

Dynamic Sources of Inflation Under Economic Development: The Case of Korea

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1. Introduction

It has long been hypothesized and argued by Lewis (1963), Schumpeter (1951) and Rostow (1952) that economic development at the take-off stage would have to be financed by inflationary measures, in particular by credit creation. In Latin America monetarists' terms the excess demand caused by any developmental efforts is in due course entirely validated by accommodating monetary policies. The implication is that the economic development is the ultimate source of continuous inflation.

Unfortunately the Lewis-Schumpeter dictum meant to many economists that inflation is conducive to economic development. This has led to the misdirection of a large amount of research activity towards discussing the compatibility of inflation and economic development. Many authors such as Thirlwall (1974) Adenkunle (1968), Bhatia (1960) Thirlwall and Barton (1971) Dorrance (1966) and U Tun Wai (1959) have come to the conclusion that inflation is not necessarily conducive to or concurrent with economic development.

More fruitful efforts were directed to the analysis of the causes of Latin American inflation. Among the numerous works Harberger (1963), Diz (1970), Diaz-Alejandros (1965), Vogel (1974) are frequently quoted. In determining the causes of inflation one should be concerned on the one hand with the signs and

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significances of the coefficients of variables chosen as sources of inflation but also on the speed of adjustment of prices to changes in source variables. Unfortunately most of the works in this area concentrate mainly on the first problem and the second question of the speed of adjustment is grossly neglected with the possible exception of Wachter (1976).

The analysis of the dynamic process in which growth of output and money are linked to the inflation process actually has its modern genesis in the writings of Lewis and Schumpeter (To be called L-S here after). These relations will be systematically investigated in the next section. It is sufficient to point out that until we know more of the lagged responses between these variables, the signs of the coefficients of source variables of inflation mean little. For instance, the positive and significant coefficient of money variable in the inflation equation may or may not mean that accommodating monetary and fiscal policies are the sources of inflation. In fact money may or may not be a source of inflation. If, for instance, over a period of economic growth, a dynamic structural change of 'monetary deepening' took place,¹ and if during the same period prices rose rapidly due to some other causes, the coefficient of money is likely to show a positive sign.

To gain a better understanding of the coefficients of the source variables one needs to sort out the way in which changes in the real outputs, money and prices interact each other in contemporaneous as well as delayed responses. The L-S scenario of economic development provides a convenient starting point in modeling these responses.

In this paper the L-S scenario of development is re-examined in a dynamic adjustment context. In doing so the Korean data over the period from latter of 1960's to the early 1970's are used. During this period the Korean economy has exhibited a high rate of real growth, a very rapid expansion of the money supply and a continually high rate of inflation, which ranges from between 10.1 to 26.3 per cent per annum with the exception of 1973. (See tables, A-1 and A-2 in the Appendix).

2. Model

In order to model the dynamic relations implied in the L-S

¹ See, for instance, McKinnon (1973) and Shaw (1973).

hypothesis let us concentrate on three major variables: the rates of changes in real output (y'), money (m') and price (p'). It is normally expected that the immediate effect of increased credit creation for developmental purposes would be inflationary. But the rate of inflation can respond to the increased money supply with delays as well. One can consider two avenues through which the rate of change in prices is affected: through a change in the aggregate demand and a change in the aggregate supply.

There are at least two reasons why the demand effect of the increased money supply would show itself with delay. First a credit creation financing a development project or an innovation in the investment goods sector will increase the demand for investment goods. Furthermore as a result of what McKinnon (1973) calls the 'conduit effect' of money balances, the increased supply of money would add a secondary rise in the demand for investment goods.² This additional rise would come through as a delayed response.

Secondly there is the unbalanced growth of demand and supply between investment goods and consumer goods as well as within the consumer goods sector. Initial price rises in one type of investment goods sector would attract scarce resources from other types of investment goods and all prices will soon rise but with different lags. The delayed price rise to past money increases is positive in this case. Let us call this delayed response between the changes in money and price the direct lag and designate it as $D(L)$, where L stands for the lag shift operator.

The supply effect of increased money supply may be explained by two causes. First there is the obvious technological and institutional lag called the gestation period. Secondly the so-called Latin-American Structuralists provide a set of interesting causes for lags of this kind which are not necessarily different from the first lags. They have proposed three famous elasticities, namely (1) the inelasticity of supply in the export sector, (2) the inelasticity of supply

² Nominal interest rates high enough to make the real return of money greater than the real return of physical capital could cause a shift of resources from physical capital to real balances. This is called a substitution effect of money in Neoclassical literatures. Some development economists such as R. I. McKinnon, F. Shaw, and J. Gurley argue that for the less developed countries real balances are a complement to investment in physical capital. High nominal interest rates do not discourage investment but increase the real saving of the community and increase the accessibility of the small investor to organized money markets and modern technology with higher productivity. Increased real balances is therefore said to have a 'conduit effect' for real investments.

in the food producing sector, and (3) the income-inelasticity of the tax structure which arises from the predominance of indirect taxes and reduces the government's ability to manage demand. Although the third inelasticity is slightly out of the line of our argument, the first two inelasticities provide clear reasons why lags should occur between money and output. Let us call this the Schumpeterian lag and designate it as $S(L)$.

When eventually the increased real output comes to the market, it will immediately start to act as a break on inflationary pressure. But there is more to it than this. If the money supply is constantly increased for the purpose of financing the continuous and successful economic growth, then there will eventually be a break in inflationary expectations. This can cause the community to adjust its demand pattern accordingly. This will result in a delayed reduction in the rate of inflation. Let us call this lag between real outputs and prices the real lag and designate it as $R(L)$.³

Figure 1 provides a schematic presentation of the above arguments. The signs in the brackets are the expected directions of delayed responses.

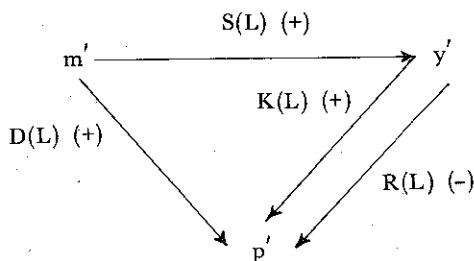


Figure 1

The final effect of changes in m' on p' will depend on the combination of the demand and supply effects. If the estimated coefficients of the lagged responses are predominately positive, it would be evidence that the demand effect is greater than the supply

³ Another frequently proposed theory, which is not structural in character, is the effect of real balance of adjustment. Increased money supply would cause consumption to rise at the expense of real saving and hence raise the consumer price index. As to whether this will happen immediately or what would be the delayed effect very little is known. Whether the increased consumption would raise or lower real investment subsequently is impossible to tell.

effect. On the other hand if the coefficients are predominantly negative, then the supply effect must be more than compensating the demand effect over time. Lewis apparently believes that the latter must be the case when he states, "Inflation for the purpose of capital formation is self-destructive. Prices begin to rise, but are sooner or later overtaken by rising output, and may, in the last state, end up lower than they were at the beginning."⁴ Let us call this combined effect the Lewis lag and designate it as $M(L)$.

It has already been argued that inflation may be lowered by the supply effect of increased real output, with delay. But there are reasons why inflation might be exacerbated by the same increases in real output. Increased income resulting from the increased real output would increase aggregate demand through the consumption, investment and import functions of the Keynesian variety. This is a positive and delayed upward pressure to inflation. Let us call this the Keynesian lag and designate as $K(L)$. The net effect of changes in real output on the rate of inflation would depend on the combination of these two lagged effects, $R(L)$ and $K(L)$.

To put the above arguments formally let us write out a linear model of the sources of inflation for a less developed country as follows:

$$y' = A + [\beta_{ym} + S(L)] m' + \epsilon_1 \quad (1)$$

$$p' = B + [\beta_y + Y(L)] y' + [\beta_m + M(L)] m' + \beta_c C' + \epsilon_2, \quad (2)^5$$

$\beta_c C'$ is short-hand notation for the linear combination of cost terms such as the wholesale price index and wage rates⁶ and ϵ_1 and ϵ_2 are stochastic disturbances assumed to be classically distributed. β_{ym} is the contemporaneous elasticity of real output with respect to money. β_y and β_m are the contemporaneous elasticities of price

4 Lewis (1969) p. 425.

5 The distributed lag operators appear as additive to coefficients of unlagged variables. This is to estimate such coefficients separately from coefficients of lag operators. The reasons for this will be explained in the estimation section.

6 The typical cost variables included in the structuralist equations e.g. Sheehy (1976) are wage rates and the exchange rate. The exchange rates of LDC's, if they are floated or blackmarket rates, are very good measures of the true rate of inflation, frequently better than the consumer price indexes. It would therefore be misleading to use exchange rates as the measure of a possible 'cause' of inflation in this case. If it is pegged, it will be a poor measure of export inelasticity, hence a poor choice for a measure of causes of inflation also. On the other hand the wholesale price indexes measure the true costs to the producers. This index is useful especially since it reflects rises in the prices of imported raw and intermediate materials.

with respect to real output and money respectively. Furthermore, in light of the discussions above,

$$Y(L) = R(L) + K(L)$$

$$M(L) = D(L) + R(L) S(L)$$

All the functions of the lag shift operator L are polynomials of L in unspecified degrees such as, for instance,

$$R(L) = r_0 + r_1 L + r_2 L^2 + r_3 L^3 \dots$$

The expected signs of coefficients are $\beta_{ym} > 0$, $\beta_y < 0$, $\beta_m > 0$ and $\beta_c > 0$. Although we have a certain a priori expectations on the signs of coefficients in $R(L)$, $K(L)$, $D(L)$ and $S(L)$ individually as we have discussed above, when it comes to $Y(L)$ and $M(L)$, it is impossible to tell the signs before estimation is made. It depends on the strength of the real effect $R(L)$ which is inflation-breaking vis a vis other lags.

Equation (2) says that the sources of inflation are contemporaneous and delayed changes in money and output as well as the cost pressure factors. Equation (1) simply says that there is a gestation period between the increase in the stock of money and the increase in real output.

So far there are two equations with two jointly determined variables y' and p' in the model. Monetary and fiscal policies in LDC may sometimes be functionally dependent on the level of economic activity. This is typically seen in areas where a bad harvest escalates grain and other prices. The government tends to react to this situation with restrictive demand management using fiscal and monetary means. To the extent that these *endogenized* demand management policies are successful in depressing the economy, rates of inflation would be positively related to changes in economic activity, y' , with some delay. This may suggest an equation of the following type,

$$m' = P(L)p' = \epsilon \quad (3)$$

where $P(L)$ is a polynomial in lag shift operators. In fact Wachter (1976) takes up this point and estimates the price money relationship in a simultaneous context. But for our purpose this is unnecessary. The coefficient of the contemporaneous term of p' in equation (3) is clearly zero so long as the passive and endogenous monetary policy takes place *only* with delay. Since this is indeed generally the case for LDC's the simultaneity complication would not arise from

equation (3). Although this equation has interesting implications on its own, it is not estimated here in this paper which is devoted to the analysis of the sources of inflations. Here money is treated as exogenous. Our model is thus recursive in y' and p' .

3. Data and Background

The Korean economy underwent a dramatic change around 1963-64. As shown in Table A-1 in the appendix, since the armistice in 1953 the economy was under constant threat of runaway inflation until around 1958 when it is generally agreed that the disequilibrium caused by war had more or less disappeared⁷. The early 60's saw a revival of high inflation. This was due to (1) the excess demand caused by launching the first five year economic plan which was then regarded as 'over ambitious', and (2) to the relaxation of fiscal stringency under the atmosphere of political uncertainty. This was coupled with pressures on the balance of payments due to Korea's typical export inelasticity. After this period inflation settled down to a 'creeping' rate by Korean standards. This is often regarded as a residual rate of inflation inevitable for a less developed economy which is expanding fast. The same table shows the stagnation in real output growth before 63-64, notwithstanding the enormous injection of foreign aid,⁸ and the high rate of economic growth after this.

Table A-2 shows the process of 'financial deepening' in Korean economy. The ratios of M_1 and M_2 over GNP increased by more than twice and nearly five times respectively. Until the early 60's both ratios remained quite stable but started to rise persistently after 63-64. The evidence that the financial deepening is taking place with rapid economic growth is unmistakable.

Available statistics tell us that during most of the data period the direct financing through security market is never more than

7 Many economists regard the incidence of low inflation in 1958 as solely the result of very harsh 'fiscal stabilization program' executed in that year. One shouldn't forget, however, the very success of such harsh program was a sign of resilience gained by the economy by this time.

8 Between 1953 and 1962 it is reported that a total of \$2,514, million in foreign aid was given to Korea in various forms and schemes. In 1962 for instance the contribution of the pure grants in aid was about 56% of total imports in that year and 73% of total tax receipts of the central government.

one-fifth of total bank financing. Such financing practice (i.e. heavily relying on banking sector) is not uncommon even with advanced economies such as Japan and Germany as reported by McKinnon (1973, p. 91).

Sustained high rates of inflation, which persistently ranged over 10% during the last decade and a half, has brought forth inflationary expectations at a similar rate. Through this long experience of inflation, entrepreneurs developed the practice of making capital gains through fixed asset revaluations and reaping the profits which accrued from the devaluation of their fixed-loan liabilities from banks. This created an excess demand for loans from the organized money markets.

For a rapidly expanding economy it is impossible to subdivide the demand for money between that related to the increases in real economic activity and that due to inflation-oriented excess demand. Government was nearly always accommodating to the demand for money, and the available liquidity acted as a conduit for increasing investment. This is to be distinguished from some of the monetary policies of Latin American countries which ratified the rising wages and prices.

As a result we have a case where real output, money and the prices all rose at rapid rates. This presents an interesting situation where the L-S thesis can be tested and the various delayed interactions between these major variables can be determined.

The empirical study covers the period December 1963 to December 1975. Quarterly data of the industrial production index, M_2 , (broad money), the consumer price index for major cities, average monthly earnings, and the wholesale price indices of all goods and of producers goods are used.

It is customary to use a broadly based definition of money when examining money and prices. However, as the predominant source of financing in Korea is bank loans, and as other financial intermediaries are not well developed, M_2 , which includes time deposits is used.

Before August 1972 many Korean firms had drawn significant parts of their financing from the curb markets. According to the census of curb-market financing conducted by the government in July 1972, approximately 26% of the total domestic credit came from the curb-market. This creates a difficult problem in using M_2

as the variable to represent developmental finance.

First there is no usable time-series statistics for the size of curb market financing. Second if this variable had a significant effect on the rate of inflation, and varied in a very different way from M_2 , then use of M_2 may give a misleading picture of the role of money in inflation.

Curb market financing existed as a built-in element in the Korean economy for a very long time. This market intermediated between mainly small savers and the industrial sector. Whereas the rate of interest in the organized market is controlled by the government, market forces determine the interest rate in the curb market. Unlike the size of credits coming from the tertiary financial intermediaries, which is excluded from M_2 , the size of curb market financing is believed to have complemented the variation of credit creation from the banks. When the organized money market is tightened by the government, many firms are known to have gone to the curb markets for their financing.

Because of this complementarity of the curb market to the bank sector if one were able to include the curb market financing in the total development financing, then the variation of the money variable would be mitigated (rather than accentuated). This may have made the money variable less significant as a source of inflation.⁹

The industrial production index reflects the growth of output in the modern capitalized sector. The effect of output variation in the agricultural and other traditional sectors is excluded by this choice. There are several reasons for this exclusion. Firstly, the output variation in the traditional sector is erratic, frequently due to weather and harvest conditions. Secondly, financing by credit creation is typically not related to the expansion of traditional farming. Finally, the government of Korea practices a double grain-price policy which maintains higher prices paid to the farmers and arbitrarily suppresses the urban grain-prices lest it should invite a general price rise. Hence the effect of variation in the traditional sector's output on the consumer price index is quite

9 Some Korean economists believe that the inclusion of the curb-market financing in M_2 would raise the significance of money variables in explaining the Korean inflation. This would be true if the curb-market financing increased as bank financing became more abundant. This is obviously absurd.

distorted. For these reasons it is best to leave this component out of our analysis, although farm price variations will be partly reflected in the wholesale price index.

Three cost variables are chosen; (1) the wholesale price index for all groups, (2) the wholesale price index for producers goods and (3) the average monthly earnings of households whose head is a wage or salary earner. Although the wholesale price index is not strictly devoid of the effects of excess demand or monetary growth, it is used as a proxy for the change in the input costs. In Korea nearly half of the weight in the WPI is assigned to imported raw and intermediate material prices, nearly 20% to the price of farm and fishery sector and the rest divided between finished capital and consumer goods.

4. Estimation

In estimating equations (1) and (2) Almon variable techniques with various lengths of maximum lags using a quadratic form of the polynomial are used. The variables are in the first differences of natural logs of the original variables. This gives estimates of constant elasticities and the results can be compared with those from similar studies. None of the data are seasonally adjusted. Seasonal dummies are used instead.

Table 1 reports the results of the estimation of equation (2). In this table the estimation is based on the maximum lag of 10 periods. Although alternative maximum lags of 7 to 12 periods were tested, the case of 10 periods gave the highest uncorrected coefficient of determination.¹⁰ From this one can conclude that the average delays in responses in the rate of inflation are fairly long.

The equation (2) is specified such that the contemporaneous elasticities of money and real income changes are separated from the weights of lag operators by operating $Y(L)$ and $M(L)$ on lagged values of y' and m' only.¹¹

¹⁰ Uncorrected R^2 is used not to be biased against longer lags.

¹¹ For quadratic function of lags, the values of the first and last coefficients are often underestimates even if one uses open-ended methods. To avoid this distortion from the estimates of contemporaneous elasticities, Almon transforms are taken only on the lagged values of y' and m' .

Table 1

OLS ESTIMATE OF EQUATION (2) $p' = B + [\beta m + M(L)] m' + [\beta y + Y(L)] Y + \beta_c C' + S.D. + \epsilon_t$

	I	II	III	IV	y'	m'	WPIA'	WPIPG'	AME'	Lags										R ²	D.W.	
										1	2	3	4	5	6	7	8	9	10			
1.	.0421*	-.0386*	-.0183	-.0271°	-.2840*	-.0022	.4812**		-.1036	(y')	-.0385	.0411	.1146	.1520	.1823	.1985	.1977	.1807	.1477	.0986	.7328	1.7572
										(m')	.0436	-.0114	-.0557	-.0872	-.1120	-.1240	-.1253	-.1158	-.0955	-.0605		
2.	.0527**	-.0363**	-.0252	-.0268°	-.3261*	-.0321	.3128*			(y')	-.0357	.0739	.1590	.2196	.2558	.2675°	.2548	.2176°	.1559	.0687	.6934	1.7384
										(m')	.0308	-.0385	-.0926	-.1316	-.1554	-.1641	-.1575°	-.1359	-.0990	-.0471		
3.	.0438**	-.0349*	-.0113	-.0209°	-.2586*	-.0432	.4627**			(y')	-.0080	.0836	.1553	.2072	.2392	.2514	.2438	.2163	.1690	.1019	.7294	1.6704
										(m')	.0262	-.0371	-.0871	-.1238	-.1474	-.1526	-.1546	-.1384	-.1089	-.0662		
4.	.0768**	-.0454*	-.0218	-.0224	-.2584°	-.2793°		.0647		(y')	.0297	.0902	.1328	.1326	.1645	.1536	.1248	.0782	.0138	-.0685	.5912	1.8222
										(m')	.0259	-.0118	-.0396	-.0576	-.0651	-.0683	-.0523	-.0308	.0006	.0418		

° Significant at 20% level of significance
 * Significant at 10% level of significance
 ** Significant at 5% level of significance

p' = rate of change in CPI
 m' = rate of change in stock of money
 y' = rate of change in real output
 c' = rate of change in cost terms
 WPIA' = rate of change in wholesale price index for all goods
 WPIPG' = rate of change in wholesale price index for producers goods
 AME' = rate of change in average monthly earnings
 S.D. = seasonal dummies (I, II, III, IV)

4.1 Sources of Inflation

A few implications are clear from this table 1. (a) The coefficients of contemporaneous changes in real output are significantly negative and robust under alternative specifications. (b) The delayed responses of inflation to past changes in real output ($Y(L) = R(L) + K(L)$) are predominantly positive and fairly long (over 6 quarters in average). (c) The contemporaneous effect of the monetary variations are negligible. (d) The delayed responses of inflation to money ($M(L) = D(L) + R(L) S(L)$) is predominantly negative and fairly long (over 6 quarters in average). (e) The cost variables are uniformly positive and very significant. (f) Seasonal variations in inflation are distinct and significant. Let us investigate these in turn.

(a) **Income** Estimated coefficients of the output variable range between $-.25$ and $-.32$. Signs are, as expected, negative and significant. Increased real output should help to combat inflation immediately.

(b) Although real output changes have an immediate dampening effect, over time the lagged coefficients show persistently positive signs. Many of the coefficients are not significant due to extensive multicollinearity, although the sums of coefficients are usually greater than twice the standard deviations of the sums. Furthermore, the Almon method is a somewhat arbitrary interpolation of the coefficients and the actual sizes of the coefficients should be seen with care. However the persistent signs of coefficients, especially if they are consistent under alternative specifications, may be used to make valid inferences.

In the case of real output one can conclude that the Keynesian lag is showing a greater effect than the real effect over time. The increased demand for consumption, investment and imported goods is the dominant delayed effect of real output expansion. In the Korean context the Keynesian lag due to increased investments and imports are particularly important. The decade-long experience of high economic growth has bred a high growth mentality in the community. This is institutionalized in the high expected (planned) growth rates. In this way past rates of high economic growth caused the higher present demand for investment goods and imported material. This explains the strong positive Keynesian lag in Korea.

(c) **Current Money Effect.** It is interesting to note that all the

coefficients of contemporary money terms are not significantly different from zero. One would immediately think about the omission of curb market financing and consequent possible misspecification of money as the cause of this insignificance. As we have seen in the previous section this is not the cause of the insignificance of the money variable. So long as the curb-market financing complements the variation of M_2 , the significance of the money variable coefficients may actually decline if one adds this source of financing in the money variable.

Money variables are reported to be a significant source of inflation in Chile by Harberger (1963), in Argentina by Diz (1970) and in cross section studies of Latin American countries by Vogel (1974). However in all these cases the cost variables are either totally excluded (Vogel) or insignificant (Harberger and Diz). In Diaz-Alexandro's study (1965) of the Argentinian inflation cost terms are reported to be significant and the money terms not significant.

In the case of Korea the cost terms are very significant and the money terms are contemporaneously not significant. Kim (1973) also finds that the money variables are not significant in Korea.

The Korean government uses control over M_1 and M_2 (through various direct controls of re-discount rates, variations of quarterly ceiling of commercial bank loans and qualitative controls of term structures of loans) as the major counter-cyclical policy tool, with some time lags. Under these circumstances money is hardly likely to be the major source of inflation, at least immediately. Campbell (1970) reports the elasticity of money with respect to inflation as .86 in Korea. This high elasticity of money is due to the delayed anti-inflationary monetary policies in Korea.

(d) Lagged Money Effect. Table 1 shows that the delayed money variables have predominantly negative signs. As discussed in section 2, the net effect of increased money supply on the rate of inflation depends on the relative strengths of (1) the demand creating direct effect $D(L)$ and (2) the delayed real supply effect of the increased output, $S(L) \cdot R(L)$. If the latter is the dominant force then, over time, inflation will dampen down, as Lewis expected, in response to the increased money supply. This is precisely the explanation for the negative signs of coefficients in $M(L)$.

(e) Wages and Other Costs. The wage variable is insignificant in all cases. The relationship between wage rises and inflation is admittedly a complex one. There is, however, evidence that in

poor countries with high inflation, for instance in Chile, wages lag behind inflation with an elasticity of less than one.¹² As a source of inflation wage growth is less menacing than in developed countries. This would be especially true in Korea which has various forms of controls over wages and industrial activities.¹³ The elasticity of inflation with respect to wages on our estimates ranges from .03 to .11 with the median somewhere near .09. This is a very low contribution to inflation even if one is prepared to admit that the statistical insignificance may be due to the intercorrelation problem.

The most consistently significant cost variable is the wholesale price index. The elasticity of inflation with respect to the WPI for All Groups is nearly .50 and that with respect to the CPI of Producers Goods is nearly .30. On this evidence cost pressures can be said to be the most important source of inflation in Korea.

To analyse further sources of inflationary pressures manifested through wholesale prices, the broad distribution of weights of WPI for All Groups are recorded in Table 2 below.

Table 2
DISTRIBUTION OF THE WEIGHTS OF WPI FOR ALL
GROUPS AND THE ELASTICITIES OF INFLATION WITH
RESPECT TO VARIOUS COST GROUPS

	Weights	Elasticities
Agricultural and Marine Goods	.179	.0828
Finished Consumer Goods	.329	.1522
Finished Capital Goods	.053	.0245
Semiprocessed Materials	.439	.2031
Total	1.000	.4627

Source: Bank of Korea *Monthly Research Report* December 1974 pp. 13.

Assuming that the weight distribution of the WPI also represents the weights of inflationary pressures arising out of each group, the

12 See Koot (1971).

13 See Lim (1971) pp. 286-287.

Table 3
OLS ESTIMATE OF EQUATION (2) WITH AGRICULTURAL
FOOD AND IMPORT PRICE INDEX

	I	II	III	IV	y'	m'	WPIMG	WPIAF	AME	R ²	DW
	.0355**	-.0311**	-.0168*	-.0147	-.2035*	.0915	.0292*	.1933**		.5836	1.9691
	(Lag Coefficients)										
(y')	.0273	.0254	.0265	.0301	.0378	.0480	.0612	.0774	.0967	.1190	
(m')	.0145	.0046	-.0048	-.0138	-.0222	-.0302	-.0377	-.0447	-.0513	-.0573	
	.0356**	-.0325	-.0193	-.0180	-.2031*	.0915	.1315*	.1941**	.0794	.5866	7.0385
	(Lag Coefficients)										
(y')	.0424	.0348	.0311	.0311	.0349	.0424	.0538	.0689	.0878	.1105	
(m')	.0020	-.0035	-.0092	-.0750	-.0210	-.0271	-.0335	-.0400	-.0466	-.0534	

WPIMG = wholesale price index of imported goods.
WPIAF = wholesale price index of agricultural foods.
For other notations see Table 1.

second column of inflation elasticities with respect to each group is computed based on the results of the specification 3 reported in Table 1. The two major areas where cost push arises are the agricultural and marine sector and semiprocessed materials which are largely imported. The high grain-price policy of the government did not help the situation either.

The main difficulty with this estimate of sources of cost pressure is that the total elasticity (.4627) is influenced partly by finished consumer goods. There may be some circularity of causation in this estimate. To avoid this complication the WPI for imported goods and the WPI for the agricultural food group are collected and used in separate regressions. The results are reported in Table 3. The new results confirm the results of table 1 very closely in all cases except for the elasticities of new variables. The inflation elasticity with respect to WPI of imported goods is about .13 and that with respect to the WPI for the agricultural good is about .20. Both coefficients are significant in all cases. Contrary to the estimates of table 2 agricultural goods make a bigger contribution to the inflation than do imported materials, but still the fact remains that cost pressure is the main cause of inflation and it comes mainly from rising prices of imported materials and agricultural goods.

(f) Seasonality. Although the values of the elasticities are very small, the seasonality dummies have distinct significance in the first quarters of the calendar year. Several factors which raise the inflationary pressures are concentrated in this period. Traditionally lump sum expenditures are concentrated during the festive season of New Year (both solar and lunar). Lump sum expenditures for fuel, and food conservation for winter days, and expenditure for school registrations are also concentrated in this period. This is usually followed by a general slack during the second quarter.

4.2 Schumpeterian Lag

Finally to determine the Schumpeterian lag $S(L)$ equation (2) is directly estimated by OLS. The result is reported in Table 4. The data period is divided into pre-1970 and post-1970 periods. From appendix A-2, it can be seen that at around 1970 the M_2/GNP ratio has stabilized at around one-third whereas before this period

Table 4

OLS ESTIMATES OF EQUATION (1) UNDER ALTERNATIVE TIME PERIODS, $(\hat{y}' = A + S(L))m' + \beta_{ym}' + S.D. + \epsilon$

	I	II	III	IV	m'	Code	Lags										R ²	D.W.	SSE
							1	2	3	4	5	6	7	8	9	10			
All period	.0060	.0586**	-.0249*	.0711**	.2352*	fixed end	-.0006	-.0014	-.0019	-.0022	-.0023	-.0022	-.0019	-.0014	-.0008	.5540	2.4131	.0587	
	-.0020	.0586**	-.0215	.0709**	.2066°	free end	.0302	.0263	.0224	.0184	.0144	.0103	.0061	.0011	-.0024	-.0068	.5697	2.4389	.0566
IV/63	-.0111	.0582**	-.0239**	.0582**	.4375**	fixed end	-.0014	-.0025	-.0034	-.1039	-.1042	-.5042	-.0039	-.0034	-.0025	-.0014	.9954	2.6085	.0233
	-.0151°	.0565**	-.0241*	.0558**	.4583**	free end	-.0267	-.0122	-.0007	.0076	.0127	.0147	.0136	.0094	.0020	-.0085	.9957	2.5962	.0216
1/71	.0403	.0652**	-.0160	.0923**	.0512	fixed end	-.0171	-.0308	-.0450	-.0479	-.0519	-.0513	-.0479	-.0410	-.0308	-.0171	.5610	2.2443	.0322
	.1340°	.0670**	.0302	.0924**	-.7900°	free end	.4856	.2419	.0405	-.1184	-.2347	-.3051	-.3408	-.3301	-.2771	-.1816	.7436	2.4739	.0188

For notation see table 1.

(d.f.)

(5.41)

(7.39)

(m.L. = 2.6282)

(m.L. = 3.7026)

(5.51)

(7.13)

(m.L. = 4.4412)

it increased steadily. For each period fixed and free end points are alternatively used in estimating the distributed lag coefficients by Almon methods.

In terms of the coefficient of determination the regression for pre-1970 period of rapid expansion of money performs better than post-1970. And in this period the contemporary dependence of the real output to money are pronounced. However there are several reservations in making this statement. Firstly, the hypothesis of structural continuity between these two periods can be tested by 'Chow test'. The computed value of F statistics is 1.7824 which is not significant at 5% level. Therefore there is no reason to suspect the coefficients of money in the pre-1970 period to be different from these of the entire period. Secondly, the estimates for the entire period show very weak or no significance (at conventional significance levels). Thirdly, the existence of negative autocorrelation as shown by high D-W statistics in the first period regression invokes a strong suspicion as to the significance of the coefficient of money.

The estimates of distributed lag coefficients in the cases with fixed end points have signs which are counter-intuitive and hence can be disregarded in selecting plausible estimates. There are three free-end-point estimates which show plausible signs. They register an average money-income lag from three quarters (2.6282) to slightly over a year (4.4432).

5. Conclusions

Econometric studies of the sources of inflation in many LDC's have one major defect in common. The speed of adjustment of prices to changes in the sources of inflationary pressure is almost totally disregarded. The idea of delayed responses between monetary expansion, real output growth and increasing prices was proposed as early as Lewis and Schumpeter.

In this paper the dynamic relationship between changes in money, real output and inflation is analysed and econometrically estimated along with the major cost pressure variables. In doing so Korea is selected as a test case because she shows simultaneous experience of economic growth, monetary expansion and a high and continuous rate of inflation.

Table A-1
CHANGES IN CONSUMER PRICE INDEX AND
GROSS NATIONAL PRODUCT IN KOREA

Year	CPI (Seoul)	Rate of change in CPI	GNP in 1970 Price	Rate of change in GNP
	1960 = 100	%	bill. won	%
1953	26.6		843.52	
1954	36.4	36.8	890.18	6.7
1955	61.3	68.4	938.24	5.9
1956	75.4	23.0	942.21	1.1
1957	92.9	23.2	1014.44	8.1
1958	89.6	-3.6	1067.15	6.5
1959	92.5	3.2	1108.33	4.8
1960	100.0	8.1	1129.72	2.5
1961	108.1	8.1	1184.48	5.0
1962	115.2	6.6	1220.98	4.1
1963	139.0	20.7	1328.31	9.3
1964	180.0	29.5	1441.99	8.9
1965	204.4	13.6	1529.70	8.1
1966	229.1	12.1	1719.18	4.9
1967	253.9	10.8	1853.01	7.8
1968	282.1	11.1	2087.52	12.7
1969	310.5	10.1	2400.49	15.0
1970	350.0	12.7	2589.26	7.9
1971	393.1	12.3	2826.82	9.2
1972	429.6	11.8	3023.63	7.0
1973	453.3	3.1	3507.45	16.0
1974	560.4	23.6*	3811.27	8.7
1975	707.7	26.3*	4129.32	8.4

Source: Bank of Korea, Economic Statistics Yearbook, Seoul, Korea, Various Issues.

* Effect of world oil crisis.

Table A-2
CHANGES IN VARIOUS FORMS OF MONEY IN KOREA

Year	Money		GNP in Current Price	M ₁ /GNP	M ₂ /GNP
	M ₁	M ₂ *			
	(bill won)				
1953	3.03	3.27	48.18	.06	.07
1954	5.81	6.19	66.88	.09	.09
1955	9.35	10.05	116.06	.08	.09
1956	12.09	13.52	152.44	.08	.09
1957	14.52	16.03	197.78	.07	.08
1958	19.26	20.87	207.19	.09	.10
1959	23.29	26.48	221.00	.11	.12
1960	24.51	27.61	246.34	.10	.11
1961	34.41	40.31	297.08	.12	.14
1962	40.82	53.51	348.89	.12	.15
1963	41.26	54.58	488.54	.08	.11
1964	48.58	63.37	700.20	.07	.09
1965	69.70	96.37	805.32	.08	.12
1966	84.18	155.97	1032.45	.08	.15
1967	120.03	250.86	1269.95	.09	.20
1968	149.84	409.83	1598.04	.09	.26
1969	217.95	669.48	2081.52	.10	.32
1970	306.47	882.78	2589.26	.12	.34
1971	357.97	1066.66	3151.55	.11	.34
1972	519.39	1430.91	3860.50	.13	.37
1973	730.30	1944.52	4901.63	.15	.40
1974	945.71	2396.27	6747.07	.14	.36
1975	1181.75	3092.36	9080.33	.13	.34

* M₂ is M₁ + time deposits.

Among the results, the role of real output is found to be inflation dampening in the short run but inflation generating in the longer run because of the operation of the Keynesian lag through excess demand which is sustained by the expectation of high economic growth.

Money is not an immediate cause of inflation for various institutional reasons operating in Korea but it is inflation dampening over time. The delayed supply effect of money is stronger than its delayed demand-generating effect. Cost variables, especially the price rises of imported materials and agricultural goods are major sources of inflation whereas the wage variable contributes little.

The findings do not necessarily vindicate all of the Lewis-Schumpeter thesis of inflation but at least in the case of Korea it shows that the financing economic development by credit creation is not inflationary over time. The reasons for the sustained high inflation in Korea are (1) the high growth mentality and associated excess demand of goods and industrial materials and (2) the cost pressures of these goods. The cause of 'developmental inflation' in Korea is not the monetary policies ratifying the rising wages and prices, nor the structuralists' rigidities of different sorts, but the growth-induced demand for food and imported materials and associated cost pressures from these markets.

It is noteworthy that the speed of adjustment in output in response to developmental financing was not longer than a year on average. The price level, however, responded to the changes in real output and money with a fairly long delay. Furthermore, the signs of the lagged coefficients are not the same as contemporary effects and are often opposite to those intuitively expected. The Lewis lag is inflation-destroying and the Keynesian lag in inflation generating.

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