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ABSTRACT (within 250 words).

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PRICE BEHAVIOUR IN INDIA - AN EXPLANATION THROUGH A MODEL OF SUPPLY AND DEMAND FOR MONEY

C. Rangarajan

Abstract

To what extent can changes in money account for changes in price level? The model presented in this paper seeks to explain changes in price level through the divergence between nominal money supply fixed by monetary authorities and warranted money supply determined by changes in real income. After developing the model in detail an attempt is made to test how far such a model explains the behaviour of general price level in India in the past twenty years.

The crucial behavioural relationship to be estimated in this model was the demand for money in real terms. Three equations were estimated using three variants of the real income variable. These equations together with the changes in real income formed the basis for computing the price indexes. We estimated the price indexes for the period 1950-51 to 1965-66.

While the 'preferred variant' of the model performes well in terms of estimating the level of prices it does not perform that well when year to year percentage changes in price level constitute the basis of comparison. Out of 16 years in six years the percentage change in estimated price index differs from the percentage change in actual index by more than 5%.

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By

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PRICE BEHAVIOUR IN INDIA - AN EXPLANATION THROUGH A MODEL OF SUPPLY AND DEMAND FOR MONEY

To what extent can changes in money account for changes in price level? The model presented in this paper seeks to explain changes in price level through the divergence between nominal money supply fixed by monetary authorities and warranted money supply determined by changes in real income. After developing the model in detail, an attempt is made to test how far such a model explains the behaviour of general price level in India in the past twenty years.

An attempt to establish a relationship between the quantity of money and price level is as old as modern economics. A direct proportionate relationship between the quantity of money and price level as postulated by the orthodox quantity theory has never been substantiated by any historical evidence. This is true of the Indian experience in the past twenty years (Table 1). The years that experienced the highest increase in price level were not the years which had the largest increase in money supply. Nor for that matter the years that had the largest increases in money supply were the ones that recorded steepest increases in price level. In establishing therefore a relationship between money and price level, one has to construct an appropriate model of demand for money and then relate the excess demand or supply of money to changes in price level.

I. Analysis of the Model

A. Outline of the Model

Both the Cambridge cash balance equation and the Keynesian theory assume a positive relationship between money held by the community and the level of income. In our model this relationship is expressed in real rather than nominal magnitudes. An increase in real income therefore generates an increase in the demand for money. If, however, the nominal money supply during the same period rises at a rate faster than that warranted by changes in real income, then the model postulates, that the price level increases to equate the supply and demand for money in nominal terms.

The model can be algebrically presented as follows: Assume that the demand for money in real terms is given by the following equation.

$$M = a + bY$$

where Money (M) and national income (Y) are measured in real terms. Let the price level in the initial year be given as P_o and money supply as MS_o and let us assume that the demand for and supply of money was in equilibrium to start with. Then the warranted money supply in period t is obtained by adding to money supply in the base year the change in the demand for money caused by the changes in the

real income i.e. $b\ (Y_t - Y_o) + MS_o$. Then it is postulated that

$$P_t = P_o \times \frac{MS_t}{b\ (Y_t - Y_o) + MS_o}$$

where MS_t is the nominal money supply in period t. The price level in any period is thus obtained by multiplying the base year price by the proportion of the actual money supply to the warranted money supply. When the actual money supply exceeds the warranted money supply, price level rises.

The model thus builds on the distinction between the nominal amount of money which is primarily determined by monetary authorities and the real amount of money determined by the functional relation between the real amount of money demanded and real income.

B. Demand for Money

The crucial behavioural relationship in the model is the demand for money which is expressed as a function of real income. Unlike the consumption function which is estimated always in real terms there is no consistency among the authors as far as the demand for money is concerned.[1] Some have estimated it in real terms and some others in

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[1] To cite some examples, Larence Klein estimates the demand function for money in nominal terms in Economic Fluctuations in the United States 1921-1941. Milton Friedman estimates the function in real terms. See Milton Friedman, "The Demand for Money: Some Theoretical and Empirical Results", Journal of Political Economy, August 1957. Allan Meltzer has experimented with both types of formulations. See Allan H. Meltzer, "The Demand for Money: The Evidence from the Time Series", Journal of Political Economy, June 1963.

nominal magnitudes. The main reason for estimating the consumption function in real terms is to avoid the presence of 'money illusion' in the behaviour of consumers. A similar consideration may be relevant respect to money holding also.

In explaining the Cambridge cash balance equation $M = kPY$, Pigou thought of K as the proportion of the real resources that the society choses to keep in the form of titles to legal tender. He writes "For these two objectives provision of convenience and provision of security, people in general like to hold in the form of titles to legal tender the aggregate value of a given quantity of wheat".[2] However, while the movitation is to hold a given proportion of real income in the form of money, under the theory, the proportion will remain the same even in nominal magnitudes in all equilibruim situations. In explaining the process of price change underlying the quantity theory of money Don Patinkin wrote: "An increase in the quantity of money disturbs the optimum relation between the level of money balances and the individual's expenditures: this disturbance generates an increase in the planned volume of these expenditures (the real - balance effect); and this increase creates pressures on the price level which push it upwards until it has risen in the same proportion as the quantity of money".[3] This kind of reasoning implies that the demand curve for real balances as a function of p would be a vertical line. The presence or absence of money illusion in the demand

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[2] A.C. Pigou, "The Value of Money" included in F.M. Lutz and L.M. Mints, 'Readings in Monetary Theory,' p. 164.

[3] Don Patinkin: Money, Interest and Prices, p. 163.

function for money can be treated as a purely empirical question. However, since in our model the demand for money equation plays the role of determining the changes in prices, it is best estimated in real terms.

In the model presented earlier, we have not introduced in the demand for money equation any variable other than income. The two other variables which are important theoretically are the rate of interest and wealth. Given the unavailability of data on net wealth, the omission of the variable in the estimation of the function is not serious. The role of rate of interest in the demand equation has a long and controversial history. Our omission of the rate of interest in the equation is not on grounds of theory but because of quantitatively small role played by interest. However, the introduction of the rate of interest variable does not affect the model so long as we treat interest rate as exogenous to the system.[4]

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[4]It is legitimate to raise the question whether or not interest rate is determined by the demand for and supply of money. To regard inrerest rate as exogenous variable is justified under the pecular conditions that prevail in India. Except for the rates that operate in the unorganized sector of the money market, all the other rates are determined by monetary authorities. They can in no sense be regarded as 'competitive'. Given the control over the funds which can be directed into financial assets, the government is able to fix not only the rate but also the quantum of investment. Undoubtedly interest rates have shown an upward trend. This is in part a recognition of the factors operating in the economic system by the monetary authorities. But this is a far cry from saying that they are competitive rates or rates determined fully by the operation of the forces on the demand and supply side.

C. Implications of the Model

The most serious objection that can be taken to the model is that it treats Y as being independent of M. Whittlesey writing on the relationship between M and Y distinguished among the three roles of M - passive, permissive and active.[5] While the passive role implies no relationship between M and Y, the permissive role emphasizes the need for M to adjust itself to changes in Y. The active role would regard Y changing as a result of changes in M. Our model on the face it implies the second role.

The impact of changes in money on income constitutes the core of monetary theory. The Keynesians trace the effect of changes in money on real income via interest rate. The post-Keynesians have extended the original two assets (money and bonds) model to include various financial assets and have thus adopted a portfolio balance approach. The monetarists have been content to establish a relationship between money and income in nominal magnitude. Friedman writes "if price and income are free to change the attempt to spend more will raise the volume of expenditures and receipts, expressed in nominal units, which will lead to a bidding up of prices and perhaps also to an increase in output."[6]

Thus the effect of an increase in money is partly on prices and partly on output. At another place Friedman writes, "The general subject of division of changes in money income between price and quantity

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[5] C.R. Whittlesey, "Relation of Money to Economic Growth," American Economic Review, May, 1956.

[6] Milton Friedman, A Theoretical Framework for Monetary Analysis, (National Bureau of Economic Research), p.3.

badly needs more investigation. None of our leading economic theorists has much to say about it".[7] While the Friedman approach of treating money as the substitute not only for financial assets but also real goods seems to be a more fruitful approach from the point of view of the developed economies, the analysis itself is not complete. In the controversy over whether money matters Friedman had said at one point "We have always stressed that money matters a great deal for the development of nominal magnitudes, but not over the long run for real magnitudes.....The real wealth of a society depends much more on the kind of institutional structure it has, on the abilities, initiative, driving force of its people, on investment potentialities, on technology - on all of those things. That's what really matters from the point of view of the level of output".[8] Perhaps what applies to developed economies in the long run applies to developing economies in the short run. Increase in output even in the short run can be treated more as a function of real factors than monetary factors. It is this kind of an approach that justifies treating real income as the independent of money.

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[7]Milton Friedman, "The Monetary Studies of the National Bureau" included in his book, The Optimum Quantity of Money, p.279.

[8]Heller and Friedman, Monetary Vs Fiscal Policy, p.47.

II. Empirical Findings

A. Demand for Money Equations

As mentioned earlier, the crucial behavioural relationship to be estimated in our study is one between real income and real money. The previous studies on the demand function for money in India have mainly dealt with nominal magnitudes. In establishing a relationship between real income and real money, we divided income into income originating in agriculture and income originating in sectors other than agriculture. This is on the assumption that the behaviour of the two types of income recipients is different. It might have been useful to take only monetised agricultural income rather than total agricultural income. But in view of the differing estimates on the degree of monetization, we have taken the total agricultural income. It has also been pointed out that bulk of the agricultural output in a year, though included in the national income of that year, actually comes into the market only in the following year.[9] Therefore, the concept of income relevant to the demand for money may be the one that includes current year's income originating in the non-agricultural sectors and the previous year's income originating in agriculture.

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[9] For this reason, K.N. Raj while making a study of price behaviour in India included the agricultural output of the previous year in computing the supply of the current year. See K.N. Raj, "Price Behaviour in India - 1949-66: An Explanatory Hypothesis", Indian Economic Review, 1968, p.66

We have indicated a combination of these two as lagged income and have estimated equations using the lagged income also as an independent variable. The concept of real money also raises some difficulties. The question is whether it is appropriate to deflate nominal money by a price index or by the national income implicit deflator. We have made estimates using both procedures.

We give below the equations that we had estimated using the annual observations for the period 1951-52 to 1965-66.

$$RM_t = 450.398 + \underset{(10.152)}{.143 Y^*_t} \qquad \bar{R}^2 = .872 \qquad (1)$$

$$RM_t = 696.854 + \underset{(3.956)}{.182 Y^*_{NAt}} + \underset{(.489)}{.051 YA_t} \qquad \bar{R}^2 = .869 \qquad (2)$$

$$RM_t = 490.487 + \underset{(11.57)}{.141 LY^*} \qquad \bar{R}^2 = .910 \qquad (3)$$

where

RM = The average of the end of the month stock of money over the year deflated by the wholesale price index.

Y = Net domestic product in 1948-49 prices.

Y_A = Net domestic product in 1948-49 prices originating in agricultural sector.

Y_{NA} = Net domestic product in 1948-49 prices originating in non-agricultural sector.

LY = The sum of net domestic product in 1948-49 prices originating in non-agricultural sector in the current year and net domestic product originating in the agricultural sector in the previous year.

$$RM' = -207.772 + \underset{(14.26)}{.212\ Y} \qquad R^2 = .936 \tag{4}$$

$$RM' = -153.629 + \underset{(20.044)}{.209\ LY} \qquad R^2 = .966 \tag{5}$$

where

RM' = the average of the end of the month stock of money over the year deflated by the national income deflator.

B. Estimating Price Level

We had given earlier the formula for estimating the price level for each year. The exact procedure followed is given below. Starting with the initial level of income, money supply and the wholesale price level as of 1945-50, we computed for each year the change in income in 1948-49 prices from 1949-50. We multiplied this change in income, by the appropriate coefficient from the demand function for money to give us the warranted change in money supply. Adding this warranted change to the base year money supply gave us the desired level of money supply in any year. Price level for each year is obtained by multiplying the base year wholesale price index by the ratio of actual money supply to the desired money supply. Corresponding to each demand function for money there was one estimated series/price level. The price indices computed and the actual price level for the years 1949-50 to 1965-66 are given in Table 1. We have also given in the same table, the estimated price index according to certain other models which we explain later.

C. Testing the validity of the Model

How well does the model presented in this paper estimate the price index? For examining this question we adopted several procedures such as a) computing the correlation between the estimated price index and the actual wholesale price index, b) comparing the year to year percentage changes in the estimated price index and the actual price index, c) the number and the extent of under estimation and over estimation, d) computing the average of the absolute difference between the percentage change in the estimated index and the actual indexes, e) predicting the price index outside the sample period and f) comparisons with the predictive ability of some other models.

i) Computing correlation between estimated and actual indexes

There is a high degree of correspondence between the movement in the estimated price index and the actual index as evidenced by the high value of R^2 (Table 3). The computed price index and the actual price index, in general, move together. There is not much difference in the value of R^2 among the different models.

ii) Comparing year to year percentage change

In an exercise of this type, it is more important to see how well the year to year changes are predicted than looking at the estimated level of index. As can be seen from Table 3, there is a sharp drop in the correlation coefficient when year to year percentage changes in the

actual index and the computed index are correlated. Also there is a marked difference in the predicting ability of the models. Model 3 which computes the price index through a demand function for money which has lagged income as the independent variable, fares best. However, even in this case, the value of R^2 is only .40. Thus our conclusion is that while the models that we have presented predict fairly well, the broad behaviour of wholesale prices, they are not quite successful in predicting year to year changes.

iii) Extent of over or under estimation

Computing the correlation coefficient may not really be the best way of comparison between the predicted and the actual price index. There are many other ways of comparison. One is to look at how many times the percentage change in the predicted index is higher or lower than that in the actual index. Details of such comparisons are given in Table 5(a). The predicted price index using Model 3 under estimates positive changes 7 times. From the point of view of forecasting, turning point errors are more serious. For 1953-54, Model 3 predicts a fall in price index, when price actually rose. For 1954-55 and 1955-56 the Model predicts rise when prices actually fell. In fact, the increase in price in 1953-54 would have been very difficult to predict by any model relating money supply with real income. In that year, money supply practically remained unchanged while aggregate real income increased

by over 5%. Whatever value of the parameter for income in the demand function in money, this type of a model could have only predicted a downward trend whereas the prices actually rose. It is easy enough for any model to predict increases in price level. This is the general feature during this period. However, between 1950-51 and 1955-56 there have been four years when wholesale price fell. These were 1952-53, 1954-55, 1955-56 and 1961-62. Of these, Model 3 predicts correctly the two negative changes in 1952-53 and 1961-62 but not the other two.

Table 5(b) estimates the extent of difference between the predicted percentage change and the actual percentage change. Out of 15 changes, according to Model 3, there are six years in which the predicted per-change change differed from actual percentage change by more than 5%. We also computed the mean of the absolute difference between the predicted percentage change in a year and the actual percentage in a year. The mean values of these absolute differences are given in Table 5(c). Model 3 which once again fares best has a mean difference of about 4%. Considering the fact that the average of absolute percentage changes in the actual price index is 5.8%, the difference of approximately 4% could be regarded as high.

iv) Predictions outside the sample period

We have analysed so far how the model estimates the price index for the period 1949-50 to 1965-66. Though actual price index does not

enter into our predicting model, this was, however, the sample period for estimating the demand for money equation. So we tried to see how well this model predicts price level outside the sample period. Using Model 3, we find that the predicted price index for 1966-67, 1967-68 and 1968-69 is 175.46, 186.28 and 185.4. This would imply an increase of 12% in the price level in 1966-67, 6% in the price level for 1967-68 and -.5 of 1% in 1968-69. These are to be compared with the actual price changes of 13.9%, 11.6% and -1.1% in these years. While the predictions for 1966-67 and 1968-69 are quite close to actuals, there is considerable under estimation of the increase in the price level for 1967-68.

v) Comparison with Other Models:

The Raj Model: The model that we have examined so far attempted to relate changes in price to changes in money supply and demand for money. There have been other attempts to predict price level changes. Perhaps, the notable among them was that of Professor K.N. Raj[10]. In a paper published some years ago, Raj constructed a model in which price changes were explained by relating aggregate demand to aggregate supply. Aggregate demand in any year was treated as being equal to aggregate demand of the previous year plus the multiplier times, the changes in

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[10] K.N. Raj, op cit.

autonamous outlays in that period. Aggregate supply in any year is taken to be equal to market value of the supply in the preceeding year plus change in supply during that year valued at the price of the preceeding year. When aggregate demand during the year exceeds, the aggregate supply at previous year's price, price rises to make the value of the latter equal to the former. It is not our intention here to examine that model critically. We compare here only the predictions of the Raj model with the predictions of the models presented in this paper. The predicted price level according to Raj model is given in Table 2.

Raj while comparing the predicted price increase with the actual had said "It will be seen that the official and predicted series move together fairly closely". This is true only if we compare the level of the predicted and the actual index. The correlation coefficient between the two series is high as .96 which is not very different from the correlation coefficient obtained by the money supply models also. However as in the case of models presented in this paper, when percentage changes are correlated the correlation coefficient falls. If we submit the Raj model to the other tests, it is seen that the model has not performed well, if year to year changes are treated as the basis of comparison. Details are found in Table 5 (a), (b) and (c).

Other Models: It is not uncommon to find writers attempting to establish a direct relationship between price level on the one hand

and the money supply and real income on the other. Money supply is assumed to have a positive effect and real income a negative effect. These models can at best be described as 'ecclectic'. They are combination of supply and demand characteristics and the exact dynamics of the price formation is not very clear from such a model. However, since such explanations are frequently offered, we tried to compare the predictions from such a model with the models of this paper.

The usual technique is to regress the price index on money and real income. We estimated two equations. The first was obtained by regressing the wholesale price index on money supply and the real income of the same year. In the second equation, we regressed the price index on money supply and non-agricultural income of the current year and agricultural income of the previous year. The predicted price index using these two equations are given in Table 2. We refer to these as models 4 and 5. It may be noted that the models presented in this paper and the Raj model belong to different category because in these models the actual price index is not directly used to get the predicted index.

Of the models 4 and 5, model 5 which introduces separately the agriculture income of the previous year performs better. In this case also, while the correlation coefficient between actual index and the predicted price index is high, the coefficient drops steeply when the two series correlated are percentage changes in price. Model 5, compares favourably with model 3 in terms of other tests as can be seen from Table

The various tests indicate that an attempt to explain the price level changes through a model of supply and demand for money performs as well as a model which approaches the problems from the side of aggregate supply and aggregate demand. However, in the case of both types of models, while the official and predicted series move together closely there is not that close correspondence when year to year changes are compared. Part of the difficulty lies in determining which price level is determined when we use a model of supply and demand for money. When we talk of demand for money in real terms, it is not very clear whether the nominal amount of money should be deflated by the wholesale price index, or consumer price index or national income implicit deflator. If the desire to hold the money is deemed to be arising out of 'transaction motive', the appropriate deflator is one which is weighted according to the importance of transactions. No such deflator really exists. We have, however, attempted to see whether a model like this would estimate better the national income deflator than the wholesale price index. In fact, movements in the national income deflator do not correspond that closely to those in the wholesale price index (Table 1). The former shows less variation than the latter and during the period 1951-52 to 1965-66 there are at least two years when the two series have moved in the opposite direction.

Comparison with national income deflator

Using equations 4 and 5 (which use money variable deflated by national income deflator) and following the general procedure outlined

earlier for computing the price level, we derived the price index. Corresponding to the two equations, there were two predicted series of price level. We refer to them as Model 1' and 3'. Predicted series and year to year percentage changes are given in Table 6. Table 7 gives the correlation coefficient and the other tests of comparison. Between models 1' and 3', the latter fares better. It can also be seen that in all the tests, the model 3' performs better in relation to national income implicit deflator than the corresponding model 3 in relation to wholesale price index. We used model 3' to predict price level outside the sample period. According to this model, the predicted percentage changes in the price level in 1966-67 and 1967-68 are respectively 13.3% and 5.5% while the actuals for these years are 15.5% and 6.5%. The predictions are close to the actuals. Thus there is reason to believe that a model of the type presented in this paper provides a better estimation of an index like national income deflator than the wholesale price index.

Price level and definition of money

We also tried to see whether inclusion of time deposits in money would give a different picture. So starting with a demand function for money which included time deposits, we followed the same procedure to derive a price series that can be compared with the wholesale price level. The results (not reported here) were not more promising than the earlier results.

III. Conclusion

The purpose of this paper is to see how far the price changes in India can be explained by excess demand or supply or money. To compute the required or warranted amount of money in a year, we used a demand function for money in real terms. Treating the changes in real income as given, we computed for each year, the required level of money. This together with the actual money supply enabled us to estimate the price level. The general conclusion that emerges from our study is that the predicted price level according to such a model moves in general closely with the actual price index. However, there are considerable divergences between the predicted and the actual series when a comparison is made of the year to year percentage changes in price level. Also a model of this type explains better the movement in an index such as national income deflator than the wholesale price index.

Table 1

Percentage Change in Money Supply (M), Wholesale Price Index (WPI) and National Income Deflator (NID)

Years	% in M	% in WPI	% in NID
1951-52	1.3	2.4	1.8
1952-53	-6.7	-10.4	-5.3
1953-54	0.4	4.7	0.7
1954-55	4.7	-6.6	-10.5
1955-56	10.4	-2.3	1.8
1956-57	8.6	10.5	7.9
1957-58	5.1	2.4	1.7
1958-59	2.5	4.4	3.4
1959-60	10.7	3.9	0.9
1960-61	2.6	6.5	1.7
1961-62	4.3	-0.6	1.9
1962-63	8.8	2.9	2.0
1963-64	11.9	6.6	6.6
1964-65	10.2	12.8	10.5
1965-66	10.6	8.1	3.2

Table 2

Predicted and actual (wholesale) price indexes

Year	Model 1	Model 2	Model 3	Raj Model	Model 4	Model 5	Actual
1950				101.5			101.5
1950-51	104.5	104.7	103.7	107.3	104.5	109.5	109.5
1951-52	103.7	103.7	103.7	108.8	104.4	108.3	112.1
1952-53	94.5	94.1	94.5	104.3	99.1	98.6	100.2
1953-54	92.2	90.6	92.5	101.6	97.8	96.1	104.9
1954-55	94.7	93.2	92.9	100.3	99.9	97.3	98.0
1955-56	102.9	101.9	101.0	107.4	106.0	104.6	95.8
1956-57	108.2	106.6	107.9	108.7	110.2	109.2	105.9
1957-58	113.0	112.8	110.5	107.6	114.5	113.2	108.4
1958-59	112.4	110.0	113.5	109.1	114.4	113.4	113.2
1959-60	122.2	121.0	119.4	113.3	122.8	122.7	117.6
1960-61	119.4	116.9	120.2	119.7	120.2	123.3	125.3
1961-62	121.6	119.6	119.5	120.8	122.5	122.2	124.5
1962-63	128.8	128.1	127.0	129.1	130.0	128.3	128.1
1963-64	139.1	138.5	139.6	144.9	140.3	138.3	136.5
1964-65	146.5	144.3	148.4	153.8	149.0	149.6	154.0
1965-66	159.6	162.6	156.0	158.8	164.8	166.3	166.5

Model 1 uses equation (1) to predict price level
Model 2 uses equation (2)
Model 3 uses equation (3)
Model 4 uses the equation: Price index = 66.58+.0336M -.0028Y
(5.475) (-1.473)

Model 5 uses the equation: Price index $= 81.02 + .0526\ M - .00041\ YA_{t-1}$
(4.420)
$-.015\ YNA_{t}$

Table 3

Percentage changes in predicted and actual indexes

Year	Model 1	Model 2	Model 3	Raj Model	Model 4	Model 5	Actual
1949-50							
1950-51	+3.0	+3.2	+2.2	+ 5.7	+ 2.9	+ 7.0	+7.9
1951-52	-0.8	-1.0	+0.2	+ 1.4	+ 0	- 1.1	+2.4
1952-53	-9.0	-9.3	-8.8	- 4.1	- 5.1	- 8.9	-10.4
1953-54	-2.4	-3.7	-2.1	- 2.6	- 1.3	- 2.5	+ 4.7
1954-55	+2.7	+2.8	+0.5	- 1.3	+ 2.1	+ 1.3	- 6.6
1955-56	+8.7	+9.4	+8.6	+ 7.1	+ 6.1	+ 7.5	- 2.3
1956-57	+5.2	+4.5	+6.9	+ 1.2	+ 3.9	+ 4.4	+10.5
1957-58	+4.4	+5.8	+ 2.3	- 1.0	+ 3.9	+ 3.7	+2.4
1958-59	-0.6	-2.5	+ 2.8	+ 1.4	- 0.1	+ 0.2	+4.4
1959-60	+8.7	+10.0	+ 5.2	+ 3.8	+ 7.3	+ 8.2	+ 3.9
1960-61	-2.3	-3.4	+ 0.7	+ 5.6	- 2.1	+ 0.5	+ 6.5
1961-62	+1.7	+2.3	- 0.7	+ 0.9	+ 1.9	- 0.9	- 0.6
1962-63	+5.7	+7.1	- 6.3	+ 6.9	+ 6.1	+ 5.1	+ 2.9
1963-64	+7.9	+8.0	+ 9.9	+12.2	+ 7.8	+ 7.7	+ 6.6
1964-65	+5.3	+ 4.2	+ 6.2	+ 6.1	+ 6.2	+ 8.2	+12.8
1965-66	+8.9	+12.6	+ 5.1	+ 3.3	+10.5	+11.1	+ 8.1

Table 4

Degree of correspondence between predicted and actual price index

			R^2
a)	Level		
	Model 1 and Actual	.961	.923
	Model 2 and Actual	.960	.920
	Model 3 and Actual	.965	.931
	Raj series and Actual	.966	.933
	Model 4 and Actual	.965	.931
	Model 5 and Actual	.977	.955
b)	Percentage Changes		
	Model 1 and Actual	.440	.191
	Model 2 and Actual	.359	.128
	Model 3 and Actual	.609	.371
	Raj series and Actual	.491	.241
	Model 4 and Actual	.472	.225
	Model 5 and Actual	.610	.372

Table 5 (a)

Other measures of comparison

(a) Number of over estimations and under estimations

	Model 1	Model 2	Model 3	Raj Model	Model 4	Model 5
Under estimate of positive change	4	3	7	7	4	5
Over estimate of positive change	4	5	3	2	5	5
Under estimate of negative change	1	1	1	2	1	1
Over estimate of negative change	-	-	-	-		
Turning point errors:						
Prediction positive when actual negative	3	3	2	2	3	2
Prediction negative when actual positive	4	4	1	2	3	2
Almost equal			2	1		1

Table 5 (b)

Extent of Deviation

Difference between predicted % change and actual % change	Model 3	Raj Model	Model 5
Less than 1%	2	2	3
Between 1 and 2	3	2	2
Between 2 and 3	2	1	1
Between 3 and 4	3	2	2
Between 4 and 5	-	2	3
Above 5	6	7	5

Table 5 (c)

Average of Absolute Deviation Between Predicted Percentage Change and Actual Percentage Change

Model 1	4.844
Model 2	5.788
Model 3	3.955
Raj Model	4.368
Model 4	4.753
Model 5	4.000

Table 6

Predicted and Actual Income Income Implicit Deflator

YEAR	Predicted Price Index		% change in Predicted Price Index		Actual Deflator	
	Model 1'	Model 3'	Model 1'	Model 3'	Level	% change
1950-51	105.3	103.8			107.7	
1951-52	103.4	103.3	- 1.9	- .45	109.6	1.8
1952-53	92.6	93.2	- 10.4	- 9.7	103.8	- 5.3
1953-54	87.5	90.2	- 5.4	- 3.2	104.5	0.7
1954-55	89.4	89.0	2.1	- 1.3	93.5	-10.5
1955-56	97.3	96.1	8.9	7.9	95.2	1.8
1956-57	100.2	102.0	2.9	6.2	102.8	7.9
1957-58	106.3	103.2	6.1	1.2	104.6	1.7
1958-59	101.7	106.1	- 4.3	2.8	108.2	3.4
1959-60	111.6	109.5	9.7	3.2	109.2	0.9
1960-61	105.6	109.5	- 5.4	0	111.1	1.7
1961-62	107.4	107.1	1.7	- 2.2	113.3	1.9
1962-63	114.4	113.0	6.5	5.5	115.6	2.0
1963-64	122.3	123.5	6.9	9.3	123.3	6.6
1964-65	125.4	129.8	2.5	5.1	136.2	10.5
1965-66	141.9	134.5	13.2	3.6	140.6	3.2

Table 7

Tests of Comparison

Degree of Correspondence

	R^2
(a) Levels:	
Model 1' and Actual	.849
Model 3' and Actual	.90
(b) Percentage changes:	
Model 1' and Actual	071
Model 3' and Actual	420

	Number of under estimation Model 3'		Extent of Deviation Model 3'	
Under estimate of positive change	5		Less than 1%	3
			Between 1 and 2%	2
Over estimate of positive change	4		Between 2 and 3%	2
			Between 3 and 4%	3
Under estimate of negative change	1		Between 4 and 5%	2
			Above 5	3
Over estimate of negative change	1			
Prediction positive when actual negative	-			
Prediction negative when actual positive	3			
Almost equal	1			