NPL is related to risk management in terms of inaccurate analysis, which is not directly related to funding ability, because they are 2 different working techniques.
- c) NIM has no direct effect on NPL,  $H_3$  is rejected. This finding is in line with the results of Sistiyarini & Poerwanti (2021) in Indonesia. It is interpreted that the element of margin tends to be related to profitability, while NPL is related to risk; it means that NIM is not a causal factor affecting NPL.
- d) CASA has no direct effect on NPL,  $H_4$  is rejected. It is interpreted that the element of low-cost funds is not a driving factor for non-performing loans, because technically the operation has not contributed directly to the technical provision of credit
- e) BOPO moderates the effect of CAR on NPL,  $H_5$  is accepted. Basically CAR does have a weak positive effect on NPL but after interacting with BOPO the results strengthen the effect of CAR on NPL; because the elements in BOPO are closely related to CAR.
- f) BOPO does not moderate the effect of LDR on NPL,  $H_6$  is rejected. Actually, LDR has an effect on NPL but not significant; after interacting with BOPO, the results do not strengthen the effect of LDR on NPL. Because the BOPO elements are not strongly related to LDR, they do not motivate the effect on NPL
- g) BOPO does not moderate the effect of NIM on NPL,  $H_7$  is rejected. Actually, NIM has an effect on NPL but not significant; after interacting with BOPO, the results do not strengthen the effect of NIM on NPL. Because the BOPO elements are not strongly related to NIM, they do not motivate the effect on NPL
- h) BOPO moderates the effect of CASA on NPL,  $H_8$  is accepted. Basically CASA does have a weak negative effect on NPL but after interacting with BOPO the results strengthen the effect of CAR on NPL; because the elements in BOPO are closely related to CASA.

### 3.3. Conclusion

The statistical results show that the independent variable has no effect on the dependent variable, while the moderator variable BOPO plays a role in strengthening the effect of CAR and CASA on NPL, so it can be concluded:

- a. The direct influence of independent variables that are not significant on the independent variables of the study is not an anomaly that deviates from theory, but is caused by changing factors such as time frame and banks group category that make the independent variable functions deviate, so it is necessary to develop research models using moderating variables or mediating variables.



- b. In practice, NPL does not only come from internal bank and economic factors; but also involves the role of elements from non-financial science such as psychology and customer behavior; This view is in accordance with research in Poland by Bialowolski et al, (2021) and Bialowolski & Bialowolski, (2021). Meanwhile in Indonesia, in the research of Rozalia & Handayani (2022) and Rosiyati et al, (2017). Likewise Zhu's (2011) research in the United States and Yusupova (2016) in Uzbekistan
- c. Preferably research on banking non-performing loans can be developed by involving elements of non-financial science in order to obtain substantive findings
- d. The results of this study are relatively due to limitations on empirical data and samples, so it is hoped that the same research can expand the limitations, with the aim of obtaining comprehensive research results.

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## Appendix 1 – Sample list

Bank Name - KBMI 1					
1	Allo	10	IBK Indonesia	19	Nobu
2	Amar Indonesia	11	Ina Perdana	20	OK
3	Arta Graha	12	Jabar	21	Panin
4	Bank Of India Indonesia	13	Jatim	22	Raya
5	Banten	14	Maspion	23	Sinar Mas
6	Bumi Arta	15	Mega	24	Victoria
7	Capital Indonesia	16	Mestika Dharma	25	Woori Saudara
8	China Construction Indonesia	17	MNC Indonesia		
9	Ganesha	18	Neo Commerce		

## Appendix 2 - Common effect

```
. reg NPLgross CARLN LDRLN NIM CASALN
```

Source	SS	df	MS	Number of obs	=	150
Model	87.3906509	4	21.8476627	F(4, 145)	=	2.45
Residual	1294.16133	145	8.92525053	Prob > F	=	0.0489
				R-squared	=	0.0633
				Adj R-squared	=	0.0374
Total	1381.55198	149	9.27216092	Root MSE	=	2.9875

NPLgross	Coefficient	Std. err.	t	P> t	[95% conf. interval]
CARLN	-.0388734	.4866238	-0.08	0.936	-1.000666 .9229189
LDRLN	.1570727	.6006101	0.26	0.794	-1.030009 1.344154
NIM	-.1213928	.1012184	-1.20	0.232	-.3214468 .0786612
CASALN	-1.217706	.4269334	-2.85	0.005	-2.061523 -.3738895
_cons	7.92082	3.698998	2.14	0.034	.6099004 15.23174

## Appendix 3 - Fixed Effect (Chow test)

```
Fixed-effects (within) regression
```

Number of obs	=	150
Group variable: id		
Number of groups	=	25
R-squared:		
Within	=	0.0169
Between	=	0.0978
Overall	=	0.0081
Obs per group:		
min	=	6
avg	=	6.0
max	=	6
corr(u_i, Xb) = -0.3165		
F(4,121)	=	0.52
Prob > F	=	0.7218

NPLgross	Coefficient	Std. err.	t	P> t	[95% conf. interval]
CARLN	.4854357	.6085622	0.80	0.427	-.7193736 1.690245
LDRLN	.4840074	.8068941	0.60	0.550	-1.113452 2.081467
NIM	-.0999709	.2241453	-0.45	0.656	-.5437256 .3437839
CASALN	.460344	.6593802	0.70	0.486	-.845073 1.765761
_cons	-.9135965	4.402611	-0.21	0.836	-9.629726 7.802533
sigma_u	2.2332331				
sigma_e	2.4462944				
rho	-.4545369				

## Appendix 4 - Random Effect

F test that all u\_i=0: F(24, 121) = 3.97 Prob > F = 0.0000

```

Random-effects GLS regression           Number of obs   =       150
Group variable: id                     Number of groups =        25

R-squared:                               Obs per group:
  Within = 0.0032                         min =           6
  Between = 0.0934                        avg =           6.0
  Overall = 0.0405                         max =           6

corr(u_i, X) = 0 (assumed)              Wald chi2(4)    =         2.23
                                          Prob > chi2     =         0.6940

```

NPLgross	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
CARLN	.3701745	.5105974	0.72	0.468	-.630578	1.370927
LDRLN	.4556093	.6679298	0.68	0.495	-.8535091	1.764728
NIM	-.1298056	.1368237	-0.95	0.343	-.3979752	.138364
CASALN	-.4245077	.5112423	-0.83	0.406	-1.426524	.5775088
_cons	2.680503	3.925193	0.68	0.495	-5.012735	10.37374
sigma_u	1.7374041					
sigma_e	2.4462944					
rho	.33528787	(fraction of variance due to u_i)				

## Appendix 5 - Breusch and Pagan LM Test

Breusch and Pagan Lagrangian multiplier test for random effects

$$\text{NPLgross}[\text{id},t] = Xb + u[\text{id}] + e[\text{id},t]$$

Estimated results:

	Var	SD = sqrt(Var)
NPLgross	9.272161	3.045022
e	5.984356	2.446294
u	3.018573	1.737404

Test:  $\text{Var}(u) = 0$

$$\begin{aligned} \text{chibar2}(01) &= 30.09 \\ \text{Prob} > \text{chibar2} &= 0.0000 \end{aligned}$$

## Appendix 6 - Hausman Test

```
. hausman fe re
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
	(b) fe	(B) re		
CARLN	.4854357	.3701745	.1152612	.3311166
LDRLN	.4840074	.4556093	.0283981	.4527117
NIM	-.0999709	-.1298056	.0298348	.1775398
CASALN	.460344	-.4245077	.8848517	.4164295

b = Consistent under  $H_0$  and  $H_a$ ; obtained from **xtreg**.  
B = Inconsistent under  $H_a$ , efficient under  $H_0$ ; obtained from **xtreg**.

Test of  $H_0$ : Difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(4) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 7.00 \\ \text{Prob} > \text{chi2} &= 0.1358 \end{aligned}$$



## Appendix 7 – Moderating Regression Analysis

Random-effects GLS regression  
Group variable: id

Number of obs = 150  
Number of groups = 25

R-squared:  
Within = 0.1451  
Between = 0.4730  
Overall = 0.2746

Obs per group:  
min = 6  
avg = 6.0  
max = 6

corr(u\_i, X) = 0 (assumed)

Wald chi2(8) = 35.87  
Prob > chi2 = 0.0000

NPLgross	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
CARLN	-22.67597	7.306553	-3.10	0.002	-36.99656	-8.355393
LDRLN	-3.130801	6.631164	-0.47	0.637	-16.12764	9.866041
NIM	4.402851	2.363431	1.86	0.062	-.2293883	9.035091
CASALN	17.16765	7.694875	2.23	0.026	2.085974	32.24933
CARM	4.979843	1.567879	3.18	0.001	1.906857	8.052829
LDRM	.8064764	1.437741	0.56	0.575	-2.011445	3.624398
NIMM	-.9776548	.5164565	-1.89	0.058	-1.989891	.0345813
CASAM	-3.881368	1.707798	-2.27	0.023	-7.228591	-.5341464
_cons	3.133284	3.871703	0.81	0.418	-4.455114	10.72168
sigma_u	1.3125666					
sigma_e	2.2798284					
rho	.24894787	(fraction of variance due to u_i)				