ECONOMIC LIBERALIZATION AND THE CAUSAL RELATIONS AMONG MONEY, INCOME, AND PRICES:
The case of Pakistan

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This study re-examines the causal relations between money and the two variables, i.e., income and prices. Using annual data from 1959-60 to 2003-04, examining the stochastic properties of the variables used in the analysis, and taking care of the shifts in the series due to the start of the economic liberalization program in the early 1990s, we investigate the causal relations between real money and real income, nominal money and nominal income, and nominal money and prices. The analysis indicates, in general, the long run relationship between the money, income, and prices. The analysis further suggests a one way causation from income to money in the long run implying that real factors rather than money supply has played a major role in increasing Pakistan's national income. The study fails to find the active role of money in changing income even after taking care of possible shifts in these variables due to economic reforms. As regards the causal relationship between money and prices, the analysis suggests a uni-directional causality from money to prices, implying that monetary expansion increases inflation in Pakistan.

I. Introduction

Money, Income, and Prices are important macroeconomic variables playing crucial role in any economy. There has been a long debate regarding their role in economics, particularly, the role of money in determination of income and prices. According to Monetarists, money plays an active role and leads to changes in income and prices. In other words, changes in income and prices in an economy are mainly caused by changes in the money stocks, i.e., the direction of causation runs from money to income and prices without any feedback. Contrary, Keynesians argues that money does not play an active role in changing income and prices. In fact, income plays the leading role in changing money stocks via demand for money, implying that the direction of causation runs from income to money without any feedback. Similarly, changes in prices are mainly caused by structural factors.

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Empirically, the two opposite views led the economists to test the causal relation of money with income and prices.

In this context, Sims (1972) developed a test of causality based on Granger approach and applied it to the U.S. data to examine the causal relation between money and income. He found the evidence of a uni-directional causality from money to income, as claimed by the Monetarists.

However, the subsequent studies on the issue did not support Sims' findings. In fact, Williams, Goodhart, and Gowland (1976) applying Sims procedure in the U.K. found a uni-directional causality from income to money, which is opposite to Sims' findings. They also found the evidence of a uni-directional causality from money to prices. Similarly, Barth and Bennett (1974), replicating Sims test in the Canadian economy, Lee and Li (1983), investigating causality among money, income, and prices in Singapore, Joshi and Joshi (1985), examining causality between money and income in India, etc., found the evidence of a bi-directional causality between income and money. Lee and Li (1983), also found a uni-directional causality from money to prices. On the other hand Brillembourg and Khan (1979), using a longer data set supported Sims' findings and found a uni-directional causality from money to income and prices in the U.S. However, Dyreyes, Starleaf, and Wang (1980), examining the pattern of causality between money and income for six industrialized countries, found a bi-directional causality in the U.S., contrary to Sims (1972), and Brillembourg and Khan (1979). Similarly, they found a uni-directional causality from money to income in Canada, contrary to Barth and Bannett (1974).

The Pakistani Evidence

The above discussion clearly indicate that empirical evidence regarding causal relations of money with income and prices remain inconclusive. The situation is not different in the case of Pakistan. For example, Khan and Siddiqui (1990) found uni-directional causality from income to money and bi-directional between money and prices. On the other hand, Bengali, Khan, and Sadaqat (1999) found a bi-directional causality between money and income, and uni-directional from money to prices. Abbas (1991) performng the causality test in the Asian countries found a bi-directional causality between money and income in Pakistan. Jones and Khilji (1988), analysed causal relationship between money and prices in Pakistan and found evidence of a bi-directional causality with money supply leading, while Siddiqui (1990) found a bi-directional causality between the two with prices leading. However, Hussain (2006), found the evidence of weak or breakdown of relationship between money and prices indicating adoption of an alternative strategy for the conduct of monetary policy in Pakistan.

In a multivariate framework, Ahmed (2003) investigating the causal relations among money, interest rates, prices, and output in the SAARC countries found a

bi-directional causality between money and prices in Bangladesh and Pakistan. Moreover, Ahmed's results indicate the interest rate to be a good policy variable in Bangladesh and Pakistan, and money supply in India. Similarly, Abbas and Husain (2006) used the tri-variate causality analysis among money, income, and prices and found a uni-directional causality from income to money and bi-directional between money and prices with money supply leading.

This study also attempts a comprehensive investigation of the causal relation between money and the other two variables: income and prices in Pakistan. Specifically, we investigate the causal relations between real money and real income, between nominal money and nominal income, and between nominal money and prices. In this context, we use a large data set from 1959-60 to 2003-04. Further, we take care of the stochastic properties of the variables used in the analysis and also the expected shifts in the variables due to the start of the economic reforms in early 1990s.

The rest of the paper is organized as follows. Section II discusses the data and outlines the methodology to test the stochastic properties of the variables and their interrelationship. Section III presents the descriptive statistics regarding money, income, and prices, as well as the relationship among these variables. Sections IV, V, and VI examine causal relations between real money and real income, nominal money and nominal income, and nominal money and prices, respectively. Finally, Section VII presents summary and conclusions of the study.

II. Data and Methodology

In this study the annual data from 1959-60 to 2003-04, is used to investigate the causal relations of money with income and prices in Pakistan, and to take care of the economic liberalization program started in the early 1990s, the sample is further classified into two sub-samples. Various measures aimed to move towards market-based economy have had, in general, significant impacts on the economy. Hence, Sample-1, from 1959-60 to 1990-91, covers the period prior to the start of the liberalization program whereas, Sample-2, from 1991-92 to 2003-04 represents the post-liberalization period. Similarly, in the regression analysis we include a dummy from 1991-92 onwards, to take care of the possible shift in relations among variables due to the economic liberalization program.

Gross National Product (GNP) at current prices and constant prices of 1980-81 are used as nominal and real incomes. Similarly, broad measure of money (M2) and GDP deflator with base 1980-81 are used as Money and Prices, respectively. Finally, real money is obtained by deflating M2.[1]

[1] The principal data source is the National Accounts of Pakistan, prepared by the Federal Bureau of Statistics. The other data source include Economic Surveys by the Finance Division, and Annual Reports by Central Bank, the State Bank of Pakistan.

We start by presenting the descriptive statistics that show the basic characteristics of the variables used in the analysis. An easy and quick way to know the relation between the two variables is to see the correlation coefficient. Similarly, the lagged correlations provide some indications regarding causal relations. Then the two correlations are reported. The formal investigation starts by examining stochastic properties of variables used in the analysis. Hence, to test the stationarity of the variables the Unit Root Test is performed on the variables. In this context, the widely used Augmented Dickey Fuller (ADF) is used. We also use Phillips-Perron (PP) tests, robust to a wide variety of serial correlation and heteroskedasticity, where the truncation lag parameters are determined, following Schwert's (1987). Next, the Engle-Granger Co-integration test is applied to explore the long run relations among the variables. Finally, the causal relationships between these variables are examined through Granger causality and/or Error Correction Models (ECM). In all cases, lag lengths are decided on the basis of minimum Final Prediction Error (FPE) and Akaike Information Criteria (AIC).

III. Money, Income, and Prices in Pakistan

The descriptive statistics of the variables used in the analysis is presented in Table 1. The table indicates that nominal money has increased over time with an average annual expansion of around 13 per cent closely followed by nominal income that has expanded by about 12.5 per cent. On the other hand, prices increased by around 7 per cent making the real money and real income to expand by around 6 per cent and 5.5 per cent, respectively. The table also shows that the money growth variables are more volatile. It may be noted that the real money growth is the most volatile variable, whereas, the real income growth is the least volatile variable.

The table also shows the descriptive statistics for the two sub-samples. Moreover, the tests for equality of means and variances between the two sub-samples are conducted. The results indicate no significant differences in the means except in the case of real income that has gone down in the second sub-sample. On the other hand, the variances in the growth in real money and prices reduced significantly in the second sub-sample.

A preliminary indication regarding relations among money, income, and prices, can be found by looking at the correlation coefficients. Table 2 reports the coefficients showing correlations between the variables expressed in growth terms. It can be seen that nominal money is not significantly correlated with either nominal income or prices in the full sample as well as in the first sub-sample. In the post liberalization period, however, nominal money has become significantly correlated with nominal income but not with prices. The high increase in correlation coefficients of nominal money with nominal income and prices in the second period can

TABLE 1

Descriptive Statistics for Growth in Money, Income, and Prices

	Real Money	Nominal Money	Real Income	Nominal Income	Prices
Full Sample: (1960-61 – 2003-04)					
Mean	0.0605	0.1325	0.0540	0.1262	0.0720
Std. Dev.	0.0697	0.0541	0.0242	0.0491	0.0499
Observations	44	44	44	44	44
Pre-liberalization: (1960-61 – 1990-91)					
Mean	0.0590	0.1292	0.0601	0.1304	0.0702
Std. Dev.	0.0781	0.0576	0.0231	0.0540	0.0555
Observations	31	31	31	31	31
Post-liberalization: (1991-92 – 2003-04)					
Mean	0.0640	0.1404	0.0393	0.1161	0.0764
Std. Dev.	0.0466	0.0457	0.0209	0.0348	0.0343
Observations	13	13	13	13	13
Equality of Means and Variances					
Mean (t-value)	0.2631	0.6852	2.9226**	1.0495	0.4486
Variances (F)	2.8075**	1.5860	1.2231	2.4096	2.6262**

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

be seen. Similarly, high correlation between nominal income and prices, although it has gone down in the second period, can also be noted. On the other hand, real money and real income have always been significantly correlated. Here too, the coefficient has gone up in the second period.

To look at the lagged correlations between variables (in growth terms) we now proceed to see whether money, income and prices are affected by the lagged values of their own, as well as of one another. These are shown in Table 3 for up to five period lags. The table indicate that real variables are neither affected by the lagged values of their own nor by those of the other variables. These two variables seem to be correlated only at the current level, as shown in Table 2. However, this is not the case in nominal variables where significant lagged correlations exist. The most striking feature of the table is the coefficient of correlation of the third lag of

TABLE 2

Correlations Among Money, Income, and Prices (in growth terms)

			Full Sample: (1960-61 – 2003-04)			
	NM	NY	DF		RM	RY
NM	1.0000			RM	1.0000	
NY	0.2502	1.0000		RY	0.4500***	1.0000
DF	0.1015	0.8870***	1.0000			
			Pre-liberalization: (1960-61 – 1990-91)			
	NM	NY	DF		RM	RY
NM	1.0000			RM	1.0000	
NY	0.1938	1.0000		RY	0.4810***	1.0000
DF	0.0477	0.9225***	1.0000			
			Post-liberalization: (1991-92 – 2003-04)			
	NM	NY	DF		RM	RY
NM	1.0000			RM	1.0000	
NY	0.6280**	1.0000		RY	0.6517***	1.0000
DF	0.3491	0.7916***	1.0000			

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

nominal income in nominal money. The coefficient is amazingly high implying that money is highly affected by three years back level of income. In fact, money seems to be significantly affected by the 2nd and 3rd 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 seems to be affected by their own 1st lags as well as by the 1st lag of the other variable. The two variables are also highly correlated at the current level as shown in Table 2.

The lagged correlations in the two sub-samples are reported in Table 4. It can be seen that the pattern of lagged correlations in the first sub-sample is exactly similar to that of the full sample, i.e., the significant effects of the 2nd and 3rd lags of income and prices on money, without any feedback, indicating a one-way causation from income and prices to money. However, in the second sub-sample representing

TABLE 3

Lagged Correlations Among Money, Income, and Prices (in growth)

	NY	NM	DF		RY	RM
		Full Sample: (1960-61 – 2003-04)				
NY(-1)	0.4828***	0.0857	0.5667***	RY(-1)	0.0199	0.0711
NY(-2)	0.1917	0.3298**	0.2029	RY(-2)	0.2264	-0.2889
NY(-3)	0.1919	0.5740***	0.0964	RY(-3)	0.1148	0.0411
NY(-4)	0.0375	0.1097	-0.0065	RY(-4)	0.1324	-0.0158
NY(-5)	-0.0797	0.0926	-0.1852	RY(-5)	0.1490	-0.1105
NM(-1)	0.2139	0.2489	0.2142	RM(-1)	0.1226	0.2390
NM(-2)	0.1083	0.0845	0.0937	RM(-2)	0.0363	-0.1597
NM(-3)	-0.0451	0.1125	-0.0356	RM(-3)	-0.1455	-0.1319
NM(-4)	-0.0433	-0.0684	0.0221	RM(-4)	-0.1370	-0.1161
NM(-5)	-0.0398	-0.2230	-0.0437	RM(-5)	-0.0892	-0.2761
DF(-1)	0.3870**	0.0487	0.4909***			
DF(-2)	0.1111	0.4542***	0.1684			
DF(-3)	0.1398	0.4924***	0.0983			
DF(-4)	-0.0105	0.1324	0.0148			
DF(-5)	-0.1791	0.0979	-0.2351			

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

TABLE 4

Lagged Correlations Among Money, Income, and Prices

	NY	NM	DF		RY	RM
Pre-liberalization: (1960-61 – 1990-91)						
NY(-1)	0.4747**	0.0042	0.5890***	RY(-1)	-0.2614	0.0634
NY(-2)	0.1473	0.4657**	0.1157	RY(-2)	0.1313	-0.3779
NY(-3)	0.1540	0.7445***	0.0041	RY(-3)	-0.1622	0.1026
NY(-4)	0.0201	0.2047	-0.0370	RY(-4)	0.1458	-0.0069
NY(-5)	-0.0289	0.2400	-0.1920	RY(-5)	0.0250	-0.0333
NM(-1)	0.1611	0.1599	0.1397	RM(-1)	0.1401	0.2431
NM(-2)	0.0275	-0.0107	-0.0451	RM(-2)	0.0019	-0.2439
NM(-3)	-0.1579	0.2149	-0.2150	RM(-3)	-0.2256	-0.0884
NM(-4)	-0.0702	0.0041	-0.0501	RM(-4)	-0.2031	-0.0970
NM(-5)	-0.0231	-0.1636	-0.0887	RM(-5)	-0.1428	-0.2576
DF(-1)	0.4041**	-0.0217	0.4789**			
DF(-2)	0.1314	0.6420***	0.1115			
DF(-3)	0.2005	0.6463***	0.0522			
DF(-4)	0.0463	0.2422	0.0031			
DF(-5)	-0.0658	0.2302	-0.2027			
Post-liberalization: (1991-92 – 2003-04)						
NY(-1)	0.3703	0.4613	0.4303	RY(-1)	0.1113	0.3197
NY(-2)	0.2047	-0.1033	0.6084	RY(-2)	-0.2817	0.1723
NY(-3)	0.2785	-0.0340	0.6002	RY(-3)	0.1025	0.0194
NY(-4)	-0.0286	-0.3273	0.0494	RY(-4)	0.2987	0.1810
NY(-5)	-0.5378	-0.5520	-0.2630	RY(-5)	-0.3359	-0.3991
NM(-1)	0.5500	0.5548	0.5650	RM(-1)	0.1387	0.2089
NM(-2)	0.3653	0.3252	0.4930	RM(-2)	0.2257	0.4301
NM(-3)	0.3229	-0.2207	0.6013	RM(-3)	-0.0911	-0.3977
NM(-4)	0.0732	-0.3262	0.2991	RM(-4)	-0.1838	-0.1980
NM(-5)	-0.0253	-0.4722	0.1657	RM(-5)	-0.0848	-0.3750
DF(-1)	0.3552	0.2984	0.4749			
DF(-2)	0.1064	-0.3350	0.4518			
DF(-3)	0.0306	-0.2373	0.4006			
DF(-4)	-0.1722	-0.4934	-0.0177			
DF(-5)	-0.5062	-0.4782	-0.5574			

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

the post liberalization period the lag effects of income and prices on money disappear. In fact, in this period money and income[2] are correlated at the current level.

It can be concluded from the correlation analysis that prior to start of the economic reforms, money used to play a passive role. Both income and prices appear to take one year to adjust and then start affecting money in the second and third years. In this context, income and prices also appear to affect each other in the first year. The similar pattern of correlations of income and prices with money may also be due to the correlation between income and prices that has always been high. It seems that, with the start of economic reforms the feedback mechanism from money to income has started as implied by the significant correlation between the two at current level (see Table 2).

Casual Relations

The formal investigation of causal relations is done within the Co-integration and Error Correction Model framework. In the first step, the variables used in the analysis are tested for the unit roots by applying both the Augmented Dickey Fuller (ADF) and the Phillips Perron (PP) tests. The results are reported in Table 5 which indicate that the variables are, in general, first differenced stationary, i.e., I(1).

The investigation for causal relation between the two variables starts by estimating the co-integrating regression suggested by Engle-Granger. If co-integration is found, the Error Correction Models are estimated, other wise, the Granger causality equations are estimated. The next three sections investigate the causal relations between real money and real income, nominal money and nominal income, and nominal money and prices.

IV. Causality between Real Money and Real Income

Looking at the causal relation between the real variables, i.e., real money and real income. The results are reported in Table 6(a). It can be seen that the ADF and PP tests in co-integrating regression are insignificant, rejecting any long run relation between real money and real income. Similarly, the F-values in the Granger equations are insignificant, rejecting any short run causal relation between the two real variables. This suggests that real money and real income are independent of each other, both in the short and long runs. However, this result has serious implications indicating that it is futile to estimate money demand function where real income is one of the important factors in determining the demand for real money. The results seems to be affected by possible shifts in variables. We now proceed to analyse those shifts due to economic reforms undertaken in the country.

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[2] as shown in Table 2.

TABLE 5

Unit Root Tests for Money, Income, and Prices

A D F				
	Levels		First Difference	
	W/O Trend	W. Trend	W/O Trend	W. Trend
Real Money	-0.4896	-3.3034	-4.9573**	-4.3652**
Real Income	-2.8367	-1.0063	-6.1195**	-6.6659**
Nominal Money	0.3143	-3.5065	-5.0124**	-4.4882**
Nominal Income	-0.3986	-1.4550	-3.6614**	-3.7112**
Prices	0.0893	-2.5628	-3.5485**	-3.5577**

PP (W/O Trend)				
	Levels		First Difference	
	(l=3)	(l=9)	(l=3)	(l=9)
Real Money	-0.214	-0.103	-4.886**	-4.763**
Real Income	-3.104**	-2.930**	-6.211**	-6.745**
Nominal Money	0.844	1.021	-5.014**	-4.888**
Nominal Income	-0.151	-0.162	-3.612**	-3.540**
Prices	0.487	0.469	-3.489**	-3.309**

PP (W. Trend)				
	Levels		First Difference	
	(l=3)	(l=9)	(l=3)	(l=9)
Real Money	-2.540	-2.152	-4.823**	-4.682**
Real Income	-0.457	-0.556	-7.325**	-7.290**
Nominal Money	-2.600	-2.433	-5.006**	-4.852**
Nominal Income	-1.788	-1.992	-3.553*	-3.457*
Prices	-2.779	-2.727	-3.488*	-3.295*

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

TABLE 6(a)

Causality Between Real Money and Real Income

Cointegration (Engle-Granger)					
	Const.	Coeff.	ADF	PP(1=3)	PP(1=9)
RM on RY	-1.3446***	1.0350***	-1.0916	-1.3868	-1.3578

Conclusion: No Cointegration.

Granger Causality			Granger Causality		
Lag 1	DRY	DRM	Lag 3	DRY	DRM
DRY(-1)	-0.0324	-0.1149	DRY(-1)	-0.1317	-0.3483
DRM(-1)	0.0588	0.2704	DRY(-2)	0.2671	-0.7314
F-Value	0.9173	0.0545	DRY(-3)	0.3207	0.7292
			DRM(-1)	0.0863	0.3942*
			DRM(-2)	-0.0123	-0.0885
			DRY(-3)	-0.916	-0.1173
			F-Value	1.3129	1.3281

Conclusion: No Short run Causality.

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

Shifts in Real Money and Real Income due to Reforms

To analyse the shift in real variables due to the economic reforms that started in the early 1990s, we introduce a dummy variable in the analysis that takes the value of one from 1991-92 onwards. The results, reported in Table 6(b), show the dummy variable in the co-integrating regression to be significant, implying significant shift in the relation between real money and real income. Moreover, the ADF and PP tests are now significant at 5 per cent level of significance, indicating the existence of a long run relation between the real variables. The error term in money equation is significant at 10 per cent verifying, although weak, the long run relation. The equations indicate a uni-directional causality from real income to real money in the long run and thus provides basis for estimating the money demand function. In the short run, however, the two real variables still seem to be independent of each other. It can also be seen that real money is affected by its own first lag, a result not supported by the correlation analysis.

Table 6(b)

Causality between Real Money and Real Income (reforms)

	Const.	D	Coeff.	ADF	PP(l=3)	PP(l=9)
Cointegration (Engle-Granger)						
RM on RY	0.1372	0.2691***	0.9110***	-2.0610**	-2.3168**	-2.1077**

Conclusion: Existence of Cointegration.

Error Correction Causality			Error Correction Causality		
Lag 1	DRY	DRM	Lag 2	DRY	DRM
D	-0.0254**	0.0102	D	-0.0281**	-0.0298
e(-1)	0.0267	-0.2704*	E(-1)	0.0349	-0.2668*
DRY(-1)	-0.3365	-0.2124	DRY(-1)	-0.3708	-0.6079
DRM(-1)	0.1101	0.3796*	DRY(-2)	-0.0755	-1.1817
F-Value	2.8269	0.1221	DRM(-1)	0.1106	0.4370**
			DRM(-2)	0.0386	0.0860
			F-Value	1.4373	1.4613

Conclusion: Unidirectional Causality from Income to Money in the long run.
            No Short run Causality.

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

V. Causality between Nominal Money and Nominal Income

The causal relation between nominal money and nominal income is investigated here and the first set of results reported in Table 7(a). It can be seen that the PP tests in the co-integrating regression are insignificant rejecting any long run relations between the two nominal variables. However, the ADF test is significant at 10 per cent level of significance. Hence, we can say that there is a weak evidence of any long run relation between the variables. The Error Correction equations verify the weak long run relation where the error term is significant at 10 per cent in money equation. The equations indicate a weak evidence of uni-directional causality from nominal income to nominal money in the long run with no short run causal effects. If we assume no co-integration between the nominal variables the Granger equations shows evidence of income affecting money at the 2nd lag, although the F-test is not statistically significant.

TABLE 7(a)

Causality between Nominal Money and Nominal Income

Cointegration (Engle-Granger)

	Const.	Coeff.	ADF	PP(l=3)	PP(l=9)
NM on NY	-1.1001***	1.0156***	-1.8588*	-1.5245	-1.4510

Conclusion: weak evidence of Cointegration.

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

Conclusion: Weak Evidence of Unidirectional Causality from income to money.

Error Correction Causality			Granger Causality		
Lag 3	DNY	DNM	Lag 3	DNY	DNM
e(-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: Unidirectional Causality from income to money at 3 years lag.

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

Since the lagged correlations in Table 3 also shows the significant effects of income on money at the 2nd and 3rd lags we also do the analysis for the 3rd lag. The results show that the error term in Error Correction equations has become insignificant implying no long run relation between money and income. The equations further shows the significant effects of income on money at the 3rd lag verified by F-value. Same result is shown by Granger equations, if we ignore the error term. Hence, there is evidence of a one-way causation from nominal income to nominal money, although the existence of a long run relation between the two nominal variables is not clear. There is also a persistent evidence of nominal income affected by its own first lag, as well as affecting nominal money at the 3rd lag, and thus, verifying the results shown by the lagged correlations.

Shifts in Nominal Money and Nominal Income due to Reforms

The results of the analysis of shifts in nominal variables due to the economic reforms are reported in Table 7(b). The co-integrating regression shows significant shift in relation between nominal money and nominal income. It also indicate the existence of a long run relation between the nominal variables as the ADF and PP tests, which are now significant at 5 per cent level of significance. However, the long run relation is not verified by the Error Correction Model where the error term is not significant in both the equations, even at the 10 per cent level of significance. The error term in money equation is significant at 11 per cent which may be considered as a weak evidence of a uni-directional causality from nominal income to nominal money in the long run. Assuming no co-integration, as in the previous case, the Granger equations show the evidence of income affecting money at the 2nd lag with F-test, not statistically significant. Similarly, the analysis for the 3rd lag provides the same result, that is, income affecting money at three years lag. Hence, there is persistent evidence of income affected by its own first lag and affecting money at the third lag, without any feed back from money.

VI. Causality between Nominal Money and Prices

Finally, we investigate the causal relation between nominal money and prices. The first set of results is reported in Table 8(a). The ADF and PP tests are highly significant indicating the existence of a long run relation between money and prices in Pakistan. The error correction equations suggest a uni-directional causality from money to prices in the long run, and thus, support the monetarists preposition. In the short run, the two variables seem to be independent of each other. There is, however, some evidence of prices affecting money at the 2nd lag. Once again, as in the case of nominal income, we do the analysis for the 3rd lag because the lagged correlations in Table 2 indicate the significant effects of prices on money at the 2nd

Table 7(b)

Causality between Nominal Money and Nominal Income (reforms)

	Cointegration (Engle-Granger)					
	Const.	D	Coeff.	ADF	PP(l=3)	PP(l=9)
NM on NY	-0.4596***	0.2896***	0.9581***	-2.1835**	-2.4117**	-2.1568**

Conclusion: *Evidence of Cointegration.*

Error Correction Causality			Granger Causality		
Lag 2	DNY	DNM	Lag 2	DNY	DNM
D	-0.0158	-0.0037	D	-0.0151	0.00
e(-1)	-0.1744	-0.3066			
DNY(-1)	0.5306**	-0.3211	DNY(-1)	0.4786***	-0.1872
DNY(-2)	0.1561	-0.0023	DNY(-2)	-0.0742	0.4085**
DNM(-1)	0.1022	0.2038	DNM(-1)	0.1238	0.2565
DNM(-2)	0.0330	-0.0178	DNM(-2)	0.0091	-0.062
F-Value	0.3013	0.9704	F-Value	0.4551	2.3654

Conclusion: *Weak Unidirectional Causality from Income to Money in the long run.*
            No Short run Causality.

Error Correction Causality			Granger Causality		
Lag 3	DNY	DNM	Lag 3	DNY	DNM
D	-0.0044	0.0165	D	-0.0144	0.0120
e(-1)	-0.3833	0.0494			
DNY(-1)	0.6903***	-0.0509	DNY(-1)	0.4839***	-0.0799
DNY(-2)	0.2349	0.1248	DNY(-2)	-0.1239	0.1045
DNY(-3)	0.4314	0.7006**	DNY(-3)	0.1388	0.5300**
DNM(-1)	-0.0252	-0.0071	DNM(-1)	0.0721	0.0948
DNM(-2)	0.0568	0.0060	DNM(-2)	0.0316	0.012
DNM(-3)	-0.0505	-0.0267	DNM(-3)	-0.1018	-0.0633
F-Value	0.0753	2.7024*	F-Value	0.2851	4.1219**

Conclusion: *Unidirectional Causality from income to money at 3 years lag.*

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

TABLE 8(a)

Causality between Nominal Money and Prices

	Const.	Coeff.	ADF	PP(l=3)	PP(l=9)
	Cointegration (Engle-Granger)				
NM on DF	3.8497***	1.6967***	-3.6957***	-2.6873***	-2.4772**

Conclusion: Evidence of Cointegration.

Error Correction Causality

Lag 2	DDF	DNM
e(-1)	-0.3139***	-0.0714
DDF(-1)	0.5895***	-0.3492
DDF(-2)	0.2160	0.4964*
DNM(-1)	0.1626	0.1672
DNM(-2)	0.0029	0.0451
F-Value	*0.8978*	*2.4457*

Conclusion: Unidirectional causality from money to prices in the long run.

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

and 3rd lags. The results (not reported here) show the uni-directional causality from money to prices in the long run with no short run causal effects.

Shifts in Money and Prices due to Reforms

The results for the analysis of shifts in nominal variables due to the economic reforms are reported in Table 8(b). The dummy variable in the co-integrating regression shows no significant shift in the relation of money and prices. The results remain the same, that is, a unidirectional causality from money to prices in the long run with no causal relation in the short run.

VII. Summary and Conclusions

The objective of this study is to re-examine the causal relations between money and the two variables, i.e., income and prices in a comprehensive manner. Using large data set from 1959-60 to 2003-04, the stochastic properties of variables used in the analysis are examined; and noting of the shifts in the series due to reforms,

TABLE 8(b)

Causality between Nominal Money and Prices (reforms)

Cointegration (Engle-Granger)

	Const.	D	Coeff.	ADF	PP(l=3)	PP(l=9)
NM on DF	3.9204***	0.0546	1.6780***	-3.7578***	-2.7160***	-2.5096***

Conclusion: *Evidence of Cointegration.*

Error Correction Causality

Lag 2	DDF	DNM
D	-0.0079	-0.0025
e(-1)	-0.3072***	-0.0617
DDF(-1)	0.5840***	-0.3486
DDF(-2)	0.2081	0.5148*
DNM(-1)	0.1630	0.1683
DNM(-2)	0.0054	0.0486
F-Value	0.8839	2.4032

Conclusion: *Unidirectional causality from money to prices in the long run.*

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

we investigate the causal relations between real money and real income, nominal money and nominal income, and between nominal money and prices.

The descriptive statistics show much lower expansion in prices, relative to money and income. Moreover, the expansions in money and income seem close to each other. The correlation analysis shows significant correlation between real money and real income but not of nominal money with either nominal income or prices. There is, however, evidence of a strong correlation between nominal variables, money and income, during the period of economic reforms. Money and prices never seem to be correlated with each other.

The lagged correlation analysis seems to suggest that prior to the start of the economic reforms, money used to play a passive role. Both income and prices appear to take one year to adjust and then start affecting money, in the second and the third years. In this context, income and prices also appear to affect each other in the first year. The similar pattern of correlations of income and prices with money may also be due to the correlation between income and prices that has always been high. It seems that with the start of economic reforms the feedback mechanism from money to income has started.

The formal analysis, however, does not verify the feedback mechanism from money. Though the economic reforms of the 1990s caused significant shifts in the relations between money and income both in real and nominal terms, money supply still seems to play a passive role in increasing national income. The analysis indicates the existence of a long run relation between money and income when expressed in real terms with income as the leading variable that affects money in the long run. On the other hand, when the two variables are expressed in nominal terms the existence of a long run relation between the two is not clear. Nevertheless, there is sufficient evidence showing income as the leading variable. In the short run, the two variables, i.e., money and income appear to be independent of each other whether expressed in real or nominal terms.

It may be mentioned here that our finding of a one-way causation from income to money is in line with previous studies conducted in Pakistan in particular, and in the developing countries, in general. Hence, it can be concluded that in these countries real factors, rather than money supply, have played a major role in increasing the National Income. On the other hand, regarding the money-prices relation, in contrast to the previous studies on Pakistan which generally find a two way causation between money and prices; our results find a one way causation from money to prices. However, the study finds the indication of a feedback mechanism from prices in the short run where they seem to affect money with two years lags. However, the previous studies are generally based on monthly analysis. Moreover, as pointed out by Hussain (2006), there appears to be a break in the money-price relationship in Pakistan. Nevertheless, it can be concluded that there exist a long run relation between money and prices with money playing the lead role.

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