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Goodness C. Aye
University of Pretoria
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Department of Economics
University of Pretoria
0002, Pretoria
South Africa
Tel: +27 12 420 2413

Short and Long Run Asymmetric Effects of Monetary and Fiscal Policy Uncertainty on Economic Activity in the U.S

Goodness C. Aye[1*]

Abstract
This paper extends the ongoing literature on the macroeconomic effects of monetary and fiscal policy uncertainty. It examined the asymmetric effects of monetary and fiscal policy uncertainty on economic activity in the short and long run using U.S. monthly data from 1985M1 to 2017M2. The industrial production index is used as a measure of economic activity while the Baker et al (2016) news based monetary and fiscal policy uncertainty were used as measures of uncertainty. To analyse asymmetry, the paper employed the nonlinear autoregressive distributed lag (NARDL) model which allows one not only to capture the effects of positive and negative uncertainty but to do so in both short and long run. Hence this paper provides new evidence of possible existence of a nonlinear and asymmetric relationship between policy uncertainty and economic activity in the short and long run. The results show that monetary and fiscal policy uncertainty share long run relationship with economic activity. Further, the effect of monetary and fiscal policy uncertainties in the long run is asymmetric. Asymmetric effect in the short run was supported only for monetary policy uncertainty. These findings have important practical and policy implications.

Keywords: Monetary policy; fiscal policy; uncertainty; asymmetry; nonlinearity, short run, long run
JEL Classification: C32, E52, E62, F62

1 Introduction

The 2007-2009 global economic and financial crisis that started from the United States has been termed the worst economic downturn since the Great Depression. Given the slow recovery from the crisis in the U.S., there has been unprecedented fiscal and monetary policy actions. Moreover, there was been no consensus about the timing and mix of fiscal and monetary policies (Fernández-Villaverde et al, 2015). There have been strong political partisan divisions, with some arguing for more economic stimulus or more economic assistance for those in need, and others arguing for contraction in government spending and transfers (Murray, 2017). Given that the slow economic recovery has been attributed to uncertainty about economic policies, one foreseeable and effective way to recovery and boosting consumer and business confidence in the U.S. as suggested by Ben Bernanke, the Federal Reserve chairman in July 2012 monetary policy report to the U.S. Congress, is to design long-run policy that removes uncertainty concerning the fiscal stance of the Federal Government.

The slow recovery and consequent economic and political hardship have raised renewed interest among policy makers, researchers and other stakeholders on the effect of uncertainty on the macroeconomy. Uncertainty may rise because of negative news, which lowers expectations of future economic activity. Sources of uncertainty may be changes in rules and

[1] Department of Economics, University of Pretoria, 0002 Pretoria, South Africa.
Email: goodness.aye@gmail.com
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regulations governing taxes and investment, change in political system, government's decision to settle its budget, and terrorist activities among others. Theoretically, rising uncertainty causes firms to wait before investing and hiring, and causes consumers to wait before purchasing certain consumption goods (Bernanke 1983, Pindyck, 1991). In other words, uncertainty could delay both investment and consumption plans as there is a real option effect to waiting (Aye et al., 2018). These consequently could slow down economic growth (Bloom 2009; 2014). Another theoretically view of uncertainty is that high uncertainty increases borrowing costs for firms (Christiano et al., 2014).

Before proceeding further, it is important that a distinction is made between economic uncertainty and policy uncertainty. Policy uncertainty relates to uncertainty regarding policy decisions from monetary or fiscal authorities while economic uncertainty incorporates both policy uncertainty and economic uncertainty such as equity market uncertainty, housing price uncertainty among others (Balcilar et al., 2017). This study focuses specifically on monetary and fiscal policy uncertainty. For instance, agents can be uncertain about monetary policy for a variety of reasons: informational asymmetries, central banks' possible lack of credibility or commitment, unknown central bank preferences, among others. Uncertainty about future policy affects agents' expectations such that perceived changes have real and nominal effects (Mumtaz and Zanetti, 2013).

When uncertainty decreases, economic activity may rebound, but not necessarily immediately (Foerster, 2014). This suggests that uncertainty could have asymmetric effect on economic activity since the macroeconomic effects of a positive volatility may not necessarily be offset by the decline in uncertainty. This paper extends previous research on the macroeconomic impact of monetary and fiscal policy uncertainty (Bloom, 2009; Mumtaz and Zanetti, 2013; Born and Pfeifer, 2014; Johannsen, 2014; Hollmayr and Matthes, 2015; Fernández-Villaverde et al, 2015; Creal and Wu, 2017; Murray, 2017; Kotzé, 2017) which have assumed symmetric effect. To the best of my knowledge there has been no previous paper that examined whether positive (increases) and negative (decreases) in monetary and fiscal policy uncertainty has differential impact on economic activity. Moreover, this paper distinguishes the asymmetric effects of fiscal and monetary policy uncertainty in the short and long run. To this end, this study employs the nonlinear autoregressive distributed lag (NARDL) model of Shin et al. (2014) which allows not only asymmetric analysis but also short and long run analysis of the relationship between monetary and fiscal policy and economic activity.

The rest of the paper is organised as follows: The next section presents the data and empirical model. Section 3 discusses the results while section 4 concludes.

2 Data and Empirical Model

The paper used monthly U.S. time series data from 1985M1 to 2017M2. Economic activity is proxied by the industrial production index (INDPRO). These are sourced from the FRED database of the Federal Reserve Bank of St. Louis. Data on monetary policy uncertainty (MPU) and fiscal policy uncertainty (FPU) were the categorical measure of uncertainty for the US economy as developed by Baker et al. (2016). The Categorical Data include a range of sub-indexes based solely on news data. These are derived using results from the Access World News database of several US newspapers. Each sub-index requires the terms: economic, uncertainty, and policy as well as a set of categorical policy terms. Although there are several measures of economic uncertainty (Jurado eta l., 2015; Strobel, 2015), the measures of policy uncertainty used in this study which are based on a news-based approach are not driven by the variables included in the econometric framework as in the measures from structural models. All variables are transformed to their natural logarithm. The plots of these series are presented in Figure 1. Industrial production has in general being on an increasing trend. However, there is a noticeable decline between 2007 and 2009, a period which corresponds to the recent global economic and financial crisis. Looking at the monetary and fiscal policy uncertainty data, one can observe large fluctuations which are typical of uncertainty series. The uncertainty variables indicate heightened uncertainty during the global financial crisis with this being more obvious in the fiscal policy uncertainty series.

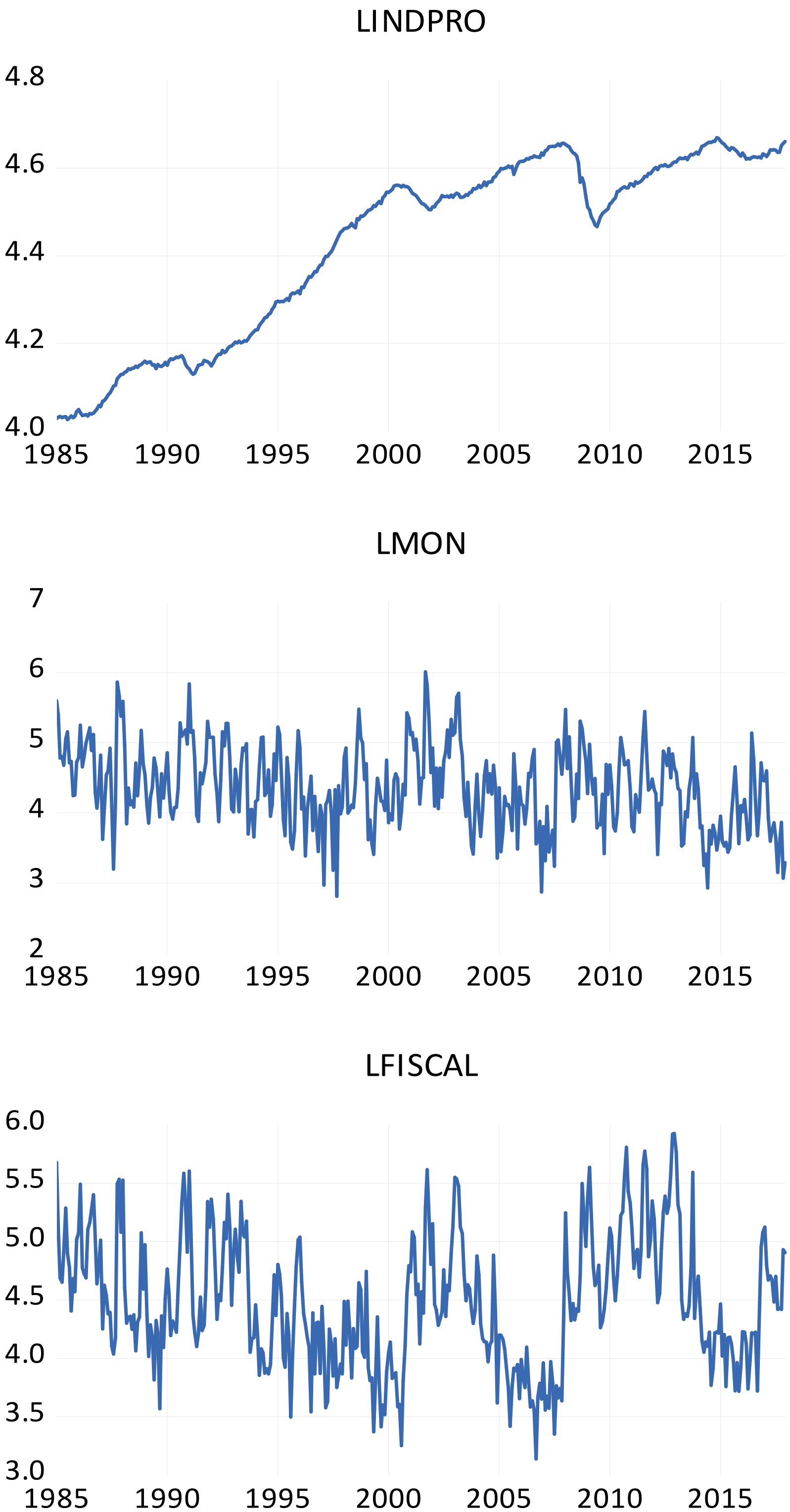

Figure 1: Log plot of monetary policy uncertainty, fiscal policy uncertainty, industrial production

The econometric method is based on the nonlinear autoregressive distributed lag (NARDL) model developed by Shin et al. (2014). This method allows one to examine the effect of positive and negative policy uncertainty on economic activity. It also allows this to be done in the short and long run. Moreover, it has the advantage of permitting both I(0) and I(1) variables for analysis.

The NARDL model is an extension of the linear autoregressive distributed lag (ARDL) cointegration model developed by Pesaran et al. (2001). Therefore starting with the linear ARDL, the short and long run relationship between for example monetary policy uncertainty (MPU) and industrial production (INDPRO) may be specified as an error correction model:

$$\Delta LnINDPRO_t = \alpha_0 + \sum_{i=1}^{p-1} \alpha_{1i} \Delta LnINDPRO_{t-i} + \sum_{j=0}^{q-1} \alpha_{2j} \Delta LnMPU_{t-j} + \theta_1 LnINDPRO_{t-1} + \theta_2 LnMPU_{t-1} + \varepsilon_t \quad (1)$$

Similar equations may be obtained for fiscal policy uncertainty (FPU). The short run effects are captured by the estimates of coefficients assigned to first-differenced variables, α_{1i} and α_{2j}, and the long run effects by the estimates of θ_2 normalized by θ_1. p and q are respectively the lag orders for the dependent variable and the exogenous variables in the distributed lag component. However, these long run effects are only valid if cointegration exists. Pesaran et al. (2001) suggest using the F-test to establish joint significance of lagged level variables as a sign of cointegration. Since this F-test accounts for integrating properties of variables in producing the critical values, there is no need for pre unit root testing under this method (Bahmani-Oskooee and Aftab, 2017) and variables could be a combination of I(0) and I(1).

Equation (1) assumes that the effect of policy uncertainty on economic activity is symmetric. To capture the asymmetric effect of policy uncertainty both in the short and long run, changes in the uncertainty measures are decomposed into their positive and negative changes.[2] This is done by first forming $\Delta LnMPU$ which includes positive changes, $\Delta LnMPU^+$, and negative changes $\Delta LnMPU^-$. Following Shin et al. (2014), two new time series variables are created namely, POS, representing only increased policy uncertainty as a partial sum of positive changes and NEG, representing decreased policy uncertainty as a partial sum of negative changes:

$$POS_t = \sum_{j=1}^{t} \Delta LnMPU_j^+ = \sum_{j=1}^{t} \max(\Delta LnMPU_j, 0) \text{ and}$$

$$NEG_t = \sum_{j=1}^{t} \Delta LnMPU_j^- = \sum_{j=1}^{t} \min(\Delta LnMPU_j, 0) \quad (2)$$

Replacing $LnMPU_t$ in equation (1) with POS_t and NEG_t variables, we get the NARDL model:

[2] It is noted that this method can also be used to analyse the effect of small versus large fluctuations in the uncertainty measure by changing the threshold from zero to a certain value such as the mean of the volatility measure or its value as certain quantiles or deciles (Pal and Mitra, 2016; Bahmani-Oskooee, 2017).

$$\Delta LnINDPRO_t = \beta_0 + \sum_{i=1}^{p-1} \beta_{1i} \Delta LnINDPRO_{t-i} + \sum_{j=0}^{q-1} (\beta_{2j} \Delta POS_{t-j} + \beta_{3j} \Delta NEG_{t-j}) + \phi_1 LnINDPRO_{t-1} + \phi_2 POS_{t-1} + \phi_3 NEG_{t-1} + u_t \quad (3)$$

where ϕ_1 is the autoregressive or persistence parameter, u_t is i.i.d. zero mean random variable with finite variance, σ_u^2. Nonlinearity is introduced by the way of constructing POS and NEG variables using partial sum concept. The bounds test is also applicable to equation (3). In this case the POS and NEG variables are treated as one variable and the same critical value for the F-test in the linear ARDL applies even though the NARDL has one additional variable. According to Shin et al. (2014), this treatment is due to the dependency between the positive and the negative variables.

Short run asymmetry adjustment could be established if the number of lags on ΔPOS variable is different from the number of lags on ΔNEG variable. Also the short run asymmetric effects could be established if the size or sign of the coefficients on ΔPOS and ΔNEG is different at each lag j (Bahmani-Oskooee and Aftab, 2017). However, to formally test for the short run cumulative or asymmetric effects, the Wald test is used to determine if $\sum \beta_{2j} \neq \sum \beta_{3j}$ in equation (3).

The symmetric long-run parameter is given by ϕ_1 while the asymmetric long run parameters are given by ϕ_2 and ϕ_3. [3]To test for the long run asymmetric effect of policy uncertainty on economic activity, the Wald test is used to determine if the normalized coefficients on POS and NEG are significantly different. This is equivalent to testing that $\frac{\phi_2}{-\phi_1} \neq \frac{\phi_3}{-\phi_1}$ in equation (3).

3 Results

Preliminary analysis as shown by the unit root tests results presented in Table 1shows that industrial production is an I(1) series while fiscal and monetary policy uncertainty variables are I(0). This justifies the use of ARDL framework. The results of the NARDL model on the asymmetric effect of monetary and fiscal policy uncertainty on economic activity are presented in Table 2. The lag orders of the models were selected using the Akaike and Schwartz information criteria. Columns 2 and 3 report the result with monetary policy uncertainty as the explanatory variable. Columns 4 and 5 report the results with fiscal policy uncertainty as the explanatory variable. Panel A of Table reports the estimated short run coefficients of the model alongside the persistent parameter, INDPRO (-1), and the non-normalized long run coefficients. The results show that the persistent parameter, INDPRO (-1), is negative and significant in both cases. This indicates that the specified NARDL models are stable. Past variations in industrial production significantly determine their own current variations and this is robust to cases where monetary and fiscal policy uncertainty are included. Specifically, increases in previous variations in industrial production lead to increases in the current variation in industrial production and vice versa. These are particularly significant from the second lag. In the short run, the effect of positive and

[3] The parameter ϕ_1 is assumed to be negative and significant to have a cointegration relationship among the variables.

negative monetary policy uncertainty is significant on economic activity. Whether the difference in the positive and negative coefficients of the monetary policy uncertainty is significantly different in the short run will be determined by the Wald symmetric test. For the fiscal policy uncertainty these short run positive and negative effects are not significant.

Turning to Panel B which presents the results on the normalized long-run estimates, it is observed that positive (increases) monetary and fiscal policy uncertainty reduces economic activity. Similarly, negative (decreases) monetary and fiscal policy uncertainty reduces economic activity. The Wald test will be used to determine whether the differences in terms of magnitude are significant.

One of the key assumptions of the NARDL model aside stability is that there should be no serial correlation. In Panel C, the LM chi-square P-values are presented and the results indicate that none of the models suffer from serial correlation. Further, the results based on either Bounds F- or T- tests provide evidence of long run relationship between monetary and fiscal policy uncertainty and economic activity, thus guaranteeing the validity of the long run estimates. In addition, the symmetric test results based on Wald are presented in Panel C. For the model involving monetary policy uncertainty the null hypothesis is rejected at 5% level in the short run and at 10% in the long. This implies that monetary policy uncertainty has both long and short run asymmetric effect on economic activity in the U.S. In other words, an increase in monetary policy uncertainty has a significant different effect on economic activity than a decrease in monetary policy uncertainty. Similar result is found for the fiscal policy uncertainty variable but only in the long run where the null hypothesis is rejected at 1% level. In the short run, the effect of fiscal policy uncertainty is symmetric. Thus, it is concluded that monetary policy uncertainty has asymmetric effect on economic activity in the short and long run while fiscal policy uncertainty has asymmetric effect in the long run only.

Table 1: Unit root tests

	ADF		PP		Ng-Perron	
	Level	First difference	Level	First difference	Level	First difference
INDPRO	-1.564	-5.366***	-1.676	-18.562***	0.702	-31.704***
MPU	-9.859***	-	-9.817***	-	-0.969	-194.161***
FPU	-6.746***	-	-6.619***	-	-9.807**	-

*** and ** Indicate rejection of the null hypothesis at 1% and 5% level respectively. Not applicable is represented by a hyphen (-).

Table 2: NARDL estimates of the asymmetric effect of monetary and fiscal policy uncertainty on economic activity

	MPU		FPU	
Panel A: Short run estimates	Coef.	T-stat	Coef.	T-stat
INDPRO(-1)	-0.008**	-2.061	-0.014***	-2.967
POS(-1)	-0.002***	-3.083	-0.002**	-2.416
NEG(-1)	-0.002***	-3.162	-0.002**	-2.543
ΔINDPRO(-1)	0.039	0.783	0.058	1.161
ΔINDPRO(-2)	0.122**	2.476	0.142***	2.884
ΔINDPRO(-3)	0.214***	4.386	0.231***	4.677
ΔINDPRO(-4)	0.171***	3.408	0.171***	3.355
ΔPOS	0.000	-0.126	-0.001	-0.828
ΔPOS(-1)	0.002*	1.826	0.000	0.186
ΔNEG	-0.003***	-2.874	-0.001	-0.760
ΔNEG(-1)	-0.001	-0.754	0.000	0.134
Constant	0.030*	1.946	0.056***	2.992
Panel B: Long run estimates				
POS	-0.266*	-1.686	-0.114**	-2.496
NEG	-0.270*	-1.735	-0.124***	-2.748
Panel C: Diagnostic Statistics				
Adjusted R^2	0.200		0.178	
LM p-value	0.482		0.465	
CUSUM	Stable		Stable	
F-Bounds test	5.004*		3.726	
T-Bounds test	-2.061		-2.967*	
Wald-SR	5.347**		0.0004	
	[0.021]		[0.985]	
Wald-LR	3.396*		55.700***	
	[0.066]		[0.000]	

Note: Values in square brackets are p-values for the Wald test for symmetry. Critical upper values for the F-Bounds test for k=1 at 5% and 10% are respectively 5.73 and 4.78 for case III. Corresponding values for T-Bounds test are -3.22 and -2.91. SR and LR denote short run and long run respectively. ***, ** and * Indicate rejection of the null hypothesis at 1%, 5% and 10% level respectively

4 Conclusion

This study examined the asymmetric effect of monetary and fiscal policy on economic activity in the United States. To this end monthly data on industrial production and the policy uncertainty variables were used. Analysis was conducted using the nonlinear autoregressive distributed lag (NARDL) model allows both long and short run asymmetric effects. The findings show that there exist long run relationship between monetary and fiscal policy uncertainty and economic activity. Monetary and fiscal policy uncertainty has adverse effect on economic activity in the short and long run. The effect of both monetary and fiscal policy uncertainty is asymmetric in the long run. However, in the short run the effect of monetary policy uncertainty is asymmetric while that of fiscal policy uncertainty is symmetric. In general one can infer that the effect of positive (increases in) policy uncertainty is quantitatively different from the effect of negative (decreases in) policy uncertainty. It implies that economic agents do not react in similar manner when policy uncertainty is heightened compared to when uncertainty decreases. This has implication on the recovery of the economy. The results have important policy implication. As the two effects are dissimilar, then short-lived spikes in monetary and fiscal policy uncertainty may persistently lower economic activity. Therefore, the monetary and fiscal authorities need to constantly seek for ways of reducing uncertainty to the barest minimum if not zero level. The results also have implications for econometric analysis, investment decisions and forecasting as it suggests that ignoring the nonlinearity and asymmetric in the nexus between monetary policy uncertainty and economic activity and also between fiscal policy uncertainty and economic activity may produce misleading conclusions.

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