An Econometric Analysis of Price Behaviour in Pakistan

by

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In this paper an attempt has been made to explore the major causes of price level changes in West Pakistan during the past thirteen years and to determine their relative importance in explaining the price fluctuations. A supplementary object of the paper is to develop a predictive mechanism which may be used to forecast the response of price level to changes in the explanatory variables used in the regression model.

There is vast literature on inflation theory [3] but not so much on quantitative evidence. Broadly, there are three groups of theories of inflation: the demand pull theories, which state that inflationary pressures result from aggregate demand exceeding aggregate supply at full employment; the cost-push theories, which stress the producers' power to pass on cost increases in higher prices even when demand remains unchanged. The third group of theories, which take a mid-way position between the demand-pull and the cost-push theories, are a number of structural theories, notably those associated with the names of Ackley, Eckstein, and Schultze [1,5,11]. According to Ackley, inflation results from mark-up of prices. He considers the price policies of the firms and the wage policies of the labour unions to be responsible for inflation. He puts forward the hypothesis that mark ups used by business in setting prices and those applied by the labour unions to their cost of living for getting higher wages tend to rise in an inflationary situation which results in pyramiding of costs. Professor Otto Eckstein advances the hypothesis that inflation may be caused by price increases in certain bottleneck industries even when there is no over-all excess demand in the economy. This has been termed "bottleneck inflation". Schultze puts forward the "demand-composition" theory according to which

producers having market power to administer prices tend to raise prices when there is a shift in the composition of demand even when there is no excess aggregate demand or increase in costs.

I. PRICE BEHAVIOUR IN PAKISTAN

The causes of price level changes in Pakistan can be grouped under the heads demand and supply. The factors operating on the demand side include monetary expansion, population increase, urbanisation, rising public expenditure, deficit financing, changes in export earnings, wage increases etc. On the supply side, one may include growth in real Gross Domestic Product, actual and contrived scarcity of goods, increases in production costs, and indirect taxes, the level and composition of foreign aid, the volume and prices of imports and exports, and smuggling.

There are also some other factors which can cause temporary price changes. If, for instance, some prices are controlled, their upward adjustment may lead to an increase in prices. Similarly, accidental factors such as a bad harvest or a crisis in production due to labour unrest may also increase prices. Prices can also be said to have risen if the quality of goods deteriorates although their prices may have remained unchanged. Sometimes prices go up simply because people fear that they will go up and rush to the market to stockpile. Often a mere press report about scarcity of goods can touch off panicky buying by the customers and hoarding by the shopkeepers thus creating a crisis in a situation where there are too many competing claims on too few resources.

Another element which can affect prices is the monopolistic pricing by producers to secure higher margins of profit. Producers having market power tend to increase prices at times when demand is rising or when costs are increasing. Producers of most manufactured commodities in Pakistan have national associations and are generally in a position to act as cartels and influence prices. Such aggressive pricing can add fuel to the fire in an inflationary situation.

The factors causing price level changes being so numerous and in many cases unquantifiable, it would be extremely difficult if not impossible to assess quantitatively the influence of each factor on price level separately. For the purposes of this study, we have used percentage changes in the money supply from year to year to represent factors on the demand side and percentage change in the real GDP to represent factors on the supply side.

II. APPROACH AND DATA

The model used for the analysis is a variant of Harberger's aggregative regression analysis of the rate of price change in Chile [7]. Our basic hypothesis is that price changes in Pakistan during the past 13 years can be largely explained by changes in aggregate demand. Our results tend to support the demand explanation of inflation in its monetary or quantity-theory version.

The quantity theory of money in its elementary form attributes changes in price level to changes in the quantity of money. In a refined version, Fisher

introduced into it the concept of the velocity of circulation. We have used the cash-balances approach (Cambridge Equation) indicated below:—

$$M = KPY \text{ or } P = M/KY$$

where P is the general price level
   M is the money supply
   Y is the real GDP and
   K is the proportion of Y over which people wish to hold command in the form of cash balances

The Regression Equation used in the analysis was derived as follows:

Postulating that the equation is linear in logarithms, it can be rewritten as:

$$\text{Log } P = \text{Log } M - \text{Log } K - \text{Log } Y$$

Differentiating with respect to T (i.e. time)

$$\frac{1}{P} \cdot \frac{dP}{dY} = \frac{1}{M} \cdot \frac{dM}{dT} - \frac{1}{Y} \cdot \frac{dY}{dT}$$

K is assumed to be constant. Therefore $\dfrac{dK}{dT} = 0$

For linear relationships, marginal change = average change i.e.

$$\frac{dP}{dT} = \frac{\triangle P}{\triangle T} \text{ etc.}$$

So $\dfrac{\triangle P}{P} = \dfrac{\triangle M}{M} - \dfrac{\triangle Y}{Y}$ i.e.

proportional change in P is a function of the proportional changes in M and Y. The regression equation can then be formulated as follows:

$$Pt = a_0 + a_1 M_t + a_2 M_{t-1} + a_3 Y_t$$

Variables and Constants

P_t represents the percentage change in the price index in year t over the previous year (t-1). The model is tested for the general wholesale price P_G the wholesale prices of food P_F the wholesale prices of raw materials P_R^W the wholesale prices of manufactured goods P_M^W and the general consumer prices for industrial workers at Karachi $P_C^{G\,W}$. The price data are shown in Appendix A.

M_t represents the percentage change in the money supply during the year t, and M_{t-1} the percentage change in money supply in the previous year.

Money supply includes currency in circulation, demand deposits and 'other deposits[1] with the State Bank of Pakistan. It may be stated here that since the monetary data of West Pakistan were not separately available, we have used the data relating to all Pakistan. It is assumed that percentage changes in money supply from year to year in West Pakistan are strongly correlated with the overall changes for the whole country till December 1971 when East Pakistan became "Bangladesh". For the period January 1972 to June 1973, percentage changes in money supply had to be calculated on the basis of estimated money supply in West Pakistan as the percentage change would have been understated if the total money supply were used as the denominator. For estimating the money supply in West Pakistan, it has been assumed that the money supply between East and West Pakistan was distributed in the proportion of 1:2 in December 1971. The monetary data are given in Appendix B.

Y_t represents the percentage changes in GDP at constant factor cost in the year t over the previous year. Separate time series of GDP data are available for West Pakistan but the series from 1969-70 to 1971-72 are not comparable with the earlier years as income of sectors like transport and communications, banking and insurance, public administration and defence and P.I.A. has not been allocated and reflected in figures prior to 1969-70. In order to have a comparable series, the incomes of these sectors were removed from the GDP figures of the last few years. It was not possible to segregate the monetised portion of the gross product for the analysis. It, however, appears reasonable to assume that the percentage changes in the monetised sector's gross product and those in the total GDP are closely and positively correlated.

Constant a_0 measures the relative change in prices when the explanatory variables remain unchanged. It represents the geometric time trend of prices. The parameters a_1, a_2 and a_3 are coefficients of the explanatory variables indicating the quantitative response of price level changes to given changes in the independent variables.

III. THE TIME PERIOD

The period chosen for the study extends from 1959-60 to 1972-73. There are two reasons for selecting this period. First, the economy was freed from price and distribution controls in 1959-60 which makes it a convenient base year. Secondly, it is the only period for which time series of GDP data are separately available for West Pakistan. The years from 1959-60 to 1965-66 were marked by relative price stability. The general index of wholesale prices which stood at 100 in 1959-60 rose only to 112 in 1965-66. The period between 1966-67 and 1972-73, however, witnessed a sharp increase in prices. The index of wholesale prices rose from 112 in 1965-66 to 180 in 1972-73.

The marked difference in the two periods is brought out in the following table which shows the means and standard deviations of the various variables during the periods.

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[1]Other deposits include miscellaneous deposits with the State Bank of Pakistan (excluding, however, IMF A/c No. 1, counterpart funds and other loan accounts) which amounted to 1.7% of the total money supply in March 1973.

TABLE I

Means and Standard Deviations of Variables

Variable	1959-60 to 1965-66		1966-67 to 1972-73	
	Means	Standard Deviations	Means	Standard Deviations
$^{G}p_{W_t}$	1.64	3.36	7.20	6.67
$^{F}p_{W_t}$	1.26	5.16	8.63	9.08
$^{R}p_{W_t}$	3.41	4.84	3.81	10.98
$^{M}p_{W_t}$	1.73	2.30	6.16	3.21
$^{G}p_{C_t}$	2.34	2.66	5.93	4.10
M_t	8.00	6.59	14.89	18.66
M_{t-1}	6.74	6.02	12.06	16.67
Y_t	5.41	2.67	4.39	2.74

Except for a few variables, it would be seen, the means and the standard deviations are so different for the two periods, that it was considered worthwhile to run the regressions separately for the later period in addition to the ones for the whole period.

IV. EMPIRICAL RESULTS

The empirical results relating to the general wholesale prices for the two periods are presented in Table II.

TABLE II

Regressions with the Dependent Variable Wholesale Prices (General)

Regression No./Period	Dependent Variable	Constant Term	Coefficients			R² (Adjusted)	D.W. Statistic
			M_t	M_{t-1}	Y_t		
1959-60/ 1972-73	$^G p_{W_t}$	5.20 (1.71)	0.13 (1.64)	0.29 (3.56)	−0.94 −(2.06)	0.64	2.90
(1.1)							
(1.2)	$^G p_{W_t}$	5.51 (1.83)	0.16 (2.14)	0.27 (3.40)	−0.88 (1.78)	0.77	1.89

Note:—Figures in brackets are t ratios.

The results can be presented in the form of following regression equations:

(1.1) $^G p_{W_t} = 5.20 + 0.13\ M_t + 0.29\ M_{t-1} - 0.94\ Y_t\ (R^2 = 0.64)$

(1.2) $^G p_{W_t} = 5.51 + 0.16\ M_t + 0.27\ M_{t-1} - 0.88\ Y_t\ (R^2 = 0.77)$

Equations (1.1) and (1.2) explain the rate of change in the general wholesale prices for the periods 1959-60/1972-73, and 1966-67/1972-73 respectively. The explanatory power of the equations especially of (1.2) is rather good. Another striking feature is that none of the signs of the explanatory variables is wrong. The constant terms in both the equations are statistically insignificant at the 0.05 level. While percentage changes in money supply have a positive relationship with the percentage changes in the price level, changes in the real GDP have a negative relationship as one would expect. With an increase in the aggregate supply, the price level would tend to decline.

Equation (1.2) which relates to the period 1966-67/1972-73 has a much better explanatory power than equation (1.1) relating to the period 1959-60/ 1972-73. This is owing to the fact that during the first 6 years i.e., 1959-60/ 1965-66, the rate of monetary expansion was much slower than in the later period and the prices were relatively stable. During this period the average increase in real GDP was over three times the mean increase in the general wholesale prices. During the later period, in contrast, the mean increase in price level greatly exceeded the average increase in real GDP. Also, the variability of prices, money supply, and the real GDP was much lower during 1959-60/1965-66 than in the later period. Table IV in the appendix presents

detailed results for the period 1959-60 to 1965-66. It will be observed that unlike in the later period, the percentage changes in the real GDP were positively correlated with the percentage changes in price level during 1959-60 to 1965-66. The explanatory power of the equation (1.1) which takes into account the period i.e. from 1959-60 to 1972-73 was thus depressed by the inclusion of the first six years in the analysis.

General Consumer Prices

The detailed results relating to general consumer prices in the two periods are presented in table III below.

TABLE III

Regressions with the Dependent Variable Consumers Prices (General)

Regression No./Period	Dependent Variable	Constant Term	Co-efficients			R^2 (Adjusted)	D.W. Statistic
			M_t	M_{t-1}	Y_t		
1	2	3	4	5	6	7	8
1959-60/ 1972-73 (2.1)	$^Gp_{C_t}$	5.33 (3.20)	0.04 (0.96)	0.22 (4.85)	−0.68 (-2.72)	0.73	1.70
1966-67/ 1972-73 (2.2)	$^Gp_{C_t}$	5.66 (3.05)	0.04 (0.96)	0.20 (4.05)	−0.63 (-2.05)	0.77	1.28

The results can be presented in the form of following regression equations:

(2.1) $\quad ^Gp_{C_t} = 5.33 + 0.04\ M_t + 0.22\ M_{t-1} - 0.68\ Y_t\ (R^2 = 0.73)$

(2.2) $\quad ^Gp_{C_t} = 5.66 + 0.04\ M_t + 0.20\ M_{t-1} - 0.63\ Y_t\ (R^2 = 0.77)$

Equation (2.1) relates to the period 1959-60/1972-73. The other equation relates to 1966-67/1972-77. As in the case of wholesale prices, equations (2.1) and (2.2) possess a fairly satisfactory explanatory power. Two coefficients (of M_{t-1} and Y_t) of these equations are highly significant at 0.05 level and have the right signs. Constant term, however, is statistically highly significant and

shows that if there were no changes in the explanatory variables, there will still be a substantial increase in the consumer price level. The explanatory power of equation (2.1) is lower than that of (2.2) for the same reasons as have been discussed earlier under the wholesale prices.

Matrix of Intercorrelation Coefficients Among Explanatory Variables

1959-60—1972-73

Variables	M_t	M_{t-1}	Y_t
M_t	1.00	0.15	−0.29
M_{t-1}		1.00	0.02
Y_t			1.00

1966-67—1972-73

M_t	1.00	0.09	−0.29
M_{t-1}		1.00	0.07
Y_t			1.00

It would be seen that the inter-correlation among the various explanatory variables is quite low which indicates that the analysis does not suffer from multicollinearity.

The General Wholesale Food Prices

The detailed results of the empirical analysis relating to the general wholesale food prices in the two periods are presented in the appendix in table I.

The regressions, it will be observed, have a modest explanatory power. The one relating to the later period (1966-67/1972-73) shows a lower R^2 and has low D.W. statistic which makes its results unreliable. The signs of coefficients, however, are the right ones in both the regressions. The major reasons for the modest explanatory power of the regressions would appear to be the discretionary action by government in fixing procurement/issue prices of wheat and rice from time to time which blanketed the effect of the explanatory variables. Lagged money supply is the only variable which has statistically significant coefficient value in regression (3.1).

The General Wholesale Prices of Raw Materials and Manufactures

Tables II and III in the appendix present the detailed results pertaining to general wholesale prices of raw materials and manufactures in the two periods. It will be seen that the regressions have little explanatory power in respect of wholesale prices of raw materials. The main reason seems to be that the prices of raw materials particularly the major ones are determined internationally rather than domestically. Furthermore, the prices of raw materials and manufactures are both too micro in nature to be explained adequately by the macro variables used in the analysis.

V. RELATIVE IMPORTANCE OF THE INDIVIDUAL EXPLANATORY VARIABLES

We discuss below the relative importance of the different independent variables in explaining the general wholesale prices and general consumer prices in the different periods. The following table gives the size of the correlation coefficients between the various explanatory variables, the general wholesale prices and the general consumer prices.

TABLE IV

Correlation Between General Wholesale Prices and Independent Variables

Dependent Variable	Independent Variables	1959-60/ 1972-73	1966-67/ 1972-73
G P W$_t$	M$_t$	0.50	0.61
	M$_{t-1}$	0.66	0.68
	Y$_t$	-0.45	-0.44
G P C$_t$	M$_t$	0.39	0.39
	M$_{t-1}$	0.75	0.79
	Y$_t$	-0.45	-0.42

It would be seen that the highest correlation of the dependent variable is with M$_{t-1}$ in both the periods. The other independent variable which also shows fairly high positive correlation with the dependent variable is M$_t$. Y$_t$ too shows a moderate negative relationship with the dependent variable. The most important explanatory variable would thus appear to be money supply.

Another way to judge the degree of influence of each of the independents on the dependent variable is to examine the partial correlation and Beta coefficients for each of the independent variables. Beta coefficient, it may be mentioned, is only an expression of the regression coefficient in units of standard deviation of each variable. It is used to compare the change in the dependent variable with a change of one sigma in each independent variable. An independent variable may have the largest regression coefficient but unless it has also the highest Beta coefficient, it cannot be said to exercise the largest influence on the dependent variable.

The partial correlation and the Beta coefficients for the regressions explaining general wholesale prices and the general consumer prices for the two periods are given in table V below.

TABLE V

Regression No.	1959-60/1972-73			Regression No.	1966-67/1972-73	
	Part.	Corr. Coeff.	Beta Coeff.		Part. Corr. Coeff.	Beta Coeff.
(1.1)	M_t	0.23	0.30	(1.2)	0.60	0.44
	M_{t-1}	0.58	0.62		0.79	0.67
	Y_t	0.32	—0.37		0.51	—0.36
(2.1)	M_t	0.09	0.15	(2.2)	0.24	0.20
	M_{t-1}	0.72	0.73		0.85	0.80
	Y_t	0.45	—0.43		0.58	—0.42

It would appear that the explanatory variables can be ranked in the descending order of importance, as M_{t-1}, M_t, and Y_t. This is borne out both by the partial correlation coefficients and the Beta coefficients. Clearly the factors operating on the demand side which are reflected in changes in the money supply have played a major role in causing changes in price level during the past 13 years. It would appear that the money supply exerts its influence on the price level after a time lag. We have used a time lag of one year. It is, however, quite possible that a shorter time lag may give better results. It would be worthwhile to try lags of different durations to determine the optimum time lag. It is also possible that the time lag during the last 6 years may be different from that in the earlier years. The duration of the time lag has important implications for the effectiveness of monetary policy. The shorter the time lag, the more effective is the monetary policy in controlling the price level.

VI. PRICE LEVEL FORECASTING

The regression equations (1.1 and 1.2) could be used to forecast changes in the level of wholesale prices. If, for instance, the anticipated percentage increase in the money supply and in the real GDP were known for the coming year and if the percentage increases in money supply during the last year were also known, it would be possible to forecast the price level change in the coming year by inserting these values in the regression equations. It is also possible to indicate the percentage increase in real GDP necessary to contain the increase in price level within certain limits given the increase in money supply during the previous year. The model also enables us to determine the limits of monetary expansion, given the expected increase in real GDP to contain price level within given limits. More sophisticated equations including other explanatory variables e.g. wage rate, international prices etc., or equation systems could be developed for predicting price level. Furthermore, quarterly instead of annual data could be used for analysis. These are, however, tasks for future research.

VII. CONCLUSIONS

Price level changes are the result of a very large number of factors operating both on the supply and the demand side. These factors include monetary expansion, population increase, urbanisation, rising public expenditure, deficit financing, changes in export earnings, wage increases, growth in real GDP, actual and contrived scarcity of goods, increases in production cost, and indirect taxes, the level and composition of foreign aid, the volume and prices of imports and exports, and smuggling. It would be extremely difficult if not impossible to assess quantitatively the impact of each of these factors separately on the price level. A very simple regression model has been used in the present study to explain some basic causes of price level changes during the past 13 years. The study does not purport to explain the causes of the existing inflation in the country.

The explanatory variables i.e. money supply in the current year, money supply in the preceding year, and real Gross Domestic Product have been used to study the price behaviour in West Pakistan during the periods 1959-60/1972-73 and 1966-67/1972-73. We have used a lag of one year to allow for the effect of past changes in money supply on the current rate of price change. The analysis shows that price level changes especially during the period 1966-67/1972-73 can be explained largely by the changes in money supply. This is the demand explanation of inflation in its monetary or quantity theory version. While money supply in the current as well as in the preceding year are positively correlated with price level, real GDP shows a negative relationship with the price level. Ranked in descending order of their influence on price level, the explanatory variables appear in following order: money supply in the preceding year, money supply in the current year and real GDP. This means that to control inflation, the control of money is of primordial importance. Simultaneously, increase in domestic production is strongly indicated by the analysis if price increases are to be checked.

The regression model was used also to explain the changes in the prices of major components of wholesale price level i.e., the general wholesale prices of food, raw materials and manufactures. The analysis, however, shows that the explanatory power of the regressions developed to explain the macro variables i.e. the general wholesale price level and the general consumer prices, is rather limited in the case of micro variables especially the general wholesale prices of raw materials and manufactures. It may be necessary to develop other models to explain the price behaviour of the components of price level. It would also be instructive to try other explanatory variables and to develop a system of simultaneous equations to study the behaviour of prices. This, however, is left for further research.

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Index Numbers of Wholesale Prices by Groups (1959-60=100)
West Pakistan

Year	General	Food	Raw Materials	Fuel, Lighting and Lubricants	Manufactures	Consumer Price Index (Karachi)
1959-60	100.00	100.00	100.00	100.00	100.00	—
1960-61	104.77	106.30	108.20	99.01	99.23	100.00
1961-62	104.65	104.73	110.80	98.29	101.03	101.25
1962-63	102.86	99.89	110.64	98.47	105.64	99.92
1963-64	106.35	104.56	112.39	103.98	107.05	103.08
1964-65	113.55	113.10	125.99	105.29	107.19	109.34
1965-66	112.03	108.24	125.57	109.18	112.70	114.87
1966-67	124.36	126.89	126.21	120.98	117.02	125.01
1967-68	125.68	133.26	105.97	123.61	121.08	127.83
1968-69	129.54	134.04	113.19	127.37	129.75	129.71
1969-70	132.19	134.10	122.15	132.20	134.27	135.53
1970-71	137.32	136.50	133.23	137.08	142.34	142.48
1971-72	150.31	153.50	159.12	150.63	151.52	150.80
1972-73	179.88	188.91	157.78	182.26	170.87	171.23

APPENDIX B.

MONEY SUPPLY

		(Rs. in crore)
June, 1960	.·.	581.29
,, 1961	..	584.20
,, 1962	..	606.45
,, 1963	..	691.09
,, 1964	..	793.97
,, 1965	..	862.14
,, 1966	..	984.29
,, 1967	..	1,038.36
,, 1968	..	1,075.82
,, 1969	..	1,244.64
,, 1970	..	1,332.56
,, 1971	..	1,234.23
,, 1972	..	1,737.47
,, 1973	..	2,144.61

APPENDIX

TABLE I

Regression with the Dependent Variable Food Prices (General)

Regress-sion No.	Dependent Variable	Constant Term	Coefficients			Wrong R²	Wrong Signs in Columns	D. W. Statistic	Period
			M_t	M_{t-1}	Y_t				
1	2	3	4	5	6	7	8	9	10
3.1	F P W	5.44 (1.00)	0.16 (1.18)	0.36 (2.39)	−1.08 (−1.32)	0.40	None	2.4	1959-60 to 1972-73
3.2	F P W	5.63 (0.78)	0.21 (1.20)	0.30 (1.61)	−0.86 (−0.72)	0.30	None	0.71	1966-67 to 1972-73

Note: Figures in brackets are t ratios.

APPENDIX

TABLE II

Regressions with the Dependent Variable: Wholesale Prices (Raw Materials)

Regres-sion No.	Dependent Variable	Constant Term	Co-efficients			R²	Wrong signs in columns	D.W. Statistic	Period
			M_t	M_{t-1}	Y_t				
1	2	3	4	5	6	7	8	9	10
(4.1)	R P W	10.88 (1.55)	0.14 (0.76)	−0.19 (−0.99)	−1.27 (−1.21)	0.05	5	2.03	1959-60 to 1972-73
(4.2)	R P W	13.08 (1.33)	0.17 (0.70)	−0.22 (−0.86)	−2.07 (−1.28)	0.11	5	1.84	1966-67 to 1972-73

Note: Figures in brackets are t ratios.

APPENDIX

TABLE III

Regressions with the Dependent Variable: Wholesale Prices (Manufactures)

Regres-sion No.	Dependent Variable	Constant Term	Co-efficients			R²	Wrong signs in columns	D.W. Statistic	Period
			M_t	M_{t-1}	Y_t				
(5.1)	M P W	4.71 (2.16)	0.10 (1.75)	0.12 (2.02)	−0.54 (−1.66)	0.47	—	1.67	1959-60 to 1972-73
(5.2)	M P W	4.94 (2.47)	0.07 (1.52)	0.13 (2.39)	−0.32 (−0.97)	0.56	None	2.60	1966-67 to 1972-73

Note: Figures in brackets are t ratios.

APPENDIX

TABLE IV

Regressions with Dependent Variables: Wholesale Prices (General) and Consumer Prices (General)

Regres-sion No.	Dependent Variable	Constant Term	Co-efficients			R^2	Wrong signs in columns	D.W. Statistic	Period
			M_t	M_{t-1}	Y_t				
1	2	3	4	5	6	7	8	9	10
6.1	G P W	−0.21 (−0.24)	−0.51 (6.54)	0.58 (6.82)	0.37 (1.95)	0.92	4,6	1.46	1959-60 to 1966-67
6.2	G C P	0.60 (0.30)	−0.10 (−0.58)	0.43 (2.20)	−0.06 (−0.14)	0.34	4	1.42	1959-60 to 1966-67

Note: Figures in brackets are t ratios.