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SRI LANKAN JOURNAL OF AGRICULTURAL ECONOMICS

(ISSN 1391-7358)

Volume 1. Number 1. 1993

PUBLISHED BY: Sri Lanka Agricultural Economics Association

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Impact of Money Supply on Aggregate Price Levels: Evidence from Sri Lanka

P. Abeygunawardena* and H.M. Gunatilake**

ABSTRACT

The effect of a stock of money on agricultural prices has been a crucial issue in recent discussions on the effectiveness of macro-economic policies on the agricultural sector. The Agricultural price level is important because it influences the supply and demand of agricultural products. Theoretically it is widely accepted that the money supply is positively related to the price level in the short run and this effect is neutralized in the long-run leaving real variables i.e. output, employment and income unaffected. The short-run impact of an increase in the money supply, theoretically, has two components: (1) increasing employment and output, and (2) increasing price levels. Empirical tests for effects of money supply on agricultural prices, however, have yielded mixed results. Some researchers have found evidence on the positive effect of the money supply on agricultural prices while others have reported that relative agricultural prices are not affected by changes in the nominal stock of money. Since the issue is inconclusive so far, it is germane to shed more light on the relationship between these two variables under various circumstances.

Monthly data of the money supply and aggregate price levels (for all commodities and food items) of the Consumers Price Index from 1970 to 1990 were used for the analysis. The same price data from the Wholesale Price Index from 1978 to 1990 were also used for the analysis. Narrow money supply and broad money supply were used to fit Vector Autoregression (VAR) models to examine the dynamic relationship between the money supply and prices in Sri Lanka. Results reveal that there is no statically significant causal effect of the money supply on aggregate food prices in both price indices for the given period of time. The Consumer Price Index for all commodities, however, shows a causal relationship to changes in the money supply. The price index of all items in WPI also does not have a significant response to the changes in the stock of money. This raises the question as to how effective would the increase in the money supply be, as a macro-economic stabilization policy in manipulating the agricultural sector in the country.

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Introduction

According to recent literature, there has been a growing interest on the nature of dynamic response of agricultural prices to changes in the money supply in various countries (Bessler, 1984; Lapp, 1990; Robertson and Orden, 1990). Traditionally, money supply (M1) is defined as currency and demand deposits held outside the commercial banks whereas the broad money supply (M2) includes time deposits in addition to currency and demand deposits. The nominal money supply is determined by the actions of the public and the central bank of a country (Dornbush and Fischer, 1978).

The agricultural price level is important because it influences the demand and supply of the agricultural products of a country. In general, the agricultural sector is considered to be more competitive compared to the other sectors of the economy (Starleaf, 1985). This is specially true for developing countries because a large number of economic entities are involved in agriculture. Therefore, it is likely that agricultural prices are more volatile when compared to non-agricultural prices (Devadoss and Meyers, 1987; Robertson and Orden, 1990). It has also been argued that an expansionary monetary policy favours farmers since it may cause short run agricultural prices to overshoot their determined levels in the long run. In contrast, a contractionary monetary policy tends to shift relative prices against the agricultural sector (Starleaf et al., 1985; Tweeten, 1980).

Theoretically, an aggregate price level is positively related to the money supply in the short run and this effect is neutralized in the long run leaving all other variables i.e. production, employment and income in real terms, unaffected (Robertson and Orden, 1990; Dornbush and Fisher, 1978, Frisch, 1983). The short run impact of an increase in money supply on the economy is twofold: (1) increasing the real output and the labour supply with no immediate change in price levels, and (2) increasing price levels through the dynamic process in response to the change in money supply (Bessler, 1984a).

Inflation caused by the increased money supply is said to be favorable for farmers who have incomes determined at the varying market conditions compared to those who earn fixed incomes. Starleaf et al. (1985) provide empirical evidence to support this thesis that farmers are the beneficiaries of an increased inflation rate and suffer losses when the inflation rate declines. On the contrary, some argue that inflation has an erosive effect on the real income of farmers. For example, Tweeten's (1980) empirical findings suggest that there is a negative impact of inflation on farm income while Gardner (1981), Chambers (1983) and Prentice and Schertz (quoted from Starleaf 1985) find that there is no significant impact of inflation on farmers' real income.

Empirical evidence on the relationship between money supply and aggregate price level show mixed results. Barnett (quoted in Bessler

1984b), Chambers (1983), Bessler (1984a), Devadoss and Meyers (1987) find evidence for the causal effect of money supply on price levels. Lapp (1990), and Gardner (1981), on the other hand, find that relative agricultural prices are not affected by the level of money supply. Therefore, there is a growing interest in seeking more empirical evidence on the relationship between money supply and aggregate price levels.

According to Cairnes (quoted in Bessler, 1984b), basic commodities such as agricultural products should respond faster to a change in money supply than industrial products. This is mainly because agricultural products have lower short run supply elasticities. Bordo (1980), Devadoss and Meyers (1987) and Robertson and Orden (1990) provide empirical evidence for this thesis. Bessler's (1984a) findings based on Brazilian data, however, do not support this theme. Furthermore, the long run neutrality of the price levels due to monetary shocks have been reported by Bessler (1984a), Robertson and Orden (1990). Such empirical evidences falsify views monetarists that "money first and then prices" as a concept with no base.

Despite the rigorous theoretical explanations of the relationship of money supply and agricultural prices, the above research findings show a considerable difference over time in different economies. Thus, there is limited scope for generalization of one's findings in an economy at a particular

time to another economy or at a different time. Therefore, the nature of the dynamic relationship between money supply and agricultural prices in a given country for a specific time period will provide valuable information such as whether there is an impact, direction and magnitude of the impact, how long will the impact last and the impact on the different sectors of the economy to the policy makers.

Objective

There is very little empirical evidence available in the literature on the response of agricultural prices to money supply shocks from developing countries. Theories such as rational expectation of inflation, perhaps, would not work to the same degree in developing economies as in developed countries. This could be due to many reasons such as the lack of information and more interventions to the market in these economies. In Sri Lanka, as Samaranyake (1986) revealed, the relationship between the interest rate and investment or savings behavior in the post-1977 period does not go along with the theoretical explanations. This, as well as many other studies, suggests that there could be some differences in the behavior of the macro-economies of developing countries compared to those of developed economies. Thus, investigations on the dynamic relationship of agricultural prices to money supply are particularly important for Sri Lanka because its economy is undergoing a series of rapid structural adjustments. Therefore, the objective of

this study is to investigate the impact of money supply on agricultural price levels in Sri Lanka.

Method and Data

Vector Auto Regression (VAR) is the statistical procedure used in this study to examine the dynamic relationship between money supply (M1 and M2) and agricultural prices at aggregate levels. The VAR allows each of the variables to influence every other variable in a multi-variate system with a pre-determined number of lags (Bessler, 1984a; Doan and Litterman, 1981; Granger and Newbold, 1977). In this method, at least initially, no specific theories or predetermined relationships can be tested. However, the empirical regularities discovered by this method may lead to alternative theoretical explanations which can then be tested using other methods (Bessler, 1984). A complete review of this methodology can be found in Doan and Litterman (1981) and Bessler (1984a). A brief representation of the model with special reference to this study is as follows:

The relationship among money supply, agricultural prices, and industrial prices can be represented by an n th order vector autoregression as

$$[I - \Lambda(L)]X(t) = e(t)$$

where,

$$X(t) = [MS(t)FP(t)ALP(t)]'$$

$I = 3 \times 3$ identity matrix

$$\Lambda(L) = \Lambda_1 L + \Lambda_2 L^2 + \dots + \Lambda_n L^n$$

L is the lag operator Λ_1 to Λ_n are 3×3 matrices of parameters

$e(t) = 3 \times 1$ innovation vector of contemporaneously correlated, normally distributed error terms with zero mean and finite variance-covariance matrix

The purpose of fitting this model is to understand the dynamic relationship between money supply and aggregate price levels with no or as few a priori restrictions as possible. This approach allows the existing regularities among the data to reveal themselves. This methodology is not fully compatible with the conventional hypothesis testing approach. It is a methodological or philosophical issue rather than a personal choice whether to use more structured or unstructured models in analyzing data. If one considers that it is one of the purposes of science to capture and explain the regularities that exist in nature, the spirit of this method also has its advantages over structural models. However, the authors look at unstructured models as complementary to the structured models rather than considering one is superior to the other.

Secondary data of money supply and price levels from the Annual Reports of the Central Bank were used for the analysis. Both narrow money supply (M1) and broad money supply (M2) were used for the analysis. Monthly data of price indices for food items (FP) and all items (APL) of the Colombo Consumers Price Index (CPI) for 21 years (1970-90) were analyzed. In previous studies by Bessler (1984b), Lapp (1990), Robertson and Orden (1990) and Devadoss and Meyers

(1987), farmgate price indices and wholesale price indices were used to represent aggregate price levels. In Sri Lanka, farmgate price indices are, however, not available and time series data of wholesale price indices (WPI) are available only from 1978 onwards. Therefore, FP and ALP of WPI (1978-1990) were used to estimate the second model. The analyses carried out separately with CPI data and with WPI data together with the narrow money supply are designated as model 1 and model 2 respectively.

Broad money supply (M2) data are available only from 1979 onwards. Another two models were fitted for CPI and WPI together with the broad money supply for the 12-year period (from 1979 - 1990). These two models are designated as model 3 and 4 respectively. In a bi-variate system, two measures of the money supply, i.e, narrow money supply and broad money supply were allowed to influence on aggregate food prices (FP) aggregate all prices (ALP) of the CPI in the system. The number of lags was set at 20, arbitrarily, to examine the effect of time lags.

Results and Discussion

Results of the analysis with narrow money supply and broad money supply are discussed separately. The impact of narrow money supply on price levels is discussed first. Narrow money supply (M1) has grown with an annual average of 16.2% over the 21-year period which ranges from 4.5% to 27.8%. There is

only a 3.2% difference in the annual average growth rate of money supply between pre- (14.6%) and post- (17.8%) 1977 periods. Price indices for all items and food items in the CPI have grown by 9.3% and 10.2% respectively during the 21-year period. The rate of growth of price levels shows a considerable difference for pre- and post- 1977 periods. On an average, both price indices (ALP and FP) have grown annually by about 4.5% before 1977 whereas the growth after 1977 was about 13%.

Estimated significance levels corresponding to F-tests on past lagged values of each variable for the first two models are given in Table 1 and 2. The F-test implies whether the Granger-type causal relationship among the studied variables exist over the fitted period or not. According to the results of the study, changes in money supply (M1) do not cause changes in the FP and there is no feedback too. These results are common to both models fitted, using price data from CPI (model 1) and WPI (model 2). Therefore, there is no evidence to say that the money supply (M1) has an impact on food prices for the 21-year period examined in this study.

Despite the theoretical relationship (positive) between money supply and aggregate food prices, it is found in this study that the influence of money supply (M1) on the aggregate food prices is not significant. This finding is similar for the analysis with CPI and WPI indices. Farmers may gain or lose by resultant

Table 1. Causal impact of narrow money supply on consumer price indices (Model 1.)

Lagged Variable	Significant levels of the F tests Current Variable		
	MS	ALP	FP
MS	0.11	0.02*	0.82
ALP	0.83	0.00	0.00
FP	0.49	0.99	0.99

* Significant at 0.05 level

Table 2. Causal impact of narrow money supply on whole sale price indices (Model 2.)

Lagged Variable	Significant levels of the F tests Current Variable		
	MS	ALP	FP
MS	0.00	0.64	0.62
ALP	0.71	0.17	0.57
FP	0.58	0.10	0.19

inflation due to monetary changes depending on the prices they receive and pay. Findings of this study indicate that there is no significant impact, of changes in money supply on food prices. Regardless of farmers gain or loss due to inflationary conditions, the analysis implies that the money supply

(M1) cannot be used as a tool to influence the food prices. Based on the findings of the study, it can be questioned as to the role of changing money supply (M1) as a stabilization policy in manipulating food prices of Sri Lanka.

The money supply (M1) however, causes changes in prices of all items (ALP). There is a causality that is observed only in model 1 which used prices of all items in the CPI. In both models there is no feedback from ALP to the money supply. Thus, these results suggest that CPI responds to the money supply shocks whereas the WPI does not respond to the changes in the money stock. If the wholesale price index represents producer prices, this suggests that a change in the money supply has an effect on prices at consumers' level whereas prices at producers' level do not have any impact. Thus, there may not be any positive impact of increasing the money supply for producers while consumers pay higher prices. This may be due to the time lag between producers' decisions and the realization of actual output in the market.

Impact of Broad Money Supply

The broad money supply has shown an annual average growth rate of 1.5% over the analysed period with a range of 0.4% to 2.7%. Causal effects of the money supply (M2) on CPI and WPI are presented in Tables 3 and 4 respectively. According to the tables, a broader money supply has a similar effect on the aggregate price level like narrow money supply. There is a causal effect on ALP and the effect is more significant. A broader money supply also does not cause changes in food prices at the consumer level.

The impact of a broader money supply on WPI is not significant for the prices of all commodities (ALP). There is, however, a significant impact of the broader money supply on food prices. This is the only case where the money supply has caused changes in food prices.

Dynamic Nature of the Impact

Statistics of the ordinary least squares method applied to equation by equation of the VAR models are given in Table 5. The results represent only the impact of the narrow money supply on CPI and WPI. These results indicate the relative strength of relationship at various lag lengths. The t statistics suggest, except for the first lag, that there is no considerable difference in the impact on CPI and WPI of food prices. The first lag of the food prices equation is significant at 5% level. In the first lag, however, the money supply has a negative impact on food prices. This may be due to the immediate feelings of the consumers resulting from increased incomes which may prompt them to switch from food items to non-food items. Within a short period of time they may realize that the increase in income is not real or lasting. None of the other lags of the money supply causes a significant impact on food prices in both price indices.

In the case of all prices, the wholesale price index has no significant impact on money supply shocks.

Table 3. Causal effect of broad money supply on consumer price indices (Model 3.)

Lagged Variable	Significant levels of the F tests Current Variable		
	MS(M2)	ALP	FP
MS (M2)	0.00	0.00*	0.53
ALP	0.00	0.00	0.89
FP	0.00	0.00	0.00

* Significant at 0.05 level

Table 4. Causal effect of broad money supply on wholesale price indices (Model 4.)

Lagged Variable	Significant levels of F tests Current Variable		
	MS	ALP	FP
MS	0.00	0.22	0.10**
ALP	0.09	0.00	0.06
FP	0.30	0.03	0.00

** Significant at 0.1 level

Table 5. The t-statistics for the Vector Autoregressions

Lag Number	FP		AIP	
	CPI	WPI	CPI	WPI
1	-2.09*	0.87	0.48	0.70
2	1.02	-1.53	0.30	-1.63
3	1.34	0.47	-0.10	0.48
4	-1.40	-0.88	-0.81	-0.40
5	0.55	1.03	-0.12	0.53
6	-0.24	-0.48	-0.55	-0.78
7	0.65	-0.31	1.20	0.40
8	-0.43	0.16	-0.98	-0.40
9	-1.23	0.39	-0.49	0.63
10	1.59	0.80	0.31	0.73
11	-0.13	-0.18	1.12	-0.42
12	-1.03	0.17	0.52	0.69
13	1.17	-0.45	-1.93*	-0.40
14	-0.57	0.54	-0.53	1.15
15	0.67	-1.11	1.98*	-1.07
16	-0.78	1.01	-0.73	0.52
17	0.15	-0.82	-0.59	-0.19
18	0.69	-0.29	0.50	-0.44
19	-1.10	-0.79	-1.89*	-0.42
20	0.74	1.42	2.75*	0.82

* indicates the significance level of 0.05.

The 13th, 15th, 19th and 20th lags of money supply have significant impacts on all prices in the consumer price index. Thus the first significant impact of a money supply shock occurs in the 13th lagged month and the impact could last up to the 20th lagged month.

Generally it is believed that the impacts of monetary policies are quicker compared to fiscal policies. Results of this study, however, indicate that the impact of a narrow money supply on

aggregate all prices is not quick as it takes a little more than a year to change the price level. If the same trends follow in the future, one cannot manipulate the money supply so as to get desired quick changes in the aggregate price levels. It should be given at least one year to observe market signals attached to a shock in the money supply. This seems quite a longer period compared to the type of macro-economic problems the country wishes to address immediately.

Conclusion

Except for the impact of the broad money supply on wholesale food prices, there is no causal effect of the money supply on food prices at both consumer and wholesale levels. Therefore, the effectiveness of an expansionary monetary policy as a tool to influence the aggregate agricultural price level is questionable. Since there is no causal effect of the money supply on food prices, accruing of benefits of inflation to farmers is not possible when the money supply increases. All price components in the CPI respond to money supply shocks while the same in the WPI do not. Thus, the resultant inflation of monetary expansion may have quite different impacts on producers and consumers.

The behavior of Sri Lankan economy with respect to changes of money supply and aggregate level food prices for the 21-year period shows a deviation from the conventional theoretical explanations. The nature of this investigation, however, does not permit any vigorous explanations for this behavior. This inconsistent behavior is shown perhaps due to imperfections in the money and commodity markets along with governmental interventions. This could also be due to differences in expectations of the individuals in different sectors of the economy which is at a dramatic transition. Furthermore, it could be purely due to the problems involved in calculating various price indices of the country. Thus it will be

worthwhile to investigate further to identify the impact of changes of the money supply on the aggregate price level in different sectors of the economy and the factors influencing the inconsistent behavior of the Sri Lankan economy with respect to money supply and aggregate price levels. Such information would be very useful in formulating future monetary policies in Sri Lanka.

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