THE INFLATIONARY IMPACT OF EXCESS DEMAND IN AGRICULTURE

by

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Introduction

This paper develops and tests a model of inflation in which both the overall level of excess aggregate demand and its sectoral distribution contribute to the inflationary process in the short run. The model is used to derive an inflation equation which is estimated using quarterly data for the post-war U.S. economy.

In developing the model, it is assumed that prices respond to excess demand conditions at different rates in different sectors. Specifically, agricultural prices are assumed to adjust more rapidly than other prices. It is then shown that, at a given level of excess aggregate demand, inflation is higher than otherwise when exogenous decreases in supply or increases in the demand for agricultural commodities raise relative food prices. The short-run inflation rate declines, given the level of excess aggregate demand, with exogenous decreases in excess demand in agriculture.

The paper thus emphasizes the role of the agricultural sector in the inflationary process. More generally, the model developed here implies that whenever demand is concentrated in those sectors where prices adjust relatively rapidly to clear markets the overall inflation rate will be higher than otherwise.

This work applies the theoretical construct which has recently received renewed attention in the literature, that the sectoral distribution of demand, as well as its aggregate level, matters in the determination of price changes. The literature rests on the assumption that prices respond asymmetrically to excess demand and excess supply conditions. Schultze describes the U.S. inflation of the late 1950's as originating out of market disequilibria (due to shifting tastes) and a floor to price changes.[1] More recently, Tobin has written that inflation can result with vacancies balancing unemployment and no inflationary expectations. This occurs in an economy in sectoral flux when unemployment retards money wages less than vacancies accelerate them[2].

The theory presented here also indicates that inflation, in the short run, can arise out of sectoral imbalances. The innovation of the model developed here is that such inflation need not be based on the greater resistance of prices or wages to downward than to upward adjustments, as in the Schultze sectoral imbalance model. All that needs to be assumed is that prices in some sectors adjust more readily than prices in other sectors.

Once this assumption is made, the short-run inflation rate can be shown to depend on the composition of excess aggregate demand, as well as on inflationary expectations and the level of excess aggregate demand. For example, the economy may be in an inflationary equilibrium with the inflation rate equal to the expected inflation rate and with zero excess aggregate demand. If there is an exogenous increase in excess demand in sectors with rapidly adjusting prices, the inflation rate in the short run will rise. This occurs since the shift to excess demand in sectors with rapidly adjusting prices causes the rate of price change in those sectors ro rise more rapidly than the shift to excess supply causes the rate of price change to decline in sectors with slowly adjusting prices. The recruiting rise in the inflation rate implies, with a given rate of monetary expansion, an increase in the velocity of money and a decline in real balances. Hence, a structurally caused rise in the overall rate of price change is a short-run phenomenon unless an accomodating monetary and fiscal policy is pursued. In the absence of such a policy, the decline in real money balances leads to a decline in real output, until the inflation rate adjusts downwards. In the short-run, however, a given monetary and fiscal policy will yield varying inflation rates depending on the distribution of excess aggregate demand across sectors. Or, in other words, the income velocity of money varies in the short-run and the variation is determined, among other factors, by the sectoral composition of excess aggregate demand.

I. The Model

The model derived here assumes that, for various reasons, sectors adjust their prices to changes in the level of demand at different speeds. First, competitive sectors, such as agriculture, may adjust their prices and wages in reaction to changed demand conditions faster than non-competitive sectors. Unionized industries in the non-competitive sectors are more likely to be committed contractually, in the short run, to a given percentage wage increase even though current demand makes the wage rise inappropriately low or high. Moreover, to maintain an industry-wide price structure, oligopolistic industries may choose to change their prices less often than competitive industries. The long-run optimal pricing strategy for an oligopolistic industry may be to move slowly in adjusting prices and wages in response to positive and negative fluctuations in excess demand. Second, even without substantial market power, some industries may adjust prices more slowly than others. This may occur because the nature of the goods they sell, for example, rental housing, requires the setting of prices for relatively fixed contract periods. The assumption maintained here is that, for whatever reasons, agricultural prices adjust more quickly than other prices.

To develop a model incorporating varying price reaction coefficients, a linear price reaction equation is adopted for an economy without inflationary expectations such that:[3]

$$\frac{P_i}{P_i} = \frac{K_i X_i}{q_i^S} = \frac{K_i(q_i^D - q_i^S)}{q_i^S} \qquad (1)$$

where P_i is the first derivative of the price of good i with with respect to time, K_i, a positive constant, X_i, the level of excess demand, q_i^D, the quantity demanded, and q_i^S, the quantity supplied. The equation states that the rate of change in a price is directly proportional to the excess for the good expressed as a fraction of the quantity supplied. Excess demand equations take the following form:

$$X_i = X_i(P_1, \ldots P_n;\ P_1^e, \ldots, P_n^e;\ A) \qquad (2)$$

where P^e indicates the expected price, and A is a term representing the initial level and distribution of assets.

The Laspeyres price index is then utilized to measure the inflation rate, $\frac{\dot{P}}{P}$. In a two-sector economy,

$$\frac{\dot{P}}{P} = \frac{\bar{q}_1 \dot{P}_1 + \bar{q}_2 \dot{P}_2}{\bar{q}_1 P_1 = \bar{q}_2 P_2}$$

where $\bar{q}_1$ and $\bar{q}_2$ are base period quantities and P_1 and P_2 and $\dot{P}_1$ and $\dot{P}_2$ are current prices and current rates of change in prices, respectively. The agricultural sector is indicated by subscript 1 and the rest of the economy by subscript 2. Substitution the price reaction equation (1) into equation (3) results in:

$$\frac{\dot{P}}{P} = \left(\frac{\bar{q}_1 P_1 K_1 X_1}{q_1^S} = \frac{\bar{q}_2 P_2 K_2 X_2}{q_2^S}\right) \Bigg/ (\bar{q}_1 P_1 + \bar{q}_2 P_2) \qquad (4)$$

$$\approx \frac{\sum_{i=1}^{2} P_i K_i X_i}{\sum_{i=1}^{2} \bar{q}_i P_i}$$

This holds precisely for the case where the quantity weights, $\bar{q}_i$, equal the quantities supplied, q_i^s.[4] Equation (4) can then be written, as follows

$$\frac{\dot{P}}{P} = \frac{K_2 \sum_{i=1}^{2} P_i X_i}{\sum_{i=1}^{2} P_i \bar{q}_i} + (K_1 - K_2) \frac{P_1 X_1}{\sum_{i=1}^{2} P_i \bar{q}_i} \qquad (5)$$

When there is excess aggregate demand by definition,

$$\sum_{i=1}^{2} P_i X_i > 0. \qquad (6)$$

Thus, equation (5) indicates that the inflation rate is positively related, first, to the current level of excess aggregate demand relative to output, and, second, assuming $K_1 > K_2$, to excess demand in agriculture relative to overall output. This is so unless prices adjust quickly to clear markets. For example, if price reaction coefficients are sufficiently large, the entire price adjustment process could occur within the quarter. Then even with $K_1 > K_2$, sectoral imbalances would not have any impact on the average inflation rate over the quarter (and excess demand in each sector χ_i would equal zero).

In general, it may be assumed, in an economy with an ongoing inflation, that the rate of price change in each sector and the overall rate of price change is composed of an equilibrium and a disequilibrium component. In a simple Phillips curve approach, the equilibrium component is represented by an expected inflation rate term and the disequilibrium component, by the unemployment rate. Equation (5) implies, however, that, in disequilibrium, the distribution of excess aggregate demand as well as its overall level, measured in the Phillips curve approach by the unemployment rate, contributes to the inflationary process. Equation (5) indicates that with zero excess aggregate demand, $\sum_{i=1}^{2} P_i X_i = 0$,[5] when excess demand exists in agriculture, $P_1 X_1 > 0$, balanced by excess supply elsewhere, $P_2 X_2 < 0$, inflation results in the short run. With this distribution of excess aggregate demand, an unemployment rate which previously did not provoke inflation or an accelerating inflation in the presence of inflationary expectations now leads to a short-run increase in the inflation rate.[6] This follows if it is assumed that prices react more quickly in agriculture than elsewhere. Equation (5) also implies, mutatis mutandis, that when excess supply exists in agriculture, $P_1 X_1 < 0$, with $\Sigma P_i X_i = 0$, there will be a decrease in the short-run inflation rate and the larger the excess supply in absolute value, the greater the decrease.

Excess demand in agriculture is not readily observable. Thus equation (5) is difficult to test. Here an alternative route is taken which substitutes the rate of change in the relative price of food into equation (5), as follows, although this too raises some problems as discussed below. By definition

$$\Psi = \frac{\dot{P}_1}{P_1} - \frac{\dot{P}_2}{P_2} \qquad (7)$$

substituting (1) into (8),

$$\Psi = \frac{K_1 X_1}{q_1} - \frac{K_2 X_2}{q_2}$$

Then, solving for X_2 in terms of X_1 and substitution into (8) results in:

$$\Psi = \left(\frac{K_1}{q_1^s} + \frac{K_2}{q_2^s} \frac{P_1}{P_2} X_1 \right) - \frac{K_2 \Sigma P_i X_i}{q_2^s P_2}$$

Letting,

$$e = \frac{1}{\frac{K_1}{q_1^s} + \frac{K_2}{q_2^s}\ \frac{P_1}{P_2}} > 0 \qquad (10)$$

and,

$$f = \frac{K_2/q_2^s P_2}{\frac{K_1}{q_1^s}\ \ \frac{K_2}{q_2^s}\ \frac{P_1}{P_2}} > 0 \qquad (11)$$

then,

$$X_1 = e\ \Psi + f\ \Sigma\ P_i X_i \qquad (12)$$

Substitution (12) into (5) results in,

$$\frac{P}{P} = \frac{\left[K_2 + f\ P_1(K_1\ K_2)\right]\Sigma\ P_i X_i}{\Sigma\ P_i \bar{q}_i} + \frac{(K_1 - K_2)\ P_1\ e}{\Sigma\ P_i \bar{q}_i} \qquad (13)$$

Essentially, the coefficient of $\Sigma P_i X_i / \Sigma P_i q_i$ represents a weighted average of the price reaction coefficients, with output shares as weights. If K_1 and K_2 are positive, the coefficient of $\Sigma P_i X_i / \Sigma P_i q_i$ in equation (13) is positive, since $0 < fP_1 < 1$.[7] Thus, the rate of change in the price level varies directly with the level of excess aggregate demand. Since $(P_1 e)/\ \Sigma\ P_i q_i > 0$,[8] the value of the coefficient of the rate of change in the relative price of food, Ψ in (13), is positive, negative, or zero depending on whether K_1 is greater, less than, or equal to K_2. The absolute size of the coefficient of Ψ approaches in the limit the share of sector 1 in the price index, as K_2 approaches zero.[9] The sign of the coefficient of Ψ depends only on the size of K_1 relative to K_2. In the estimation of an inflation equation, the coefficient of Ψ may overestimate the separate influence of structural imbalances since Ψ, as indicated by equation (12), is influenced by excess aggregate demand. This is discussed further below. However, here it can be noted that this would occur only if price reaction coefficients were larger in agriculture than elsewhere. Only if K_1 is greater than K_2 as hypothesized, will the inflation rate vary directly with the rate of change in the relative price of food. If X_1 is chosen as a sector in which prices adjust more slowly than elsewhere, K_2 will be greater than K_1 and a negative coefficient for Ψ is predicted.

II. ESTIMATION

The importance of the sectoral inflation described above depends on the difference in the speed with which prices adjust to market disequilibria in different sectors. An indirect test of the differential in the size of price reaction coefficients is provided by the estimation of inflation equation (13). This equation states that the rate of price change varies with excess aggregate demand relative to output and the rate of change in the relative price of food. Given the way excess demand in the ith sector, X_1, has been defined, the excess aggregate demand variable, $\frac{\Sigma P_i X_i}{\Sigma P_i q_q}$, indicates demand-pull pressures at any given expected rate of price change. One way then to estimate the inflation equation is to include as independent variables measures of excess aggregate demand such as the unemployment rate and the rate of capacity utilization, as well as a measure of price expectations, and the rate of change in the relative price of food. To capture the possible impact of demand-pull pressures in markets where prices adjust so rapidly that excess demand conditions do not appear, the current rate of change in the money supply can also be included. Thus, the following basic equation is tested with quarterly data:

$$\frac{\dot{P}}{P}(t) = B_0 + B_1 U(t) + B_2 CU(t) + B_3 M(t) + B_4 \frac{P_e}{P}(t) + B_5 \Psi(t) \quad (14)$$

where $\frac{\dot{P}}{P}(t)$ indicates the percentage change in the consumer price index across each quarter; U(t), the average unemployment rate a quarter; CU(t), the Wharton index of capacity utilization;[10] M(t), the quarterly rate of change in the money supply defined as M_1; and, $\frac{\dot{P}_e}{P}(t)$, a price expectations term. To measure $\Psi(t)$, the rate of change in the relative price of food, first, the relative price of food is derived by dividing the food price component of the CPI in period t by the CPI in period t. $\Psi(t)$ is then the quarterly rate of change in this variable.[11]

The use of demand-pull measures (such as unemployment, capacity utilization, and money supply) as independent variables in a price inflation equation rather than measures of change in costs, (such as the rate of change in wages) reflects a quasi-reduced-form approach. It is assumed that wages and other input costs are themselves to a large degree determined by demand-pull factors and past price changes.[12] Demand variables affecting wages as well as those directly affecting prices, legitimately enter this type of equation. The separate use of unemployment, capacity utilization, or the money supply may not provide an adequate measure of demand-pull pressures in all sectors. However, the use of these variables together leads to problems of multicollinearity. Thus, inflation equations are estimated with various combinations of these variables. Furthermore, there are difficulties in divising a measure of inflationary expectations, $\frac{\dot{P}_e}{P}(t)$. Hence, inflation equations are estimated using several proxies for $\frac{\dot{P}_e}{P}(t)$. The equation is estimated both with and without $\Psi(t)$, using quarterly data from 1948-1974 with the results given in Table 1. In equations 1.1 through 1.8 the lagged dependent variable is used as a proxy for inflationary expectations.

The Results

In each of the estimated equations the coefficient of the lagged dependent variable is significant with the expected positive sign. This may reflect the impact of inflationary expectations as well as the impact of omitted variables or of lag on included variables. As expected, a good deal of multicollinearity is observed in equations (1.7) and (1.8) where all of the demand-pull variables are used. Further, the coefficient of the unemployment term is significant with the expected negative sign only in equation (1.4) which includes the money supply and the rate of change in the relative price of food. However, in equations (1.1), 1.2), (1.5), and 1.6) which include capacity utilization with one other excess demand variable, the coefficient of capacity utilization is significant with the expected positive sign. Similarly, in the four equations (1.3), (1.4), (1.5), and (1.6) in which the money supply is found with one other excess demand variable, the coefficient of the money supply term is significant and positive as expected.

Finally, in equations (1.2), (1.4), (1.6), and (1.8) where Ψ, the rate of change in the relative price of food is included, its coefficient is significant with the anticipated positive sign. The presence of this term does not lower the levels of significance of the other included variables. However, there is a difficulty in interpreting the size of the coefficient of Ψ . Since, as indicated by equation (9), Ψ is a function of excess aggregate demand, its coefficient may, to some extent, reflect the influence of excess aggregate demand variables on the inflation rate. If, as is assumed, agriculture prices adjust more rapidly than other prices, Ψ will be a leading indicator. That is, in an excess aggregate demand caused spurt in inflation, food prices will go up before other prices and there will be a positive correlation between the rate of change in relative food prices and the inflation rate. If demand-pull pressures continue at the same level, supporting inflation at the new level, the relative price of food will drop to its original level. In this case, the period of positive correlation between the rate of change in the relative price of food and the inflation rate is followed by a period of negative correaltion and, overall, Ψ and $\frac{\dot{P}}{P}$ will not be positively correlated. It is likely, though that, at times, increases in aggregate demand and the inflation rate are reversed, before relative food prices can adjust back to their original level. Under these circumstances, the size of the independent influence of the distribution of excess aggregate demand on inflation will be overstated by the coefficient of Ψ in the inflation equation. But agriculture can be a leading sector only if prices adjust more rapidly in agriculture than elsewhere. Thus, even where aggregate demand changes direction before relative prices fully adjust, the finding of a positive and significant coefficient for Ψ indicates that the concentration of excess aggregate demand has an impact on the inflation rate, although the size of the impact will be overstated by the coefficient of Ψ.

An alternative method of capturing the influence of price expectations is to estimate a distributed lag on the dependent variable using an Almon technique.[13] As seen in a sampling of the findings, given in equations 1.9 through 1.11 in Table 1, using an Almon lag on the dependent variable as a proxy for the expected inflation rate does not change the earlier results. Additionally, the technique of instrumental variables maybe employed to find a proxy for $\frac{\dot{P}_e}{P}$. In this approach, expectations may be viewed as being based on lagged values of the independent variables where the lagged weights are determined in a first stage regression of $\frac{\dot{P}}{P}(t-1)$ on past values of unemployment, capacity utilization, the money supply, and the rate of change in the relative price of food. The $\frac{\dot{P}}{P}(t-1)$ that is predicted by this equation is substituted for $\frac{\dot{P}}{P}(t-1)$ and the equations are reestimated with the results given in equations of Table 1. As indicated in these equations the results of estimating inflation equations using this procedure also support the earlier findings.

It is also useful to estimate these equations over a shorter time period since the latter years of the period over which the inflation equations have been estimated are unusual in several respects.[14]

Thus, the equations are reestimated only through 1970 with the results given in Table 2. As can be seen, these results substantially duplicate the results for 1948-1974 of Table 1.

In summary, in all of the equations, the coefficient of at least one excess demand variable is significant with the expected sign, as is the coefficient of the lagged dependent variable. Furthermore, again, the coefficient of the rate of change in the relative price of food is also significant and positive. Hence, these results support a broad interpretation of the inflationary process in which both excess aggregate demand and the concentration of excess demand in agriculture have a role.[15]

III. IMPLICATIONS FOR CONTINUING INFLATIONARY PRESSURES

The model developed in this paper suggests that part of the variation in the short-run inflation rate and in the income velocity of money is due to the changing sectoral composition of excess aggregate demand. The empirical evidence suggests that a theory of "commodity inflation" may be relevant for the U.S. economy. Such an inflation, while it temporarily worsens the Phillips curve trade-off, will not continue in the long run, without an accomodative monetary and fiscal policy.[16] However, the short-run rise in overall prices that occurs due to sectoral imbalances may produce pressure to implement policies that lead to a rise in the long-run inflation rate. This is illustrated in the 1973-74 U.S. experience in double-digit inflation. Sharp increases in demand for U.S. produced agricultural commodities resulted in higher food prices and a higher overall inflation rate because, it is argued here, non-food prices adjusted more slowly than food prices to a changed sectoral composition of demand. The higher inflation and interest rates put downward pressure on aggregate demand which resulted in declines in output and increased unemployment. In turn, this led to pressure to undertake a more expansive monetary and fiscal policy which if followed, would have had the effect of validating the increased inflation. A similar rise in the relative price of food, if it occurs, will continue to force a choice between an increase in the short-run unemployment rate and persistent inflation at a new higher rate.

FOOTNOTES

*Assistant Professor of Finance, University of Pennsylvania. The author wishes to thank Stephen Ross for helpful suggestions.

[1] Charles Schultze, Recent Inflation in the United States, Study Paper No. 1 for the Joint Economic Committee of Congress, Washington, 1959.

[2] James Tobin, "Inflation and Unemployment," American Economic Review, March 1972. In his article, Tobin also comments on the impact of differing price reaction coefficients across sectors as follows: "An unlucky random drawing might put the excess demands in highly responsive markets and the excess supplies in especially unresponsive areas." (p. 10). See also G. C. Archibald, "The Structure of Excess Demand for Labor," in Edmund Phelps, et al., Microeconomic Foundations of Employment and Inflation Theory (New York: W. W. Norton, 1970). The studies of Tobin and Archibald point out that an implication of the assumption of asymmetrical price reaction coefficients is that of the variance of sectoral unemployment rates increases so will the inflation rate. For derivation of a short-run Phillips curve in a world of sectoral imbalances without the necessity of assuming asymmetrical price and/or wage responsiveness see R. Barro and H. Grossman, Money, Inflation, and Employment, forthcoming.

[3] The framework used here is similar to one evolved originally by A. Enthoven in his "Monetary Disequilibria and the Dynamics of Inflation," Economic Journal, June 1956, which derives necessary and sufficient conditions for a price rise under a variety of price reaction assumptions.

[4] This assumption which essentially requires the quantity weights to equal the current quantities supplied is maintained throughout. The assumption simplifies the exposition but is not necessary for the testing of the model.

[5] Hereafter, the range of the index is suppressed. It should be assumed the range continues to be from 1 to 2, as indicated here.

[6] In other words, the non-inflationary rate of unemployment varies not only with the dispersion of unemployment as suggested by Tobin and others, but also with the sector in which unemployment is concentrated.

[7]By definition

$$f = \frac{K_2/q_2{}^s P_2}{\dfrac{K_1}{q_1^s} + \dfrac{K_2}{q_2{}^s}\dfrac{P_1}{P_2}} \qquad \text{(i)}$$

Multiplying the numerator and denominator of (i) by $q_2{}^s P_2 q_1{}^s$, results in:

$$f = \frac{K_2 q_1{}^s}{K_1 q_2{}^s P_2 + K_2 q_1{}^s P_1} \qquad \text{(ii)}$$

Then, multiplying (ii) by P_1,

$$P_1^f = \frac{K_2 q_1{}^s P_1}{K_1 q_2{}^s P_2 + K_2 q_1{}^s P_1} \qquad \text{(iii)}$$

which is, assuming K_1 and K_2 greater than qero, positive and less than 1. Letting h be the coefficient of $\Sigma P_i X_i / \Sigma P_i q_i$ in (1.13), this implies that,

$$\begin{aligned} h &= K_2 + f\ P_1\ (K_1 - K_2) = K_2 + K_1\ f\ P_1 - K_2\ f\ P_1 \\ &= K_2\ (1 - f\ P_1) + K_1\ f\ P_1 > 0. \end{aligned} \qquad \text{(iv)}$$

Substitution for fP_1 from (iii), this becomes

$$h = \frac{K_2 q_1 P_1}{K_1 q_2 P_2 + K_2 q_1 P_1} K_1 + \left(1 - \frac{K_2 q_1 P_1}{K_1 q_2 P_2 + K_2 q_1 P_1}\right) K_2. \qquad \text{(v)}$$

Essentially, h equals a weighted sum of the K's, where the weights are each sectors' share of output. Over time h may decline. This may occur because fP_1 varies with agriculture's share of output, given K_1 and K_2. If agriculture's share of output declines, and $K_1 > K_2$, the value of h declines. (If $K_1 = K_2$, this has no impact on h.) This implies the reasonable result that, because of the growing importance of the sector where prices react more slowly, a given amount of excess aggregate demand relative to output has less of an immediate impact on the inflation rate.

[8]By definition,

$$e = \frac{1}{\frac{K_1}{q_1^S} + \frac{K_2}{q_2^S}\frac{P_1}{P_2}} \qquad (1)$$

Multiplying the numerator and denominator of (i) by $q_2^S\ P_2\ q_1^S$, results in:
results in

$$e = \frac{q_2^S\ P_2\ q_1^S}{K_1\ q_2^S\ P_2 + K_2\ q_1^S\ P_1} \qquad (ii)$$

Then,

$$P_1 e = \frac{P_1\ q_1^S\ P_2\ q_2^S}{K_1\ q_2^S\ P_2 + K_2\ q_1^S\ P_1} \qquad (iii)$$

which is, assuming positive K_1 and K_2, greater than zero.

[9]To show this result let ν equal the coefficient of $\psi^{\sim}$

$$\nu = (K_1 - K_2)\ \frac{P_1 e}{P_1\bar{q}_1 + P_2\bar{q}_2} \qquad (i)$$

Using the result of footnote 8, substitute for P_1e in ν as follows:

$$\nu = (K_1 - K_2)\ P_1\ q_1^S\ P_2\ q_2^S\ /\ (K_1\ q_2^S\ P_2 + K_2\ q_1^S\ P_1)\ /\ (P_1\ \bar{q}_1 + P_2\ \bar{q}_2) \qquad (ii)$$

$$= (K_1 - K_2)\ \frac{P_1\ q_1^S\ P_2\ q_2^S}{(K_1\ q_2^S\ P_2 + K_2\ q_1^S\ P_1)(P_1\ \bar{q}_1 + P_2\ \bar{q}_2)}$$

which, for the case of $\bar{q}_i = q_i^S$,

$$= (K_1 - K_2)\frac{P_1 q_1\ P_2 q_2}{K_2(P_1 q_1)^2 + (K_1 + K_2)\ P_1\ q_1 P_2 q_2 + K_1(P_2 q_2)^2}$$

As K_2 approaches zero, ν approaches $\frac{P_1q_1}{P_1q_1 + P_2q_2}$, or the share of sector 1 in the price index. If both sectors of the economy grow at the same rate, no change occurs in the coefficient of ψ. If agriculture grows faster than the rest of the economy, the coefficient of ψ becomes larger.

[10] For construction of this index, see L. Klein and R. Summers, The Wharton Index of Capacity Utilization, Philadelphia, Economic Research Unit, Department of Economics, University of Pennsylvania 1966. The use of unemployment and capacity utilization as independent variables in equation (14) can be questioned. In a broader model, unemployment and capacity utilization would be determined simultaneously with the inflation rate. Thus, it is admitted that simultaneous equations bias is present in the inflation equation. Although the degree of bias is unknown the widespread use of single equation inflation models in the literature suggests that, hopefully, important information can still be attained using this approach.

[11] Money supply, unemployment, and price data are all obtained from the Bureau of Labor Statistics and are seasonally adjusted.

[12] For a justification of this approach, see Michael L. Wachter, "The Changing Cyclical Responsiveness of Wage Inflation," Brookings Papers on Economic Activity, (1976, Vol. 1).

[13] See Shirley Almon [ ] for an explanation of the technique. For each independent variable estimated with a lag, four Almon variables are used. This permits the estimation of a third degree polynomial. The length of the lags do not interfere with the 1948 starting date for the regression, since values of the independent variables are available for the period preceding 1948.

[14] During the years 1940-1974, various price control plans were implemented, OPEC succeeded in pushing up the price of oil, and a surge in overall and food prices occurred. It is difficult to devise variables to reflect the impact of the control programs' phases of the pressure on prices due to the oil embargo. Moreover, there is a possible violation in homoscedasticity assumption, due to the high inflation rates of this period.

[15] The equations described above were reestimated with ψ defined as the rate of change in the relative price of rental housing. To construct ψ, the consumer price index component for rental housing is used. Following the comments made on page above, a negative coefficient should be found for this term. The equations of Table 1 were

estimated with results similar to those reported above, except that the coefficients of ψ are all negative and significant as predicted The results are avaialble from the author.

[16] Assume $\Sigma P_i X_i = 0$, then according to inflation equation (13), inflation occurs if excess demand arises in agriculture such that $P_1 X_1 > P_2 X_2$. Because $K_1 > K_2$, the price level rises. But since $K_2 > 0$, with $X_2 < 0$, eventually prices will fall in the non-food sector bringing the overall price level down. Further, there is a wealth effect since the rise in prices lowers real balances, a component of assets. With the fall in assets, excess demand in the i^{th} sector, as (2) indicates, will decline.

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