Discussion Paper

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THE INFLATIONARY EFFECT ON THE STRUCTURE OF TRADE

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Abstract

This study incorporates the monetary sector into a conventional simple factor intensity model in order to study the inflationary effect on the structure of trade. From an empirical study on the U.S. quarterly data for seventeen manufacturing industries, it has been found that the inflationary effect, operating through the capital intensity, capital structure and liquidity demand channels, has certain explanatory power on the U.S. relative export performance. The adjustment of relative export performance is very slow, with respect to these three factors in the earlier moderate inflation period; but it becomes faster, and significantly important in the later high inflationary period. The different level of inflation in the two periods is the source of a structural shift in the industries' relative export performance.

1. Introduction

The factors that determine a country's comparative advantage in foreign trade have long been a subject of major interest in the pure theory of international trade. From Richardian comparative cost theory to Heckscher-Ohlin's factors proportion theory, and recently, the so-called neofactor and neotechnological theories to explain the direction and the composition of trade; all of these resort to real factors.[1/] Only until recently, Dornbush, Fischer and Samuelson (1977), found that in a Richardian model integrating trade and balance of payments with both traded and nontraded goods, a change in a country's money supply shifts its comparative advantage. Their study leads one step forward in the field of pure theory of international trade.

This study incorporates the monetary sector into the conventional simple factor intensity model by expanding the definition of capital to include long term, short term and very short term capital (money) to study an inflationary effect on the structure of trade. The structure of the model and the effect of inflation on the structure of trade will be presented in the next section. A time series analysis of the U.S. trade pattern during the period from 1963 to 1979 with quarterly data will be given in section six.

2. Theoretical Model

Consider an open economy that is initially in a fully employed equilibrium position. Suppose, then, inflation rises in the home country for some exogenous reason, while economic position of the real world remains unchanged. Inflation causes purchasing power to be eroded. As soon as people realize this, they demand higher interest rates on the financial assets sold by industries to compensate for this cost, i.e.,

(1) $i_t = a + b\,(dP/P)^e_t \qquad a > 0;\quad 1 \geq b \geq 0,$

where both a and b are positive coefficients; and the value of b is between zero and one, which gives the adjusting factor of the nominal rate of interest to the inflationary expectation.[2/]

Lemma 1. The real rate of interest decreases with inflation, even if the increase of the nominal rate of interest is equal to the rate of inflation.[3/]

Proof. This can be shown by a total differentiation of the equation of the real rate of interest[4/]

(2) $r = (i - (dP/P))/(1 + (dP/P)),$

where i = the nominal rate of interest; r = the real rate of interest; and (dP/P) = the rate of inflation.

$$dr=\{[1+(dP/P)][di-d(dP/P)]-[i-(dP/P)]d(dP/P)\}/[1+(dP/P)]^2$$

By rearranging terms, we derive

$$dr=\{[1+(dP/P)]di - (1+i)d(dP/P)\}/[1+(dP/P)]^2$$

if $di = d(dP/P)$, $dr/di = \{(dP/P)-i\}/\{1+(dP/P)\}^2 < 0$,

because the initial value of inflation is equal to zero.

Suppose there exists no money illusion in the labor market. The real wage rate remains constant while inflationary expectations develop. A lower real rate of interest will induce businessmen to switch their production techniques to more capital intensive methods of production in order to extract more profit from the lower real interest cost of capital. This argument can be shown as follows.

Lemma 2. Capital labor ratio is a function of the real rate of interest.

Proof. Suppose that the production function is Cobb Douglas with two production factors -- capital and labor,

(3) $F = a K^g L^{1-g}$,

where F is output; K is capital; L is labor; and the elasticity of output with respect to capital g must be between zero and one, $0 < g < 1$. The cost of production is expressed as

(4) $C = r K + w L$,

where C is the cost of production in real terms; r is the real rate of interest; and w is the real wage rate. The profit of each industry in real terms is equal to the value of production minus the cost of production:

(5) $Q = F - C = a K^g L^{1-g} - (r K + w L)$.

Industries will derive the optimal quantity of capital by maximizing their profits. The condition is

$$\partial Q/\partial K = a\ g\ K^{g-1}\ L^{1-g} - r = 0.$$

After rearranging terms, the condition becomes

$$(6) \quad k = K/L = (a\ g)^{-1/(g-1)}\ r^{1/(g-1)} = s\ r^{h},$$

where $s = (a\ g)^{-1/(g-1)} > 0$ and $1/(g-1) = h < 0$.

Corrollary. The capital intensity changes negatively whenever the real rate of interest increases.

Proof. By total differentiation of equation (6)

$$dk = s\ \{\ 1/(g-1)\ \}\ r^{(2-g)/(g-1)}\ dr.$$

Since $s > 0, r > 0$, $1/(g-1) < 0$, and $(2-g)/(g-1) < 0$, dk/dr must be negative.

Now let us expand the definition of capital to include short-lived and long-lived capital equipments. As soon as inflationary expectations develop, the nominal rates of interest rise. The short-lived capital equipment must be replaced earlier than the long-lived capital equipment. Suppose that industries finance the short-lived capital investment by the short term loans and debts, and the long-lived capital investment by the long term loans and debts.[5/] Inevitably, the industries using the shorter-lived capital equipment have to bear the higher replacement costs earlier than those industries that do not; thus causing the cost of production to be higher. And they also have to pay higher interest rates than other industries financing their investment by long term borrowing, and who, as well, enjoy the previously contracted low interest rate.[6/] Therefore, industry's investment will shift toward longer term capital in order to enjoy relatively low interest costs.

Lemma 3. The short term-long term capital ratio is a function of the ratio of the long term-short term nominal interest rates.

Proof. Suppose there are, now, three production factors -- labor, long term and short term capital; the Cobb-Douglas production function is expressed as:

(7) $F = a\,(K_S)^f\,(K_L)^g\,L^h$,

where K_S is short term capital; K_L is long term capital; and f, g, and h are the elasticities of production with each input factor, respectively; and are subject to the conditions: $0 < f, g, h < 1$, and $f + g + h = 1$. The cost of production is equal to the summation of the value of each factor employed, i.e.,

(8) $c = i_S\,K_S + i_L\,K_L + W\,L$,

where c is the nominal cost of production; i_S is the rate of interest of short term capital borrowing; i_L is the rate of interest of long term capital borrowing; W is the nominal wage rate. The capital structure equation can be derived from the profit maximization conditions. Set the Lagrange function as:

(9) $Z = a\,(K_S)^f\,(K_L)^g\,L^h + z\,(c - i_S\,K_S - i_L\,K_L - W\,L)$,

where z is the Lagrange multiplier. By taking partial derivatives of equation (9) with respect to both short term and long term capital, the result is expressed as:

$\{a\ f\ (K_S)^{f-1}\ (K_L)^g\ L^h\} / i_S = z = \{a\ g\ (K_S)^f\ (K_L)^{g-1}\ L^h\} / i_L$.

Simplifying this condition, we have

(10) $K_{SL} = K_S / K_L = (f/g)\ (i_L / i_S)$.

Corrollary. If the change in the long term interest rate is not greater than tne change in the short term interest rate, the shift of interest rates has a positive effect on the structure of short term-long term capital.

Proof. Totally differentiating equation (10), we have:

(11) $dK_{SL} = (f/g)\{(1/i_S)\ di_L - (i_L / i_S^2)\ di_S\}$

If $di_S = di_L$, $dK_{SL} = \{(f/g)(i_S - i_L)/i_S^2\}di_S < 0$.

Because $f>0$, $g>0$ and $i_S < i_L$, the level of the short term interest rate must be less than that of the long term interest rate. If $di_S > di_L$, the first term of (11) is still less than the second term. If $di_S < di_L$, the absolute effect is inconclusive.

As is the concensus of economists, an industrial money demand, M^d_{jt} , is a function of the nominal rate of industry, i_t, the inflation rate, and its sales, S_{jt} .

(12) $M^d_{jt} = f_3\ (i_t\ ,\ (dP/P)_t,\ S_{jt})$ $j=1,2,\ldots,n;$ $t=1,2,\ldots,T;$

where j represents the jth industry. The income variable, sales, is treated as an exogenous variable in this model. As the nominal rates of interest rise in an inflationary period, the opportunity cost of holding cash increases. Industries which require higher cash balances for liquidity suffer a higher operational cost. Hence, the cost of production rises for those industries.

The comparative advantage is represented by the relative price ratio between countries before trade. Since the comparative advantage is unobserved, it is customary to represent the revealed comparative advantage by the relative export performance, because a country's relative export performance apparently indicates the presence of this country's comparative advantage. The relative export performance is, then, expressed as a function of the ratio of home country's price to the world price. Because we assume constant price in the rest of world, the relative export performance, X_{jt}, is a function of the home country's price of specific goods, P_{jt}, and, in turn, is a function of its production cost, C_{jt}, because under long run perfect competition, the producer charges the price which equals to production cost.

(13) $X_{jt} = X_{jt} (P_{jt}) = X_{jt} (C_{jt})$

Because changes in capital intensity, capital structure and liquidity demand affect the production cost, the cost of production can be specified as a function of these three factors, i.e.,

(14) $C_{jt} = f(M^{d}_{jt} , k_{jt}, K_{SLjt})$.

The relative export performance of the individual industry is, then, expressed as a function of demand for money, capital structure ratio and capital-labor ratio:

$$(15) \quad X_{jt} = f_4 \{ M^d_{jt} , k_{jt} , K_{SLjt} \}$$

Through this cost-price-channel, the external and domestic sectors of an economy are linked together.

In an inflationary period, in order to extract more profit from the lower real interest cost of capital, any industry which can shift to more capital intensive production processes will enjoy relatively lower real production costs.[7/] Since inflation shifts the term structure of interest rates to favor long term finance, any industry that can shift to longer term capital investment will enjoy lower interest costs. As the nominal rate of interest rises with the inflation rate, the cost of holding cash increases. Any industry who can hold less cash, lessens the opportunity cost and the loss of purchasing power suffered. Therefore, any industry that can shift to capital intensive production processes, long term capital investment, and less liquidity demand, will have a favorable trade position in contrast to those industries which can not.

Theorem Under free trade, perfect competition and profit maximization conditions, any industries whose relative costs have been reduced by inflation, have a favorable position in the relative export performance if the change in the short term interest rate is not less than the change in the long term interest rate.

Proof. In order to make proof simple, following Muth (1961), we assume that the inflation of the last period contains all information required to form expectations, i.e.,[8/]

(16) $(dP/P)^{e}_{t} = (dP/P)_{t-1}$.

Substituting (16) into equations (1) and (2), we have

(17) $i_{nt} = a_{n} + b_{n}(dP/P)_{t-1}$, $n= S, L$

(18) $r_{t} = \{ i_{t} - (dP/P)_{t-1} \} /\{ 1 + (dP/P)_{t-1} \}$.

Equations (6), (10), (12), (15), (17), and (18) form our model. We can express the change of the relative export performance as a function of the change of inflation rate by taking total differentiation on each equation and substituting the rest of equations into equation (19) as follows:

$$\begin{aligned}(19)\quad dX_{jt} &= f_{4M}\, dM^{d}_{jt} + f_{4K}\, dK_{SLjt} + f_{4k}\, dk_{jt} \\ &= f_{4M} f_{3i}\, di_{at} + f_{4M}\, f_{3P}\, d(dP/P)_{t} + f_{4k}\, shr^{h-1}_{t}\{[1/(1+(dP/P)_{t-1})]di_{Lt} \\ &\quad - (1+i_{t}) / (1+ (dP/P)_{t-1})^{2}\, d(dP/P)_{t-1} \} \\ &\quad + f_{4K}\, (f/g)\, [i_{St}\, di_{Lt} - i_{Lt}\, di_{St}] / i^{2}_{St}\end{aligned}$$

where f_{3i} , f_{3P} , f_{4M} , f_{4k} , and f_{4K} are partial derivatives. The higher inflation is, the higher the interest rate is; hence, the lower the demand for cash; so f_{3i} and $f_{3P} < 0$. Since, the higher cash holding is, the lower the relative export share is, $f_{4M} < 0$. The first two terms are positive. Because $h < 0$ and f_{4k} and $s > 0$; and because, from Lemma 1, the term within the curly bracket is negative; the sign of the third term is positive. The sign of the fourth term is positive, because, from the Corrollary of Lemma 3, the term within the bracket is negative if the change in the short term interest rate is equal to or larger than the change in the long term rate. Hence, the inflationary effect on the relative export perfomance of the jth industry is positive. If the change in the short term interest rate is less than the change in the long term rate, we have an inconclusive result.

3. Hypotheses to Be Tested

The theoretical model described in section 2 needs to be applied to the real world situation to see how much it can explain. Three hypotheses, which characterize the theory discussed in the last section, can be specified as follows:

1. Relative export performance is determined by capital intensity, the structure of capital, and liquidity demand.
2. Relative export performance is affected by inflation through the capital intensity channel, the structure of capital channel, and the liquidity demand channel.
3. The shift of inflation levels changes relative export performance.

This study, by using the time series data of seventeen U.S. manufacturing industries (in two and three digit SIC code), will analyze the United States' trade pattern in the period from the first quarter of 1963 to the last quarter of 1979. To test the first two hypotheses, we simply estimate our model with U.S. quarterly data. In the relative export performance equation, if the coefficients of three explanatory variables are significant and with the correct sign, we conclude that hypothesis one is corroborated. To test the second hypothesis, we check whether coefficients of related variables which connect inflation and the relative export performance are significant and with right signs. To test hypothesis three, an F-test of the stability suggested by Chow (1960) will be used. If there exists instability of coefficients in our model, we conclude that hypothesis three is corroborated.

4. The Estimated Model

To test these hypotheses, we have to respecify our model to be an estimable one and then convert it from deterministic form to stochastic form. Suppose that the relative export performance of each industry can be expressed as a function of the demand for money, the capital structure, and the capital-labor ratio of each industry in a Cobb Douglas type functional form with a lagged dependent variable to capture the lagged adjustment effect.

$$X_{jt} = a_1 X^{b_1}_{jt-1} \; k^{f_1}_{jt} \; K^{g_1}_{SLjt} \; (M^d)^{h_1}_{jt} \; e^{u_1},$$

where f, g, and h are the elasticities of the relative export performance with respect to each argument in the function; and u is a purely randomly fluctuated residual or, is a residual term which captures the uncertainty that there may exist either excluded variables or measurement errors. The other notations are the same as last section.

By adding a lagged dependent varable and a residual term, the capital intensity equation is expressed as:

$$(20) \quad k_{jt} = a_2 \, k^{b_2}_{jt-1} \; r^{h_2}_{t} \, e^{u_2}$$

The equation of real interest rate is treated as an identity.

(22) $r_t \equiv [i_{Lt} - (dP/P)_t]/[1 + (dP/P)_t]$

The specification of the capital structure equation is modified slightly to incorporate a lagged dependent variable and a residual term and to treat the ratio of long term short term interest rate as a single variable.

(23) $K_{SLjt} = a_3 K^{b_3}_{SLjt-1} \; i^{g_3}_{LS} \; e^{u_3}$,

we define a new equation of the long term-short term interest rate as equal to the long term interest rate divided by the short term interest rate, and treat it as an identity.

(24) $i_{LS} \equiv i_L/i_S$.

The equation of demand for money is specified as follows:

(25) $M^d_{jt} = a_4 \; (M^d)^{b_4}_{jt-1} \; S^{f_4}_{jt} \; i^{g_4}_t \; (dP/P)^{h_4}_t \; e^{u_4}$,

where i is the short term rate of interest, S is the net sales of individual industry.

The inflationary expectation is measured by all past inflation rate.

$(dP/P)^e_t = \sum_{i=0}^{\infty} a_i (dP/P)_{t-i}$, where $(dP/P)_{t-1}$ is the ith lag of inflation rate, and ∞ is equal to infinity. By substituting it into the long term and the short term interest rate equations and using Koyck's method, we can solve these two equations as follows:

(26) $i_{St} = a_{50} + a_{51} \, i_{St-1} + a_{52} \, (dP/P)_t + u_5$

(27) $i_{Lt} = a_{60} + a_{61}\, i_{Lt-1} + a_{62}\, (dP/P)_t + u_6$

The residuals may come from a specification error since we use a constant term to capture terms of real interest rate, liquidity premium, and risk premium.[10/]

Equations (20) to (27) form our model for estimation. Since the equations (20), (21), (23) and (25) are nonlinear, they can be transformed into log-linear equations by taking natural logarithms on both sides of these equations in order to apply linear econometric estimation methods.[11/] The linear system of equations are presented in Table 1 and the measure of varialbes are discussed in an appendix.

5. Identification

Before we can discuss how to estimate this model, it is necessary to show that this model is identified, i.e., it can be solved. Following Fisher's theory (1966, P 129-33), we can check the rank condition of identification, which is a necessary and sufficient condition, and the order condition of identification, which is a necessary condition for each equation. The rank conditions of all equations are equal to 7. The order conditions of each equation are:

$0_1 = 6 > 4-1;\ \ 0_2 = 6 > 2-1;\ 0_3 = 6 > 2-1;\ 0_4 = 4 > 2-1;$

$0_5 = 6 > 1-1;\ \ 0_6 = 6 > 1-1;\ 0_7 = 7 > 3-1;\ 0_8 = 8 > 3-1.$

Since the order conditions of all equations are greater than the included endogenous variables minus one, this model is over-identified.

6. The Estimation

Two stage least squares estimation, provides a consistent estimation of the parameters in an over-identified simultaneous equations model with a small sample of data, and is less sensitive to errors in specification and measurement.

In this study, two stage least squares regression will be used to estimate our model for periods from the first quarter of 1963 to the last quarter of 1973 and from the first quarter of 1974 to the last quarter of 1979.

An iterative two stage least squares Cochrane-Orcutt estimation (2SLS-CORC) suggested by Fair (1970) will be conducted with a maximum of twenty iterations, if Durbin's h statistic indicates the existence of autocorrelation in the residuals. If Durbin's h statistic cannot be calculated, a t-statistic of rho (the autocorrelation coefficient), derived from an iterative two stage least squares Cochrane-Orcutt estimation, will be used to determine whether an autocorrelation problem exists. If it is significant, the estimated result will be reported.

Results of the regressions are reported in tables 2 to 10. The test of the stability of coefficients is reported in Table 11.

A. Time Series Analysis in the Period from 1963 to 1973

There are seven industries with a positive sign for the factor intensity variable in the relative export performance equation; only two of which are significant; these are paper products and textiles. Tobacco, fabricated metal and motor vehicles show, on the other hand, a significantly negative coefficient. These show a weak support for the factor intensity explanation of trade patterns. After regressions are adjusted for autocorrelation, eleven of the total seventeen industries have a negative coefficient on the capital structure variable in the same equation. This coefficient is significant for only four industries -- rubber, textile, electrical machinery, motor vehicle. More than one half of the total 17 industries (nine) show a negative sign on the liquidity holding variable in the same equation. Only food, petroleum, and electrical machinery, are significant. There are also three industries -- industrial chemicals, paper, and textiles -- with a significant positive sign.

Among 17 industries, the food, petroleum, rubber, and electrical machinery industries' relative export performance can be explained by any combination of these three factors with a significant correct sign. The paper, textile, and motor vehicles industries' relative export performance can also be explained by any combination of three factors; and where too, the sign of some coefficients is not what we expected. The tobacco, industrial chemical and fabricated metal industries' relative export performance are affected by these factors; however, with wrong sign. Thus, this result gives evidence to support hypothesis one.

Since no industries show a significant negative sign on the coefficient of the real interest rate and all industries show a significant lagged effect in the capital intensity equation and the coefficients on the lagged capitla intensity variables are all close to one; it then implies that, there exists almost no change in the capital-labor ratio based on information about the real rate of interest within a quarter. The electrical machinery industry exhibits a significantly positive relation between the real interest rate and capital intensity. Probably the reason is that this industry is a growing one and, as such, heavily emphasizes research and development which employs many professionals and technicians.

The coefficients of the long term-short term interest rate in the capital structure equation are significantly positive for the food and the nonferrous industries, but it is significantly negative for the electrical machinery and the aircraft industries. Except for the food industry, there exists a long lag effect for all industries to adjust their capital structure to the term structure of interest rates.

From the regression results of both, the short term interest rate and the long term interest rate equation, the coefficient of the inflation rate variable is higher in the short term interest rate equation, 0.31 (and 0.795 after adjusting for the lagged effect), than it is in the long term interest rate equation, 0.098 (and 0.7 after adjusting for a lagged effect). The mean lag for the short term interest rate is 1.56, compared with 6.143 for the long term rate of interest. These results confirm Cargill and Meyer's (1980) finding, i.e., the short term rate of interest is more sensitive to the inflation rate than the long term rate of interest, and the adjustment is completed in a shorter period for the short term interest rate than that associated with the long term interest rate.

In the equation for industry's liquidity demand, twelve industries have a significantly positive coefficient on the net sales variable. Seven industries show significantly negative coefficients on the short term interest rate variable. Only the motor vehicle industry shows a significantly negative coefficient on the inflation rate variable; whereas, there are two industries, textiles and paper products, with a significantly positive coefficient on this variable.

In this period, no evidence shows support of the inflation explanation of the relative export performance operating through the capital intensity channel. The relative export performance of the electrical machinery industry is affected by inflation operating through the capital structure channel, because a negative reaction of capital structure to the long term-short term interest rate ratio raises production costs; which, in turn, induce a loss in the relative export share.

The food and the electrical machinery industries show significantly negative coefficients both on the interest rate variable in the liquidity demand equation and on the liquidity demand variable in the relative export performance equation. This evidence shows the inflationary effect on the relative export performance of these two industries operating through the liquidity demand channel. However, the paper and the textile industries show the controversial consequence of inflation on their relative export performance through the liquidity demand channel.

B. Time Series Analysis in the Period from 1974 to 1979

The number of industries with a significantly positive coefficient of capital intensity variable in the relative export performance equation increases to five from two; and the number of industries with a significantly negative coefficient on the same variable drops to one from three, in this period. This finding indicates that the explanatory power of the conventional factor intensity theory rises.

The number of industries with a significantly negative coefficient on the capital structure variable in the same equation decreases from five to two; and the number of industries with a significantly positive coefficient increases from one to two. The number of industries with a significantly negative coefficient on the liquidity demand in the same equation increases from three to five (which are petroleum; aircrafts; instruments; iron and steel; and stone, clay, and glasses). Only the drug industry shows a significantly positive coefficient on this variable in this period.

In this period there are nine industries whose relative export performance can be explained by any combination of these factors with a significantly correct sign. Also there are three industries whose relative export performance can be explained by any combination of these three factors whith a significantly wrong sign. By comparing with the regression results from the earlier period, we conclude that the explanatory power of capital intensity, capital structure and liquidity demand factors for the U.S. trade structure rises with the higher inflation level in the later period.

The number of industries with significantly negative coefficients for the real rate of interest variables in the equation of capital intensity increases from zero to two (i.e., iron and steel and petroleum); and the number of industries with a significantly positive coefficient does not change between the two periods.

Again both the short term and long term interest rates show a significantly positive response to the inflation rate in the period after 1973. The coefficient of inflation rate is 0.2485 in the short term interest rate equation and .1076 in the long term rate of interest equation.

The mean lag is 2.264 for the short term interest rate and 2.4173 for the long term interest rate. The adjustment of the short term interest rate to inflation is stronger and takes place in a shorter period than the long term interest rate. But the difference between the two rates becomes smaller.

The number of industries with a significantly negative coefficient on the ratio of long term-short term interest rates in the equation of capital structure increases from two to five. This shows that the explanation power of the inflation theory of capital structure is degraded.

The results of regressions on the industry's demand for liquidity equation show that the transaction theory and the liquidity theory become less powerful in the later period than in the earlier period because there are, now, fewer industries (ten) with a significantly positive coefficient on net sales; and fewer industries (three) with a significantly negative coefficient on the inflation rate variable.

Both the petroleum and the textile industries' relative export performance can be explained by inflation because the petroleum industry shows a significantly negative coefficient on the real interest rate variable in the capital intensity equation, and a significantly positive coefficient on the capital intensity variable in the relative export performance equation. And because a decrease of the textile industry's capital intensity will raise the real production cost, which, in turn, will cause a loss on the relative export share.

The food industry's relative export performance is affected by the inflation rate through capital structure channel because significantly negative coefficients exist on both the long term-short term interest rate variable in the capital structure equation, and the capital structure variable in the relative export performance equation. But the machinery industry shows a significantly negative coefficient on the long term-short term interest rate variable in the capital structure equation and a significantly positive coefficient on the capital structure variable in the relative export performance equation. This is contradictory to what we expect.

The aircraft and instrument industries show significantly negative coefficients on the interest rate variable in the liquidity demand equation. The petroleum and stone, clay, and glass industries show significantly negative coefficients of the inflation variable in the same equation. A positive reaction of the iron and steel industry's liquidity demand to interest rate will cause a higher production cost, then, a lower relative export share. Because these facts and because all of these industries show significantly negative coefficients on the liquidity demand variable in the relative export performance equation, the aircraft; instrument; petorleum; iron and steel; and stone, clay, and glass industries' relative export performances are affected by inflation through the liquidity demand channel.

The results for the drug industry is contradictory to our theory for it has a negative relation between inflation and liquidity demand and a positive relation between liquidity demand and the export-import ratio.

C. The Instability Effect

Ten out of seventeen industries show a structural shift in the coefficients of the relative export performance equation. Most industries show no shift in the coefficients of the industry's capital intensity equation, with the exceptions being the nonferrous metal, the electrical machinery, and the textile industries. Next, there are nine industries which show a structural shift in the coefficients of the capital structure equation. Most industries, except tobacco, textile, and aircraft, show a structural shift in the coefficients of the industry's liquidity demand equation. The coeffieients in both the short term and the long term interest rate equations are stable.

By looking at Table 11, we can see that every industry with a structural shift in the coefficients of the relative export performance equation has corresponding structural shifts in any combination of the capital intensity, capital structure,and liquidity demand equations, excepting the aircraft industry. But can these structural shifts be resorted to the different level of inflation rates? If industries with significantly different regression results between two periods and with instability in these estimations, we can conclude that these structural shifts are due to the different level of inflation rates.

From the last two sections, we know that the relative export performance of both the petroleum and the textile industries significantly reflects inflation through the capital intensity channel in the later period although not in the earlier period. We observe, also, instability in the coefficients of the relative export performance equation for both industries, as well as, for the coefficients of the capital intensity equation for the textile industry. The food industry shows a significantly inflationary effect on its relative export performance through the capital structure channel in the later period; although, not in the earlier period. Also, its coefficients in the capital structure equation are unstable. The electrical machinery industry shows a significantly inflationary effect in the earlier period, although not in the later period and also that its coefficients in both relative export performance and capital structure equations are unstable. The inflationary effect on the relative export performance through the liquidity demand channel shows up in the petroleum; aircraft; instrument; iron and steel; and stone, clay, and glass industries in the later period, although not in the earlier period. The effect shows up also in the food and the electrical machinery industries in the earlier period but not in the later period. All these industries, except aircraft, show unstable coefficients in the liquidity demand equation. Four of them (pertroleum; aircrafts; electrical machinery; and stone, clay, and glass) show unstable coefficients in the relative export performance equation. These results indicate clearly that the different level of inflation in the two periods is the source of a structure shift in the relative export performance.

7. Conclusions

From our empirical study on the U.S. data, we can draw the following conclusions. Firstly, the capital-labor ratio becomes more important in explaining the U.S. trade pattern as the inflation rate increases sharply after 1973. The effect of inflation on the term structure of interest rates reduces the real relative cost of long lived capital assets in the earlier period. As the inflation rate accelerates after 1973, the risk premium charged on long term borrowing increases rapidly, and raises this capital cost. The adjustment of capital structure to the term structure of interest rates, meanwhile, follows the pattern suggested by our theory; as, relatively less long lived investments are undertaken in the second period. Correspondingly; as our theory suggested, industries intensive in long lived capital assets improve their relative export performance in both inflationary periods, although more so in the earlier one.

Secondly and by contrast, the demand for liquidity (i.e., an industry's "liquidity intensiveness" by analogy to the Heckscher-Ohlin view of trade determination) reflects in relative export performance more strongly in the latter than in the former period. In general, it appears that the adjustment of relative export performance to all three channels; namely, the capital-labor ratio, the distribution ratio of longer lived to shorter lived capital, and liquidity intensiveness, through which inflation was hypothesised to operate accelerates along with inflation.

Fourthly, it was observed that liquidity intensiveness significantly explains static comparative advantage; whereas, we found (consistently with the Leontief paradox results) that capital intensiveness and also capital structure have little relationship to trade structure. Finally, however, inflation-induced changes in the relative costs of the three imputs reflect in changes in trade structure as measured by relative export performance.

Appendix

The individual industry's relative export performance is measured by the export-import ratio. If the category of commodity group breaks down to single good, this measure may give us a set of zeros and infinties. However, with aggregation over goods, there exists no such problem. The data for these measures are calculated from the monthly data from U.S. Export and U.S. Imports published by Bureau of the Census, U.S. Department of Commerce.

The capital intensity of each industry is measured by the current net value of plants and equipment of each quarter, plus the depletion at the end of that quarter, and then divided by the total employment of that industry in the same quarter. The data of net plant and equipment and the depreciation is taken from the Quarterly Financial Report for Manufacturing Corporations published by the United States Federal Trade Commission. The quarterly data of total employment of each industry is copied from the Employment and Earnings published by the U.S. Department of Labor, Bureau of Labor Statistics.

The measure of long term capital is the sum of the long term loans from banks, other long term debts, and the stockholder's equity in each quarter. The data of the short term loans from banks is the measure for the short term capital. They are all derived from the Quarterly Financial Report for Manufacturing Corporations.

The liquidity demand for each industry is defined as cash on hand and demand deposit in bank which includes cash and demand deposits in the U.S., time deposits in the U.S. including negotiable certificates of deposit, and deposits outside the U.S., (the definition of M2), which are derived from the _Quarterly Financial Report for Manufacturing Corporations._

The long term rate of interest is represented by the long term corporate bonds rate over twenty years which is derived from various issues of the _Federal Reserve Bulletin._ The data of the short term rate of interest, which is measured by the four to six month commercial paper rate, and the net sales of individual industry are derived from the _Quarterly Financial Report for Manufacturing Corporations._ The inflation rate is calculated from the consumer price index (1967 = 100) by the formula:

$$(dP/P)_t = (P_t - P_{t-1}) / P_{t-1}.$$

References

Bhagwati, J., "The Pure Theory of International Trade: A Survey," Economic Journal, Mar. 1964, P. 1-84.

Boughton, James M. and James S. Fackler, "The Nominal Rate of Interest, The Rate of Return on Mondy, and Inflationary Expectations," Discussion papers, 80-4, Department of Economics, Indiana University, 1980.

Cargill, Thomas F. and Robert A. Mayer, "The Term Structure of Inflationary Expectations and Market Efficiency," Journal of Finance, Vol. 35, NO. 1, Mar. 1980, P. 57-70.

Chow, Gregory, "Tests of Equality Between Subsets of Coefficients in Two Linear Regressions," Econometrica, 1960, pp. 591-605.

Culbertson, J. M., "The Term Structure of Interest Rates," Quarterly Journal of Economics, Nov. 1957, P. 489-504.

Darby, M. R., "The Financial and Tax Effects of Monetary Policy on Interest Rates," Economic Inquiry, Vol. 13, June 1975.

Dornbusch, R., S. Fischer and P. A. Samuelson, "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods," American Economic Review, 1977, p. 823-39.

Fair, Ray. C., "The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First Order Serially Correlated Errors," Econometrics, May 1970.

Fisher, F. M., The Identification Problem in Econometrics, McGraw-Hill, New York, 1966.

Fisher, Irving, The Theory of Interest, New York: MacMillan, 1930.

Hartigan, James C., "The U.S. Tariff and Comparative Advantage: A Survey of Method," Weltwirtschaftliches Archiv, 1981, p. 65-108.

Hua, Mingshu, Inflation and the Structure of Trade, Ph.D. Dissertation, Indiana University, 1981.

Lutz, Friedrich A., "The Structure of Interest Rates," Quarterly Journal of Economics, Nov., 1940, p. 36-63.

Makin, John H., "Anticipated Inflation and Interest Rates in an Open Economy," Journal of Money, Credit, and Banking, Vol. 10, No. 3, 1978, p. 275-289.

Metzler, Lloyd, "Wealth, Saving, and the Rate of Interest," Journal of Political Economy, Vol. 59, Apr. 1951, p. 93-116.

Mundell, Robert A., "Inflation and Real Interest," Journal of Political Economy, June 1963, p. 280-283.

Muth, J. F., "Rational Expectations and the Theory of Price Movements," Econometrica, Vol. 29, July 1961, p. 315-335.

Poole, William, Money and Economy: A Monetarist View, Addison-Wesley, 1978, p. 70.

Shiller, Robert J., "The Volatility of Long Term Interest Rates and Expectations Models of the Term Structure," Journal of Political Economy, Vol. 87, No. 6, Dec. 1979, p. 1190-1219.

Stern, Robert M., "Testing Trade Theories," in Peter B. Kenen ed. International Trade and Finance: Frontiers for Research, Cambridge University Press, 1975, p. 3-50.

Walker, Charles E., "Federal Reserve Policy and the Structure of Interest Rates on Government Securities," Quarterly Journal of Economics, Feb. 1954, p. 22-23.

Yohe, W. P. and D. S. Karnosky, "Interest Rates and Price Level Changes," Federal Reserve Bank of St. Louis Review, Dec. 1969, Vo. 51, p. 19-36.

Footnotes

1. For a survey on past theories and empirical studies, see Bhagwati (1964), Stern (1975), and Hartigan (1981).

2. The relation between interest rates and inflationary expectations was first explored by Fisher (1930) and has been followed by numerous studies. Here we assume that the nominal rate of interest is a simple linear function of inflationary expectation. This is a similar specification as found in Yohe and Karnosky's (1969) study. For a survey on other specifications see Hua (1981, p. 34).

3. There are several other arguments about why inflation has a negative effect on the real rate of interest. For example, Metzler (1951) and Mundell's (1963) wealth effect, Darby's (1975) income tax effect, Boughton and Fackler's (1980) information cost or money illusion effect in the labor market, and Makin's (1978) import impact effect. Results of empirical studies are mixed. For reference, see Hua (1981, p. 18).

4. This equation is derived from the definition of nominal interest rate. For its derivation, see, for example, Poole's (1978) textbook.

5. This assumption is supported by the market segmentation theory of the term structure of interest rates suggested first by Walker (1954) and Culbertson (1957). Since the transaction costs are relatively higher for short term borrowing than for long term borrowing, borrowers are not inclined to incur liabilities with maturities shorter than the time for which they are needed, as Lutz (1940) asserted.

6. Cargill and Meyer's recent (1980) study has found that the inflationary effect on the term structure of the rates of interest favors longer term maturity financing, which supports our assertion.

7. Under the limitations of technology, not every industry can shift to capital intensive production processes. Hence production factors will be reallocated among industries.

8. A survey on various rational expectation models can be found in Shiller (1978). References for other expectation hypotheses can be found in Hua (1981).

9. We simply multiply a constant to the equation with one period lag on each variable and subtract this derived lag equation from the original equation.

10. This approach was used by Yohe and Karnosky (1969), and Cargill and Meyer (1980).

11. Since we cannot take natural logarithms on either zero or negative values, we have difficulty with the real rate of interest. To solve this problem, we just assign zero to both logarithms on zero and negative values. But this approach may cause error on the estimated coefficient and make it insignificant.

TABLE 1
The Estimated Models

$$\log X_{jt} = a_{11} \log k_{jt} + a_{12} \log K_{SLjt} + a_{13} \log M^{d}_{jt} + b_{10} + b_{11} \log X_{jt-1} + u_{1t}$$

$$\log k_{jt} = a_{24} \log r_{t} + b_{20} + b_{22} \log k_{jt-1} + u_{2t}$$

$$\log K_{SLjt} = a_{35} \log i_{LSt} + b_{30} + b_{33} \log K_{SLjt-1} + u_{3t}$$

$$\log M^{d}_{jt} = a_{46} \log i_{st} + b_{40} + b_{44} \log M^{d}_{jt-1} + b_{45} \log S_{jt} + b_{46} \log(dP/P)_{t} + u_{4t}$$

$$i_{St} = b_{50} + b_{56} (dP/P)_{t} + b_{59}\, i_{St-1} + u_{5t}$$

$$i_{Lt} = b_{60} + b_{66} (dP/P)_{t} + b_{69}\, i_{Lt-1} + u_{6t}$$

$$r_{t} \equiv i_{Lt} - (dP/P)_{t} - r_{t} (dP/P)_{t}$$

$$i_{LSt} \equiv i_{Lt} / i_{St}$$

Endogenous: $\log X_{jt}$, $\log k_{jt}$, $\log K_{SLjt}$, $\log M^{d}_{jt}$, i_{St}, i_{Lt}, i_{LSt}, r_{t}, $\log r_{t}$, $\log i_{LSt}$, $\log i_{St}$;

Exogenous: $(dP/P)_{t}$, $\log(dP/P)_{t}$, $\log S_{jt}$;

Predeterminated Endogenous: $\log X_{jt-1}$, $\log k_{jt-1}$, $\log K_{SLjt-1}$, $\log M^{d}_{jt-1}$, i_{St-1}, i_{Lt-1}.

TABLE 2
2SLS Regressions on the Relative Export Performance Equation in the Period 1963-73

Industry	$\log X_{jt-1}$	$\log k_{jt}$	$\log K_{SLjt}$	$\log M^{d}_{jt}$	C	R^2	H
Food	0.5601*** (0.1422)	0.13744 (0.2639)	-0.0995 (0.0889)	-0.7723** (0.3664)	14.7503** (5.9576)	0.6682 (0.1747)	Rho=-0.3896 # (0.1438)
Tobacco	-0.4688*** (0.164)	-0.7872*** (0.1816)	-0.2454 (0.1649)	-0.2109 (0.4222)	14.836** (7.2493)	0.7218 (0.2298)	Rho=0.3531 # (0.1461)
Petroleum	0.0687 (0.1505)	0.3538 (0.3498)	-0.2072 (0.1306)	-1.8663*** (0.4236)	34.051*** (6.3203)	0.7405 (0.2087)	-1.9237
Industrial Chemicals	0.6612*** (0.1457)	-0.6321 (0.4972)	0.147 (0.1589)	0.269* (0.141)	1.9714 (5.1207)	0.6471 (0.1125)	-0.6164
Drugs	0.7432*** (0.1436)	-0.6834 (0.4207)	0.231 (0.2732)	0.1808 (0.1607)	4.1288 (3.6581)	0.6445 (0.1626)	-0.4585
Rubber	0.4960*** (0.1238)	-0.9755 (0.6057)	-0.2745* (0.1513)	-0.2098 (0.3587)	12.365*** (4.4291)	0.9557 (0.1574)	-0.3341
Paper	-0.2515 (0.1643)	0.7129*** (0.2463)	0.1087 (0.0801)	0.3619** (0.1583)	-14.511*** (2.6614)	0.6609 (0.0998)	Rho=-0.1531 (0.1543)
Textile	1.18*** (0.1141)	0.1682* (0.0948)	-0.1775* (0.0984)	0.0932** (0.0373)	-3.6228*** (1.0637)	0.7169 (0.1183)	Rho=-0.4517 # (0.1393)
Stone, Clay & Glasses	0.3931** (0.1548)	-0.0980 (0.168)	-0.0008 (0.0716)	-0.1721 (0.1341)	3.9716 (2.439)	0.4469 (0.0805)	Rho=-0.2807 (0.1499)
Iron & Steel	0.3698** (0.168)	0.6985 (0.8377)	-0.4433 (0.2921)	0.1397 (0.4081)	-12.1324 (14.5174)	0.6648 (0.2541)	2.3527 #
Nonferrous Metal	0.2912* (0.1620)	-0.2925 (0.4027)	0.0399 (0.2661)	0.5803 (0.4731)	-9.471 (9.046)	0.4777 (0.2273)	2.4139 #
Fabricated Metal	-0.2481 (0.1968)	-1.2123*** (0.3236)	0.0441 (0.1326)	-0.3637 (0.2506)	18.1896*** (4.3834)	0.9339 (0.0778)	Rho=0.5813 # (0.1271)
Machinery	0.9404*** (0.1247)	-0.089 (0.0954)	0.0495 (0.1017)	0.0671 (0.1392)	-0.4843 (2.5160)	0.9656 (0.0621)	Rho=-0.3071 # (0.1486)
Electrical Machinery	0.3838* (0.1974)	0.0725 (0.0648)	-0.5646** (0.2208)	-0.7037** (0.2912)	13.333** (5.5475)	0.9073 (0.1364)	Rho=0.244 (0.1515)
Motor Vehicles	0.6406*** (0.0999)	-0.5491** (0.2285)	-0.1709* (0.102)	-0.0885 (0.0723)	6.5819** (3.1288)	0.9656 (0.1031)	-2.863 #
Aircrafts	0.5618*** (0.1469)	-0.2447 (0.3248)	-0.0457 (0.1752)	0.5038 (0.4781)	-7.2794 (7.0772)	0.5175 (0.2638)	-0.8553
Instruments	0.0268 (0.1809)	0.1052 (0.2546)	0.1225 (0.1484)	-0.3178 (0.2228)	6.3961*** (2.3055)	0.5609 (0.9908)	Rho=0.04 (0.156)

Note:
* denotes significant at 0.10 significant level;
** denotes significant at 0.05 significant level;
*** denotes significant at 0.01 significant level;
# indicates the existence of autocorrelation at 0.025 significant level and the coefficients are adjusted for autocorrelation in this case;
C = constant term;
R^2 = R-square;
H = Durbin's h statistic;
Rho = The converged value of rho;
The values within the parentheses are the standard errors;
All notations are the same for the rest of tables.

TABLE 3
2SLS Regressions on the Capital Intensity Equation in the Period 1963-73

Industry	$\log k_{jt-1}$	$\log r_{Lt}$	C	R^2	H
Food	0.9672*** (0.0459)	0.0115 (0.0141)	0.3517 (0.4421)	0.9506 (0.0592)	-0.2959
Tobacco	0.9939*** (0.046)	-0.0145 (0.0349)	0.0481 (0.5132)	0.9507 (0.1392)	0.1574
Petroleum	0.9522*** (0.0315)	0.0093 (0.009)	0.6382 (0.4032)	0.9689 (0.0455)	-1.6587
Industrial Chemicals	0.964*** (0.0176)	-0.001 (0.0043)	0.3985** (0.1954)	0.9907 (0.0196)	0.1152
Drugs	0.9877*** (0.0285)	-0.0112 (0.0114)	0.1067 (0.3015)	0.977 (0.0487)	-1.4223
Rubber	1.0004*** (0.0204)	0.0029 (0.0057)	0.0221 (0.1926)	0.9893 (0.0248)	0.5439
Paper	0.9687*** (0.0231)	0.0031 (0.0039)	0.3158 (0.2237)	0.9831 (0.0185)	1.0276
Textile	0.9942*** (0.0107)	-0.0028 (0.0027)	0.056 (0.0951)	0.9933 (0.0169)	Rho=-0.4409 # (0.1402)
Stone, Clay & Glasses	0.9607*** (0.0367)	0.0047 (0.0084)	0.3946 (0.3576)	0.9634 (0.0355)	-0.2587
Iron & Steel	0.9867*** (0.0291)	-0.0033 (0.0073)	0.1301 (0.2944)	0.9742 (0.0339)	-1.2939
Nonferrous Metal	0.9953*** (0.0325)	-0.0096 (0.0098)	0.03 (0.3452)	0.9701 (0.0418)	-0.8873
Fabricated Metal	1.0183*** (0.0182)	-0.0053 (0.0051)	-0.1582 (0.1656)	0.9921 (0.0218)	0.5168
Machinery	1.0071*** (0.0187)	-0.0082 (0.0067)	-0.0691 (0.1790)	0.9909 (0.0291)	-0.4996
Electrical Machinery	0.8186*** (0.3005)	0.4839*** (0.1399)	3.2824 (2.871)	0.50 (0.6234)	A
Motor Vehicles	0.8987*** (0.0635)	-0.0036 (0.0171)	0.9763 (0.6357)	0.8599 (0.0807)	-1.4282
Aircrafts	0.9912*** (0.0189)	-0.0045 (0.0078)	0.0905 (0.1713)	0.9952 (0.0338)	2.15 #
Instruments	0.9709*** (0.0196)	0.0014 (0.0106)	0.2962 (0.1943)	0.9873 (0.0511)	0.8129

A: No available value.

TABLE 4
2SLS Regressions on the Capital Structure Equation in the Period 1963-73

Industry	$\log K_{SLjt-1}$	$\log i_{LSt}$	C	R^2	H
Food	0.2419 (0.2774)	1.0473*** (0.36)	-2.0829*** (0.6964)	0.0851 (0.3664)	Rho=-0.1464 (0.1545)
Tobacco	0.4407*** (0.1441)	-0.2489 (0.2578)	-1.2673*** (0.3517)	0.193 (0.2753)	-0.3192
Petroleum	0.8162*** (0.0834)	0.1046 (0.1924)	-0.882** (0.4091)	0.7203 (0.1979)	-0.3204
Industrial Chemicals	0.8875*** (0.0484)	0.0489 (0.1903)	-0.3968* (0.2047)	0.9089 (0.1831)	-1.0698
Drugs	0.9409*** (0.0365)	-0.0252 (0.0843)	-0.153 (0.1239)	0.8955 (0.1263)	-3.2555 #
Rubber	0.8735*** (0.0753)	0.0273 (0.1866)	-0.3218 (0.2083)	0.7933 (0.1851)	-0.4585
Paper	0.8536*** (0.084)	0.0382 (0.2046)	-0.5378* (0.3229)	0.7507 (0.2019)	-0.6837
Textile	0.0407 (0.1602)	0.1497 (0.3455)	-2.3986*** (0.4086)	-0.0036 (0.3575)	Rho=-0.001 (0.1562)
Stone, Clay & Glasses	0.7851*** (0.099)	0.1106 (0.2454)	-0.7406** (0.3492)	0.6187 (0.2552)	0.8538
Iron & Steel	0.9254*** (0.0545)	-0.0501 (0.1885)	-0.2693 (0.2525)	0.891 (0.188)	-1.2017
Nonferrous Metal	0.7381*** (0.0791)	0.2946* (0.1663)	-0.9635*** (0.2911)	0.735 (0.1643)	-1.2567
Fabricated Metal	0.5995*** (0.124)	-0.0331 (0.1448)	-1.0574*** (0.3331)	0.3766 (0.1518)	0.7018
Machinery	0.8776*** (0.0808)	-0.172 (0.138)	-0.2828 (0.2242)	0.7556 (0.139)	-0.3387
Electrical Machinery	0.972*** (0.0583)	-0.32*** (0.0978)	0.0103 (0.1515)	0.8801 (0.0962)	0.3571
Motor Vehicles	0.9571*** (0.0449)	-0.17 (0.1119)	-0.0796 (0.1548)	0.9279 (0.1104)	-1.1542
Aircrafts	0.9649*** (0.0835)	-0.5055*** (0.1736)	-0.0025 (0.214)	0.7825 (0.1664)	-0.1671
Instruments	0.9534*** (0.0743)	-0.1632 (0.1031)	-0.1008 (0.2279)	0.8352 (0.0923)	-0.5336

TABLE 5
2SLS Regressions on the Liquidity Demand Equation in the Period 1963 - 73

Industry	$\log M^{d}_{jt-1}$	$\log S_{jt}$	$\log i_{st}$	$\log(dP/P)_t$	C	R^2	H
Food	0.1919 (0.134)	0.5759*** (0.1043)	-0.0997* (0.0557)	0.0106 (0.0215)	3.406** (1.3673)	0.9139 (0.0532)	1.2131
Tobacco	0.3675** (0.1774)	0.4506** (0.1783)	-0.0508 (0.1566)	0.0353 (0.0582)	2.3359 (2.5038)	0.7556 (0.1308)	Rho=0.1461 (0.1545)
Petroleum	0.2841** (0.1315)	0.5334*** (0.0993)	0.0077 (0.07)	-0.0342 (0.0275)	2.9012* (1.5413)	0.8989 (0.0687)	1.8195
Industrial Chemicals	0.8171*** (0.14)	0.1675 (0.1312)	-0.166 (0.1247)	0.0601 (0.4475)	-0.2284 (2.7259)	0.8002 (0.1058)	1.4851
Drugs	0.9679*** (0.0785)	0.1296 (0.1098)	-0.159* (0.0942)	-0.0006 (0.0346)	-2.567* (1.4785)	0.9726 (0.0857)	0.3773
Rubber	0.4232*** (0.1479)	0.8199*** (0.2245)	-0.2789** (0.1192)	-0.021 (0.0437)	-7.4254*** (2.7505)	0.8994 (0.1046)	1.2385
Paper	1.11*** (0.098)	0.0348 (0.0957)	-0.1505** (0.0689)	0.0652* (0.0333)	-3.1975 (2.0059)	0.8108 (0.0826)	-2.1523 #
Textile	0.5218*** (0.1262)	0.0638 (0.5786)	-0.2741 (0.4797)	0.3774** (0.185)	8.6466 (13.408)	0.5413 (0.448)	1.771
Stone, Clay & Glasses	0.5396*** (0.1177)	0.2846*** (0.0718)	-0.08263 (0.0861)	-0.0033 (0.0345)	2.8692 (2.5048)	0.6595 (0.0825)	1.4233
Iron & Steel	0.8987*** (0.073)	0.1853* (0.1022)	-0.0371 (0.1023)	-0.0507 (0.0377)	-2.3187 (2.7312)	0.8166 (0.0984)	0.9827
Nonferrous Metal	0.3798** (0.1573)	0.3579** (0.1441)	0.0543 (0.1237)	-0.0051 (0.0254)	4.9762 (4.9294)	0.8369 (0.0739)	2.8717 #
Fabricated Metal	0.2309* (0.1262)	0.6132*** (0.1053)	-0.143** (0.0561)	-0.0109 (0.0221)	1.6539 (1.2311)	0.9224 (0.0533)	0.3006
Machinery	0.4579*** (0.1183)	0.702*** (0.1574)	-0.395*** (0.0875)	0.0172 (0.0277)	-5.7328*** (1.8299)	0.9457 (0.0664)	0.2851
Electrical Machinery	0.5169*** (0.1111)	0.5034*** (0.1261)	-0.2176** (0.0911)	0.0008 (0.0348)	-2.0762 (1.8009)	0.9065 (0.0846)	0.082
Motor Vehicles	0.545*** (0.0924)	0.618*** (0.0907)	-0.0887 (0.1257)	-0.0822* (0.0471)	-5.3511** (2.3341)	0.814 (0.1211)	-1.618
Aircrafts	0.8937*** (0.065)	0.0442 (0.0747)	0.1049 (0.1063)	-0.0124 (0.0418)	1.4245 (1.7793)	0.898 (0.109[illegible])	-1.0017
Instruments	0.6434*** (0.1047)	0.5285*** (0.1538)	-0.14 (0.1171)	-0.0427 (0.0445)	-4.9209*** (1.9543)	0.9563 (0.1062)	-0.4796

TABLE 6
2SLS Regressions on the Interest Rate Equations

Equation 5	i_{St-1}	$(dP/P)_t$	C	R^2	H
1963-73	0.6108***	0.3066***	0.0112***	0.8848	0.5757
	(0.0838)	(0.0613)	(0.0034)	(0.0056)	
1974-79	0.6936***	0.2485*	0.00458	0.8101	2.6845 #
	(0.1968)	(0.1344)	(0.0109)	(0.011)	

Equation 6	i_{Lt-1}	$(dP/P)_t$	C	R^2	H
1963-73	0.8606***	0.0975***	0.0066**	0.9435	-0.0617
	(0.0486)	(0.0369)	(0.0027)	(0.0039)	
1974-79	0.7074***	0.1076***	0.01855	0.677	-1.6654
	(0.156)	(0.0346)	(0.0134)	(0.0046)	

TABLE 7
2SLS Regressions on the Relative Export Performance Equation in the Period 1974-79

Industry	$\log X_{jt-1}$	$\log k_{jt}$	$\log K_{SLjt}$	$\log M^{d}_{jt}$	C	R^2	H
Food	-0.2757	0.182	-0.5061**	0.0215	-4.6912	0.388	Rho=0.4126 #
	(0.2237)	(0.2666)	(0.2413)	(0.382)	(8.4666)	(0.1165)	(0.1899)
Tobacco	0.1823	0.2309	-0.0802	-0.3434	5.8485	0.4464	Rho=-0.2614
	(0.3125)	(0.4093)	(0.2401)	(0.2776)	(4.6572)	(0.1981)	(0.2013)
Petroleum	0.2183	1.4597**	0.0076	-0.9754*	1.457	0.2453	Rho=-0.3842
	(0.2537)	(0.6814)	(0.2484)	(0.5864)	(9.0465)	(0.2564)	(0.1925)
Industrial Chemicals	0.5764**	-0.25	-0.3687	0.4819	-8.6696	-0.0743	Rho=0.0378
	(0.2358)	(0.2654)	(0.2984)	(0.4115)	(7.97)	(0.1638)	(0.2084)
Drugs	-0.0955	-1.6015**	-0.0952	0.6364**	4.2472	0.3777	Rho=-0.2032
	(0.2851)	(0.7410)	(0.1331)	(0.2579)	(4.7856)	(0.113)	(0.2042)
Rubber	0.6595***	-1.1667	-0.2295	-0.7977	26.178**	0.8022	-0.7227
	(0.1749)	(0.8734)	(0.3114)	(0.5455)	(12.952)	(0.2671)	
Paper	0.2645	-0.6754	0.0794	0.0274	6.2958	0.6541	3.2956 #
	(0.2261)	(0.527)	(0.2778)	(0.3399)	(6.0132)	(0.1635)	
Textile	0.6793***	0.5878*	0.0618	0.1678	-8.3737*	0.6258	1.0755
	(0.1673)	(0.3142)	(0.1152)	(0.2341)	(4.8828)	(0.1062)	
Stone, Clay & Glasses	0.5853***	0.4392**	-0.0605	-0.3781**	3.0718	0.7261	Rho=-0.4543 #
	(0.1502)	(0.1984)	(0.0722)	(0.1526)	(2.2749)	(0.0815)	(0.1858)
Iron & Steel	0.318*	0.7544	-0.4248	-0.8887**	8.6404	0.8522	3.3519 #
	(0.1637)	(0.8317)	(0.2764)	(0.3565)	(11.952)	(0.1551)	
Nonferrous Metal	0.4887***	0.1014	-0.2873*	0.417	-11.124	0.6149	1.3799
	(0.1772)	(0.3931)	(0.1714)	(0.3581)	(8.9198)	(0.1813)	
Fabricated Metal	-0.088	1.3652**	-0.0818	0.4837	-23.089**	0.5671	Rho=0.7602 #
	(0.1982)	(0.5926)	(0.1986)	(0.4121)	(10.4581)	(0.0841)	(0.1354)
Machinery	1.0187***	-0.0023	0.1407	0.1504	-2.8442	0.8316	-5.692 #
	(0.1193)	(0.1174)	(0.0713)	(0.1914)	(3.6229)	(0.0703)	
Electrical Machinery	0.3397	-0.1239	-0.3787	-0.6754	14.678*	0.777	Rho=-0.1261
	(0.2754)	(0.6983)	(0.2963)	(0.43)	(7.7416)	(0.1161)	(0.2069)
Motor Vehicles	0.6994**	-0.2185	0.2219**	0.1411	-0.0506	0.6335	-0.0406
	(0.1641)	(0.2079)	(0.0923)	(0.1053)	(2.0765)	(0.1026)	
Aircrafts	0.1188	1.0506	-0.1293	-0.3375**	-0.8872	0.3117	Rho=-0.4642 #
	(0.2562)	(0.7067)	(0.0892)	(0.139)	(4.4344)	(0.2566)	(0.1847)
Instruments	-0.027	0.8117*	-0.0268	-0.2836*	-1.4499	0.543	Rho=0.4537 #
	(0.1906)	(0.4878)	(0.17)	(0.1452)	(5.58)	(0.0964)	(0.1858)

TABLE 8

2SLS Regressions on the Capital Intensity Equation in the Period 1974-79

Industry	$\log k_{jt-1}$	$\log r_{Lt}$	C	R^2	H
Food	0.9872*** (0.062)	-0.003 (0.0057)	0.1411 (0.6047)	0.926 (0.047)	-0.4944
Tobacco	1.0025*** (0.0792)	-0.0159 (0.0168)	-0.0278 (0.8385)	0.8859 (0.1362)	-0.7524
Petroleum	1.0683*** (0.0765)	-0.0143* (0.0081)	-0.8798 (0.9768)	0.9053 (0.0635)	-0.3595
Industrial Chemicals	1.01*** (0.0615)	-0.0095 (0.0077)	-0.1086 (0.6846)	0.928 (0.0605)	-0.6686
Drugs	0.8299*** (0.1407)	-0.0082 (0.0092)	1.7065 (1.4232)	0.6242 (0.0726)	1.0796
Rubber	0.8092*** (0.16)	0.0003 (0.0066)	1.7771 (1.4824)	0.5564 (0.0522)	1.5234
Paper	0.9667*** (0.034)	-0.0027 (0.0041)	0.3585 (0.3402)	0.9747 (0.034)	1.2898
Textile	0.9678*** (0.0884)	0.0089** (0.0045)	0.3152 (0.782)	0.8725 (0.0355)	0.1407
Stone, Clay & Glasses	0.993*** (0.101)	0.0012 (0.0057)	0.0865 (0.9812)	0.0821 (0.0462)	1.2122
Iron & Steel	0.983*** (0.044)	-0.0086* (0.0047)	0.1778 (0.4479)	0.96 (0.0386)	1.6155
Nonferrous Metal	0.8276*** (0.1267)	-0.0051 (0.0075)	1.7923 (1.313)	0.7239 (0.058)	1.9236
Fabricated Metal	0.9218*** (0.0827)	0.0023 (0.0042)	0.7204 (0.7427)	0.8595 (0.0334)	1.6018
Machinery	0.8417*** (0.1514)	0.0084 (0.0126)	1.5198 (1.4173)	0.6028 (0.1036)	-1.6483
Electrical Machinery	0.9234*** (0.0606)	0.0007 (0.0032)	0.7152 (0.5502)	0.9208 (0.0293)	4.4321 #
Motor Vehicles	0.978*** (0.1408)	0.0016 (0.0088)	0.2332 (1.3833)	0.7022 (0.0719)	0.5446
Aircrafts	1.057*** (0.0701)	-0.006 (0.0051)	-0.5184 (0.642)	0.9174 (0.0397)	0.3646
Instruments	0.6394*** (0.1703)	-0.0135 (0.0098)	3.3944** (1.6027)	0.6115 (0.0633)	1.4091

TABLE 9

2SLS Regressions on the Capital Structure Equation in the Period 1974 - 79

Industry	$\log K_{SLjt-1}$	$\log i_{LSt}$	C	R^2	H
Food	0.717*** (0.1226)	-0.1959** (0.084)	-0.7136** (0.324)	0.6484 (0.0985)	3.7515 #
Tobacco	0.7528*** (0.1429)	0.1821 (0.4182)	-0.9626* (0.5197)	0.6062 (0.4348)	-1.3367
Petroleum	0.214 (0.208)	-0.2082 (0.3913)	-4.1361*** (1.0816)	0.0873 (0.4093)	Rho=0.2522 (0.2018)
Industrial Chemicals	0.2489* (0.1503)	-0.1605 (0.2179)	-3.3146*** (0.6589)	0.1504 (0.2374)	0.5185
Drugs	0.6895*** (0.131)	0.3671 (0.2751)	-1.3698*** (0.5294)	0.6005 (0.2935)	0.8464
Rubber	0.037 (0.2048)	-1.1137*** (0.2726)	-2.8955*** (0.618)	0.725 (0.1618)	Rho=-0.2307 (0.2029)
Paper	0.8443*** (0.1226)	-0.1748 (0.129)	-0.6125 (0.5124)	0.6945 (0.1405)	-0.6567
Textile	0.7302*** (0.1578)	0.0491 (0.1898)	-0.775* (0.4406)	0.5095 (0.2078)	-0.3072
Stone, Clay & Glasses	0.702*** (0.1433)	-0.0193 (0.2018)	-1.1169** (0.5153)	0.5441 (0.2217)	-1.11
Iron & Steel	0.291 (0.2366)	-0.2312 (0.195)	-2.6486*** (0.87)	0.2933 (0.1612)	Rho=-0.0106 (0.2085)
Nonferrous Metal	0.6396*** (0.1808)	-0.2169 (0.2305)	-1.2394** (0.6305)	0.5207 (0.2141)	-1.4337
Fabricated Metal	0.6971*** (0.1213)	-0.3708** (0.1506)	-0.7813** (0.3281)	0.7798 (0.1426)	1.0619
Machinery	0.8156*** (0.0764)	-0.2535** (0.1226)	-0.5669** (0.2413)	0.8682 (0.1288)	-1.4697
Electrical Machinery	0.7747*** (0.078)	-0.0393 (0.1386)	-0.7534*** (0.2396)	0.8411 (0.1443)	-0.5581
Moter Vehicles	0.687*** (0.1264)	-0.1761 (0.3137)	-1.2785** (0.5301)	0.583 (0.345)	0.6393
Aircrafts	0.8705*** (0.0843)	-0.5582* (0.2951)	-0.3893 (0.3158)	0.8406 (0.3225)	-0.2455
Instruments	0.8961*** (0.0974)	-0.1346 (0.1487)	-0.3656 (0.3285)	0.8178 (0.1615)	0.6546

TABLE 10

2SLS Regressions on the Liquidity Demand Equation in the Period 1974-79

Industry	$\log M^{d}_{jt-1}$	$\log S_{jt}$	$\log i_{St}$	$\log(dP/P)_{t}$	C	R^2	H
Food	-0.2247 (0.1838)	0.5927*** (0.1239)	-0.0328 (0.0876)	-0.1178* (0.061)	11.756*** (3.828)	0.6116 (0.0566)	1.6838
Tobacco	0.0838 (0.2507)	0.1372 (0.3912)	-0.6272 (0.5877)	0.1686 (0.43)	13.21 (9.2315)	0.1125 (0.3881)	Rho=0.0944 (0.2076),
Petroleum	0.4928*** (0.1565)	0.4626*** (0.1363)	0.4547*** (0.1672)	-0.3681*** (0.1255)	0.1566 (2.595)	0.8464 (0.1093)	0.2783
Industrial Chemicals	0.1964 (0.2265)	0.0088 (0.2049)	-0.0002 (0.1904)	0.0225 (0.1479)	16.5698*** (6.2141)	0.1142 (0.1492)	2.6089 #
Drugs	0.358*** (0.0937)	0.7715*** (0.1537)	0.0724 (0.1807)	-0.2317* (0.1331)	-4.3607 (3.4996)	0.7514 (0.1197)	1.2817
Rubber	0.4727** (0.207)	0.2465 (0.1922)	-0.0642 (0.1403)	-0.1097 (0.1039)	4.7045 (2.9456)	0.6055 (0.1148)	3.2849 #
Paper	0.4725*** (0.141)	0.3928*** (0.1042)	0.2182*** (0.1103)	-0.1374* (0.08)	2.1891 (2.5146)	0.8392 (0.0758)	0.5546
Textile	-0.0984 (0.1869)	0.2214 (0.2511)	0.3772** (0.1616)	-0.2421** (0.0896)	17.7296** (7.8013)	0.4513 (0.101)	Rho=0.6408 # (0.1601)
Stone, Clay & Glasses	0.2579*** (0.09)	1.0034*** (0.1187)	0.0156 (0.1247)	-0.3051*** (0.0904)	-8.1857*** (2.3458)	0.9019 (0.0875)	0.4389
Iron & Steel	0.4091** (0.1835)	-0.1827 (0.1589)	0.3248** (0.1621)	-0.0983 (0.1137)	17.412** (6.928)	0.5141 (0.1124)	0.9835
Nonferrous Metal	0.2162 (0.1488)	-0.4681** (0.2109)	0.715*** (0.1963)	-0.2598** (0.1198)	27.772*** (7.3035)	0.5596 (0.109)	0.7465
Fabricated Metal	0.2508* (0.1516)	0.7097*** (0.1644)	-0.1456 (0.1047)	-0.2067*** (0.0648)	-1.5506 (2.2049)	0.8869 (0.0652)	1.113
Machinery	0.0519 (0.1053)	0.9757*** (0.1106)	-0.1751* (0.101)	-0.1145 (0.0702)	-3.4576* (1.962)	0.9049 (0.0657)	0.6956
Electrical Machinery	0.4398*** (0.1456)	0.9019*** (0.3034)	-0.0107 (0.1351)	-0.1804** (0.081)	-9.8664** (4.9189)	0.9416 (0.0841)	2.1276 #
Motor Vehicles	-0.1271 (0.121)	1.7469*** (0.2072)	0.0364 (0.2697)	-0.0176 (0.2169)	-17.697*** (4.0429)	0.8417 (0.1948)	0.3544
Aircrafts	0.9647*** (0.1103)	0.4387 (0.4279)	-0.4466* (0.2508)	0.0908 (0.1741)	-10.198 (8.0375)	0.9613 (0.1662)	1.0803
Instruments	0.1912 (0.1293)	1.3372*** (0.2348)	-0.4558* (0.2298)	-0.1738 (0.1631)	-15.287*** (4.0469)	0.858 (0.1621)	0.7154

TABLE 11
The Stability Test

Industry	Equation 1	2	3	4	5	6
	$(F_{5,56})$[a]	$(F_{3,60})$	$(F_{3,60})$	$(F_{5,56})$	$(F_{3,60})$	$(F_{3,60})$
Food	1.27839	0.21028	4.88236**	8.28538**	0.88554	0.44702
Tobacco	0.74168	0.15057	3.43327*	1.89465		
Petroleum	7.13386**	1.89364	11.2684**	6.80795**		
Industrial Chemicals	1.94407	1.31046	8.88858**	8.21212**		
Drugs	0.64121	0.63897	7.82425**	11.2461**		
Rubber	2.58541*	1.26446	4.624**	5.00629**		
Paper	19.5361**	0.56641	0.71928	3.38885*		
Textile	3.53877**	3.13955*	3.64305*	0.12362		
Stone, Clay & Glasses	4.3209**	0.13784	1.12467	8.01595**		
Iron and Steel	1.90285	0.16708	1.82406	2.4265*		
Nonferrous Metal	0.06562	11.6928**	-0.6136	11.4087**		
Fabricated Metal	6.55814**	-0.6448	1.35495	4.13265**		
Machinery	2.9717*	-0.4647	2.20063	15.8483**		
Electrical Machinery	14.4463**	13.2683**	8.29898**	5.79772**		
Motor Vehicles	2.62991*	0.47314	4.61848**	13.6687**		
Aircrafts	2.6156*	1.43776	1.29955	1.05507		
Instruments	1.43347	1.25615	1.39963	8.50828**		

Note:
1. $F_{0.05\ 5,56} = 2.4$, $F_{0.01\ 5,56} = 3.4$, $F_{0.05\ 3,60} = 2.76$, $F_{0.01\ 3,60} = 4.13$.

* denotes significant at 0.05 significant level.
** denotes significant at 0.01 significant level.