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Total Spending Equation of St. Louis Model: A Causality Analysis for Turkish Economy*

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Andersen and Jordan (1968) aimed to measure efficiency of monetary and fiscal actions on real GDP by employing a time-series model which was called as St. Louis Model afterwards. Although the model is performed in many countries similarly, the results differ from each other in accordance with the economic structure of relevant country. In this regard, the aim of this paper is to investigate the effectiveness of monetary and fiscal policies on real activity and to find out causal relationship among questioned variables using OLS and causality methodologies in Turkish economy over the period 1998: I-2010: IV. Empirical findings indicate that only monetary policy has a significant positive effect on economic activity in the short run. Nonetheless, neither monetary nor fiscal policy has significant impact on real output in the long run. Causality analysis shows that there exists a unidirectional causality running from real output and money stock to government expenditures. Moreover, not surprisingly, it is also found that crisis experiences of Turkey in sample period have highly adverse impact on real activity. Causality analysis suggests us considering government expenditures as explained variable instead of real output. Hence, it can be concluded that St. Louis Model total spending equation is not applicable for Turkish economy during 1998-2010 periods.

Keywords: St. Louis model, monetary policy, fiscal policy, Turkish economy, causality

Introduction

Monetarist economists, headed by Milton Friedman and Edmund Phelps, stated during the discussions which are concentrated on macroeconomic literature specifically through the 1950s and 1960s, that demand-oriented policies would be ineffective; for the aggregate output is indifferent to the prices in the long-run whereas monetary policy is more effective than fiscal policy since aggregate supply curve is positive in the short run. On the other hand, some fiscalists such as Tobin, Samuelson, and Klein claimed that both monetary and fiscal policies could maintain the increase in the national output for a period long enough, but fiscal policy is more effective than monetary policy.

Can the changes in real output growth be explained by the changes in money supply or the changes in

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government expenditures? That is, are Monetarist or Keynesian policies more influential on the changes in reel output? Most economists discussed the relative effectiveness of monetary and fiscal policies both theoretically and empirically. However, no conclusion has been attained yet.

The earliest paper on this subject was carried out by Leonall Andersen and Jerry Jordan of Federal Reserve Bank of St. Louis. For that reason, the regression among money stock, government expenditure and real output is known as St. Louis Model.

King and Wolman (1996) mentioned four major features of St. Louis Model. First model is sufficiently small that one can actually understand how it works by looking at model's equation. Second model can be used to analyze the effects of monetary and fiscal actions on inflation, interest rates and output. Third, the model reflects all features of Monetarist school due to its monetarist structure. Fourth, model combines short-run non-neutrality of changes in money with log-run neutrality.

In this study, the effect of Keynesian and Monetarist policies on real output in Turkey during the period 1998: I-2010: IV was examined by total spending equation of St. Louis model. Following the introductory part, related literature will be analyzed in the second part and the methodology of the study and econometric model will be put forth in the third part and finally the findings will be interpreted and a general review will be made.

Literature Review

In the second half of the 20th century, influence of monetary and fiscal actions on GDP became very popular, especially in the United States. Andersen and Jordan from Federal Reserve Bank of St. Louis primarily did a research about this subject. Ever since this publication and its later appearance as a cornerstone of the St. Louis Model, the model became the subject of great debate. Many papers on it were written by economists.

Andersen and Jordan (1968) aimed to measure the influence of a few major forces on the changes in GDP. They regressed monetary and fiscal actions on economic activity. This paper is known as the birth of St. Louis Model. Estimation results show that monetary actions as measured by money stock have highly significant effects on the changes in GDP but fiscal actions do not have significant effects on the changes in GDP.

Andersen and Carlson (1970) developed an econometric model designed to analyze economic stabilization issues within a framework which focuses on the impact of monetary expansion on total spending. According to the empirical findings, fiscal actions have some short run effects, but they have no effect on output, spending and prices in the long run. Monetary actions play strategic role because the model developed in monetarist character.

Cooper and Fischer (1974) worked with a different version of St. Louis Model over the period 1998: I-2010: IV and extended the earlier studies in three directions. First, they used stochastic simulation rather than deterministic. Secondly, they examined the possible effects of fiscal rules. And finally, the economists did not use the St. Louis Model itself in earlier papers in choosing monetary rules. In this paper, St. Louis Model was used in order to find the optimal monetary rules, fiscal rules and a joint money-fiscal rule. Empirical findings indicate that money stock is clearly superior to government expenditures as a stabilization policy.

Carlson (1975) maintained that St. Louis Model generally regressed with quarterly data. He used monthly data instead of quarterly and used changes in personal income as dependent variable rather than changes in GDP over the period 1953-1973. He questioned that whether St. Louis Model continues to hold when monthly data are used in estimation. Regression results were consistent with the results that are obtained with quarterly data.

Elliott (1975) reexamined total spending equation of St. Louis Model in the light of possible statistical objections that may be raised as to its interpretation. The regression results show the conclusion that fluctuations in nominal GDP more importantly attach to monetary movements than to movements in government expenditures. In addition, the relationship between government expenditures and total expenditures was found to be significantly bidirectional.

Carlson (1978) revealed the improved model developed by Andersen and Jordan (1968) over the period? and focused whether fiscal policy is effective in a Monetarist model. When the overall effects of money stock as measured by M_1 and government expenditures are compared, empirical findings support the hypothesis that monetary disturbances effect the changes in nominal GDP. Nonetheless, the evidence does not support the contention that the St. Louis Model "believes in" fiscal policy.

Batten and Hafer (1983) reestimated the model as a panel data for six developed countries including Canada, France, Germany, Japan, United Kingdom and the United States by using quarterly data. Regression results indicate that changes in money growth have a significant impact on nominal GDP growth in all of these six cases. In contrast, fiscal actions are significant only in the USA and France.

Ahmed and Johannes (1984) extended the St. Louis Model literature by first testing the joint exogeneity of the regressors in it and then, by testing jointly restrictions imposed by the model on relevant regressors and lag specifications. The results indicate that neither exogeneity nor the other restrictions can be rejected at high confidence level. According to them, there are three major criticisms for St. Louis Model in most of the papers outside the St. Louis Fed. First, some authors, for example, De Leeuw and Kalchbrenner (1969), have argued that regressors in total spending equation of St. Louis Model are not statistically exogenous. Thus, OLS estimates of this equation are potentially biased and inconsistent and do not show the relative effectiveness of monetary and fiscal policy. Secondly, Blinder and Solow (1974) and Modigliani and Ando (1976), pointed out that there may be other relevant regressors in addition to money stock and government expenditure variables. Finally, Schmidt and Waud (1973) argued that constrained Almon lag procedure imposed on equation for estimation purposes may "lead to biased and inconsistent estimates and invalid tests"[1].

Batten and Thornton (1984) investigated the robustness of the policy conclusions of St. Louis model total spending equation with respect to its polynomial distributed lag specification from 1962: I to 1982: III in the Unites States. It was found that in the long run monetary policy is effective and fiscal policy is ineffective in influencing the growth of GDP.

Raj and Silkos (1986) examined the role of fiscal policy in the total spending equation of St. Louis Model by using spectral analysis and spectral estimates of a two-sided distributed lag model in the USA over the period 1947: I-1984: IV. As a result, it was found that fiscal policy has statistically significant partial coherences with nominal income. It was also found that income is jointly related to the lead terms of fiscal policy in a two-sided distributed lag model.

King and Wolman (1996) constructed a small scale macroeconomic model that can be used to study the impacts of alternative monetary and fiscal policies in accordance with Lucas's recommendations named "A St. Louis Model of the 21th Century". This model is a rational one that defines the intertemporal optimization

[1] In order to get detailed information, see references to find the papers that are mentioned.

problem of individuals and firms. They examined the costs and benefits of inflation targeting in a modern macroeconomic model of the relationship between real and nominal variables. Their conclusions show that findings are in line with Monetarist school and the builders of St. Louis Model.

Belliveau (2011) analyzed the impact from stabilizing instruments important to macroeconomic policy on output using St. Louis equation in the USA over 1956-2007 period. Regression results show that both monetary and fiscal policies are viable options for policymakers, seeking to stabilize output across a business cycle.

On St. Louis equation in Turkey, Dikmen (2006) calculated the effects of variations in money stock (M_1 and M_2) and government expenditures by using 1987-2003 annual data on GDP growth rate. As a result, he concluded that monetary policy is efficient for Turkey.

Methodology and Model

Andersen and Carlson (1974) mentioned eight algebraic forms of St Lois Model: total spending equation, price equation, demand pressure identity, total spending identity, interest rate equation, anticipated price equation, unemployment rate equation and GNP gap identity (Andersen & Carlson, 1974, pp. 307-308). However in literature, total spending equation is most commonly used; for it contains the effects of Monetarist and Keynesian schools.

In this paper, the relationship among money stock, government expenditures and real output is investigated for Turkish economy. Total spending equation of St. Louis Model which is used for the analysis of this relationship is formulized as follows:

$$\Delta lnY_t = \alpha_0 + \sum_{i=0}^{4} \alpha_1 \Delta lnM_{t-i} + \sum_{i=0}^{4} \alpha_2 \Delta lnG_{t-i} + dummy + \varepsilon_t \quad (1)$$

In equation (1), left-hand-side variable is the change in the log of real GDP as measured by expenditure approach on GDP at 1998 prices. Right-hand-side variables are the change in the log of money stock as measured by M_2 and the change in the log of government expenditure. Since any effect of monetary and fiscal actions may occur with a lag, the contemporaneous and four lagged[2] values are included in equation within a theoretical framework. The regression also includes a constant and a dummy variable representing the effects of 1999, 2001 and 2008 crises. For related periods we named dummy variable the value of 1; otherwise 0. Data used in this paper, gathered from the Turkish Statistical Institute web page (Retrieved from http://www.turkstat.gov.tr) and Turkish Republic Central Bank Electronic Data Delivery System (Retrieved from http://evds.tcmb.gov.tr). The data are quarterly and the sample period is 1998: I-2010: IV.

It is necessary to test the stability of series before the identification of the relationship between variables. Granger and Newbold (1974, pp. 111-120) stated that the regression analysis among the variables would not be consistent and spurious regression problem would occur if unstable data are used. Dickey-Fuller (DF) (1979), Augmented Dickey-Fuller (ADF) (1981) and Phillips-Peron (PP) (1988) tests are commonly used for stationary in empirical applications. In this paper, ADF and PP tests are used for unit root.

DF unit root test supposes that error terms are statistically independent and have constant variance. In order to resolve autocorrelation problem in ADF test, dependent variable lag must be parallel with optimal lag length. DF (Dickey-Fuller) equation uses this as independent variable.

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

[2] Optimum lag length is also determined by information criteria (see Appebdix for criteria results).

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \varepsilon_t \quad (3)$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \alpha_{1t} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \varepsilon_t \quad (4)$$

The equations (2)-(4) respectively indicate the models without *intercept + trend*, with only intercept and *intercept + trend*. The equations test whether $\gamma = 0$. If the null hypothesis stating that series have unit root was rejected, that would mean series are stationary.

PP unit root test permits error term to be dependent at a weakly level and distributed heterogeneously (Enders, 2004, p. 229). Phillips and Peron use nonparametric statistical methods to take care of serial correlation in the error terms without adding lagged difference terms (Gujarati, 2004, p. 818). PP test has three different regression models just as in ADF test. Since the asymptotic distribution of PP test is the same as ADF test statistic, it is not required to include formulization.

Gujarati claims that the causality relationship could be questioned between these variables if the variables in the equation set were stationary. There is no condition on series to be stationary in levels; it is possible for causality to become stationary in their first difference (2004, p. 698).

Causality test is used to see whether there is a cause and effect relationship between variables in the model, and to specify the direction of this relationship if there is. In practice, the common method to determine the causality relationship between time series is the Granger causality analysis, developed by Granger (1969). The analysis has been shown through the equations below:

$$\Delta lnY_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i \Delta lnY_{t-i} + \sum_{i=1}^{l} \beta_i \Delta lnM_{t-i} + \sum_{i=1}^{m} \delta_i \Delta lnG_{t-i} + dummy + \varepsilon_t \quad (5)$$

$$\Delta lnM_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i \Delta lnM_{t-i} + \sum_{i=1}^{l} \beta_i \Delta lnY_{t-i} + \sum_{i=1}^{m} \delta_i \Delta lnG_{t-i} + dummy + \varepsilon_t \quad (6)$$

$$\Delta lnG_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i \Delta lnG_{t-i} + \sum_{i=1}^{l} \beta_i \Delta lnY_{t-i} + \sum_{i=1}^{m} \delta_i \Delta lnM_{t-i} + dummy + \varepsilon_t \quad (7)$$

In the equations (5)-(7), k, l and m indicate lag lengths respectively and ε signifies error term. In order for any model to yield meaningful results, the independent variable coefficients on the right side of equation (β's and δ's) must be statistically significant. The fact that the coefficient of any independent variable is significant means that the variable is the reason of dependent variable. If the null hypothesis that there is no causality relationship is rejected through F test, the existence of a causality relationship for mentioned direction will be proven.

Findings

In Table 1, analysis results of ADF unit root test are given. In the table, it can be seen that Y, M and G series are stationary in their levels for the tests of all models have only intercept, *intercept + trend* but do not have *intercept + trend*.

In Table 2, stationary analysis results of series are given for PP test. In the table, it can be seen that Y, M and G series are stationary in their levels for the tests of all models have only intercept, *intercept + trend* but do not have *intercept + trend*.

St. Louis equation is applied to Turkish economy as it was modeled in Elliott (1975)[3]. Monetary policy has a significant positive influence on Turkish economy in the short term while fiscal policy has insignificant. Besides, in the long term, cumulative effects[4] of money growth and government expenditure growth on real GDP growth have been calculated as $\sum_{i=0}^{4} \alpha_1 = 0.113445$ and $\sum_{i=0}^{4} \alpha_2 = -0.181354$ respectively. That means a 1 percent increase in money stock is associated with an increase of 0.11 percent in output and 1 percent increase in

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[3] See Appendix for short term (A1) and long term (A2) regression result.

[4] The sum of the coefficients on the current and four lagged values of each variable.

government expenditure is associated with a decrease of 0.18 percent in output over the next year. But none of the variables have a significant effect on output in the long run except for dummy variable. 1999, 2001 and 2008 crises effect GDP negatively both in short and long run becoming accordance with the theory. Since there is no significant long term correlation among these variables, it is tried to find a probable causality running among variables and the direction of causality.

Table 1

ADF Unit Root Test

	H_0: Series have unit root			
Variables[5]	Intercept	Trend + intercpt	None	Desicion
ΔlnY	-3.00[0.04]**	-3.40 [0.04]**	-2.91[0.00]***	H_0: Reject
ΔlnM	-2.94[0.04]**	-6.76 [0.00]***	-2.13[0.03]**	H_0: Reject
ΔlnG	-9.87[0.00]***	-10.48 [0.00]***	-8.35[0.00]***	H_0: Reject

Notes. Numbers of lags used in ADF regressions was selected using Akaike Information Criteria (AIC). Probability values of *t*-statistics are in brackets. *** and ** denote significant at 1% and 5% respectively.

Table 2

PP Unit Root Tests

	H_0: series have unit root			
Variables	Intercept	Trend + intercpt	None	Desicion
ΔlnY	-13.50[0.00]***	-13.30[0.00]***	-10.10[0.00]***	H_0: Reject
ΔlnM	-8.01[0.00]***	-9.86[0.00]***	-5.88[0.00]***	H_0: Reject
ΔlnG	-9.80[0.00]***	-11.60[0.00]***	-8.26[0.00]***	H_0: Reject

Notes. Probability values of *t*-statistics are in brackets. *** denotes significant at 1%.

Table 3

Granger Causality Test Results

Null hypothesis	Obs.	*F*-Stat.	Desicion
H_0: ΔlnY does not Granger cause ΔlnM	48	0.044[0.99]	H_0: Accept
H_0: ΔlnY does not Granger cause ΔlnG	48	2.955[0.03]**	H_0: Reject
H_0: ΔlnM does not Granger cause ΔlnY	48	1.685[0.17]	H_0: Accept
H_0: ΔlnM does not Granger cause ΔlnG	48	4.146[0.00]***	H_0: Reject
H_0: ΔlnG does not Granger cause ΔlnY	48	2.306[0.07]	H_0: Reject
H_0: ΔlnG does not Granger cause ΔlnM	48	0.639[0.63]	H_0: Accept

Notes. Probability values of *t*-statistics are in brackets. *** and ** denote significant at 1% and 5% respectively.

Before the Granger causality analysis, optimum lag length must be determined. As it was mentioned before, information criteria are used in order to determine optimum length. According to the LR, FPE, AIC and HQ criteria, optimum lag length is determined[6] as 4.

The results of the Granger causality analysis are summarized in Table 3. According to the results, there is a unidirectional causality running from real activity to government expenditures and a unidirectional causality running from money stock to government expenditures.

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[5] In this and following table for unit root, *Δ* does not mean first difference of the variables. All the variables are in levels.

[6] Table A3 in Appendix shows lag length selection results detailed.

Conclusions

It's very important to know that which policies of a country are more effective. This information will be extremely valuable especially in developing countries to create a road map for growing process. The policies and policy tools which are more effective on economy are given place mostly in the economic programmes that will be applied.

This study analyzes the effectiveness of monetary and fiscal policies on Turkish economy from 1998: I-2010: IV by total spending equation of St. Louis Model. In the light of the findings obtained from the analysis, it is seen that in the short term, both monetary policy and fiscal policy have positive effect. Nonetheless, only monetary policy has a significant effect on GDP. On the other hand, when we focus on long term, it is seen that monetary policy has positive and fiscal policy has negative effect. While an expansionary monetary policy increases real activity, an expansionary fiscal policy decreases real activity by causing budget deficit. That is, the findings prove that monetarist view is acceptable. However, it is concluded that both of the policies are statistically insignificant. The fact that variables representing both policies are insignificant proves that monetary and fiscal policies are ineffective on the economy for the given period. In addition, dummy variable has significant and highly adverse effect. Thus, mentioned crises influence economic activity negatively for questioned period.

Because the model presents insufficient results on policy proposal, causality relationship among these variables is analyzed. Causality analysis shows that there exists a unidirectional causality running from real output and money stock to government expenditures.

As a result, it is determined that money supply and government expenditures growth do not cause changes in real output growth; but money supply and real output growth do cause changes in government expenditures growth. When we take causality analysis results into account, empirical findings suggest us considering government expenditures as explained variable instead of real output. Thus, it can be concluded that St. Louis Model total spending equation is not applicable for Turkish economy over 1998-2010 periods.

References

Ahmed, E., & Johannes, J. M. (1984, November). St. Louis equation restrictions and criticisms revisited: Note. *Journal of Money, Credit and Banking, 16*(4), 514-515.

Andersen, L. C., & Carlson, K. M. (1970). A monetarist model for economic stabilization. *Federal Reserve Bank of St Louis Review, 52*(4), 7-25.

Andersen, L. C., & Carlson, K. M. (1974). St. Louis model revisited. *International Economic Review, 15*(2), 305-327.

Andersen, L. C., & Jordan, J. (1968). Monetary and fiscal action: A test of their importance in income stabilization. *Federal Reserve Bank of St. Louis Review*, November, 11-24.

Batten, D. S., & Hafer, R. W. (1983), The relative impact of monetary and fiscal actions on economic activity: A cross-country comparison. *Federal Reserve Bank of St. Louis Review*.

Batten, D. S., & Thornton, D. L. (1984). Discount rate changes and the foreign exchange market. *Journal of International Money and Finance,* 279-292.

Belliveau, S. (2011). A St.-Louis equation to reassess the influence of macroeconomic-policy instrument. Munich Personal RePEc Archiv, Paper No. 28771.

Blinder, A. S., & Solow, R. M. (1974). Analytical foundations of fiscal policy. The Economics of Public Finance Washington, D.C.: Brookings Institution, 3-115.

Carlson, K. M. (1975). The St. Louis equation and monthly data. *Federal Reserve Bank of St. Louis Review, 57,* 14-17.

Carlson, K. M. (1978). Does the St. Louis equation now believe in fiscal policy? *Federal Reserve Bank of St.Louis, Review, 60,* 13-19.

Cooper, P. J., & Fischer, S. (1974). Monetary and fiscal policy in the fully stochastic st louis econometric model. *Journal of Money, Credit and Banking, 6*(1), 1-22.

De Leeuw, F., & Kalchbrenner, J. (1969). Monetary and fiscal actions: A test of their relative importance in economic stabilization—Comments federal. *Reserve Bank of St. Louis Review, 51,* 6-11.

Dickey, D., & Fuller, W. A. (1979). Distrubition of the estimators for autoregressive time series with a unit root. *Journal of American Statistical Association, 74,* 427-431.

Dickey, D., & Fuller, W. A. (1981). Likelihood Ratio statistics for autoregressive time serise with a unit root. *Econometrica, 49*(4), 1057-1072.

Dikmen, N. (2006). Nominal GSUH ve politika tercihi: St. Louis model uygulaması. *Atatürk University Journal of Economics and Administrative Sciences, 20*(2), 87-105.

Elliott, W. J. (1975). The influence of monetary and fiscal actions on total spending. *Journal of Money, Credit and Banking, 7*(2), 181-192.

Enders, W. (2004). *Applied econometrics time series*. New York: John Willey & Sons.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424-438.

Granger, C. W. J., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics, 2,* 111-120.

Gujarati, D. N. (2004). *Basic econometrics* (4th ed.). The McGraw-Hill Company.

King, R. G., & Wolman, A. L. (1996). Inflation targeting in a St. Louis model of the 21st century. *Federal Reserve Bank of St. Louis Review, 78*(3), 83-107.

Modigliani, F., & Ando, A. (1976). Impacts of fiscal actions on aggregate income and the monetarist controversy: Theory and evidence. In J. L. Stein (Ed.), *Monetarism.* Amsterdam: North-Holland.

Phillips, P. C. B., & Peron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 336-346.

Raj, B., & Siklos, P. L. (1986, July). The role of fiscal policy in the st. louis model: An evaluation and some new evidence. *Journal of Applied Econometrics, 1*(3), 287-294.

Schmidt, P., & Waud, R. N. (1973). The almon lag technique and the monetary wtsus fiscal policy debate. *Journal of the American Statistical Association, 68,* 11-19.

Turkish Republic Central Bank. (2011). *Electronic data delivery system.* Retrieved May 7, 2011, from http://evds.tcmb.gov.tr

Appendix A

Table A1

Short Term OLS Regression Results

Dependent variable: Δln*Y*				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
ΔlnM	0.001610	0.000665	2.421786	0.0193
ΔlnG	0.049914	0.044031	1.133610	0.2626
DUMMY	-5.65E+08	7.85E+08	-1.989186	0.0455
C	1.69E+10	7.67E+08	21.97434	0.0000
R-squared	0.705753	*F*-statistic		38.37606
Adjusted *R*-squared	0.687362	Prob(*F*-statistic)		0.000000

Table A2

Long Term OLS Regression Result

Dependent variable: Δln*Y*				
Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	1.690034	0.001631	12.909254	0.0000
ΔlnM	-0.198104	0.218489	-0.906703	0.3704
ΔlnM(-1)	-0.145274	0.234288	-0.620065	0.5390
ΔlnM(-2)	0.026914	0.242846	0.110829	0.9124
ΔlnM(-3)	0.263656	0.244686	1.077530	0.2882
ΔlnM(-4)	0.166253	0.238565	0.696887	0.4902

(TableA2 coutinued)

Dependent variable: Δln$Y$				
Variable	Coefficient	Std. error	t-statistic	Prob.
ΔlnG	-0.054985	0.138999	-0.395580	0.6947
ΔlnG(-1)	-0.084344	0.151549	-0.556546	0.5812
ΔlnG(-2)	-0.161119	0.148432	-1.085469	0.2847
ΔlnG(-3)	0.021395	0.147326	0.145224	0.8853
ΔlnG(-4)	0.097699	0.133889	0.729702	0.4702
DUMMY	-3.49E+08	9.61E+08	-2.363863	0.0281
R-squared	0.761881	F-statistic		10.329980
Adjusted R-squared	0.686259	Prob (F-statistic)		0.000000

Table A3

Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	509.3558	NA	2.03e-14	-23.01617	-22.89452	-22.97106
1	518.6466	16.89241	2.00e-14	-23.02939	-22.54279	-22.84894
2	571.8376	89.45763	2.71e-15	-25.03807	-24.18653*	-24.72228
3	581.5954	15.08020	2.66e-15	-25.07252	-23.85603	-24.62138
4	598.8994	24.38288*	1.88e-15*	-25.44997*	-23.86853	-24.86350*
5	605.6233	8.557732	2.19e-15	-25.34651	-23.40013	-24.62470
6	610.0419	5.021071	2.91e-15	-25.13827	-22.82693	-24.28111
7	618.3674	8.325545	3.36e-15	-25.10761	-22.43133	-24.11511
8	624.1222	4.970038	4.59e-15	-24.96010	-21.91887	-23.83226

Note. * indicates lag order selected by the criterion.