CAUSALITIES AMONG U.S. COUNTERCYCLICAL POLICIES AND THEIR IMPACTS ON THE ECONOMY

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ABSTRACT

The Granger causalities among gross domestic product (GDP), broad money supply, fiscal deficits and exports were analyzed to evaluate the impacts of economic policies on the growth of the US economy. The Granger-causality tests were based on the vector error correction model and the augmented level VAR model with integrated and cointegrated processes. Empirical results reveal that short-run Granger causalities among GDP, exports, and broad money supply are bidirectional. They are exogenous from the budget deficit. These short-run causalities hold true in the long run except that the Granger causality between the broad money supply and budget deficit becomes bidirectional. **JEL Classification:** E13; E52; E62; F13

INTRODUCTION

The growth and development of every economy, developed or otherwise, around the globe have not been stable over the years. As a result, every economy has witnessed shocks and disturbances both internally and externally over the decades. Internally, unstable investment and consumption patterns, improper implementation of public policies, changes in future expectations, and the accelerator are some of the factors responsible for economic instabilities. Similarly, external factors responsible for instabilities are war, revolution, population growth rates and migration, technological transfer and change, and the openness of the economy.

Almost three quarters of a century ago, commenting on business cycles, Burns (1947, p. 27) articulated that "….For well over a century business cycles have run an unceasing round. They have persisted through vast economic and social changes; they have withstood countless experiments in industry, agriculture, banking, industrial relations, and public policy; they have confronted forecasters without number, belief repeated prophecies of 'a new era of prosperity' and outlived repeated foreboding of 'chronic depression'." With regard to the nature of business cycles, Schumpeter (1939, p. 5) posited that "….. Cycles are not like tonsils, separable things that might be treated by themselves, but are, like the beat of heart, of the essence of organism that displays them." Clearly, these observations still hold true in the second decade of the

21st century.

The cyclical fluctuations in economic activities have led to the periodic increase in unemployment and inflation rates as well as the external sector disequilibria (Gbosi, 2001). Keynes in his sentential General Theory (1936) articulated that the task of restoring these macroeconomic variables back to their long term trends cannot be left to the market forces of demand and supply. Countercyclical fiscal, monetary, and international trade policies are major economic stabilization instruments that involve measures taken to regulate and control the volume, cost and availability, and direction of money in an economy to achieve specified macroeconomic policy objectives and counteract undesirable trends in the economy.

Monetary policy and fiscal policy are two approaches by which governments attempt to manage their national economies. Fiscal policy uses the government's taxation and spending powers to influence the economy while monetary policy uses interest rates or the money supply to ensure stable economic growth. Although monetary and fiscal policies have differing effects, both strive to ensure economic stability. International trade policy or commercial policy, also referred to as a trade policy, is a set of rules and regulations that are intended to change international trade flows, particularly to restrict imports. The purpose of trade policy is to help a nation's international trade run more smoothly, by setting clear standards and goals which can be understood by potential trading partners.

Since the late 1930s, Keynesian fiscal policy has played a critical role in macroeconomic management in market economies. Beginning in the 1960s, changes in international economic conditions resulted in persistently large government budget deficits in economies around the world. Mishkin (1995, p. 3) posits that concern over budget shortfalls and doubt that the political system can utilize the fiscal policy instrument in a timely manner to achieve the desirable stabilization outcome; thus, fiscal policy has lost its luster. Consequently, the stabilization of output and inflation was left largely to monetary policy.

Additionally, the short-run dynamic and the long-run causal behavioral relationships among the aforementioned policies and their impacts on the economy are also important information for designing and implementing national countercyclical economic policies. The relationships between fiscal and monetary policies and exports, hence international trade policy, have been firmly established theoretically in the literature by well-known *purchasing power parity* and *interest rate parity theories*. As to the relationship between the US fiscal and monetary policies, Glenn and Samad (2012, p. 62) articulate that currently the Federal Reserve is not in a position to influence the government's deficit pathway in the United States, but rather simply manages the debt as generated by the deficit, indicating that fiscal authority constrains monetary authority. Their articulation suggests the exogeneity or unidirectional Granger causality from fiscal policy to monetary policy i.e., from budget deficit to money supply.

It should be noted here that Granger causality is not a conventional causal relationship. Rather, as pointed out by Granger (1969, p. 430), the definition of Granger causality is based entirely on the predictability of some series, say w. If some other series y contains information in past terms that helps in the prediction of w, and if this information is contained in no other series used in the predictor, then y is said to Granger cause w. Additionally, if x_2 Ganger causes x_1, but x_1 does not Granger cause x_2; then, there is a unidirectional Granger causality from x_2 to x_1 or x_2 is weakly

exogenous from x_1. Otherwise, if x_2 Ganger causes x_1 and x_1 also Granger causes x_2; then, their Granger causality is bidirectional.

Given the aforementioned articulation on the *purchasing power parity theory* and *interest rate parity theory,* as well as the current US fiscal, monetary policies, trade deficit, national debts being 100 percent of the GDP, continuous government deficit spending in the age of globalization, it is of special interest to empirically investigate the cointegrating relationship among the US gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) as well as their impacts on the economy. To achieve this objective, this study utilizes the recent advances in time series statistical techniques: (i) the vector error correction modeling (VECM) approach outlined in Toda and Phillips (1993); and (ii) the augmented level VAR modeling with integrated and cointegrated processes (of arbitrary orders), separately introduced by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – henceforth, TYDL, to investigate above causal relationships. As pointed out by Awokuse (2005-a, p. 693), the latter methodological approach is useful because it bypasses the need for potentially biased pre-tests for unit roots and cointegration, common to other formulations. As far as it may be ascertained these procedures have not been used in this type of investigation.

The remainder of the study is organized as follows. The following section briefly reviews the literature; the section that follows discusses the data, methodology, model specification, and descriptive statistics; the next section reports the empirical results; the final section provides some concluding remarks.

BRIEF REVIEW OF LITERATURE

Impact of national economic policy has been theoretically articulated rigorously and voluminously in literature; however, the empirical part is scarce, Checherita and Rother (2010, p. 5). With regard to international trade policy and economic growth, over the last three decades the role of exports in stimulating economic growth has been the subject of debate among development economists. The Newly Industrializing Countries of East Asia pursuing export-led policy resulting in phenomenal growth in output and exports have further helped fuel this debate. On the other hand, the on-going rebalances of their economies by the People's Republic of China and Socialist Republic of Vietnam after decades of promoting exports to develop their economies face the historical lessons that the relatively inwardly oriented economies in Africa and Latin America have experienced with very dismal growth rates. Since trade theory does not provide definitive guidance on the causal relationship between exports and output growth, the debates are usually settled by empirical analyses that often yield ambiguous results.

As to fiscal policy and budget deficit, and hence national debts and growth in the gross domestic product, Checherita and Rother (2010, p. 5) point out that the theoretical literature tends to point to a negative relationship. However, the authors posit that empirical evidence is primarily focused on the impact of external debt on growth in developing countries, while for the euro area, several studies analyze the impact of fiscal variables, including government debt, on long-term interest rates or spreads against a benchmark, as an indirect channel affecting economic growth.

In an effort to fill this void, Checherita and Rother (2010) investigate the average relationship between the government debt-to-GDP ratio and the per-capita GDP growth rate in Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain for a period of roughly four decades starting in 1970. They find statistically significant non-linear relationship between the government debt ratio and per-capita GDP growth for these twelve euro area countries. The debt-to-GDP ratio turning point of this concave relationship (inverted U-shape) is roughly between 90 and 100% on average for the sample, across all models (the threshold for the models using trend GDP is somewhat lower). This means that, on average for the 12-euro area countries, government debt-to-GDP ratios above such threshold would have a negative effect on economic growth.

Checherita and Rother (2010, pp. 23-24) further articulate that government budget deficits are found to be linearly and negatively associated with the growth rate of both real and potential output. The fact that the change in the debt-to-GDP ratio and budget deficits are linearly and negatively associated with growth (and with the long-term interest rates) may point to a more detrimental impact of the public debt stock even below the threshold. Hence, targeting a higher debt level to support growth is not a policy option. Any policy with such a target would reduce the leeway of governments before the debt burden has an unmistakably adverse growth impact. In the current economic environment, the results represent an additional argument in favor of swiftly implementing ambitious strategies for debt reduction. If policy makers let high debt ratios linger for fear that fiscal consolidation measures will be unpopular with voters, this will undermine growth prospects and thus will put an additional burden on fiscal sustainability. This debt-based argument thus adds to the positive growth effects of fiscal deficit reduction found in the literature for the long term and frequently also in the short term. Lwanga and Mawwejje (2014) found causalities between budget deficits and selected macroeconomic variables in Uganda in the 1999 -2011 period.

Fiscal policy is undoubtedly one of the most important tools used by government to achieve macroeconomic stability of the economy of most developing countries (Siyan and Adebayo, 2005). Therefore, the attempt to empirically test the efficacy of monetary and fiscal policy in an economy dates back to the pioneering studies of Friedman and Meiselman (1963). These authors empirically investigated the responsiveness of the general price level on economic activity represented by aggregate consumption to change in money supply and autonomous government expenditure using ordinary simple linear regression model to estimate the US data from 1897-1957. They found that a stable and predictable causal relationship existed between demand and money supply while no such significant relationship was observed for government expenditure (Bogunjoko, 1997).

Bernanke and Gertler (1995, p. 27) pointed out that monetary policy, at least in the short-run, can affect the real economy. Recent empirical research (Romer and Romer, 1990; Bernanke and Blinder, 1992; Christiano, Eichenbaum, and Evans, 1994) confirmed earlier findings by Friedman and Schwartz (1963) that monetary policy actions affected the real output of the economy for the succeeding two years or more. Certainly, monetary policy is a powerful tool; however, Mishkin (1995, p. 4) argued that this instrument has unintended consequences. Therefore, to conduct monetary policy successfully, the monetary authorities must have accurate knowledge as to the timing and the effect of their policy actions on the economy. This in turn requires the policymakers to understand the mechanism through which monetary policy affects the

economy, which is often known as the monetary transmission mechanism, dubbed by economists as the "black box".

Clearly, monetary policy becomes more and more important as an instrument for macroeconomic policy making. As pointed out by Bernanke and Gertler (1995, p. 27), the same research, that has established that changes in monetary policy are eventually followed by changes in real output, is largely silent about what happens in the interim. To address this void, the fall 1995 issue of the *Journal of Economic Perspectives* arranged a symposium on the monetary transmission mechanism. At this symposium, major papers were presented by prominent economists such as Frederic S. Mishkin, John B. Taylor, Ben S. Bernanke and Mark Gertler, Allan H. Meltzer, and Maurice Obstfeld and Kenneth Rogoff. In summarizing the papers presented at the symposium, Mishkin (1995, pp. 4-9) articulated that these authors identified the channels through which monetary policy actions are transmitted to real economic activities: the interest rate channel, the exchange rate channel, other asset price effects, and the credit channel.

THE DATA, METHODOLOGY AND DESCIPTIVE STATISTICS

This study follows Audu (2012) to use the quarterly time series data on the natural logarithms of the US gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit or deficit spending (DEF_t) to study the cointegrating relationships among themselves and their impacts on the economy as a means to investigate the impacts of the US national economic policies over the period from the first quarter of 1960 to the first quarter of 2013. The rationales for using the above variables as proxies for policy measures are as follow: (i) fiscal policy measures would affect gross domestic product and the deficit; (ii) monetary policy measures would change broad money supply; and (iii) international trade policy actions would alter exports. The data for all four time series are from the FRED of the Federal Reserve Bank of St. Louis.

In order to apply augmented VAR[k+d(*max*)] model, developed by TYDL, the lag order of the original VAR*(k)* and the order of cointegration, *d(max*), must be determined. As to the maximum order of integration of the time series in question, *d(max*), the two standard unit root tests were conducted: the augmented Dickey–Fuller (1979) and Phillip–Perron (1988) tests. The null hypothesis for both tests is that a unit root exists in the autoregressive representation of the series. The augmented Dickey-Fuller and Phillip-Perron unit root test results are reported in Table 1. An analysis of the test results suggests the presence of unit roots in levels in all series. Except for the broad money supply MS_{2t}, all other series are stationary after first differencing. As to the MS_{2t}, the augmented Dickey Fuller procedure fails to reject the null hypothesis of unit root after the first differencing; however, the Phillip-Perron test rejects the null hypothesis at 1 percent level. These findings suggest that the time series under consideration are non-stationary and integrated of order I(1)

The lag order of the original VAR model, *k*, can be determined by using several lag order selection criteria such as the sequential modified LR test statistic (LR), final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). Additionally, Liew (2004, p. 5) articulated that if the objective is to avoid selecting a lag length that is

too short, it is advisable to adopt AIC and/or FPE. The gain in choosing of these two criteria is even significant in sample size of not more than 60 observations. In such ideal case, apart from minimizing the chance of under estimation, one can simultaneously maximize the chance of getting the correct lag length. This conclusion may be taken as formal statistical support for the well-liked use of AIC criterion in previous empirical studies. The results of the lag selection procedure are summarized in Table 2. The LR, and AIC suggest using a lag of seven. Subsequent analysis therefore proceeds with the use of VAR with lag length *k*=7

From the neoclassical theoretical framework of economic policy that is rooted in the two gap model and by the implicit function theorem, the relationship among the natural logarithms of US quarterly gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) can be written as:

$$Q(GDP_t, EXP_t, MS_{2t}, DEF_t) = 0$$

Moreover, let $X_t^{'}$ be a (*1 x 4*) transposed row vector with the following elements:

$$X_t^{'} = (GDP_t, EXP_t, MS_{2t}, DEF_t)$$

Additionally, Engle and Granger (1987) articulated that if two series are integrated of order one, I(1), there is need to test for the possibility of a long-run cointegrating relationship between the variables. Since the cointegration and error correction methodology is well documented elsewhere (Engle and Granger 1987; Johansen and Juselius 1990; Banerjee et al. 1993) only a brief overview is provided here. Johansen and Juselius' (1990) general multivariate cointegration model is based on the error correction representation given by:

$$\Delta X_t = \mu + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + \Pi X_{t-1} + \varepsilon_t$$

where X_t is an (*n x 1*) column vector of p variables, μ is an (*n x 1*) column vector of constant terms, Γ and Π represent coefficient matrices, Δ is a difference operator, k denotes the lag length, and $\varepsilon_t \sim N(0,\Sigma)$. The coefficient matrix, Π, is known as the impact matrix, and contains information about the long-run relationships. Johansen and Juselius' (1990) methodology requires the estimation of the VAR equation (3), and the residuals are then used to compute two likelihood ratio (LR) test statistics that can be used in the determination of the unique cointegrating vectors of X_t. The number of cointegrating vectors can be tested for using two statistics: the trace test and the maximal eigenvalue test. The testing results are reported in Table 3. As shown in Table 3, results for cointegration tests suggest the existence of, at most, one cointegrating vector. This implies the presence of three independent common stochastic trends in this system of four variables.

Moreover, the augmented VAR procedure, proposed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), complements the VECM technique because it allows for causal inference based on an augmented level VAR with integrated

and cointegrated processes. The causal relationships among gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) were examined, using the following VAR in level specification:

$$X_t = \mu + \sum_{i=1}^{p-1} \Gamma_i X_{t-k} + \varsigma_t$$

where X_t and μ are previously defined vectors, Γ represents coefficient matrices, k denotes the lag length, and ς_t is *i.i.d.* and *p*-dimensional Gaussian error with mean zero and variance matrix Λ.

As pointed out by Awokuse (2005-a, p. 695), the TYDL procedure uses a modified Wald test for the restriction on the parameters of the VAR(*k*) model. This test has an asymptotic chi-squared distribution with *k* degrees of freedom in the limit when a VAR[*k*+*d(max)*] is estimated, where d(max) is the maximal order of integration for the series in the system. Awokuse (2005-b, p. 852) further articulates the attraction of the TYDL approach in that prior knowledge about cointegration and testing for unit root are not necessary once the extra lags, i.e., d(*max*) lags, are included, Given that VAR(*k*) is selected, and the order of integration d(max) is determined, a level VAR can then be estimated with a total of p=[k+d(*max*)] lags. Finally, the standard Wald tests are applied to the first *k* VAR coefficient matrix (but not all lagged coefficients) to make Granger causal inference.

EMPIRICAL RESULTS

Based on the above determined appropriate lag length *k* =*7* and the *d(max)* = *1*, the Granger causality test results using both the VECM and the augmented level VAR specifications are reported in Table 4. F-statistics and p-values (in parentheses) for Granger causality tests from the VECM specification are presented in Table 4(a). Statistically, the VECM determines the Granger causalities among changes in variables. Therefore, the Granger causality tests are carried out to study the *short-run dynamic causalities* among the variables of interest.

An analysis of the short-run empirical results reported in panel (a) of Table 4, based on the p-values and pairwise comparisons, indicates that the short-run dynamic Granger causalities among gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) are bidirectional. However, they are weakly exogenous from the budget deficit (DEF_t) over the sample period.

As to the long-run causality, the estimation results of the augmented VAR procedure, TYDL, reported in panel (b) of Table 4, also reveal strong bidirectional Granger causalities among gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) bidirectional. Additionally, the empirical results also suggest very strong bidirectional Granger causality between broad money supply M_2 (MS_{2t}) and the budget deficit (DEF_t). Finally, similar the short-run dynamic causalities, gross domestic product (GDP_t), and exports (EXP_t) are still weakly exogenous from budget deficit (DEF_t).

CONCLUDING REMARKS AND POLICY IMPLICATIONS

This study employs estimation techniques for non-stationary but cointegrated time series to investigate the short-run dynamic and the long-run causal behavioral relationships among of the US economic policies and their impacts on the economy. To this end, this study utilizes the recent advances in time series statistical techniques: (i) the vector error correction modeling (VECM) approach outlined in Toda and Phillips (1993); and (ii) the augmented level VAR modeling with integrated and cointegrated processes (of arbitrary orders), separately introduced by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) – henceforth, TYDL, to investigate above causal relationships. More specifically, VECM was used to investigate short-run dynamic Ganger causalities among the US quarterly gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) among themselves and their impacts on the economy from the first quarter of 1960 to the first quarter of 2013.

Additionally, the augmented level VAR model with integrated and cointegrated processes (of arbitrary orders) developed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996) was used to test for long-run Granger causality among the US quarterly gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) among themselves and their impacts on the economy over the same period.

As to the short-run dynamic causalities, empirical results reveal that short-run Granger causalities among gross domestic product (GDP_t), export (EXP_t), broad money supply M_2 (MS_{2t}) are bidirectional. They are however exogenous from budget deficit. In the long run, except that Granger causality between the US broad money supply M_2 and government budget deficit becomes bidirectional; the nature of the Granger causalities are identical to those in the short run. Also, as far as it may be ascertained, these procedures have not been used jointly in empirically investigating the well theoretically articulated Ganger causalities among the US quarterly gross domestic product (GDP_t), exports (EXP_t), broad money supply M_2 (MS_{2t}) and government budget deficit (DEF_t) among themselves and their impacts on the economy.

Despite the long-held tradition that, by design, the US fiscal authority (the administration) and monetary authority (the FED) are independent, the empirical results support the theoretical articulations on the aforementioned causalities; thus, they provide policy makers with empirical evidence in designing and implementing national economic policies. However, the estimation results support Glenn and Samad's (2012, p. 62) articulation only in the short run but not in the long run, as evidenced by the short-run unidirectional Granger causality and bidirectional Grange causality in the long run from broad money supply and budget deficit. Also, Johansen and Juselius' (1990) cointegrating test results suggest that US countercyclical policies are cointegrated.

As to the macroeconomic debate whether deficits and hence debts matter, the empirical results suggest deficits do not matter because the empirical results reveal that deficits only cause money supply to increase in the long run and marginally impact the international trade in the short run.

Finally, Granger causality is based entirely on the predictability of some series; therefore, the Johansen and Juselius'(1990) cointegrating test results and the nature

(bidirectional, unidirectional or exogenous) of the estimated Granger causality between fiscal and monetary policy measures would help practitioners to predict the policy response by one authority given the measures taken by the other. This predictability is useful in their business decisions, financial or otherwise.

ENDNOTE

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TABLE 1: ADF AND PP TEST RESULTS, US QUARTERLY DATA 1960:Q1-2013:Q1

	Augmented Dickey- Fuller		***Phillip- Perron***	
Series	**Level**	**First Differencing**	**Level**	**First Differencing**
GDP_t	3.0595	-4.4388*	5.1499	-6.6132*
EXP_t	2.7847	-9.3423*	3.1174	-6.4866*
MS_{2t}	7.5475	0.8373	11.2395	-6.8019*
DEF_t	1.9305	-8.0631*	1.7414	-14.2595*

Note: * denotes rejection of the hypothesis at the 1 percent level.

TABLE 2: LAG LENGTH: US QUARTERLY DATA 1960:Q1-2013:Q1

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-4911.498	n.a.	7.89e+15	47.95608	48.02092	47.98230
1	-3043.907	3644.080	1.13e+08	29.89178	30.21597	30.02291
2	-2977.629	126.7367	69024801	29.40126	29.98481	29.63729
3	-2917.496	112.6386	44896498	28.97070	29.81361*	29.31163
4	-2879.026	70.56042	36088756	28.75147	29.85374	29.19731
5	-2860.004	34.14608	35088031	28.72199	30.08362	29.27274
6	-2820.383	69.57903	27921661*	28.49154	30.11252	29.14719*
7	-2804.339	27.54950*	27986722	28.49111*	30.37145	29.25166
8	-2794.184	17.04031	29737680	28.54813	30.68783	29.41359

Notes: **indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwartz information criterion
HQ: Hannan-Quinn information

TABLE 3: JOHANSEN COINTEGRATION TEST RESULTS, US DATA 1960:Q1-2013:Q1

	Trace Statistics		***Max-Eigen Statistics***	
Number of cointegrating vectors	**Statistics**	**C (5%)**	**Statistics**	**C (5%)**
$r \leq 0$	86.76408*	47.85613	41.86783*	27.58434
$r \leq 1$	44.89626*	29.79707	31.07843*	21.13162
$r \leq 2$	13.81783	15.49471	11.61489	14.26460
$r \leq 3$	2.20294	3.84146	2.20294	3.84146

Note: * denotes rejection of the hypothesis at the 5 percent level.

TABLE 4: GRANGER CAUSALITY TEST RESULTS, US DATA 1960:Q1—2013:Q1

(a) Results based on error correction model (ECM)

Dep.	Short run lagged differences (*F-statistics*)			
Variables	ΔGDP_t	ΔEXP_t	ΔMS_{2t}	ΔDEF_t
ΔGDP_t	-	5.6972 (0.0000)	4.2430 (0.0001)	1.0250 (0.4109)
ΔEXP_t	5.4443 (0.0000)	-	5.2663 (0.0000)	1.9805 (0.0537)
ΔMS_{2t}	11.0006 (0.0028)	10.7619 (0.0000)	-	0.7968 (0.5898)
ΔDEF_t	4.0223 (0.0002)	2.2389 (0.0283)	4.1809 (0.0001)	-

(b) Results based on an augmented VAR model (TYDL procedure)

Dep.	Modified Wald-statistics			
Variables	GDP_t	EXP_t	MS_{2t}	DEF_t
GDP_t	-	28.2251 (0.0002)	17.8329 (0.0127)	8.1523 (0.3194)
EXP_t	78.8157 (0.0000)	-	19.8254 (0.0060)	4.3063 (0.7439)
MS_{2t}	35.0776 (0.0000)	33.8394 (0.0000)	-	85.722 (0.0000)
DEF_t	27.2947 (0.0003)	56.1974 (0.0000)	0.6138 (0.0000)	-

Notes: *The [k+d(max)]th order level VAR was estimated with d(max) = 1 for the order of integration equals 1.*

Lag length selection of k= 7 was based on LR, and AIC.

Reported estimates are asymptotic Wald statistics. Values in parentheses are p-values.