JURNAL AKUNTANSI, MANAJEMEN DAN EKONOMI
Vol.24, No. 1, 2022, pp. 33 - 40
Published online in http://jos.unsoed.ac.id/index.php/jame
ISSN: 1410-9336 / E-ISSN: 2620-8482

# Internal and External Determinants of Rural Banks' Profitability: A Time-Series Analysis

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**Abstract**

This research aims to investigate how internal and external factor influence the rate of profitability of rural banks in Indonesia. Internal factors are factors within the bank itself, namely core capital, loan to deposit ratio, and nonperforming loan ratio. External factors are macroeconomics variables uncontrollable to the rural banks, such as inflation and interest rate. VECM test proved the existence of cointegration function. Any deviation from last period will be adjusted at the rate of 8.863%. In the long-run, core capital and inflation affect rural banks' performance. Impulse response function indicated that any shocks that occurred to core capital, inflation, loan to deposit ratio and nonperforming loan had the inhibiting effect on rural banks' performance. On the other hand, interest rate was the only variable that provided positive stimulus on rural banks' performance. This showed us that rural banks should have improved risk and capital management practice so that they will not have to depend on the interest rate to have a better performance.

**Keywords** **Profitability, Cointegration, Impulse Response Function, Vector Error Correction Model**

## INTRODUCTION

Indonesia has two types in its banking system namely conventional and Islamic banks. Within each type lies two further catgeories of banks, commercial and rural banks. The majority of market share is still dominated by commercial banks whether it be conventional or Islamic commercial banks. Rural conventional and Islamic banks share a small portion of banking industry. In light of conventional banking system, loan and third party fund still reside mostly within commercial banks. The figure below shows the comparation between commercial and rural banks in terms of the funds deposited.

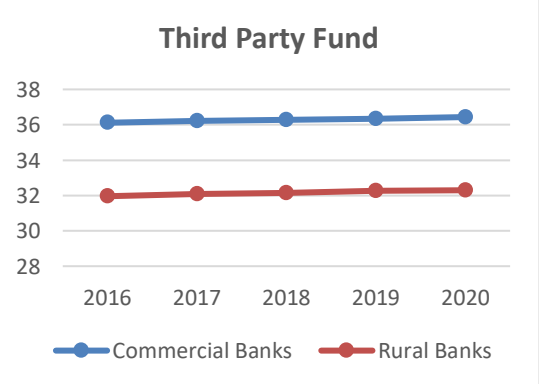


**Figure 1 Third Party Fund**

Source: OJK, 2021

The above figures show the amount of third party fund in natural logarithm form. There has been a very steady increase of deposits in commercial and rural banks. This shows than each of the type of the bank has its own market segment that is firmly established. In 2016, the amount of third party fund is Rp. 4,826 trillion (36.12 in natural logarithmic term), while rural banks house Rp. 75 trillion of third party fund (31.96 in natural logarithmic term). Over the course of five years, commercial banks collects Rp. 6,665 trillion deposits and rural banks have around Rp. 102 trillion third party fund. Customerwise, rural banks target lower income segment. This is in contrast to commercial banks that focus more on higher income segment, although it also serves lower income market. Commercial banks focus more in urban areas, although some commercial banks also operate on rural areas. In light of supervision by central banks, profitability serves an important function. It is the early warning signal of financial distress that might be imminent on a bank. Whenever a bank experience a loss, regulator will conduct assessment on the likelihood of bank failure and whether the failure could result in materialized systemic risk (van Oordt & Zhou, 2019). Therefore, it is pivotal to investigate

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Received: 23 December 2021
Accepted: 1 March 2022
Published: 30 March 2022

predictors of banks profitability. The figure below provides the visual inspection of peofitability compatrison among rural and commercial banks in Indonesia.

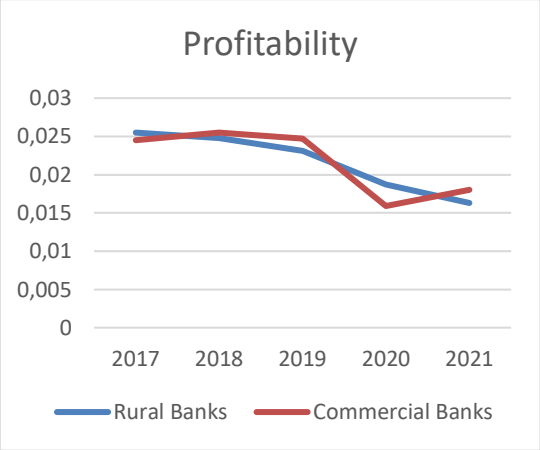


**Figure 2 Banks Profitability**
Source: OJK, 2021

The above figure shows that for the past 5 years, profitability rate has a declining trend for rural and commercial banks. This certainly raises concerns for regulator whether the banking industry is facing imminent distress. Therefore, regulator will take steps to ensure that banks will remain healthy and sound and can function well in the economy. The purpose of this research is to investigate how internal (microeconomic) and external (macroeconomic) factors contribute to the profitability of rural banks. Many research has been conducted in this realm. However, most research focus on commercial banks (Fahrul & Rusliati, 2016; Herdhayinta & Supriyono, 2019; Octavio & Soesetio, 2019; Serly, 2021; Sofie, Manurung, Usman, & Trisakti, 2020; Suryanto, 2017; Usman, 2019; Wardhani, 2020; Widyastuti, Dedi, & Zulaihati, 2017; Wulandari, Anggraeni, & Andati, 2016). Some researches investigated the profitability of Islamic rural banks (Sanusi, 2019; Warninda & Hosen, 2015; Widarjono, Mifrahi, & Perdana, 2020). One research in particular focused on conventional rural banks' profitability (Purnamawati, 2014). The marked difference between Purnamawati (2014) and this reseach is that this research empoyed Impulse Response Function (IRF) generated by Vector Error Correction Model (VECM) as the intrument of analysis, while Purnamawati (2014) use linear regression. IRF allows for further analysis on whether a shock to the system will generate a negative or positive response from the endogenous variable and the periods in which the response persists. Fahrul & Rusliati (2016) investigated the profitability of commercial banks. They found that NPL negatively affect profitability and LDR and interest rate positively affect profitability. However, no significant influence derived from Net Interest Margin ratio. Wulandari, Anggraeni, & Andati (2016) divided profitability into two proxies, ROA and ROE, and started examining the influence of certain factors on each of the ratio. ROA was later ound out to be affected by NPL, BOPO, and GDP. ROE was affected by more factors, i.e loan to Micro and SMEs, BOPO, inflation, GDP, and interest rate. Here we can see that the researchers differentiated between micro- and macroeconomics factors. Macroeconomics factors are inflation, GDP, and interest rate. Those are factors uncontrollable to the banks. Suryanto (2017) focused only on major banks in Indonesia as his main sample. Panel regression was the methodology employed to find what factors affect the ROA. He found that Loan to Asset ratio and NPL directly affect ROA. While CAR had no influence. Widyastuti, Dedi, & Zulaihati (2017) specifically explored the influence of internal determinants. Ratios of NIM, LDR, Operating Efficiency, NPL and CAR were hypothesized to influence profitability. Contrary to Suryanto (2017), NPL and CAR did not have influence on profitability. However, other variables affected profitability. Similar to Wulandari, Anggraeni, & Andati (2016), Herdhayinta & Supriyono (2019) also represented profitability by ROA and ROE. They further divided their independent variables into micro- and macroeconomics factors. Macroeconomic variables were inflation, interest rate, and money supply. Only inflation and interest rate that significanly influenced ROA and ROE. The microeconomic factors were CAR, NPL, LDR, operating efficiency, NIM, assets, and capital. All these variables affected both profitability ratios. Octavio & Soesetio (2019) included human capital as one of the variable that could influence profitability. They later found out that human capital indeed contributed to profitability along with total assets, loan loss provision, and GDP. Usman (2019) did a cross country comparison of banking profitability. The samples extended across two ASEAN countries. The independent variables used are those of capital ratios and ownership ratios. He found that none of LDR, DER, and CAR that had effects on banking profitability in Indonesia

and The Phillipines. However, ownerships did influence profitability (managerial and institutional) in both countries. He posited that although banking environments are different, some fixed effects remained. Wardhani (2020) used panel regression to investigate factors affecting profitability. LDR, interest rate, and inflation posited random effect on profitability. Interestingly, intellectual capital had no significant effect on profitability. Serly (2021) presented ROA, ROE, and NIM as proxies for profitability. She found that NPL really influenced all proxies of profitability. The same case also applies for operating efficiency that negatively affected profitability. Prasanto et al (2020) used VECM method to research about banks profitability. They found cointegrating relationship in the model. This means a long-run realtionship exists in which profitability was affected by interest rate and inflation. This embodies cointegration among interest rate, inflation and profitability. They later found that shocks imminent to the independent varuables do not affect profitability. The sample used in Prasanto (2020) was state-owned commercial banks. Gaps still exist in which time-series model implemented on rural banks in indonesia has not been applied. Research using rural banks focus more on Islamic rural banks. Therefore this research endeavor to fill in the gap in the literature by investigating profitability of conventional rural banks using VECM to arrive at IRF analysis.

## RESEARCH METHODS

The variables involved in this research are ROA, Core Capital (CAP), inflation (INF), interest rate (INT), loan to deposit ratio (LDR), and nonperforming loans ratio (NPL). Core Capital will be the natural logarithm of the rural banks' core capital (tier 1 capital). The research period extend from January 2010 until May 2021. The main analysis for this research is Impulse Response Function (IRF). IRF can only be generated after Vector Error Correction Model (VECM) is implemented. Before arriving at VECM, firstly stationerity test should be conducted. This step will allowus to see whether the data is stationary at level or at 1st difference. Subsequently, we have to test for lag length criteria. This is because the current state of variable could be affected by previous period state. Subsequent to lag length criteria, we conduct Johansen cointegration test to investigate whether cointegrating relationship exists within the model, followed by VECM estimation. The financial step would be IRF analysis. However, before IRF, Variance Decomposition Analysis will be presented to provide ideas about the variance conditions over time.

## RESULTS AND DISCUSSION

Time-series econometrics require all variables included in the model to be stationary to prevent spurious regression from happening. Stationarity test is also called unit root test. The result of stationarity test is as follows:

**Tabel 1.** Stationarity test using Augmented Dickey-Fuller (ADF) and Phillips-Ferron (PF)

| Variable | Level | | 1st Difference | |
|---|---|---|---|---|
| | ADF | PF | ADF | PF |
| ROA | 0.905 | 0.916 | **0.000** | **0.000** |
| CAP | **0.004** | 0.569 | **0.016** | **0.000** |
| INF | 0.891 | 0.421 | **0.000** | **0.000** |
| INT | 0.163 | 0.308 | **0.039** | **0.000** |
| LDR | 0.678 | **0.042** | 0.116 | **0.000** |
| NPL | 0.093 | 0.691 | 0.537 | **0.000** |

The above table shows that at level form, only CAP variable is stationary (bold indicates nonstationary). However, the stationarity for CAP is not absolut. Only ADF supports the notion of stationarity, whereas PF rejects it. All other variables are not stationary at level. The corresponding p-value is greater than 0.05. According to ADF, NPL is stationary at 10% level. Based on this result, the variables should be differenced once to achieve stationarity. After differencing the variables, PF test supports the stationarity of the variables. ADF states that all the variables are stationary except for LDR and NPL. Therefore, we can be certain that first difference is enough to proceed to the next test, i.e. lag length criteria. Lag length criteria will provide the lag required to investigate further with VECM. The result of lag length criteria is as follows:

**Tabel 2.** Lag Length Criteria

| Lag | AIC | SC | HQ |
|---|---|---|---|
| 0 | -33.51571 | -33.37995 | -33.46056 |
| 1 | -44.11826 | **-43.16795*** | **-43.73220*** |
| 2 | -44.32303 | -42.55816 | -43.60606 |
| 3 | -44.25760 | -41.67818 | -43.20972 |
| 4 | -44.32541 | -40.93143 | -42.94661 |
| 5 | -44.00484 | -39.79631 | -42.29514 |
| 6 | -43.82292 | -38.79984 | -41.78231 |
| 7 | -43.61607 | -37.77843 | -41.24455 |
| 8 | -43.40201 | -36.74982 | -40.69958 |
| 9 | -43.49713 | -36.03038 | -40.46378 |
| 10 | -43.75900 | -35.47770 | -40.39474 |
| 11 | -43.95762 | -34.86176 | -40.26245 |
| 12 | **-44.77120*** | -34.86079 | -40.74512 |

The above table presents the result of lag lenth determination based on three methods, Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan Quinn (HQ). AIC determines that the VECM model should contain 12 lags. This means that any independent variables at lag 12 can still influence the current state of ROA. (for example INFt-12 can influence ROAt). However, SC and HQ conted that lag length 1 is enough for the VECM model. Therefore, this research will use lag length 1 to have a more parsimonious model. After determining the lag lenth, the nnext step would be cointegration analysis. Below is the result of Johansen cointegration test.

**Tabel 3.** Johansen Cointegration test

| ROA | CAP | INF | INT | LDR | NPL |
|---|---|---|---|---|---|
| 1 | 0.0180 | 0.352 | -0.227 | 0.064 | 0.526 |
| | (0.002) | (0.078) | (0.100) | (0.039) | (0.133) |
| Cointegration coefficient is -0.08863 | | | | | |

The above table shows that there exists 1 cointegrating relationship. The test shows that the ROA should occupy the position of a dependent variable. This is exactly what we concur. Profitability should be the target variable that will be affected by other independent variables. The existing cointegrating relationship shows that there is a long-run effect from other variables. The effect is contrary to the coeeficient shown in the table because the cointegration relatioship have negative coefficient. The cointegration model is:

$$ROA_t = -0.08863\delta_{t-1} (0.01801CAP_{t-1} + 0.35220 INF_{t-1} – 0.22789 INT_{t-1} + 0.064538LDR_{t-1} + 0.526624NPL_{t-1})$$

In the above model, $\delta$t-1 indicates the error correction term (ECT). This means that any deviation from last period, will be corrected 8.863% in the current period. This is a rather slow adjustment process. So rural banking industry in Indonesia has a very slow recovery process should a shock be imposed on it. Therefore, direct intervention from central bank is required to bring stability to the rural banking industry. In the long run, CAP has negative effect on profitability. This shows that rural banks still lack in the management of capital to provide for profits. Human capital investment must be implemented so that the rural banks can better manage and allocate its capital to profitable sector. Inflation also affects profitability negatively. This shows the vulnerability of the rural banks to the bad economic condition, although it will not happen instantly (in one period). Interest rate can increase profitability in the long run. Increase in interest rate will generate more interest revenue to the rural banks. Jence, the monetary policy take by central banks will affect the performance of rural banks. LDR affects profitability negatively. In similar vein to CAP, this indicates poor risk management within the rural banks. The credit officer and leaders of rural banks should be equipped with sound risk management knowledge, so that they can prevent credit risk from materializing. Lastly, NPL renders profitability worse. NPL is a direct charge to the income recorded by rural banks. Overall, the NPL level is a reflection of risk management technique of the rural banks. Regulators should facilitate improvement in risk management practive of rural banks. The table below shows the result of VECM:

**Tabel 4.** VECM Result

| | D(ROA) | D(CAP) | D(INF) | D(INT) | D(LDR) | D(NPL) |
|---|---|---|---|---|---|---|
| **D(ROA(-1))** | **-0.364151*** | -0.313118 | 0.223129 | 0.031328 | 0.663130 | -0.063423 |
| | (0.07494) | (1.87219) | (0.23875) | (0.18952) | (0.60178) | (0.12092) |
| | [-4.85923] | [-0.16725] | [ 0.93456] | [ 0.16530] | [ 1.10196] | [-0.52451] |
| **D(CAP(-1))** | 0.001689 | **-0.403638*** | -0.007651 | -0.000815 | 0.060324 | 0.005167 |
| | (0.00379) | (0.09477) | (0.01209) | (0.00959) | (0.03046) | (0.00612) |
| | [ 0.44518] | [-4.25915] | [-0.63305] | [-0.08499] | [ 1.98033] | [ 0.84423] |
| **D(INF(-1))** | 0.006130 | 0.057821 | **0.361138*** | 0.041739 | 0.058186 | 0.019354 |
| | (0.02668) | (0.66641) | (0.08499) | (0.06746) | (0.21420) | (0.04304) |
| | [ 0.22979] | [ 0.08677] | [ 4.24942] | [ 0.61873] | [ 0.27164] | [ 0.44965] |
| **D(INT(-1))** | 0.006278 | -0.027574 | 0.129294 | **-0.303073*** | 0.010359 | 0.034773 |
| | (0.03322) | (0.82988) | (0.10583) | (0.08401) | (0.26675) | (0.05360) |
| | [ 0.18899] | [-0.03323] | [ 1.22169] | [-3.60772] | [ 0.03883] | [ 0.64876] |
| **D(LDR(-1))** | 0.027600 | -0.831591 | -0.012378 | 0.017352 | 0.069415 | 0.020936 |
| | (0.01267) | (0.31653) | (0.04037) | (0.03204) | (0.10174) | (0.02044) |
| | [ 2.17834] | [-2.62718] | [-0.30664] | [ 0.54154] | [ 0.68226] | [ 1.02406] |
| **D(NPL(-1))** | -0.139841 | **-4.551964*** | 0.251812 | -0.058677 | 1.283044 | -0.163477 |
| | (0.06148) | (1.53605) | (0.19589) | (0.15549) | (0.49373) | (0.09921) |
| | [-2.27440] | [-2.96343] | [ 1.28550] | [-0.37737] | [ 2.59868] | [-1.64781] |
| **C** | -0.000230 | 0.014120 | 4.47E-05 | -0.000321 | -0.000365 | -2.08E-05 |
| | (0.00015) | (0.00366) | (0.00047) | (0.00037) | (0.00118) | (0.00024) |
| | [-1.56676] | [ 3.85630] | [ 0.09583] | [-0.86602] | [-0.30981] | [-0.08780] |

The above table shows the short-run relationship among variables. Overall the relationship is more of an autoregressive nature. We can see that previous period state is a good predictor of the current period state. ROA at previous period determines the value of ROA at current period. The same applies to CAP, INF, and INT. However the previous period NPL affects the current period CAP. If NPL is high in the last period, then CAP will be lower in the next period. As indicated by the table the influence of last period NPL to current period CAP is positive.

So the bad effect of NPL will not be felt in the same period, but instead it will be felt in the next period. This shows that rural banks are vulnerable to nonperforming loan. Any nonperforming loan will make capital deteriorates. Therefore, sound risk management practice is urgently needed by the rural banks. As an additional analysis, VDC is performed next. The figure below shows the result of VDC:

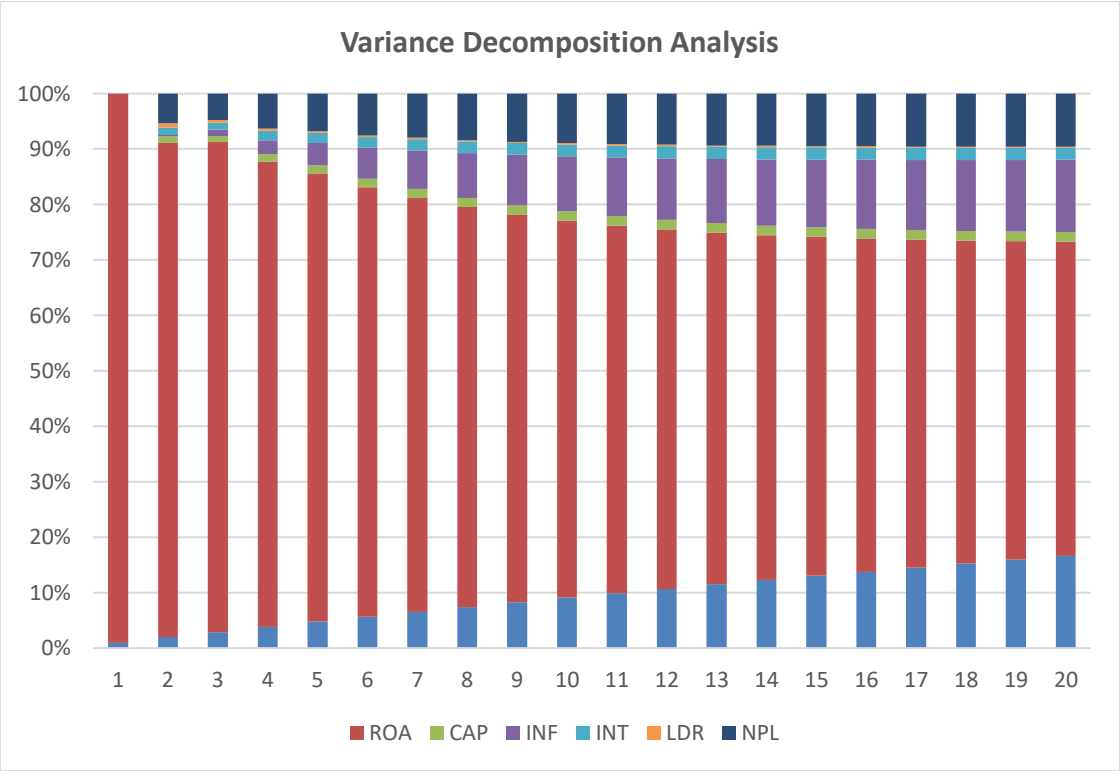


**Figure 3 Variance Decomposition Analysis**
Source: Processed Data, 2021

The figure above shows how the variance of ROA is explained by the other variabels over time. The maximum time shown in the figure is 20 periods. In the time 1, almost 100% of ROA variance can only be explained by the autoregressive components (the ROA itself). However as time progresses, other variables have more roles in explaining the variance of ROA. This means the role of previous period ROA will become smaller overtime. The variable CAP has the least amounts of ROA variance explained over period. Only about 3-4% of ROA variance can be explained by capital. INF, INT, and NPL have moderate effect on explaining ROA variance. They strated small, but at the end of the period around 10-15% of ROA variance can be explained by variance in INF, INT, and NPL, each.

This shows that at the long run, INF, INT, and NPL will have most effect on ROA compared to other variables. INF and INT are two macroeconomic variables, uncontrollable by the rural banks. Therefore rural banks can only anticipated the effect of both variables on profitability. System should be ready in place to mitigate the effect of macroeconomic conditions. NPL is a microeconomic factor. It is controllable to the rural banks. Again, this shows NPL has significant effect on profitability and there is a pressing need for rural banks to have good risk management practice. LDR, just like CAP, can explain modest variance of ROA. The following figure shows the result of IRF:

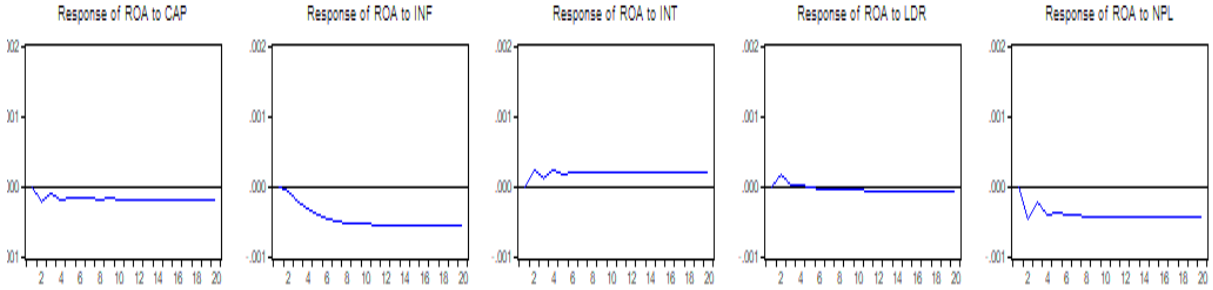


**Figure 4. IRF**
Source: Processed Data, 2021

The figure above shows the IRF results. The first graph on the left, shows how ROA reacts whenever a shock happens to CAP, hence the stimulus. Whenever there is a shock on the CAP, the ROA will react negatively. This means there is a declining trend on the ROA. This proves that CAP has an inhibiting effect on the ROA. The negative effect will be felt instatntly from the period 1. Until period 20, ROA will always decline. The stabillity will be achieved in the period 5 onwards with little turbulence. Therefore, we can expect declining profitability should a shock happen to capital. The second graph shows the stimulus given by INF to ROA. The ROA will respond negatively. The response is very drastic in the first period to the 6$^{th}$ period. Shock that happens to INF will cause a deep decline in ROA. The macroeconomic condition will affect profitability. The third graph shows that when a shock happens to INT, ROA will react positively. We can see that rural banks rely their profitability on the interest rate. The higher the interest rate, the higher rural banks profitability. Therefore, interest rate targetted by central banks as part of its monetary policy will determine the level of rural banks' profitability. The 4$^{th}$ graph is the graph of ROA's response on stimulus given by LDR. LDR does not induce bad negative influence on ROA although the response lies in the negative area. Until the period 20$^{th}$, the response is just minimal below the 0 level. The last graph shows that NPL will attract negative response from ROA. Any shock imminent that happens on NPL will lower the profitability of the rural banks. In the long-run, the response remain negative. In the short-run, the negative response can be seen straight from period 1. This showcases the sensitivity of profitability tot the nonperforming loans.

## CONCLUSION

The results of the research shows that all the variables have long-run effect on rural banks proftability. Microeconomic variable, capital and NPL, have inhibiting effect on banks profitability. Bad capital management and risk management practice will cause a decline in ROA. This shows how sensitive the profitability to the miecroeconomic condition. In regard to this finding, regulator and owner of rural banks should ensure that rural banks management is equipped with good capital management and risk management knowledge. Competence enhancement programs should be conducted so that the inhibiting effects of capital and nonperforming loan can be mitigated. Ongoing supervision should also be committed by regulators to make sure rural banks carry out good capital management and risk management practice. On the other hand, macroeconomic factors (inflation and interest rate) affect rural banks profitability. Inflation will affect profitability negatively, but interest rate positively. Inflation is a parameter for bad economic condition. Whenever Indonesian economy is not very good, rural banks tend to have a declining performance. For the moment, they cannot avoid the effect of inflation. Rural banks should have a system ready to anticipate bad ecoomic condition. Loans should be allocated to productive SMEs that can withstand bad economic condition. Lastly, interest rate is still the driving factor behind rural banks profitability. Lacks of fee-based revenue resources force rural banks to depend on the level of interest rate targetted by central bank. Rural banks should have the capability to read the monetary policy taken by central bank so that it can prepare whenever the interest rate is not favorable.

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