

Detection of Ventricular Fibrillation Based on Sequential Increment Method

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Abstract—This study is for developing an embedded method for automatic diagnosis of ventricular fibrillation (VF) by using a neuro-fuzzy system embedded in an automated external defibrillator (AED). To diagnose VF using AEDs, we use the neural network with weighted fuzzy membership functions (NEWFM), a wavelet transform (WT), a sequential increment method (SIM), and phase-space reconstruction (PSR) in order to classify normal sinus rhythm (NSR) and VF of electrocardiogram (ECG) episodes. This study has the following key points. The first contribution is the extraction of peaks from ECG episodes by the use of the WT and SIM by a time-frequency technique. The second contribution is that NSR and VF are distinguished by means of three-dimensional (3D) PSR based on a 3D graphic model. The third contribution is the identification of feature differences between NSR and VF by the use of graphical characteristics of weighted fuzzy membership functions (WFMs) supported by the NEWFM. The final contribution is the development of a neuro-fuzzy system for automatic diagnosis of VF using the WFMs embedded in the AED. The following four preprocessing steps are implemented to extract features from ECG episodes. In the first step, the WT is used for multi-scale representation and analysis and wavelet coefficients are then generated from the ECG episodes. In the second step, the SIM is used to extract peaks from the wavelet coefficients. In the third step, successive peaks are plotted in a 3D phase-space diagram by performing 3D PSR. In the final step, the distance between the origin (0, 0, 0) and the successive peaks plotted in a 3D phase-space diagram is calculated; then, 20 features are extracted from the calculated distances by using statistical methods, including frequency distributions and their variability. The 20 extracted features are applied as inputs to the NEWFM, and the result is that the classification accuracy of the NEWFM is 100%.

Keywords—ventricular fibrillation, automated external defibrillator, neuro-fuzzy system, electrocardiogram, wavelet transform.

I. DESIGN

FIG. 1 shows frequent peaks in an ECG episode. The peak of an ECG episode is the point at which the ECG point is at its highest. To reach a peak, an ECG point rises from a lower point to a higher point. Some ECG points rise sequentially. However, some rise just once and then fall. Therefore, it is necessary to develop a technique for extracting the peaks of an ECG episode that rise sequentially two or more times. Algorithm 1 describes how to extract the peaks of an ECG episode that rise sequentially two or more times.

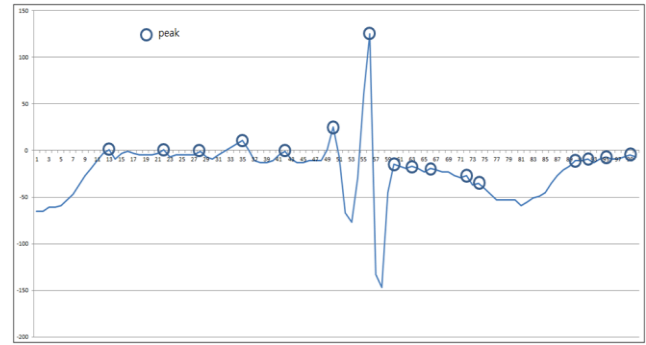


Fig. 1 Example of peaks in ECG episode

Algorithm 1. Peak extraction based on sequential increment method

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n : Number of wavelet coefficients
Wn : nth wavelet coefficient
Cn : nth counter for sequential increment
Xn : Array of peaks
index : Location of array initialized to 0
01 : C1, C2, ..., Cn are initialized to 0
02 : W1, W2, ..., Wn are wavelet coefficients
03 : for i = 1 to n do
04 :   if Xi+1 > Xi then
05 :     Ci+1 = Ci + 1 // Sequential increment is accumulated
    by one
06 :     Ci = 0
07 :   end if
08 : end for
09 : for i = 1 to n do
10 :   if Ci >= 2 then
11 :     Xindex = Ci
12 :     index = index + 1
13 :   end if
14 : end for
15 : return (X1, X2, ..., Xn)

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II. RESULT

This study uses data acquired from MIT-BIH Arrhythmia Database provided by PhysioBank (<http://physionet.org/physiobank/database/mitdb/>) [1]. The 20 extracted features were used as inputs for the NEWFM, with the result that the classification accuracy of the NEWFM was 100%.

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Global in Fiscal Variable Uncertainty and the Transmission of Economics with VAR Model

Teguh Sugiarto, and Pudjiono

Abstract—This research aims to provide input and prove empirically how the impact of fiscal policy over the shocks and surprises globally in its application. The research was done by the author using data of two variables i.e. fiscal GDP and Gov. Expenditures on every country in the world during the period from 2014. If the view does not exist empirically, which can or could explain how the effects of fiscal policy and the emergence of as well as the existence of a process of uncertainty globally, but the results of this study at least can be set as a challenge that can be represented, with respect to the identification of the shocks which occurred in IRF and FEVD. IRF approach and FEVD are in use by the author in this study using model var. In the basic model in the form of a variable will connect the GDP and Gov. Expenditures in every country in the world.

Keywords— Government spending, GDP, IRF, FEVD and VAR..

I. INTRODUCTION

IN some research and a lot of studies shows that there is a situation in which the occurrence of uncertain economic conditions, when we had to do against the effects of the Government's anticipated economic variables that exist in the form of expenses in doing by the Government and the onset of shock on GDP variables can make the State of the economy was initially well be biased. Generally when we look at the State of global financial markets always shows the instability in the economy, especially since the onset of the monetary crisis in 1998 and until recently. Many developing countries in the world currently in influence by the external conditions in the circumstances deem could always be profitable for them. If we look at the State of the economy of the country Indonesia, 2016 budget balance in there is some improvement in which there are several items related to spending, which in turn can increase the resources and budget for subsidies for the general public relating to issues of food, energy, infrastructure, health and social activities of the Government that has been on schedule. Some commitment from State agencies to speed up the development process, which can cause the expenditure be increased by 2015. Although the figures are at a little lower map out when compared with the projections of revenue that has been received, but nonetheless it opens opportunities for debt to foreigners. The occurrence

of numbers in that year's fiscal deficit of 2.5 per cent to GDP in that year, making a trend in other policies that may be in the count. If we examine the next month period occurring increase slightly higher when compared to previous periods. Need to take note that the occurrence of such improvement also make the deficit balance of walking in some period in the future.

In september 2015 there's a reform agenda by the State, where the agenda provided a package of policies in seven criteria to announce the rules and structural in nature as well as in the field of fiscal stimulus. It makes the market share over the sale of assets valuable assets during the next months little experience recovery, and recorded in the previous month the deficit occurred several quite dismaying. The existence of these events, making market share be no brightness or development, caused the occurrence of a slowing rate of the economy in developed countries such as China, the USA and some countries in Europe. This is visible from the interest rate on a scale that is still considered high. Although many of the outside investment that comes in, but it is still considered a pseudo, and yet could be considered advantageous in terms of the players of the market according to the author. With the presence of capital flows to developing countries such as Indonesia, for example, is still considered a camouflage in economics by the existence of the loan interest rate is still above average. However, events like the one above, can create some variables in the economy could make the decisive tools in for a country, especially GDP and Government spending. With the tightening process that expenditure funded by any country in particular, will be able to cause the increase will demand from the external parties or from out of State. This will can lead to the State in the short term and the constant commodity price decline in the medium term. The table below looks how GDP g rowth worldwide for the fourth quarter in a row.

TABLE I
IN THE BASE CASE, GDP GROWTH IS PROJECTED AT 5.3 PERCENT IN 2016

		2014	2015p	2016p
Real GDP	(Annual percent change)	5.0	4.7	5.3
Consumer price index	(Annual percent change)	6.4	6.3	4.6
Current account balance	(Percent of GDP)	-3.1	-2.0	-2.4
Budget balance*	(Percent of GDP)	-2.2	-2.5	-2.2

Note: * October realization reported for 2015; Projection of the Ministry of Finance for 2016.

Source: BI; BPS; Ministry of Finance; World Bank staff calculations

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In the third quarter, real GDP grew 4.7 per cent, but there is a slight acceleration on Q1 and Q2 column by 2015. The onset of growth in the quarter and could be supported by an increase in the spending on sectors such as Government and do the existence of consumption goods and capital. At the same time will increase numbers occur at variable investments for the private sector, which is estimated to occur a high enough increase frequency if we see and refer to the above data. Impending a level of aggregate which is in the form of increased unemployment on the scale variable 6.2 percent, that originally there was 5.9 percent on the figure in the quarter a year earlier.

In this study with the view and the glassy to Indonesia's economy, which deals with the world's economy indirectly. As a proxy to measure the uncertainty of the world economy then, authors use variables of the GDP and expenditure that has been done in each country, with no notice to the market volatility index. The author does this research with the goal of analyzing the possibility of uncertainty or not impacting the world economy against Indonesia, which can be predicted by the author analysis using two models of the economic variables that exist in the world, with models in analysis VAR. first showing effect of GDP and spending by the Government in each country, which would be no surprise in GDP and the second analysis will show the impact of government spending on the mark with the surprise on variables that do research. By doing this analysis was later able to see a difference between the onset of the reaction variables in doing research.

In the next page will present methods, research results and conclusions reached by the economic analyst from the opinions of the authors. The data used in this research is shaped by estimating the time series model of the VAR.

II. LITERATURE REVIEW

In a study done by Christiano et al. (1999) and Perotti (2007), using the model of large scale vector autoregressive (VAR) models in assessing the shocks which occurred against the fiscal and monetary policy. VAR is one of the econometric measurement model, to see the influences and shocks are happened in the macro economy, with Harken to the impulse response function and factor error variance decomposition has been in the VAR model of consent in form. In empirical studies of the results look how the effects of monetary policy shocks in Real as well as the effects of fiscal shocks in Perotti. In the empirical literature has shown a picture and strong facts in analyzing fiscal and monetary policy. In the study that they use the variables of which consists of the private consumption, the level of wages of workers that they can explain how it can help to discriminate between economic theories competing. In the study also mentioned how the VAR model is built and in use can show symptoms symptoms and can perform a process control on the specification of the VAR model in top view and explain the differences. With an explanation that occurs can interpret the distinction as something things are considered uncertainty over the effect of a shock that was in doing research, but

theoretically the impact of the effects of policies that can be taken in consider. From the results of their study that explains also how there is a new evidence empirically showing the deficit figures from the onset in policy do it over tax cuts. In the study also found the effects of shocks from taxes when we see from identification in use, whether from the existing literature can describe qualitatively or quantitatively, so that the existence of the Genesis effect estimates from the shocks that began a non-distortionary became a thing that distortionary. Most of the results of the study showed a difference in scale size automatically estimated or calibrated to process stabilizers in order to approach a policy alternatives considered unidentified, or in other words the existence of approximate distortions that would relate to a surprise with the granting of tax incentives, so that the size of the top automatic stabilization of yesteryear will be positive.

The following are some of the research done by Sims (1980), Ramey and Shapiro (1998), Edelberg et al. (1999), Fatas and Mihov (2001), Blanchard and Perotti (2002), Perotti (2005, 2007), Uhlig (2005), Mountford and Uhlig (2005), Eichenbaum and Fisher (2005), Perotti (2007) and Ramey (2007) to discuss and identify the use of VAR models by looking at the identification of deterministic shocks as well as empirically. In the study they did the average use of the terms in the use of the sample period, which variables will be one set of endogenous variables, as well as using the term deterministic as well as analysis of the length of the lag length as the initial analysis tools. In the analysis of literature and studies they do empirically there are many differences especially of model approaches that they use, the variety of identification as well as the scale of the policies and shocks at the discretion of the variables in the analysis. The emergence of the recursive approach in proposing makes the results more interesting analysis. There are some final conclusions which can be taken in addition to proposing a new approach model to measure the scale of the shocks, the emergence of the latest model of the VAR in the form of large scale Structural VAR, the following use restrictions that approach is developed and applied in the analysis of fiscal policy. The last use of the existence of an unexpected effect of the approach of a policy taken or in use, which is considered as a model of a model defensive analysis in suggestion.

Still in research performed by Fisher and Eichenbaum (1998), Edelberg et al. (1999), Fatas and Mihov (2001), Blanchard and Perotti (2002) Burnside et al. (2004), Eichenbaum and Fisher (2005), Perotti (2005, 2007), Mountford and Uhlig (2005), Ramey (2007), and Perotti (2007) various econometric analysis model in apply, such as the DSGE, VAR, SVAR till VECM model ECM as well as for example. In the study empirically shows how the impact of macro economic variables one that is Government spending shocks occur, they consider it is not describing the incident and they do not share. They assume that specifically for personal consumption experience a response on the report that private consumption is significant, so the impact will continuously affect positively, and thus the Government would spend the reserve or stock. From the results of their

study also shows and provide proof that the upper response variable consumption of households is at zero and insignificant in the statistics. So is the impulse response function as a whole is seen on the horizon is long term and short term significantly in response to the surprise of surprises in the economy.

Following studies In Blanchard and Perotti (2002), Perotti's (2005), (2006), Linnemann Ravn et al (2006) and Galí et al (2007), Woodford (2010), Caldara and Kamps (2008) by making model predictions with the standard model which can be considered consistent in looking at the influence of consumption and GDP. Some of such research exists that gives the opinion that the consumption variables in minutely more influenced positively against the shock and the response of the other variable in use, namely the labor market in responding to variable consumption. By using model analysis of the wage increase of DSGE looks real, yet at the same time occur an increase in varabel jobs. So empirically, there is enough positive relations over the varibel con-sumption labor wages in receive, which ultimately can improve the level of welfare of labor, and the impact to the growth rate.

In the few studies ever done in some of these countries, look how the existence of the tax variable in one study, a positive impact can increase but can also impact positif. This happened in the US, where the increase in tax revenue, negatively impact the outut does not react when State economic shock occur. When we see theoretically, then indirectly tax variables above will experience a distortion. Many writers who do research using item fiscal variables, many of which wear model of Blanchard-Perotti. With the model of Blanchard-Perotti fiscal variables in use i.e. tax, will be in a State of non distorted, because with this model there will be a measure of automatic stabilizers that are can be calibrated, because there is a proof in the extra models. However, in the use of models from the approach of Blanchard-Perotti will occur a relationship between linear measurement is calibrated in automatic stabilizers, as well as the existence of an approximate upper size also tagging and output response occurs in the presence of exogenous shocks from the use of a variable in the model of fiscal tax. In Blanchard and Perotti (2002), using structural VAR model, where the existence of a large scale model usage that is more suitable and appropriate in making a model of fiscal policy. Because with this model there is a view for analysis of the Cholesky decomposition and FEVD in identifying system of equations. So what do we want, a policy which is monetary or fiscal, then it will happen one reson that possibility could make changes in the form of policy in use.

in this study the author uses a large scale model of the VAR to explain the IRF and FEVD of economic variables in the analysis. In the 20s today many researchers who conduct economic analysts with various kinds of approaches, which considered could explain the influence between the variables in each other thoroughly. In this paper, a model analysis of fiscal policy that will be in use in this study, the authors then guided to the main approaches in identifying fiscal policy. One of them is by using a recursive model VAR by Sims

(1980) which was in use in the analysis of fiscal shocks by Fatas and Mihov (2001). The VAR model of Blanchard and Perotti (2002) that in this proposal is the VAR model is not a model for non structural VAR approach, to produce the IRF and FEVD from fiscal policy. In refining the approach to the top of the sign-writers restriction not applying the model developed by Uhlig (2005) as well as ever in applied in the analysis of fiscal policy by Mountford and Uhlig (2005), but will use another way to explain it. Meanwhile, to see how the effects of an increase in government spending over GDP ratio, model of Ramey and Shapiro (1998) used by the authors to model in the proposal.

III. DATA

In the analysis of uncertainties and fiscal policy transmission occurs in almost all countries including Indonesia, the authors use data by 2014 as a tool in helping to analyze the possibility. The basic model will be built including variable GDP and Government spending in each State in this research, by not inserting variable such as the consumer price index and the market volatility. Table 1 below shows the notation used when estimating the variables and form VAR models as a basis for analysis of the IRF and FEVD.

TABLE I
VARIABLES NOTATIONS USED TO ESTIMATE THE VAR MODEL

Name variable	Item
Variable 1	GDP
Variable 2	Government Expenditure

Figures 1 and 2 in [Table 1] shows the variables used in the study are comprised of variable GDP and Government expenditure are recognised as author index measurements that can be analyzed. The author considers both of these variables have an influence and interconnected and related issues.

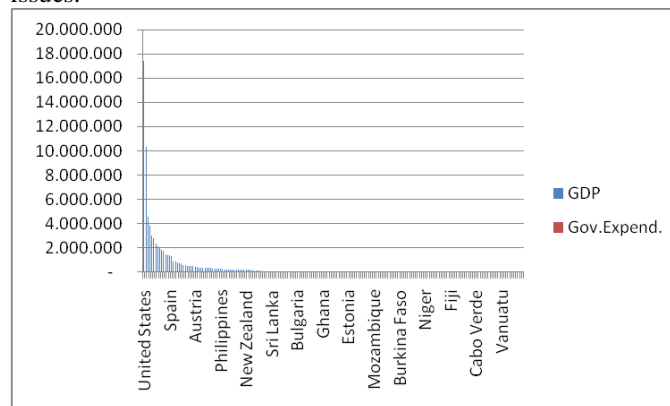


Fig. 1. The evolution of the government expenditures and GDP

In [Fig. 1] GDP and index numbers Visible government expenditures in view on the table, for data on countries that are in use as research data, which is data for both of these variables in the can the author through the website of the world bank. These authors show some data on top of sports, over GDP and Government expenditure variables in a billion dollars on the [Figure 2].

Ranking	Country	(millions of US dollars)	(millions of US dollars)
		GDP	Gov.Expend.
1	United States	17.419.000	22,19253597
2	China	10.354.832	13,60132716
3	Japan	4.601.461	16,47339522
4	Germany	3.868.291	19,34546328
5	United Kingdom	2.988.893	19,67013481
187	Dominica	524	19,85865724
188	Tonga	434	12,04917577
189	São Tomé and Príncipe	337	12,07455748
190	Micronesia, Fed. Sts.	318	13,50229536
191	Palau	251	14,93003325
192	Marshall Islands	187	6,351697338
193	Kiribati	167	5,844609047
194	Tuvalu	38	6,098153193

Fig. 2. The data GDP and government expenditure all country

To figure 2 above there are a number of variables data GDP and Gov. Expenditures, where the author does not process the data at the top of the logarithm may have, because the author thinks using the original data without adjustment process, will be able to give a better results and more real. Some of the steps performed by the author in data analysis: first do an analysis of causality analysis, Granger, IRF and FEVD analysis. A null hypothesis is given by the author to test and Granger causality, that data will be in doing the test and Granger causality data for government expenditures and GDP variables berkointegrasi and berkausalitas. To produce the model IRF and FEVD then the writer will use the VAR model, due to the use of the VAR model estimates it can shows a result of IRF and better FEVD. [Figure 3] shows the results produced by the test and can be seen that the null hypothesis is rejected among the following variables:

- government expenditures and GDP; Causality

Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
GOV_EXPEND_ does not Granger Cause GDP	193	4.09709	0.0444
GDP does not Granger Cause GOV_EXPEND_		0.27488	0.6007

Fig. 3. Granger causality test

- government expenditures and GDP; Cointegration test

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Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.487599	173.1408	15.49471	0.0001
At most 1 *	0.219203	46.76626	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Fig. 3.Cointegration Johansen test

IV. ECONOMETRIC METHOD USED

In an equation to describe a simple VAR model that will be analyzed for GDP and variable Gov. Expenditure are described the u.s. follows:

$$Y_t = A(L)*Y_{t-1} + B(L)*X_t + \hat{I}_t \tag{1}$$

where:

- Y_t – the endogenous variables vector;
- X_t – the exogenous variables vector;
- \hat{I}_t – the errors vector;
- $A(L)$ and $B(L)$ – the coefficients of the endogenous and exogenous variables vector.

In the equation above looks for GDP and Gov. Exenditures variable models use VAR. in these studies try to use VAR modeling in order to see how the countries of the world can control the growth rate of the economy on a large scale, with respect to the influence of some fiscal policy variables, by not taking into account the existence of other variables are variables in the fiscal policies that can affect the global economy. And this can be made by other writers to make further research material later.

for model continuation in the first equation in the model equation explained in the VAR the latter. The author assumes that there will be shocks happen one output and can and does not affect variables variables that are currently in the research. So when we write the next equation is going to be into the form of the following models:

$$Y_t = [g_expend_t, gdp_t] \tag{2}$$

The second model emerged because in the equation happen one response variable to capture the impact of the instability of the fiscal variables being thorough. So it appears the equation 3, which is useful later to see how the variables in meticulous facing the onset of a shock at the time do it in research, then the variable will be affected by shocks that are caused from the form of the equation on the make.

$$Y_t = [g_expend_t, gdp_t] \tag{3}$$

The author chose the model VAR, as it considers this a large scale measurement model easier to run and in understanding, and can reduce the occurrence of an error in the model made in karenakan VAR models there is the IRF and FEVD which can be set as additional guidelines to analyze fiscal variables in intent. Some of the ways such as test the AIC, the SIC, Homokedastisitas and other are not funded by the author. In order to obtain the results of modeling of large scale in the proposal or the VAR model, later writers will do an analysis FEVD and IRF, in order to clarify that the variables in the research process looks of surprise and shock that occurred or had disappeared. The author argues that FEVD is a slightly different way, in the modeling analysis using a large-scale model of the VAR model.

V.RESULTS

The author is already explained in the previous section, that in this study using VAR model approach because in the modeling of the SVAR in the wake, for the analysis of the IRF and FEVD still have not been able in the perfect tool, the author considers it because there are still many criticisms over the results of the model IRF and the FEVD form. [Figure

4] below looks acyl modeling model IRF cholesky decomposition over GDP and gov. variable expenditure.

Response to Cholesky One S.D. Innovations ± 2 S.E.

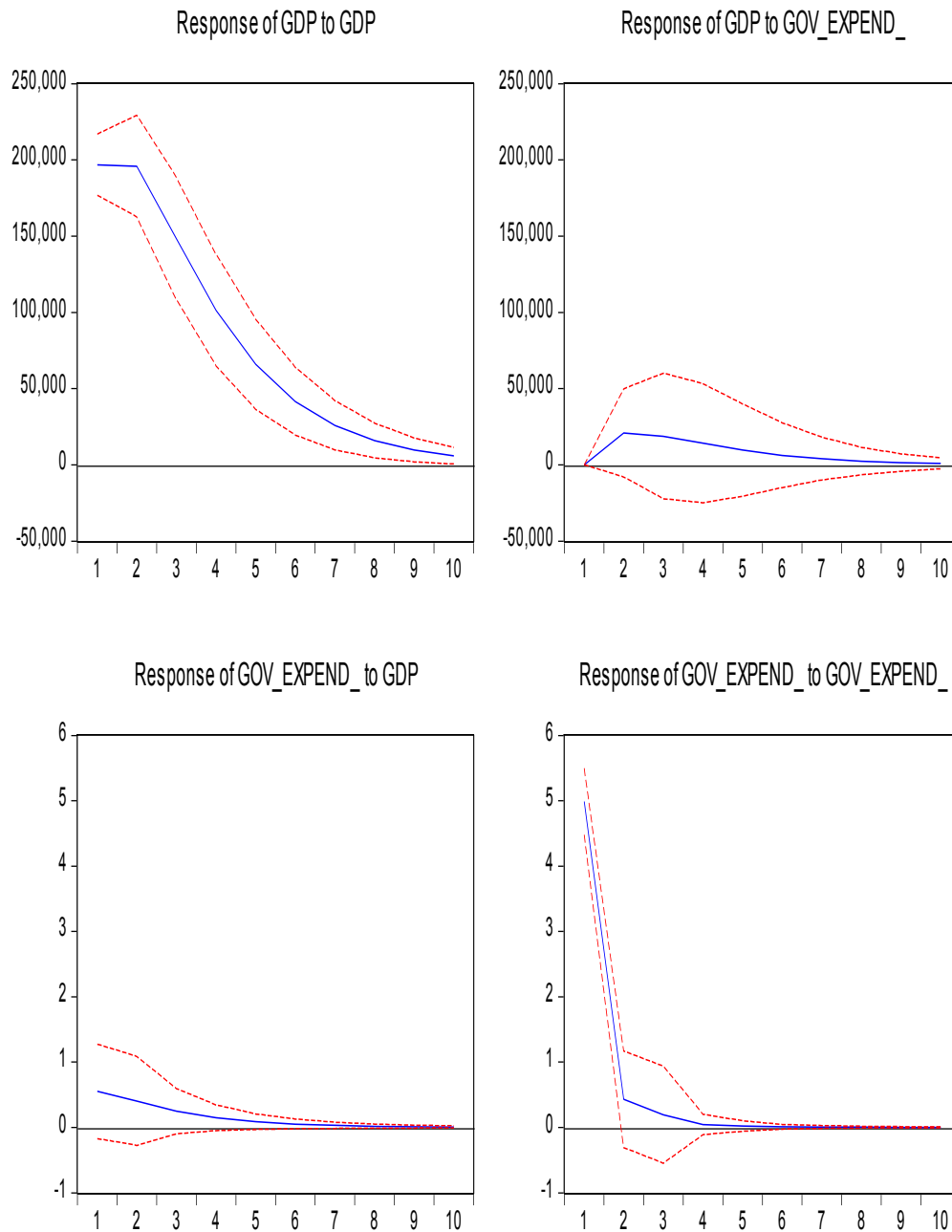


Fig. 4. (a) Response of government expenditure to GDP shock; (b) Response of GDP to government expenditures shock;

With based on the results of [Figure 4] above, to the IRF in produce with the VAR model in form, there is the presence of surprise and shock that in naturally by the variables used in the study. For the response of the GDP against gov. expenditres on the first year experience of surprise or are on the point of balance, and began a surprise and shock occurred in the second year could earn up to the ninth year of the surprise decline, but the rate of big surprises happen in the third year. Then experience the slowdown entered its fifth year until the tenth year. While the surprise to gov.. Expenditures GDP ratio occurs only time lapse period in the second year entered its third year, and begin to experience the

slowdown entered its fifth year. Response to Gov. Expenditures experienced a shock occurred in the first and second, but in the second year of entering the third year of experiencing a slowdown and point balance. For the FEVD of the VAR model is built we can see on the [Figures : 5] below.

Response of GDP:		
Period	GDP	GOV_EXPEND_
1	196802.5	0.000000
2	193524.1	21066.56
3	146299.5	18913.24
4	99823.29	14230.95
5	64771.83	9669.637
6	40867.72	6268.164
7	25362.77	3952.744
8	15581.72	2452.500
9	9512.220	1506.492
10	5783.655	919.5984

Response of GOV_EXPEND_:		
Period	GDP	GOV_EXPEND_
1	0.000000	5.022072
2	0.355793	0.432351
3	0.227042	0.194017
4	0.141548	0.044689
5	0.083944	0.019414
6	0.049835	0.009113
7	0.029653	0.005036
8	0.017717	0.002907
9	0.010620	0.001721
10	0.006380	0.001028

Nonfactorized One Std.Dev.

Fig. 5. (a) Response of government expenditures toGDP ; (b) Response of GDP to government expenditures shock;

On [Figure : 5] FEVD above look how the response of the variables of the GDP against Gov. Expenditures, and on the contrary response Gov. Expenditures GDP ratio on the chart the next column. In the first year if GDP and variables visible Gov. same same Expenditures have significant influence and in explain by the influence of the variable itself. As GDP which has influence on the donate by variable GDP itself of 196802.5 without any response from gov. Expenditures, and vice versa. In the second year of shocks over the response variable of the GDP against Gov. Expenditures in GDP amounted to explain variable by 193524.1 while the rest in the explain by variable Gov. Expenditure. So in contrast to variable Gov. Expenditures.

VI. CONCLUSIONS

The results of this study can conclude that using two variables contained on the model of fiscal policies globally, estimated over influence in the produce of both models use variable is visible from the VAR model analysis in the wake by using the IRF and FEVD analysis as a tool in explaining the relationship between the two variables in maskud globally. In this study the author does not use a proxy to measure the uncertainty, or not using the third variable as a proxy variable that affect fiscal variables policy outside globally. But with two models of this variable can already explains how forms from simple fiscal policy globally in explain using the IRF and FEVD of large scale model of the VAR in the proposal.

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