Money, Income and Prices in Pakistan: A Bi-variat and Tri-varate Causility

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Money, Income and Prices in Pakistan: A Bi-variate and Tri-variate Causality

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This paper re-examines the causal relationship between money and income and between money and prices in Pakistan. Using an annual data set for fiscal years 1959–60 to 2003–04 and employing co-integration and error correction models as well as the standard Granger causality analysis we investigate the bi-variate and tri-variate causal relationships. The co-integration analysis indicates, in general, the long-run relationship among money, income and prices. The error correction and Granger causality framework suggest a one-way causation from income to money in the long run implying that probably real factors rather than money supply have played a major role in increasing Pakistan's national income. Regarding the causal relationship between money and prices, the causality framework provides the evidence of bi-variate causality indicating that monetary expansion increases, and is also increased by inflation in Pakistan. However, money supply seems to be the leader in this case.

(JEL Classification: E52, E58) **Keywords:** Money, income, prices, causality.

1. Introduction

Monetary policy plays an important role in boosting the economic growth provided money is exogenously determined in the economy. Its impact on income and prices has been widely examined in the developed and developing countries in the context of Monetarists and Keynesians controversies. Monetarists claim that money plays an active role and leads to changes in income and prices.

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Hence, the direction of causation runs from money to income and prices without any feedback. The Keynesians, on the other hand, argue that money does not play any significant role in changing income and prices. In fact, changes in income cause changes in money stocks through demand for money implying that there exists a uni-directional causality from income to money. Similarly, changes in prices are mainly caused by structural factors.

The causal relationships between money and income and between money and prices have been an important area of investigation in economics particularly after the provocative paper by Sims (1972). Based on Granger causality, he developed a test of causality and applied it to the US data to examine the causal relationship between money and income. He found the evidence of uni-directional causality from money to income as claimed by the Monetarists. However, his results were not supported by subsequent studies. Barth and Bannett (1974) replicating Sims' test in the Canadian economy showed a bi-directional causality between income and money. Williams et al. (1976) applying Sims' procedure in the UK, found the evidence of uni-directional causality from income to money, opposite to Sims' findings. They also pointed out evidence of uni-directional causality from money to prices. Brillembourg and Khan (1979) using a longer data set supported Sims' findings and established a uni-directional causality from money to income and prices in the US. However, Dyreyes et al. (1980), examining the pattern of causality between money and income for six industrialized countries showed bi-directional causality in the US, contrary to Sims (1972) and Brillembourg and Khan (1979). Similarly, they pin pointed uni-directional causality from money to income in Canada, contrary to Barth and Bannett (1974). However, their finding of uni-directional causality from income to money in the UK was in line with Williams et al. (1976).

Lee and Li (1983) examined causality among money, income and prices in Singapore and concluded bi-directional causality between income and money and uni-directional causality from money to prices. Joshi and Joshi (1985) pointed out a bi-directional causality between money and income in India. Khan and Siddiqui (1990) showed uni-directional causality from income to money and bi-directional causality between money and prices in Pakistan. Abbas (1991) performed a causality test between money and income for Asian countries and identified bi-directional causality in Pakistan, Malaysia and Thailand. Bengali et al. (1999) pin pointed a bi-directional causality between money and income and uni-directional causality from money to prices in Pakistan.

The above discussion indicates that empirical evidence regarding causal relations between money and the other two variables, income and prices, remains inconclusive. Attempts were also made to perform multivariate causality in this context. Ho (1982) investigated causality among money, domestic prices and import prices in Hong Kong using a tri-variate causality approach. He found a uni-directional causality from domestic prices to money and import prices to domestic prices. However, his results were not different in both the bi-variate

and tri-variate cases. Ahmed (2003) while investigating multivariate causality among money, interest rate, prices and output in SAARC countries established bi-directional causality between money and prices in Bangladesh and Pakistan. His results further indicate the interest rate to be a good policy variable in Bangladesh and Pakistan and money in India.

This paper re-examines the causal relationship between money and income and between money and prices in Pakistan. We use an annual data set for fiscal years (July–June) 1959–60 to 2003–04. Further, we take care of the stochastic properties of the variables used, which has not been done earlier in general. In addition, we also investigate the causal relationship through the tri-variate approach not attempted before in Pakistan.

The rest of the paper is organized as follows. The next section discusses data and outlines the methodology to test the stochastic properties of the variables and their inter-relationship. Section 3 shows the trends in money, income and prices as well as the relationship among these variables. Section 4 presents and discusses the empirical results. The final section contains the summary and conclusions.

2. Data and Methodology

Annual data from 1959–60 to 2003–04 were used to investigate the causal relations between money and income and between money and prices in Pakistan. Gross National Product (GNP) at current prices, broad measure of money (M2), and GDP Deflator (Defl) with base 1980–81, are used as income, money and prices respectively. The principal source is *50 Years of Pakistan in Statistics*, prepared by the Federal Bureau of Statistics (1998). The other data sources include *Economic Surveys* by Finance Division and *Annual Reports* by State Bank, the central bank (see Government of Pakistan [various issues]).

The formal investigation starts by examining the stochastic properties of the variables used in the analysis. Hence, the unit root test is performed on the variables to test for the stationarity of the variables. In this context, both the Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) (1988) tests are used. Next, we apply the Engle-Granger co-integration test to examine the long-run relations among the variables. Finally, the causal relationships between these variables are examined through Granger causality and error correction models (ECM). In this context, both the bi-variate and tri-variate causality are investigated. In the case of tri-variate causality, for example, between money and income, the third variable—prices—is introduced in the causality equations which examine the causal relationship between money and income conditional on the presence of prices. In all cases, lag lengths are decided on the basis of Schwert (1987) log likelihood, Akaike information criteria, and Bayesian information criteria.

3. Income, Money and Prices in Pakistan

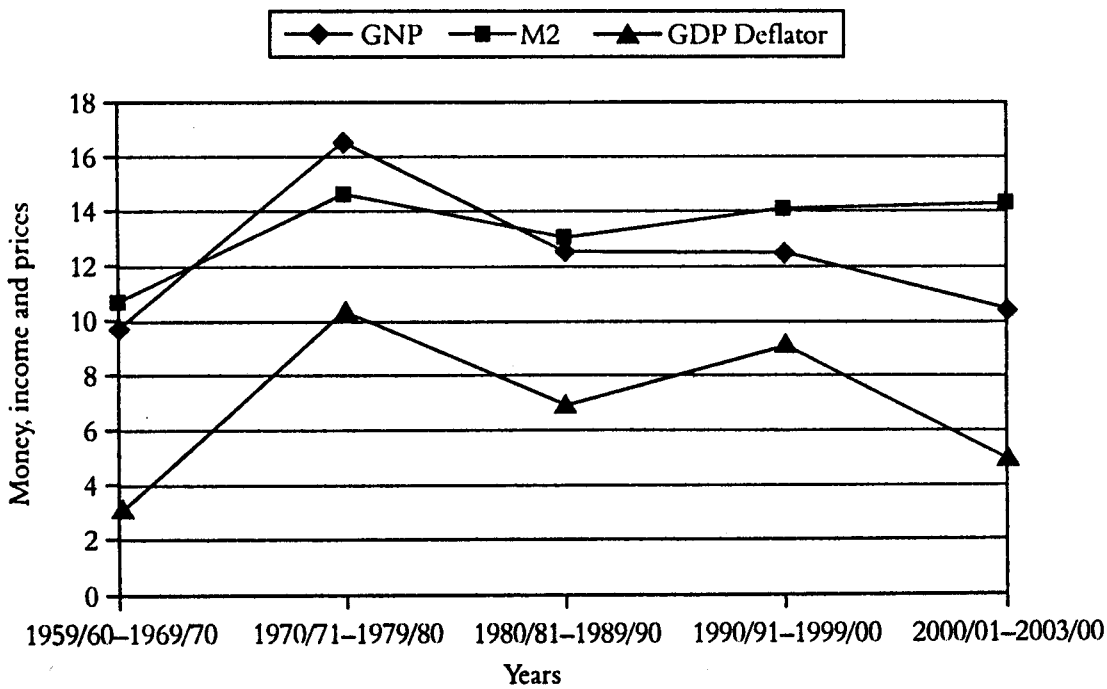
Before the formal investigation, it would be useful to look at the trends in income, money and prices in Pakistan's economy over the years. Table 1 and Figure 1 show the average annual percentage changes in these variables over the decades.

TABLE 1
Average Annual Percentage Change in Income, Money and Prices

Time	*Income (GNP)*	*Money (M2)*	*Prices (defl)*
1960/61–1969/70	9.74	10.68	3.18
1970/71–1979/80	16.58	14.71	10.43
1980/81–1989/90	12.57	13.06	6.93
1990/91–1999/00	12.48	14.12	9.16
2000/01–2003/04	10.43	14.35	5.01
1960/61–2003/04	12.62	13.25	7.20

Source: Government of Pakistan (1998 and various issues).

FIGURE 1
Percentage Change in Money, Income and Prices



Source: Based on Table 1.

The analysis shows that the expansion in money has always been the highest except in the seventies. The expansion in prices has generally been much lower than those in income and money. In the sixties, income and money expanded at almost the same rate, that is, 10 per cent. Prices expanded by 3 per cent, which was well below the income and monetary expansions. The seventies witnessed phenomenal expansion in all the cases. In particular, the expansion in prices increased from 3.2 per cent to 10.4 per cent. This high inflation resulted in

significant expansion in income from 9.7 per cent to 16.6 per cent. Money expanded by almost 15 per cent. In the eighties, the expansion in all the variables decreased. The decrease was very significant in the case of prices, that is, from 10.4 per cent to 6.9 per cent. It was marginal in the case of money implying little role of money supply in controlling inflation. The nineties, a period of economic reforms, shows mixed trends where the expansion remained almost the same in income. There was a slight increase in money and prices again touched the position of the seventies. The first half-decade of the new millennium witnessed significant decrease in the expansion of income and prices. But the expansion remained the same in the case of money.

Overall, the expansion in money and income seems close to each other suggesting a possible association between the two. The expansion in prices is well below the expansion in income and money. It can be inferred from Table 1 that there does not exist a proportional relation between money and prices in Pakistan.

It would be useful to look at the lagged correlations. That is, how the lags of income, money and prices affect one another. The lagged correlations were calculated for up to five lags (Table 2).

TABLE 2
Lagged Correlation among Income, Money and Prices

Lags	*GNP*	*M2*	*Defl*
GNP(–1)	0.4828***	0.0857	0.5667***
GNP(–2)	0.1917	0.3298**	0.2029
GNP(–3)	0.1919	0.5740***	0.0964
GNP(–4)	0.0375	0.1097	–0.0065
GNP(–5)	–0.0797	0.0926	–0.1852
M2(–1)	0.2139	0.2489	0.2142
M2(–2)	0.1083	0.0845	0.0937
M2(–3)	–0.0451	0.1125	–0.0356
M2(–4)	–0.0433	–0.0684	0.0221
M2(–5)	–0.0398	–0.2230	–0.0437
Defl(–1)	0.3870**	0.0487	0.4909***
Defl(–2)	0.1111	0.4542***	0.1684
Defl(–3)	0.1398	0.4924***	0.0983
Defl(–4)	–0.0105	0.1324	0.0148
Defl(–5)	–0.1791	0.0979	–0.2351

Note: *** and ** imply significance at 1% and 5% respectively.

The most striking feature of Table 2 is the coefficient of correlation of the third lag of income in M2. The magnitude and significance of the coefficient is relatively high implying that money is highly affected by the level of income three years back. In fact, money seems to be significantly affected by the second and third lags of income as well as of prices. On the other hand, income and prices do not seem to be affected by the lags of money. This suggests a one-way causation from income and prices to money. Both income and prices seem to be affected by their own first lags as well as by the first lag of the other variable.

4. Empirical Results

A formal investigation of causal relations was carried out with the help of co-integration and error correction model framework. At the first step, the variables used in the analysis were tested for unit roots by applying both the ADF and PP tests. The results are reported in Table 1 in the Appendix, which indicate that the variables are integrated of order one [I (1)]. We now proceed to examine the relation of money with income and prices.

4.1 Money and Income

The bi-variate causal relationship between money and income is presented in Table 3. Co-integrating regression is estimated to examine the long-run relationship.

TABLE 3
Causal Relation between Money and Income

	Co-integration (Engle-Granger)					
	Const.	*Coeff.*	*DW*	*ADF*	*PP(l = 3)*	*PP(l = 9)*
M on Y	–1.1001***	1.0156***	0.2398	–1.8588*	–1.5245	–1.4510

Conclusion: Weak evidence of co-integration

Error Correction Causality			*Granger Causality*		
Lag 2	*DY*	*DM*	*Lag 2*	*DY*	*DM*
e(–1)	–0.0368	–0.2010*			
DY(–1)	0.5201**	–0.3109	DY(–1)	0.495***	–0.196
DY(–2)	–0.0116	0.1245	DY(–2)	–0.06	0.401**
DM(–1)	0.0845	0.2080	DM(–1)	0.115	0.261
DM(–2)	0.0191	–0.0165	DM(–2)	–0.009	–0.052
F-Value	0.1815	1.0607	F-Value	0.371	2.346

Conclusion: Weak evidence of uni-directional causality from income to money.

Note: ***, **, * imply significance at 1%, 5% and 10% respectively.

Applying the PP test in co-integrating regression rejects any long-run relation between money and income. However, the application of the ADF test indicates a long-run relation between these variables at 10 per cent level of significance. Hence, we can say that there is weak evidence of any long-run relation between money and income. The error correction equations verify the weak long-run relation where the error term is significant at 10 per cent in the money equation. The equations indicate weak evidence of uni-directional causality from income to money in the long run with no short-run causal effects. Granger equations show the evidence of income affecting money at the second lag although the F-test is not statistically significant. Since the lagged correlations in Table 2 also show the significant effects of income on money at the second and third lags we

do the analysis for the third lag too. The results show that the error term in error correction equations has become insignificant implying no long-run relation between money and income (Appendix Table 2). The equations further show the significant effects of income on money at the third lag that was verified by F-value. The same result is shown by the Granger equations if we ignore the error term.

In general, the analysis indicates uni-directional causality from income to money in Pakistan supporting the Keynesians' point of view. The analysis also shows persistent evidence of income affected by its own first lag as well as affecting money at the second and/or third lags. It seems that income takes one year to adjust it self and starts affecting money in the second and third years.

4.2 Money and Prices

Table 4 elaborates the bi-variate causality between money and prices in the context of the error correction model.

TABLE 4
Causal Relation between Money and Prices

	Co-integration (Engle-Granger)					
	Const.	*Coeff.*	*DW*	*ADF*	*PP(l = 3)*	*PP(l = 9)*
M on P	3.8497***	1.6967***	0.3515	–3.6957***	–2.6873***	–2.4772**

Conclusion: Strong evidence of co-integration.

	Error Correction Causality	
Lag 2	*DP*	*DM*
c(–1)	–0.3139***	–0.0714
DP(–1)	0.5895***	–0.3492
DP(–2)	0.2160	0.4964*
DM(–1)	0.1626	0.1672
DM(–2)	0.0029	0.0451
F-Value	0.8978	2.4457*

Conclusion: Uni-directional from money to prices in the long run.
In the short run, from prices to money at 2-year lag.

Note: ***, **, * imply significance at 1%, 5% and 10% respectively.

The existence of a long-run relationship between money and prices in Pakistan emerged by applying both the ADF and PP tests. The error correction equations suggest uni-directional causality from money to prices in the long run. However, in the short run there is evidence of prices affecting money at the second lag although F-value is not significant. Once again as in the case of income we do the analysis for the third lag because the lagged correlations in Table 2 indicate significant effects of prices on money at the second and third lags. The result

when the PP test was applied (at 10 per cent level of significance). Hence we can say that there exists a long-run relation among money, income and prices in Pakistan. The error correction equations show the causal relationship between money and income conditional on the presence of prices. Similarly, the equations in the bottom part show the causal relationship between money and prices conditional on the presence of income.

As in the case of bi-variate causality, this analysis indicates weak evidence of uni-directional causality from income to money in the long run. In the short run there seems to be no causal relations between money and income although prices appear to affect money at the second lag. It is interesting to note that the second and third lags of income, affecting money in bi-variate analysis, have now become insignificant. On the other hand, when we introduced income in the money-prices causality we found a bi-directional causality between money and prices in the long run. Although the evidence of feedback from prices to money is weak in the short run, prices affect money at a two-year lag.

5. Summary and Conclusions

The analysis of data indicates that the overall expansion in money and income seems to be close to each other suggesting a possible association between the two. Lagged correlations, Granger causality tests and the error correction models verify the significant effect of income on money at the second and third lags. The co-integration analysis indicates weak evidence of a long-run relation between money and income. The causality analysis also shows weak evidence of uni-directional causality from income to money in the long run. In the short run there is considerable evidence of income affecting money after two and three years. However, in a tri-variate framework when prices are introduced into the analysis, these short-run effects disappear. The long-run effects remain the same. The persistent evidence, although weak, of uni-directional causality from income to money suggests that probably real factors rather than money supply have played a major role in the growth of national income in Pakistan.

The expansion in prices is well below the expansion in income and money. Therefore, it can be inferred that there exists a disproportional relation between money and prices in Pakistan. Regarding the relationship between money and prices, the results show a strong relationship between the two in the long run. The bi-variate analysis indicates a uni-directional causality from money to prices in the long run. In the short run, prices affect money at two-year's lag. The two-year lag effect remains in the tri-variate framework when income is introduced into the analysis. However, in the long run the results show a bi-directional causality between money and prices although the evidence of feedback from prices to money is weak. In general, the two variables seem to affect each other indicating that monetary expansion causes, and is also caused by, inflation in Pakistan.

APPENDIX TABLE 1
Unit Root Tests

(ADF)	*Levels*		*First Difference*	
	W/O Trend	*W. Trend*	*W/O Trend*	*W. Trend*
Money (M)	0.3143	–3.5065	–5.0124**	–4.4882**
Income (Y)	–0.3986	–1.4550	–3.6614**	–3.7112**
Prices (P)	0.0893	–2.5628	–3.5485**	–3.5577**

(PP)

	Levels		*First Difference*	
W/O Trend	*(l = 3)*	*(l = 9)*	*(l = 3)*	*(l = 9)*
Money (M)	0.844	1.021	–5.014**	–4.888**
Income (Y)	–0.151	–0.162	–3.612**	–3.540**
Prices (P)	0.487	0.469	–3.489**	–3.309**

(PP)

	Levels		*First Difference*	
W Trend	*(l = 3)*	*(l = 9)*	*(l = 3)*	*(l = 9)*
Money (M)	–2.600	–2.433	–5.006**	–4.852**
Income (Y)	–1.788	–1.992	–3.553*	–3.457*
Prices (P)	–2.779	–2.727	–3.488*	–3.295*

Note: The truncation lag parameters in PP are determined following Schwert's (1987).
** and * imply significance at 5% and 10% respectively.

APPENDIX TABLE 2
Causal Relation between Money and Income

Error Correction Causality			*Granger Causality*		
Lag 3	*DNY*	*DNM*	*Lag 3*	*DNY*	*DNM*
c(–1)	0.0655	–0.0754			
DNY(–1)	0.5692**	–0.1587	DNY(–1)	0.504***	–0.097
DNY(–2)	–0.0685	–0.0045	DNY(–2)	–0.115	0.097
DNY(–3)	0.2093	0.5591**	DNY(–3)	0.15	0.520**
DNM(–1)	0.0202	0.0339	DNM(–1)	0.061	0.104
DNM(–2)	0.0487	0.0167	DNM(–2)	0.019	0.022
DNM(–3)	–0.0953	–0.0253	DNM(–3)	–0.111	–0.056
F-Value	0.1482	2.5031*	F-Value	0.288	4.034**

Conclusion: Uni-directional causality from income to money at 3-year lag.

Note: ***, **, * imply significance at 1%, 5% and 10% respectively.

References

ABBAS, KALBE (1991), 'Causality Test between Money and Income: A Case Study of Selected Developing Asian Countries (1960–1988)', *The Pakistan Development Review*, 30(4): 919–29.

AHMED, MUDABBER (2003), 'Money-Income and Money-Price Causality in Selected SAARC Countries: Some Econometric Exercises', *The Indian Economic Journal*, 50: 55–62.

BARTH, J. and J. BANNETT (1974), 'The Role of Money in the Canadian Economy: An Empirical Test', *Canadian Journal of Economics*, 7: 306–11.

BENGALI, K., A. KHAN and M. SADAQAT (1999), 'Money, Income, Prices and Causality: The Pakistani Experience', *Journal of Developing Areas* 33(4): Summer: 503–14.

BRILLEMBOURG, A. and M. KHAN (1979), 'The Relationship between Money, Income, and Prices: Has Money Mattered Historically?', *Journal of Money, Credit, and Banking*, 11(3), August: 358–65.

DYREYES, F., D. STARLEAF and G. WANG (1980), 'Test of Direction of Causation between Money and Income in Six Countries', *Southern Economic Journal*, 47(2), October: 477–87.

GOVERNMENT OF PAKISTAN (1998), *50 Years of Pakistan in Statistics*. Islamabad: Federal Bureau of Statistics.

——— (various issues), *Economic Survey*. Ministry of Finance.

——— (various issues), *Monthly Statistical Bulletin*. State Bank of Pakistan.

HO, YAN-KI (1982), 'A Trivariate Stochastic Model for Examining the Cause of Inflation in a Small Open Economy: Hong Kong', *The Developing Economies*, 48, September: 301–4.

JOSHI, K. and S. JOSHI (1985), 'Money, Income, and Causality: A Case Study for India', *Arthavikas*.

KHAN, A. and A. SIDDIQUI (1990), 'Money, Prices and Economic Activity in Pakistan: A Test of Causal Relation', *Pakistan Economic and Social Review*, 28(2): 121–36.

LEE, S. and W. LI (1983), 'Money, Income, and Prices and their Lead-Lag Relationship in Singapore', *Singapore Economic Review*, 28 April: 73–87.

PHILLIPS, R. and P. PERRON (1988), 'Testing for a Unit Root in Time Series Regression', *Biometrika*, June, 335–46.

SCHWERT, W. (1987), 'Effects of Model Specification on Tests for Unit Roots in Macroeconomic Data', *Journal of Monetary Economics*, 20(1), July: 73–103.

SIMS, C. (1972), 'Money, Income, and Causality', *American Economic Review*, 62, September: 540–52.

WILLIAMS, W., C. GOODHART and D. GOWLAND (1976), 'Money, Income, and Causality: The U.K. Experience', *American Economic Review*, 66(3), June: 417–23.

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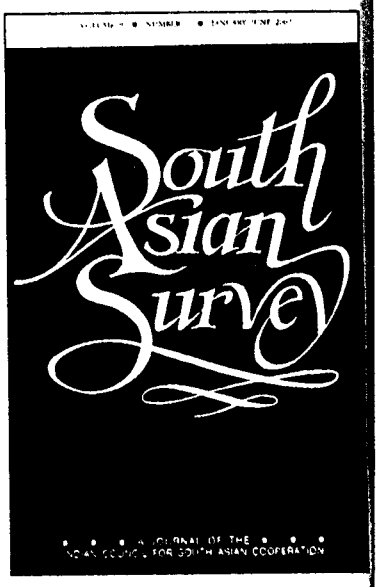

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