

Causality Test between Money and Income: A Case Study of Selected Developing Asian Countries (1960–1988)

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1. INTRODUCTION

Money supply in developing countries, like Pakistan plays an important role. According to classical theory, supply creates its own demand. Any increase in money supply will give rise to increase in prices only but the effect on output will remain unchanged. The Keynesians argue that aggregate demand determines output, therefore, fiscal policy is more important. The monetarists on the other hand, argue that in the short run money and only money matters. In the case of the rational expectation approach, anticipated changes in money supply are neutral but short-run unanticipated changes in money supply have a role in determining the growth of output.

Monetary policy is an effective instrument in the hands of government to obtain the desired targets such as level of output, unemployment, and prices. Therefore, it is very important to know whether changes in money supply cause changes in output or vice versa. In other words, we have to identify the direction of the causality. If both variables are serially correlated with each other then we cannot use any of them as a determinant of the other.

Sims (1972) argues, "Hence in principle a large proportion of econometric studies involving distributed lag should include a preliminary test for direction of causality". The results of the causality test will provide useful information to policy-makers in stabilizing the economy. The main purpose of this paper is to examine the exogeneity or endogeneity of the money supply for selected developing Asian countries. The comparison of the analysis, obtained from the results, will help a great deal in determining the role of money supply in influencing various

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Author's Note: I would like to thank Dr Sarfraz K. Qureshi, Joint Director, and Dr Ashfaq H. Khan, Chief of Research, PIDE, for their great support in conducting the study. I am extremely grateful to Dr Nasir M. Khilji for his continuous guidance and encouragement during my studies in the Catholic University of America, Washington D. C., USA. The excellent typing of Mr Mahboob Iqbal is also appreciated. However, I alone am responsible for any errors and omissions.

economic parameters.

The relationship between money supply and income in the case of five developing countries according to Barth and Bannet (1974); Brillembourg and Khan (1979); Dereyes *et al.* (1980) and Sims (1972) is from money to income, as is prescribed by the theory while in the case of three countries, Dereyes *et al.* (1980) and Hsio (1979) show interdependence between money and income. In two cases, described in Dereyes *et al.* (1980) and William and Gowland (1976) both series are independent of each other. The causality in the case of U. K., Dereyes *et al.* (1980) is found to be from income to money, and the causality is bi-directional in India and Singapore. Joshi (1985), found a bi-directional relationship between money and income, using thirty-two year's data for India. In another study by Patil and Ramanathan (1989), money supply and income are independent of each other. The above-mentioned relationships are drawn on the basis of different tests using different filters and the study refers to the period 1950-51 to 1985-86, based on annual data. Khan and Siddique in an unpublished study based on the Sims's test conclude that in Pakistan, income causes money supply without any feedback.

Section 2 describes the methodology used in the test procedure. The results and its analysis are presented in Section 3. The last section summarises the concluding remarks.

2. METHODOLOGY

In this study, we will use the Granger Causality Test to examine the directions of causation between gross domestic product (GDP) and money supply (M1 and M2).¹ The test is recommended by Geweke, Meese and Dent (1983) due to its desirable statistical properties based on the Monte Carlo Study. The authors applied eight different techniques including Sims's (1972) and Granger's (1969) and found that the Granger's test is more appropriate because it does not involve complex statistical procedures and saves time. We will select the lag length on the basis of:

1. One to three years arbitrarily chosen lag-length of the exogenous and endogenous variable; and

¹M1 = Currency + Demand Deposits M2 = M1 + Time Deposits. The simple aggregation of monetary assets, especially in the short-run are thought not to be valid in the case of developing countries. In this respect, for Pakistan, Hasson (1988) has found that the monetary assets are substitutable in the long run.

pendent variables respectively. They found FPE to be very appropriate on the basis of their results obtained from the Granger Causality Test. We can take any lag-length according to our requirement but we must be very careful in taking the lags and interpreting the results drawn from the selected lag-lengths. The reasons for selecting an arbitrary lag-length of maximum three years for an independent and the dependent variable are as follows:

Firstly, the lag-length is considerably large enough to draw reasonable conclusions. It is obvious when lag-length becomes larger its effect on endogenous variable becomes negligible. Therefore, three year lags are sufficient to serve our purpose.

Secondly, most of the authors used maximum 8 to 12 lags in their studies and those studies are based on quarterly data. In our case quarterly data are not available for income.

Thirdly, to avoid the degrees of freedom problem we have not used a lag-length of more than three years for exogenous and endogenous variable.

The data are obtained from the International Monetary Fund (1988); Government of Pakistan (1990) and Kemal *et al.* (1980). Time series are based on an annual data consisting of twenty-nine observations (1960 to 1988). Data for the countries except Pakistan, for 1988, have been generated by taking the average of last three-year's growth rate. To make the series stationary, growth rates of both the variables are used. The time trend is also used as an explanatory variable to further smoothen the series. The first difference procedure has been adopted to remove the influence of the past values of income and money on their current values. Patil and Ramanathan (1989) used two standard filters while the results obtained are very sensitive to the tests employed and not to the filters. Each equation is estimated using the Ordinary Least Square Method (OLS). The conclusions will be drawn on the basis of the significance of the *F*-test.

3. RESULTS AND THE ANALYSIS

The results of this empirical study are presented in appendix Table 1 and are explained in Chart 1.

For Pakistan, two-year's lag indicates that the money supply (both M1 and M2) cannot be used as a policy variable because M1 and Y are independent of each other and a bi-directional relationship is found between M2 and Y. The same is true when we tried it with a three-year's lag. Money and income are independent of each other. In the case of Malaysia there is a feedback between money supply and income except for the third lag, where Y is dependent on M2,

Chart 1

*Chart of Direction of Causation between
Money Supply and Income*

	Pakistan	Malaysia	Korea	India	Thailand
One-Year's Lag					
M1 & Y	—/—	<---->	/—	—/—	—/—
M2 & Y	---->	<---->	/—	—/—	<---->
Two-Year's Lag					
M1 & Y	—/—	<---->	/—	—/—	<---->
M2 & Y	<---->	<---->	/—	—/—	<---->
Three-Year's Lag					
M1 & Y	—/—	---->	/—	—/—	<---->
M2 & Y	<---->	<---->	/—	—/—	<---
FPS Selected Lags					
M1 & Y	—/—	<---->	/—	---->	---->
M2 & Y	<---->	<---->	<---	—/—	<---->

therefore, both M1 and M2 cannot play any role in determining income for arbitrarily chosen lags. M1 and M2 are independent of Y in the case of Korea and India for all the lags. Money supply and income cause each other in the case of Thailand, except for the first and the third lags where M1 is independent of Y for the first and M2 is dependent on income for the third lag. In this exercise for, one, two and three lags of explanatory variable we have 24, 22, and 20 degrees of freedom, respectively.

Our analysis of money supply in Chart I, for PFE selected lags indicates that M1 and M2 are not exogenously determined in the case of Pakistan and Malaysia, while M1 is exogenous for India and Thailand. This test shows no relationship between M2 and Y for India.

The analysis of the chart shows that the results of the FPE selected lags are different to the arbitrarily chosen lags for most of the cases. Within arbitrarily chosen lags the results are almost the same. Money supply in the case of Pakistan, Malaysia, and in part in Korea (for M1) and India (for M2) gives the same results

for the two-year's lag and FPE selected lags. Exogeneity of money supply (MI) for India and Thailand in FPE selected lags while M2 for Pakistan and M1 for Malaysia in case of first and the third lag respectively, is questionable.

4. CONCLUDING REMARKS

Generally, it is believed that in developing countries money supply cannot be used as a determinant of income. The present study supports this hypothesis that money supply cannot be taken as a policy variable when the Granger Test is employed in the case of most of the developing countries.

The results of this study, in the case of India, are very similar with the latest study by Patil and Ramanathan (1989), for M2 in the case of FPE selected lags.

In those countries where money supply is not exogenous in the system, it becomes difficult for the policy-makers to control it as a policy variable to achieve economic objectives.

The present paper does not provide any support to those studies which used money supply as an explanatory variable without any test procedure in developing countries where the relationship is not from money to income. It is true that due to government intervention standard economic theories are not implementable but we cannot determine the direction of the relationship without having any solid test. Therefore, it is the job of economists to keep the governments aware of the current situation so that those (governments) might implement their policies accordingly.

William W., C. A. E. Goodhart and D. H. Gowland (1976) Money, Income and Causality: The U. K. Experience. *American Economic Review* 66 : 3

Comments on
“Causality Test between Money and Income:
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(1960–1988)”

First of all let me congratulate Abbas on producing a good quality paper. His paper represents a technically sound piece of work. He has dealt with a subject which is interesting as an exploration of theory and useful for its potential impact on policy. Considerable work has been done on this topic in other countries and lately there has been an accretion of studies on this topic using data from Pakistan as well. Abbas's paper is an important contribution to this growing body of knowledge.

A bit of background may be useful here. I am sure Abbas would have done it himself but for the constraints of the space usually imposed on conference papers. It is a legitimate question to ask, what is it that one is trying to determine when one talks of causality testing. We are all familiar with correlation where we observe the direction and the strength of two or more variables without being able to make any determination about the underlying causal structure. Then we have regression used especially in the simultaneous equation model type framework. The basic premise of these models is, or was, that the data are assumed to have been generated by a system of simultaneous equations. The classification of variables into 'endogenous' and 'exogenous' and the causal structure of the model are both given *a priori* and are untestable. The main emphasis is on the estimation of unknown parameters. One of the criticisms of this approach obviously is that classification of variables as exogenous and endogenous is arbitrary.

Then appeared two articles, one by Granger (1969) and the other by Sims (1972) where the authors developed empirical tests to determine causality.

Since the statistical forms of these tests and their implications for causality are well-known therefore they would not be reproduced here.

Coming to the article written by Abbas he has used Granger's test for causality and found that M1 does not cause income (Y) irrespective of whether the lag-length is 1, 2, or 3 years or even when the lag-length is selected using the Final Prediction Error method, M1 and Y fail to show any relationship. M2 and Y show a bi-directional causality for lag-lengths of 2 and 3 years and also on the basis of FPE. Also that M2 cause Y when lag-length is one year.

The above results by themselves are interesting and the author in his future research may like to investigate the reasons for these particular results.

Abbas has also referred to an unpublished study by Khan and Siddiqui where they used not the Granger but the Sims's test and got results which are different from that of Abbas. Their results showed that income was causing money supply. *Ceteris paribus* the difference in results seems to be the consequence of the difference in the testing procedure. Now in a situation like this as a researcher one may like to pause in order to think that is one testing some hypothesis or putting to test the testing procedure itself. Because no doubt that there are some econometric differences in the Granger and Sims tests of causality yet they basically test the same hypothesis. In this connection I would like to refer the author to an article by Chamberlain "The General Equivalence of Granger and Sims Causality" published in *Econometrica* Vol. 50, 1982. In my view this point is important because if results are changing merely by changing the testing procedure then the policy recommendations that flow from these results cannot be accepted uncritically.

Abbas can further extend his research by using Sims's test and then comparing the results with the ones mentioned by him in his article.

There seems to be one error in typing which could be a source of confusion for the reader. I quote "Secondly, income does affect money growth means $F_p = 0$ " I believe it should be income does not affect money growth.

I also feel that in his concluding section the statement that "Policy-makers of the developing countries, where money supply has not been found exogenous cannot try to stabilise the economy through the control on money supply" is rather strong and general as we have seen that the evidence is inconclusive.

If Abbas decides to pursue this topic in the future, I would like to recommend two articles that he may like to consult and they are, Jacobs, Leamer and Ward, "Difficulties with Testing for Causation" *Economic Inquiry* 1979. Hsiao, "Autoregressive Modelling and Money-income Causality Detection" *Journal of Monetary Economics*, 1981.

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