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INFLATION, GROWTH AND EXCHANGE RATES

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Inflation, Growth and Exchange Rates

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Inflation, Growth and Exchange Rates

The past decade's turmoil in the international economy has provided economists with a treasure trove of interesting research topics. Throughout this period, the developed nations of the Atlantic Basin have wrestled with problems of inflation, growth and exchange adjustment. Meanwhile, the developing nations — generally fast-developing nations — of the Pacific Basin have faced variations of the same problems. This issue of the **Economic Review** investigates several of these problems, and especially their effects on Pacific Basin economies.

Maxwell J. Fry notes that some developing economies have exhibited a negative correlation between long-run average inflation and real economic growth. He suggests one possible explanation — financial repression, that is, institutional interest rates fixed below their competitive, free-market equilibrium levels by administrative fiat. To test that thesis, he applies a small-scale model of inflation and economic growth to seven Pacific Basin developing countries that have utilized such financial restrictions.

Fry's analysis provides an important policy conclusion: "Flexible interest-rate policies in financially repressed economies can be used to counter inflationary shocks and accelerate the real rate of economic growth." An increase in the real deposit rate towards its competitive equilibrium level raises real money demand, so reducing inflationary pressures. At the same time, the availability of credit increases in real terms. Consequently, real economic growth rises, which increases real money demand some more. "Inflation drops; the virtuous circle is complete."

Fry notes the well-known policy dilemma: Lowering the rate of monetary expansion to bring down inflation raises unemployment and reduces real economic growth in the short run. "However, financially repressed economies can use both the money supply and nominal interest rates as independent policy instruments." Monetary deceleration could have a **permanent** inflation-reducing but **temporary** depressing effect on real economic growth. But raising nominal institutional interest rates towards their competitive equilibrium levels could have a **temporary** inflation-reducing but **permanent** growth-enhancing impact. "In combination, monetary deceleration with interest-rate increases could lower inflation and, simultaneously, raise the real rate of economic growth."

Hang-Sheng Cheng discusses the policy dilemma faced by the People's Republic of China, especially in the current environment of inflation. "Over the years, tight controls have strangled work incentives and caused serious waste and inefficiency; yet under the present institutional set-up, administrative controls appear to be indispensable for combating inflation." Then he asks: In the long run, do the authorities have adequate policy instruments for fighting inflation without administrative controls? The answer to this question will to a large extent depend on whether China can forge an effective monetary policy that does not rely primarily on direct controls.

Cheng argues that money has a significantly lesser role in the Chinese command economy than in the typical market economy, and that monetary policy thus has a more restricted role than it does elsewhere. China's monetary policy has been circumscribed, first, by a nearly complete reliance on administrative controls for regulating monetary growth, and second, by the monetary authorities' lack of independence from both central- and local-government authorities with respect to credit allocation. Other complications arise from the

authorities' mechanical reliance on the quantity equation of money for determining money-growth targets — and also from their reliance on a narrow definition of money, limited to currency, which tends to lead to an underestimate of the inflationary pressures on the economy.

Cheng says that monetary policy is coterminous with credit policy, given China's exclusive reliance on administrative controls for regulating money growth. In this regard, official thinking continues to be guided by the "real bills doctrine" and by the so-called "separation principle," even though theoretical support for these principles is found wanting even in the Chinese context. These principles, moreover, require continued reliance on administrative controls for enforcing compliance. "Their replacement by a flexible interest-rate policy would not only be more in tune with the spirit of Modernization, but also would help support the development of an effective monetary policy, operating through market forces rather than administrative controls."

Charles Pigott next reviews the experience of several major industrial countries since the beginning of flexible exchange rates in 1973. He asks, "To what extent have **real** factors — factors such as tastes, productivity, and oil costs, determining relative commodity prices in the **long-run** — actually affected these exchange rates?" He points out that nominal exchange rates can be divided into two components — one reflecting the ratio of national price levels as determined (mainly) by money supplies and demands, with the other 'real' or 'terms-of-trade' component reflecting the relative prices of individual commodities. He notes, however, that the 'terms-of-trade' is potentially affected not only by real factors but also by real interest fluctuations or other influences leading to **temporary** changes in relative commodity prices.

Pigott shows that fluctuations in nominal exchange rates about their trend have largely represented terms-of-trade changes in recent years. And for the floating-rate period as a whole, variations in the terms of trade have tended to be highly persistent, suggesting they mainly reflect real-factor influences. "Thus, real factors have represented a major source — in some cases the single largest source — of exchange-rate fluctuations about trend over the last eight years." He adds that this conclusion, although tentative, suggests that models of exchange-rate determination which consider only financial-market conditions while ignoring fundamental commodity-price determinants will inevitably miss an important aspect of actual exchange-rate behavior.

Pigott warns, however, that the importance of real factors creates difficulties for interpreting actual movements in exchange rates. "This is particularly the case as neither real interest rates nor the long-run factors influencing relative commodity prices are directly observable." He notes that U.S. officials have used foreign-exchange market conditions as a major policy guide in recent years, partly reflecting a belief that these markets convey early signals of developing inflation pressures. "But the analysis here indicates that exchange-market signals normally are highly ambiguous, reflecting as they do a variety of factors. Since the appropriate response to one source of exchange-rate variation may be inappropriate in another case, policy-makers at the least should be very cautious in using foreign-exchange market developments as a regular guide to policy."

Kenneth Bernauer turns to another aspect of exchange rates — specifically, the effectiveness of exchange-rate changes on the Japanese trade account. He notes that analysts no longer take for granted the view that exchange-rate movements will be completely passed forward into export and import prices. In his analysis, therefore, he first considers the impact of an exchange-rate change on the prices of exports and imports, and then considers the effects of these price changes on the quantities demanded of exports and imports. This two-stage procedure permits him to trace out the "J curve" measuring the effects of a yen depreciation on the Japanese trade account. The curve is so named because the initial deteriora-

tion and subsequent improvement in a depreciating country's trade account resemble the letter J when the trade account is plotted on the vertical axis against time on the horizontal axis.

Bernauer measures this effect by estimating volume and price equations for four separate commodity categories. His results show that a 10-percent yen depreciation would lead to about a 3.8-percent deterioration in the terms of trade. With no change in export and import quantities, this terms-of-trade effect would then lead to an initial deterioration in the trade account. The duration of the worsening trade balance — the duration of the first segment of the J-curve — would depend upon the time lag between movements in quantities and prices, and upon the size of the price elasticities of demand for exports and imports.

Turning to the actual trade results, Bernauer shows that a 33.6-percent effective yen depreciation between the third quarter of 1978 and the first quarter of 1980 was followed by a 17.6-percent rise in Japanese export volume between 1979IV and 1980IV — and by a 6.8-percent decline in Japanese import volume. Ironically, the export upsurge occurred almost simultaneously with a 16.6-percent appreciation of the yen against the dollar and major European currencies between 1980I and 1980IV. "From the evidence, though, the reverse J-curve effects stemming from the yen's appreciation made only a modest contribution to the improvement in Japan's trade account. The expanding surpluses of 1980 and 1981 stemmed largely from an improvement in Japan's price competitiveness, leading to robust export-volume gains." Bernauer thus sees little prospect of a reduction in the U.S. bilateral-trade deficit with Japan, given the continued erosion of U.S. price competitiveness during 1981. The U.S.-Japanese controversy over trade matters consequently may not subside in the foreseeable future.

Inflation and Economic Growth in Pacific Basin Developing Economies

Maxwell J. Fry*

The absence of any long-run relationship between inflation and the real rate of economic growth in **developed** economies has been well documented. The short-run positive correlation between inflation and real economic growth holds only so long as expectations of future inflation lag behind actual inflation rates. In the long run, the inflation/growth tradeoff disappears because actual inflation becomes fully anticipated.

Several **developing** economies have exhibited a negative correlation between long-run average inflation and real economic growth rates. One explanation may be financial repression — institutional interest rates fixed below their competitive, free-market equilibrium levels by administrative fiat. Under such circumstances, higher inflation rates generally produce lower real (i.e., inflation-adjusted) institutional rates — deposit, loan and bond rates of interest.

In many developing economies, commercial banks dominate the financial sector. Hence, institutional interest rates consist, in the main, of deposit rates offered to lenders/savers and loan rates charged borrowers/investors. Financial savings are held as bank deposits — a major component of the money stock. Money is defined throughout this paper to include savings, time and post office deposits, as well as sight deposits and currency in circulation.[1]

Higher inflation rates typically reduce real deposit rates of interest. And lower deposit rates tend to contract real money demand, i.e., demand for money expressed in constant-value terms. The decline in the real value of the banking system's deposit liabilities must be matched by a similar fall in the real value of the banking system's assets (or by a corresponding increase in bank capital). The primary asset of most banking systems is domestic credit.

A fall in real money demand may affect the price level in the same way as a rise in nominal money supply. Provided the money market clears, i.e., supply equals demand, inflation can be expressed as the difference between rates of change in nominal money supply and real money demand. In contrast, a fall in real money demand may not affect real economic growth in the same way as a rise in nominal money supply. **Ceteris paribus,** a decline in real money demand reduces real credit supply, but in the very short run, an increase in nominal money supply has exactly the opposite effect.

As inflation accelerates, and as real deposit rates, real money demand and real credit supply all decline, the government may expropriate an increasing proportion of the contracting supply of real domestic credit to finance its rising deficit. Hence, funds for both working capital and fixed investment are doubly pinched. The fall in real money demand produces a credit crunch which, in turn, reduces the real rate of economic growth.

The long-run negative relationship between inflation and real economic growth in financially repressed developing economies has important implications for stabilization policy. Policy-makers face the well-known dilemma: lowering the rate of monetary expansion to bring down inflation raises unemployment and

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reduces real economic growth in the short run. However, financially repressed economies can use both the money supply and nominal interest rates as independent policy instruments. While lowering the rate of monetary expansion, they can raise nominal institutional interest rates. The monetary deceleration has a **permanent** inflation-reducing but **temporary** depressing effect on real economic growth. Raising nominal institutional interest rates towards their competitive, free-market equilibrium levels, however, has a **temporary** inflation-reducing but **permanent** growth-enhancing impact. In combination, monetary deceleration with interest-rate increases could lower inflation and, simultaneously, raise the real rate of economic growth.

This paper tests the hypothesis that lowering real deposit rates below competitive levels increases inflation and, at the same time, reduces real economic growth. Section I examines the credit-availability mechanism. Section II applies a small-scale model of inflation and real economic growth to seven Pacific Basin developing countries. Section III analyzes alternative stabilization strategies for financially repressed developing economies.

I. Financial Repression and the Credit Availability Effect

Low interest-rate policies found in a number of developing economies are often part of a broader policy of financial restriction. Such a policy encourages financial intermediaries and financial instruments from which the government can expropriate a large seigniorage, while discouraging other entities. For example, the system favors money and the banking system: reserve requirements and obligatory holdings of government bonds can be imposed to tap this source of saving at zero- or low-interest cost to the public sector. However, the system suppresses private bond and equity markets — through transaction taxes, stamp duties, special tax rates on capital income, an unconducive legal framework, etc. — because seigniorage cannot be taken so easily from private bonds and equities. The government can impose interest-rate ceilings and foreign-exchange controls to stifle competition with government borrowing. It can then use high reserve requirements to increase the flow of resources to the public sector with minimum effects on inflation and/or borrowing costs.

Nominal interest-rate ceilings established to reduce competition under financially restrictive policies can be disruptive in the face of an inflationary shock. Just as U.S. deposit-rate ceilings have caused serious disintermediation in an environment of rising inflation and free-market interest rates, so developing economies' all-embracing interest-rate ceilings on financial assets have caused violent portfolio shifts from financial to tangible assets (i.e., inflation hedges) in a situation of accelerating inflation (Shaw, 1975). This type of reaction magnifies the initial inflationary shock. It also turns financial restriction into financial repression, a condition in which the financial sector contracts in real terms.

Typically, it seems, financial repression is the unintended consequence of an inflexible interest-rate system — established under financial restriction, selective credit policies and/or a bank cartel — in the face of accelerating inflation. Shaw's central proposition (1973, pp. 3-4) is that financial repression — indiscriminate "distortions of financial prices including interest rates and foreign-exchange rates" — reduces "the real rate of growth and the real size of the financial system relative to nonfinancial magnitudes. In all cases this strategy has stopped or gravely retarded the development process." More recently, Cheng (1980) has analyzed the phenomenon of financial repression and the process of financial deepening in seven Pacific Basin developing economies.

This paper considers the effects of financial repression on credit availability in seven Pacific Basin developing countries: Indonesia, Korea, Malaysia, Philippines, Singapore,

Taiwan and Thailand. The ratio of investment to GNP increased in all these countries between the 1960s and the 1970s. (Table 1). Yet in every case, except the Philippines, a higher investment ratio was required just to sustain the 1960s' real economic growth rate. In other words, incremental output/capital ratios fell. Also, five countries (Indonesia, Korea, Singapore, Taiwan and Thailand) showed a negative relationship between real economic growth and inflation. In fact, inflation accelerated in all the sample countries except Indonesia, where lower inflation was accompanied by substantially higher real economic growth.

Until 1975, institutional interest rates were determined, not competitively, but rather by a bank cartel in Singapore and by administrative fiat in the other six countries. With the worldwide acceleration of inflation in 1974, the real 12-month time-deposit rate declined in all the sample countries — indeed, became substantially negative in every case except Malaysia (Table 2). Apart from Indonesia, real deposit rates were considerably lower in the 1970s than they had been in the 1960s. The lower incremental output/capital ratios of the 1970s may have been due to lower capacity utilization, due to reduced credit availability for working-capital needs.

The traditional link between credit and output is through demand — the increase in credit created by monetary expansion is accompanied by an increase in demand which stimulates real output. Within the past decade, Kapur (1976), Keller (1980), Mathieson (1980), McKinnon (1973) and Shaw (1973) have analyzed the link between credit and real output through the supply side. This Wicksellian view holds that the availability of working capital determines, **ceteris paribus,** the volume of production which can be financed. In particular, as Keller (1980, p. 455) argues, "... production **expansion** may depend, entirely or in part, on credit availability and/or the cost of credit."

Evidently, this supply link between credit availability and real economic growth springs from the ratio of credit to output, or from the real rather than the nominal volume of credit. In the very short run, the real availability of credit can be increased through an acceleration in nominal domestic-credit expansion. **Ceteris paribus,** this accelerated credit expansion is accompanied — in fact, brought about — by accelerated monetary expansion. Momentarily, the money market does not clear — money supply exceeds money demand. The ensuing inflation erodes the real supply of domestic credit as well as the real money stock. If real money demand actually falls due to higher inflation, then the new equilibrium will, **ceteris paribus,** result in a lower ratio of credit to output.[2]

Conversely, a deceleration in domestic credit expansion decreases credit availability in the very short run (Kapur, 1976; McKinnon,

Table 1
Investment, Growth and Inflation, 1962-81

Country	Investment Ratio		Incremental Output/Capital Ratio		Real GNP Growth Rate		Inflation Rate	
	1962-71	1972-81	1962-71	1972-81	1962-71	1972-81	1962-71	1972-81
Indonesia	11.0	20.9	0.42	0.33	4.6	6.9	85.1	18.5
Korea	20.1	32.3	0.43	0.26	8.7	8.3	15.7	18.1
Malaysia	18.8	24.1	0.33	0.31	6.1	7.5	0.1	7.1
Philippines	21.1	25.6	0.23	0.24	4.8	6.2	6.9	12.1
Singapore	24.1	34.9	0.38	0.23	9.0	7.9	1.5	5.4
Taiwan	20.9	29.5	0.44	0.26	9.1	7.7	4.0	10.3
Thailand	24.1	24.4	0.33	0.30	8.0	7.2	1.1	9.9

Note: Growth and inflation rates are continuously compounded.
Source: World Bank, *World Tables* (1980), and IMF estimates.

1973). With the consequent disequilibrium in the money market, the real money stock is less than real money demand. The subsequent decrease in inflation may raise real money demand, and the new equilibrium will exhibit a higher ratio of credit to output. At this point, credit availability is greater than it was before the initial deceleration in credit expansion.

I am not concerned with the very short run, for which this annual model is unsuitable, but rather with the somewhat longer-run relationship between the rate of nominal domestic credit expansion and the ratio of credit to real output. Faster expansion of money and nominal credit raises the inflation rate. If the nominal deposit rate is fixed, the ensuing increase in expected inflation reduces the real deposit rate of interest — and this in turn reduces real money demand or decreases the ratio of money to nominal GNP. The ratio of domestic credit, DC, to nominal GNP, PY, also falls. In this way, an acceleration in nominal domestic credit and in money supply reduces credit availability in real terms, i.e., DC/PY declines.

The Pacific Basin countries considered here have placed little reliance on progressive income-tax systems. This results in inflation-inelastic real tax revenue due, in large part, to lags in tax collection. For fighting inflation, they tend to favor price controls on the output of nationalized industries. As inflation increases, nationalized industries tend to post larger losses. The gap widens between conventional tax receipts and public expenditure, and this is financed by heavier reliance on seigniorage and the inflation tax. The government extracts greater seigniorage by increasing the proportion of domestic credit allocated to the public sector, and thus reduces the ratio of private sector credit, DCp, to total domestic credit, DC. The government levies an inflation tax by creating more money than the public wishes to hold at the current level of prices. This creates a double squeeze on credit available for private-sector working capital, i.e., DCp/PY falls due to the decline in both DC/PY and DCp/DC.

This credit-availability mechanism can be tested for the 1961-77 period by regressing three ratios — domestic credit to nominal GNP, DC/PY; private-sector domestic credit to total domestic credit, DCp/DC; and private-sector domestic credit to nominal GNP, DCp/PY — on the real rate of interest, $d/\dot{P}^*$, where d is the continuously-compounded 12-month time-deposit rate of interest and $\dot{P}^*$ is the continuously-compounded expected inflation rate (see Appendix). The ordinary least-squares (OLS) estimates are (t values in parentheses):

Table 2
Real Deposit Rates of Interest, 1962-81

	Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
1962-71	-65.3	3.6	5.7	0.5	3.9	6.6	5.6
1972	-10.4	0.2	5.4	-1.0	1.5	3.7	4.8
1973	-7.7	-1.8	2.2	-3.0	-1.4	-3.2	0.1
1974	-10.5	-4.5	1.6	-5.8	-3.0	-15.9	-3.0
1975	-5.8	-5.6	3.1	-4.1	-1.2	7.9	-1.4
1976	-3.2	-4.6	0.4	-2.9	0.8	6.5	-0.9
1977	-4.1	-2.9	-0.8	-1.9	2.6	3.4	-0.4
1978	-4.7	-2.8	-1.0	0.5	4.2	4.5	-0.1
1979	-9.9	-0.4	-1.4	2.0	4.9	-0.3	0.1
1980	-9.8	0.6	-0.4	1.9	3.2	-3.6	1.7
1981*	-9.1	-3.0	-0.6	1.0	3.2	-1.4	1.1
1972-81	-7.5	-2.5	0.9	-1.3	1.5	0.2	0.2

*Nominal deposit rates are assumed to remain at their December 1980 levels throughout 1981.

Source: Deposit rates are from central-bank publications. Expected inflation is from polynomial distributed lags estimated for each country in money-demand functions (Appendix).

$$\frac{DC}{PY} = \underset{(-0.983)}{-0.045} + \underset{(2.683)}{0.034}(d\text{-}\dot{P}^*) + \underset{(1.361)}{0.007}\, z + \underset{(35.348)}{0.972}\left(\frac{DC}{PY}\right)_{t-1} \quad ; \quad (1)$$

$$\bar{R}^2 = 0.93$$

$$\frac{DCp}{DC} = \underset{(2.717)}{0.095} + \underset{(0.542)}{0.048}(d\text{-}\dot{P}^*) + \underset{(34.173)}{0.913}\left(\frac{DCp}{DC}\right)_{t-1} \quad ; \quad (2)$$

$$\bar{R}^2 = 0.91$$

$$\frac{DCp}{DC} = \underset{(17.408)}{1.099} + \underset{(2.992)}{0.847}(d\text{-}\dot{P}^*); \quad (3)$$

$$\bar{R}^2 = 0.06$$

$$\frac{DCp}{PY} = \underset{(3.125)}{0.014} + \underset{(2.399)}{0.025}(d\text{-}\dot{P}^*) + \underset{(52.344)}{1.005}\left(\frac{DCp}{PY}\right)_{t-1} \quad ; \quad (4)$$

$$\bar{R}^2 = 0.96$$

$$\frac{DCp}{PY} = \underset{(20.825)}{0.227} + \underset{(4.158)}{0.203}(d\text{-}\dot{P}^*); \quad (5)$$

$$\bar{R}^2 = 0.12$$

where z is the natural logarithm of per capita real GNP. All of these estimates are consistent with the credit-availability model presented in this section.[3]

II. Inflation and Real Economic Growth

Inflation in the Pacific Basin developing economies, as elsewhere, is a monetary phenomenon. Its analysis centers on the market for money, whose market-clearing or equilibrium condition can be expressed as the difference between the rates of growth in per capita nominal money supply and in real money demand (a dot is $\Delta \ln$):

$$\dot{P} = \frac{\dot{M}^s}{N} - \dot{m}^d, \quad (6)$$

where $\dot{P}$ is the continuously-compounded rate of change in the GNP deflator, M^s is the nominal money supply, N is population, and m^d is the per capita demand for real money balances, i.e., $(M^d/P)/N$. It seems reasonable to expect that the market clearing or equilibrium condition — short-run demand equal to supply — would hold for this model because of the preponderance of auction markets in all the sample countries.

The inflationary process in the sample countries can be properly understood only through an analysis of the determinants of nominal money supply and real money demand. The money-supply mechanism takes different forms in different countries, which precludes any generalized analysis of the money-supply process. I make one crucial assumption, however — the feedback mechanisms from inflation to money-supply growth occur with a certain lag (see Aghevli and Khan's (1977) study of Indonesia). Hence, the system is recursive and changes in the nominal money supply can be treated as if they were exogenous for the purpose of estimating the inflation function without biasing the estimate.

Real money demand, on the other hand, is invariably determined by one or more price (i.e., interest rate) variables and a budget constraint. Here, the price variable is the real deposit rate of interest, $d\text{-}\dot{P}^*$, and the budget con-

straint is per capita real permanent GNP, y^*. A standard stock-adjustment process is added. The money-demand function then is expressed in first-difference, semi-logarithmic form:

$$\dot{m}^d = a_1\dot{y}^* + a_2\Delta(d\text{-}\dot{P}^*) + a_3\dot{m}_{t-1}. \qquad (7)$$

The rate of change in per capita real permanent income, $\dot{y}^*$, and the change in the expected inflation rate, $\Delta\dot{P}^*$, were both estimated as polynomial distributed lags (see Appendix). This procedure allows expectations regarding future changes in inflation and income growth to be formed on the basis solely of current and past values of the variables themselves. Still, given the dearth of econometric forecasting and low levels of economic education in the sample countries, this seems reasonable. However, such expectations are "rational" only in special circumstances.

Equation (7) is substituted into equation (6) and the coefficient of $\dot{M}^s/N$ is no longer constrained to one. The OLS estimate of this inflation equation, with 1961-77 pooled time series data, is:

$$\dot{P} = \underset{(33.196)}{0.930}\left(\frac{\dot{M}}{N}\right) \underset{(-4.359)}{-\,0.927\dot{y}^*} \underset{(-10.849)}{-\,0.986\Delta(d\text{-}\dot{P}^*)} \underset{(-4.303)}{-0.280m_{t-1}}$$

$$\bar{R}^2 = 0.92 \qquad (8)$$

The coefficients of the four variables in equation (8) all agree with **a priori** beliefs. The coefficient of the rate of change in the nominal money supply is not significantly less than one. The implied long-run real-income elasticity of money demand is 1.286, a figure comparable to those produced directly in most demand estimates for broad money aggregates. The implied long-run coefficient for the real deposit rate of 1.368 is also similar to coefficients estimated in money-demand functions for other developing economies (Fry, 1978). Finally, the coefficient of the lagged per capita real money stock indicates that over 70 percent of the adjustment to current expected real-income and interest-rate values takes place within the year.

The other equation of this model, equation (9), below is a modified Phillips curve with the credit-availability effect added. The real rate of economic growth, g (i.e., ΔlnGNP/P) — the dependent variable — is determined in the short run by the ratio of the actual to the expected price level, P/P^*. If actual price exceeds expected price, entrepreneurs interpret the difference to reflect a real increase in the demand for their products. In response, they raise their rate of capacity utilization to increase output immediately, and also invest more to increase that capacity.

Expected inflation also affects short-run real economic growth through the real deposit rate of interest, $d\text{-}\dot{P}^*$. An increase in expected inflation reduces the **real** deposit rate in all the sample countries, except Singapore since 1975, because of the fixing of **nominal** rates by administrative decisions. In this situation, adjustments to nominal rates invariably occur too little and too late to prevent a decline in real deposit rates. A fall in the real deposit rate decreases real money demand — equation (8) — and the resultant contraction in the real size of the banking system reduces the real supply of domestic credit.

Rising inflation typically enlarges public-sector deficits in developing countries due to the lag in the collection of tax receipts (Tanzi, 1977), to the erosion of the tax base, and to price freezes on nationalized-industry products. The government finances the larger deficit by allocating a greater proportion of domestic credit flows to the public sector. Indeed, the private sector is doubly constrained as the real supply of domestic credit declines and as the government extracts increased seigniorage from the money supply. This credit squeeze dries up working-capital funds and reduces the utilization of the existing capital stock. Hence, the real deposit rate affects positively the real rate of economic growth, at least indirectly.

In the very long run, real economic growth depends on the volume and productivity of investment, both of which are related positively to real institutional rates of interest in the sample countries (Fry, 1980 and 1981). However, for this shorter-run analysis, I assume that investment raises productive capacity — so moving the transformation fron-

tier outwards — smoothly over time. For industrial countries, the time trend of real GNP may provide a reasonable proxy for "normal" supply, the noncyclical component determined solely by productive capacity — but for most developing countries, annual fluctuations in agricultural output are also important. Year-to-year changes in farm-output growth determined largely by shifting weather conditions represent exogenous shifts in the production-possibility curve. Normal supply for this sample of developing countries thus may be defined as trend real GNP plus the difference between actual and trend real agricultural output.

Normal real economic growth, g^+, exerts a positive effect on actual real economic growth, g. However, above-average growth in agricultural output may depress real growth elsewhere because of the higher priority accorded to the credit requirements of food-procurement and agricultural price-support programs, which are of course positively related to farm-output growth. Hence, other sectors would suffer a credit squeeze in real terms whenever agriculture obtained a greater share of the fixed real supply of domestic credit.

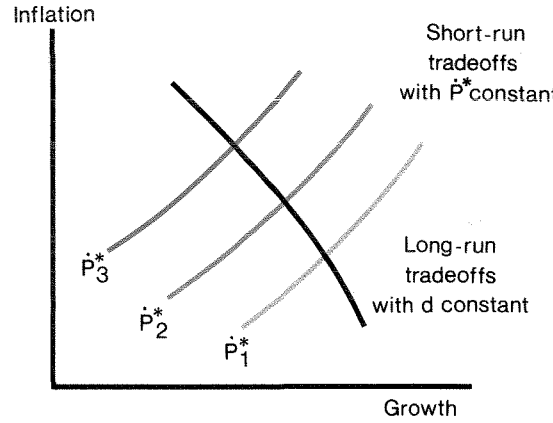
The effect of g^+ on g would therefore be expected to be positive but the coefficient of g^+ should be somewhat less than one, despite the fact that on average g equals g^+. Above-average growth in agricultural output imposes a credit squeeze on other sectors which reduces their capacity-utilization rates and hence their growth rates. The two-stage least-squares (2SLS) estimate of this short-run economic-growth equation for the 1961-77 period is:[4]

$$g = \underset{(9.139)}{0.390}g^+ + \underset{(11.403)}{0.043}\left(\frac{\hat{P}}{P^*}\right) + \underset{(4.257)}{0.049}(d\text{-}\dot{P}^*). \qquad (9)$$

$$\bar{R}^2 = 0.26$$

Figure 1

Short and Long-Run Inflation/Growth Tradeoffs



The short-run Phillips curves show the standard positive relationship between inflation and growth. This is caused by price exceeding expected price in the short run as inflation accelerates and expected inflation temporarily lags behind. In the long run, expectations are realized. *Ceteris paribus*, a higher inflation rate results in a lower real deposit rate of interest. In turn, real money demand and real credit supply contract. The credit squeeze reduces the rate of growth, so producing a negative relationship between inflation and growth in the long run.

Equation (8) suggests that an acceleration in nominal money growth raises the inflation rate and so P/P*. This, in turn, seems to raise growth in real GNP (equation (9)), but expected inflation meanwhile starts to rise. In long-run equilibrium, P equals P* because inflation is fully anticipated. In the long run, therefore, inflation **per se** has no effect on real economic growth. With d held constant, however, the real credit-supply mechanism leads to a negative relationship between inflation and real economic growth in a financially repressed economy (Figure 1).[5]

III. Stabilization Strategies for Financially Repressed Economies

Central banks of financially repressed economies have at their disposal two independent monetary-policy instruments — the nominal money supply and the nominal deposit rate of interest. There is, in practice, an upper bound to the deposit-rate instrument — the free-market equilibrium rate in the absence of discriminatory taxation of financial intermediation (Fry, 1981). Since a higher real deposit rate appears to reduce inflation and raise real economic growth at the same time, an optimal monetary policy would set the nominal deposit rate at (or allow it to increase to) its upper bound. The obvious approach would be to abolish all institutional interest-rate ceilings and dismantle any discriminatory taxes. However, a **minimum** deposit rate might be needed to force cartelized and oligopolistic banking systems, found in all the sample countries except Singapore, to achieve the ideal competitive solution.

This analysis suggests that when the authorities accelerate money-supply growth, they should also change nominal interest rates to maintain an appropriate level of real interest rates and hence prevent a real credit squeeze. As shown above, monetary acceleration by itself tends temporarily to enhance or sustain growth, but this is followed by a credit squeeze which reduces growth. The real credit squeeze can be avoided through appropriate interest-rate policy designed to prevent administered rates from falling further below their market-equilibrium levels.

Interest-rate policy, by reducing inflation **and** raising real economic growth can be a useful instrument for stabilization purposes in financially repressed Pacific Basin developing countries. To illustrate, I simulate three alternative stabilization policies for a composite economy, using the model estimated in Section II. The usual caveats apply about the reliability of these forecasts.

The composite economy (somewhat resembling Indonesia) starts off in a steady state, with a 20-percent continuous rate of inflation over the past decade and with expectations realized regarding both expected inflation and per capita real permanent income. The real deposit rate is -10 percent, the normal real economic-growth rate is 7 percent, and the population-growth rate is 2 percent. The lag coefficients for expected inflation and per capita real permanent income are: t-1, 0.4; t-2, 0.3; t-3, 0.2; t-4, 0.1. Equation (9) can then be solved to yield an actual real economic-growth rate of 6.54 percent, and per capita real permanent income growth, $\dot{y}^*$, of 4.54 percent. The steady-state solution of equation (8) shows a smooth increase of money-supply growth at 30.63 percent a year.

The first stabilization strategy reduces the growth of the nominal money supply from 30.63 percent in the base year, year 0, to 17.14 percent in year 1 and all subsequent years. This lowers the inflation rate in the new long-run equilibrium to 7 percent and, hence, raises the real deposit rate from -10 to +3 percent with no change in the nominal deposit rate. The new long-run equilibrium real-growth rate increases from 6.54 to 7.18 percent (Table 3). The second stabilization strategy again reduces nominal money growth to 17.14 percent, but also raises the real deposit rate (through deposit indexation) to 3 percent at the outset of the program, i.e., in year 1. The third strategy establishes the 3-percent real deposit rate, but sets money growth at whatever rate is required to maintain a constant real rate of economic growth of 7.10 percent.

The main point to note in the simulation results (Table 3) is that the first and second strategies both produce a recession. Per capita real GNP growth initially declines because actual prices fall below expected prices. To some extent, increased credit availability offsets this expectations-reduction in supply. Naturally, the credit availability effect is stronger for the second strategy — real economic growth does not fall so much and picks up faster, despite the fact that higher real money demand actually reduces the price **level.** Both economic growth and inflation converge to their new steady-state values

Table 3
Simulation of Three Stabilization Strategies*

Year	Strategy 1		Strategy 2		Strategy 3		
	Real Per Capita GNP	Price Level	Real Per Capita GNP	Price Level	Real Per Capita GNP	Price Level	Money Supply
0	4.54	20.00	4.54	20.00	4.54	20.00	30.63
1	4.09	7.45	4.27	-5.37	5.10	17.85	42.10
2	4.34	2.94	4.96	4.23	5.10	17.01	31.73
3	4.73	1.16	5.20	6.74	5.10	16.04	28.00
4	5.15	1.51	5.27	7.20	5.10	14.99	26.15
5	5.45	3.34	5.26	7.14	5.10	13.92	24.81
6	5.56	6.07	5.19	7.00	5.10	12.92	23.65
7	5.51	8.08	5.17	6.95	5.10	11.90	22.51
8	5.36	9.02	5.17	6.96	5.10	10.90	21.39
9	5.21	8.99	5.18	6.98	5.10	9.90	20.29
10	5.09	8.33	5.18	7.00	5.10	8.92	19.20
∞	5.18	7.00	5.18	7.00	5.18	7.00	17.14

*Continuously compounded percentage rates of change

faster under the second than under the first strategy. The third strategy maintains a constant per capita real growth rate somewhat below its new steady-state level. This permits a gradual and smooth reduction in the inflation rate. However, because of the sharp, deflationary increase in the real deposit rate in year 1, nominal money growth must initially **accelerate.** Thereafter, nominal money growth falls gradually and smoothly in step with the declining inflation rate.

The strategies of raising the real deposit rate are more successful than the money-growth-only strategy in achieving both higher real growth and lower inflation.[6] However, once the optimal real deposit rate has been fixed, higher nominal money growth always increases inflation as well as real economic growth in the short run — but does not affect the latter in the long-run steady state. Conversely, lower monetary growth reduces inflation and real economic growth in the short run, but again has no long-run influence on real economic growth. Optimal policy with respect to nominal money growth could be solved as a dynamic control problem, given policymakers' loss function.

The two strategies making active use of the nominal deposit rate are clearly superior to the strategy which relies solely on control over the nominal money supply. And, of course, other policy instruments are also important, such as fiscal, price, exchange-rate and foreign-trade policies. Indeed, fiscal policy strongly influences money-supply growth in all the sample countries, with the possible exception of Singapore. Again, appropriate price and exchange-rate policies are crucial for the success of any stabilization program. However, their consideration is beyond the scope of this paper, which was designed solely to examine the role of monetary policy for stabilization in financially repressed economies.

IV. Summary and Conclusions

The international economic environment over the past decade has not been conducive to stable economic growth. The oil shocks of 1973-74 and 1979-80 were accompanied by a worldwide acceleration in inflation. Economies with rigid nominal interest rates experienced declining real rates of interest. In turn, real money demand fell, compounding the inflationary forces. Declining real deposit rates also reduced the real supply of domestic credit and this credit squeeze lowered real rates of economic growth.

This analysis provides an important policy conclusion: flexible interest-rate policies in

financially repressed economies can be used to counter inflationary shocks and accelerate the real rate of economic growth. An increase in the real deposit rate of interest towards its competitive, free-market equilibrium level raises real money demand, so reducing inflationary pressures. At the same time, the availability of credit increases in real terms. Consequently, real economic growth rises, which increases real money demand some more. Inflation drops; the virtuous circle is complete.

Appendix

The lag coefficients for per capita real permanent income and expected inflation were obtained by applying polynomial distributed lags to the rate of change in per capita real GNP and to the rate of change in inflation in the following first-difference semi-logarithmic money-demand function:

$$\dot{m} = a_1\dot{y}^* + a_2\Delta\dot{P}^* + a_3\dot{m}_{t-1}; \qquad (A.1)$$

where m is per capita real money holdings.

Unconstrained first-, second- and third-order polynomials were applied to the coefficients of the current and (up to six) past rates of change in inflation and real per capita income. Choices of polynomial degrees and lag lengths were based on the pattern of the lag coefficients, a nonnegativity criterion and the $\bar{R}^2$s. **Ceteris paribus,** monotonically declining or inverted U-shaped coefficient patterns were preferred as being most consistent with an **a priori** assumption about formation of expectations. For the same reason, sign changes were inadmissible — the nonnegativity criterion. "Satisfactory" results were obtained for all the sample countries with first- or second-order polynomials. The lag coefficient estimates used for the pooled time-series analysis reported here are presented in Tables A.1 and A.2.

Table A.1
Permanent Income Lag Coefficients

Country	Order	t	t-1	t-2	t-3	t-4	t-5	t-6
Indonesia	1	0.597	0.403					
Korea	1	0.652	0.348					
Malaysia	1	0.300	0.247	0.193	0.140	0.086	0.033	
Philippines	1	0.338	0.662					
Singapore	0	1.000						
Taiwan	0	1.000						
Thailand	2	0.594	0.159	0.247				

Table A.2
Expected Inflation Lag Coefficients

Country	Order	t	t-1	t-2	t-3	t-4	t-5	t-6
Indonesia	2	0.326	0.236	0.164	0.109	0.071	0.050	0.046
Korea	2	0.304	0.245	0.190	0.137	0.086	0.039	
Malaysia	1	0.243	0.213	0.182	0.151	0.121	0.090	
Philippines	2	0.187	0.234	0.240	0.206	0.133		
Singapore	1	0.780	0.220					
Taiwan	1	0.994	0.006					
Thailand	2	0.334	0.240	0.166	0.113	0.080	0.068	

FOOTNOTES

1. The annual financial-stock figures used in this paper, i.e., the money stock, domestic credit, and domestic credit to the private sector, are centered monthly averages. End-of-month figures were averaged first to provide mid-month estimates. Then the 12 mid-month estimates were averaged for the annual figures.

2. With perfectly elastic international capital flows, an increase in domestic credit would, in the main, produce a decline in foreign-exchange reserves under a fixed (including crawling peg) exchange-rate system. Exchange-rate policy, not domestic credit policy, thus would determine nominal money growth and inflation. In none of the Pacific Basin developing countries, with the recent exception of Singapore, are international capital flows perfectly elastic. Indeed, capital controls permitted the independent interest-rate policies pursued by all these countries until 1975. Singapore abolished its interest rate-setting bank cartel in 1975 and thereafter dismantled such controls. With capital-account controls at least partially effective, an acceleration in domestic credit expansion raises the rate of growth in the nominal money supply while reducing foreign-exchange reserves.

3. The coefficients of the lagged dependent variables are biased upwards, since country dummy variables were not used (see Fry 1978, p. 469).

4. The instrumental variable technique is used to deal with both simultaneous-equation bias and measurement error in P/P*. The instruments used in the first stage were the rate of change in per capita real permanent GNP, the real deposit rate of interest, income terms of trade, the ratio of foreign exchange receipts to GNP, the lagged ratios of national saving investment to GNP, the lagged real deposit rate of interest, the normal growth rate, the rate of change in per capita nominal money balances, exchange-rate overvaluation as measured by the ratio of the black/free market to the official exchange rate, and the real exchange rate.

5. In the long run, financial repression also affects the saving rate and the average efficiency of new investment (Fry, 1980 and 1981).

6. How to control the money supply is a separate issue beyond the scope of this paper. One prerequisite for monetary control in all the sample countries is undoubtedly fiscal discipline.

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Money and Credit in China

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The purpose of this paper is twofold: to introduce the role of money and credit in China to those unfamiliar with the subject, and to propose some fundamental re-thinking in the conduct of Chinese monetary and credit policy.

China today is in a period of transition. Dissatisfied with the economy's past performance, the authorities in recent years have instituted a series of reform measures designed to infuse more material incentives and a greater use of market principles in an otherwise rigidly controlled economy. The essence of the reform lies in giving farmers and enterprises greater autonomy in production and investment decisions in response to market forces.

The future of the reform is now threatened by inflation. To combat inflation, the government has ordered draconian cutbacks in investment projects, thus in effect suspending the recently instituted production and investment autonomy. This creates a policy dilemma: over the years, tight controls have strangled work incentives and caused serious waste and inefficiency; yet, under the present institutional set-up, direct administrative controls appear to be indispensable for combating inflation. In the short run, the government has decided to fight inflation now and ease controls later. But, in the long run, do the authorities have adequate policy instruments for fighting inflation without direct controls? The answer to this question will determine whether future spending decisions will be made by the market according to the spirit of the reform or by the central-planning authorities as under the old regime.

Inflation is in essence a monetary phenomenon. In the long run, China's ability to "modernize" its economy without aggravating inflationary pressures will to a large extent depend on whether China can forge an effective monetary policy that does not rely primarily on direct controls.

Section I presents an overview of money and banking in China. The rest of the paper raises a number of policy issues, specifically (1) the usefulness of the quantity equation of money and the measurement of money in the Chinese context, (in Section II), and (2) the principles of credit policy followed in China (in Section III). The findings and conclusions are summarized in Section IV.

I. Money and Banking in China

To assess the role of money and banking in China it is essential first to understand how the Chinese economy functions, as, not surprisingly, China under socialism operates along vastly different lines from economies under capitalism. In this section, we describe the structure of the Chinese economy, the use of economic planning (and especially financial planning) to allocate the nation's resources, and then some fundamentals of the banking and monetary system. Our sketch of the real side of the economy will be brief, limited to what is necessary to help explain the functioning of the financial system.[1] And because institutions and policies are changing rapidly,

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we do not try to incorporate all the recent changes into this brief overview. The emphasis here is rather on the fundamentals of China's monetary and banking system, which remain largely intact in spite of recent modifications.

Economic Structure and Planning

The People's Republic of China was founded in 1949, but it took the authorities about seven years to communize what had been a largely private-enterprise economy. Prior to 1949, nearly all the means of production had been privately owned, aside from state-owned infrastructure facilities such as harbors, railroads, schools, hospitals, and public utilities. After 1949, by stages, all the farms, mines, factories, shops, and banks became either state-owned enterprises (i.e., belonging to "all people") or collectives (i.e., owned collectively by members). Except for a presumably small amount of interest income, total household income today consists of either state-paid wages and salaries or collective distributions of funds according to earned work points and retained earnings.[2] On the farms, where eighty percent of the population reside, the collective form predominates; in industry and commerce, except handicrafts, the state-ownership form is dominant. In either case, everyone works directly or indirectly for the state, and all economic activities are, at least in theory, conducted in accordance with state-designed economic plans and under close state supervision.

China under communism has operated, both in theory and in fact, as a planned economy, based on a series of five-year plans stipulating medium-term national economic goals. The State Planning Commission drafts the five-year plans, and is also responsible for drafting (a) an annual economic plan in terms of physical input and output of goods and services, and (b) a counterpart annual financial plan in terms of money flows. The Commission works with proposed plans of individual government and enterprise units, which are consolidated and approved layer by layer up the government structure. The State Planning Commission, after final consolidation and reconciliation, submits the final plans to the State Council (Cabinet) for approval. Once approved, the plans become the blueprint of the nation's economic activities during the next year.

Price Stability and Inflation

Implicit in the physical and financial plans are the prices of all the products included in the plans. In principle, the authorities set all prices, which cannot be changed thereafter without explicit permission. Since the early 1950s, the authorities have attempted to maintain price stability for individual commodities as well as in the aggregate.[3] Indeed, for several decades, government officials claimed that China had been able to maintain prolonged price stability in the midst of a world racked by unstable and rising inflation.[4] They provided no price indices in support, but most outside scholars generally agreed with this claim.[5]

However, price stability was purchased at considerable cost. Government officials now admit that the rigid price system, by favoring heavy industries at the expense of agriculture, coal mining and consumer goods, has resulted in serious production imbalances — with perennial shortages of food, fuel, raw materials and consumer goods co-existing with excess inventories of a variety of unsold goods.[6] Waste and inefficiency are rampant. The authorities are well aware of the problem, but they also recognize that changing the price system would mean a redistribution of income among industries and regions, inevitably benefitting some and hurting others. Few prudent bureaucrats would want to open that Pandora's box in a heavily politicized economic system.

In a system where prices do not necessarily reflect relative scarcity, it is not always possible to distinguish between a condition of repressed inflation and one of sectoral maladjustment. Long queues may be indicative of shortages of only certain goods; even a general rise in consumer prices may represent only a correction of a previous disparity between consumer and producer-goods prices. Neither case provides definitive evidence of the existence of infla-

tionary pressures.

Yet, in spite of these conceptual difficulties, China apparently experienced brief periods of open inflation in 1953, 1956, 1960-61 and again in 1979-81[7] In all these episodes, widespread price increases followed unusually rapid increases in currency circulation brought forth by large unplanned government budget deficits or credit expansions. The resultant inflationary pressure manifested itself in two forms: first, price increases for a wide range of consumer goods, which were sold on a "free market" that periodically operated alongside the official market; and second, official price increases, which helped to mop up excess currency issues through enhanced revenues of the state trading agencies.[8]

Financial Planning

The Chinese authorities have long maintained that inflation can arise only through excess currency issue, which occurs only through excess bank-credit extension for financing business investments and government budget deficits. (Banks do not extend credit to consumers in China.) The authorities attempt to regulate currency issues through deliberate financial planning.[9]

The financial plan, as stated previously, is the counterpart of the physical economic plan. It is composed of the Government Budget, the Credit Plan, and the Cash Plan. The Budget needs no explanation. The Credit Plan sets out the expected sources and uses of banking funds. The Cash Plan specifies the planned change in currency in circulation as a net result of cash transactions between the government sector (including enterprises) and households (including the farm sector). The Ministry of Finance is responsible for the Budget, and the People's Bank of China for the Credit Plan and the Cash Plan. All three plans are simultaneously constrained by a national flow-of-funds identity, so that increases in currency in circulation must equal the increases in banks' net lendings (i.e., net of increases in deposits) to the government and enterprises, minus increases in households' time and savings deposits. Thus, the banking system plays a key role in regulating currency in circulation, and hence supporting the nation's financial stability.

Banking System

The banking system in China today consists of the People's Bank of China and three special-purpose banks: the Bank of Agriculture, the Construction Bank of China, and the Bank of China. With more than 15,000 branches and offices and 330,000 staff members at the end of 1979, the People's Bank is at once the nation's central bank and the only bank providing a wide range of banking services to the general public.[10] In contrast, the other three banks either perform special functions or serve specific sectors: the Bank of Agriculture serves the agricultural sector; the Construction Bank finances plant-equipment and infrastructure projects for enterprises and government units; and the Bank of China handles foreign-trade financing and foreign-exchange administration. Within the government structure, the President of the People's Bank is a member of the State Council with cabinet rank; the Bank of Agriculture and the Bank of China, though reporting directly to the State Council, come routinely under the People's Bank supervision; while the Construction Bank, although reporting to the State Council, comes under Ministry of Finance supervision.

(a) **Financial supervision.** As stated, each year the banking system is responsible for drafting a Credit Plan and a Cash Plan for submission to the State Planning Commission. In addition, it is responsible for monitoring the nation's financial flows to ensure that all is in accordance to the plans. To facilitate surveillance, all government units and enterprises must set up accounts, called "transfer balances," in one or more of the four banks according to the designated functional divisions, and all payments among the entities must be conducted through these bank accounts. The entities may keep only a minimal amount of cash on hand, sufficient for three days' operation in localities where there is a banking office and up to 14 days where

there is none. Only banks may extend credit, since supplier's credits are prohibited, and they must ensure that credits are extended only as planned and used only for specified purposes. Thus, the banking system serves as the "controller" of the government and enterprise sectors, exercising financial control over all their economic activities.

In fact, however, banks must function within the bureaucracy of which they are a part. Deviations from plans can and do occur, depending on the relative political clout of the banks versus other entities within the power structure. According to Vice Premier Yao Yi-lin, in 1980 the financial plan called for the banking system to issue 3.0 billion yuan in currency; the actual currency issue that year amounted to 7.6 billion.[11] That excess currency issue provides a good barometer of the political pressure operating on the banking system.

(b) **Financial intermediation.** In advanced industrial countries, many types of financial institutions — e.g., banks, savings institutions, pension funds, insurance companies, mutual funds — perform a financial intermediation role by channeling household and business savings into investments. In China, only the banking system carries out that role.[12] By prohibiting government agencies and enterprises to hold more than a bare minimum of cash on hand, the law funnels all their financial surpluses through the banking system. Households may hold their surplus funds in any form, but their only real choice is between currency and bank savings and time deposits.

Banks do not offer checking deposits. Savings and time deposits are available only to households. Individuals may withdraw savings deposits at any time without penalty, but must pay an interest penalty when withdrawing time deposits prior to maturity (ranging from six months up to five years). Banks pay interest on the transfer balances — restricted checking accounts — held by enterprises, but not on those held by government agencies.

China has built up a vast organization for financial intermediation. This organization includes 15,000 branches and offices of the People's Bank in cities throughout the nation, and more than 20,000 branches and offices of the Agriculture Bank in smaller cities and townships, in addition to 59,000 agricultural-credit cooperatives scattered throughout rural areas.

(c) **Allocation of capital.** China has adopted the Soviet model of finance in distinguishing between a "fiscal channel" and a "credit channel" of fund allocation. This has given rise to the so-called "separation principle," which is based on the idea that all the means of production belong to the people, so that financial surpluses arising from their labor should be used for capital formation without interest and repayment obligation. However, government agencies, enterprises and households sometimes have idle funds on hand, while others have temporary needs for funds. Banks must attract these idle funds and redirect the funds to those that have temporary need for them. The theory asserts that, corresponding to the two sources of funds: fiscal and banking, the uses of these funds must also be separated. Bank credit should be limited to temporary financial needs, such as fluctuations in inventories, agricultural credit between planting and harvest, goods in transit, gaps between receipt and payment, etc. Banks must charge interest on the use of such funds so that they can pay the depositors. In contrast, funds needed for fixed capital formation and working capital (e.g., wages, investories) should be provided through government budget appropriations and disbursed through banks without interest and repayment obligations.[13]

The authorities claim that this separation principle is not only compatible with a communist philosophy of social organization, but also constitutes prudent banking and a safeguard against inflation. It is prudent banking, because it does not tie up "temporarily idle funds" taken from depositors in "permanent capital needs" of the fund-users. It safeguards against inflation, because credits are extended on the basis of idle funds mobilized by banks, not through issuance of currency. The validity of these arguments will be discussed in the next section.

According to officials interviewed in 1980, the two channels of financing differ in importance according to the type of economic activity involved. On the whole, about 70 percent of industry's capital needs are met through fiscal appropriations, while 30 percent are provided through bank credit — and conversely for commercial financing. Agricultural financing is nearly all through bank credit, except for relief and capital construction (e.g. roads, irrigation facilities). For the nation as a whole, fiscal funds financed 73 percent of total capital formation, banking funds only 13 percent, and other sources (mainly capital-depreciation allowances) another 14 percent.

A related, but somewhat different, principle states that bank credit should be limited to short-term financing of production and distribution of goods and services. Whereas the separation principle emphasizes the distinction between permanent and transitory needs of capital, this bank-credit principle draws the line between credit extension that enhances *current* production and that which does not. The distinction is important because, according to this principle, credit extensions that enhance current production and distribution are necessarily non-inflationary, since any consequent increase in currency circulation would be matched by an equivalent expansion of output. Moreover, upon the final sale of goods and repayment of credit, a return flow of currency is generated from consumers through enterprises back to the banks. In contrast, bank credits to finance government deficits, consumer expenditures, stock speculation, etc., do not add to the flow of goods and services and hence are inherently inflationary. This is, of course, the "real bills doctrine" familiar to students of monetary economics of an older generation in market economies. We will consider its validity in a Chinese context in the next section.

(d) **Interest rate policy.** As stated, banks in China pay interest on deposits and charge interest on bank loans. According to People's Bank data, interest rates were relatively low, in view of the six percent annual inflation rate in 1980: 2..88 percent a year on savings deposits, 5.40 percent on one-year time deposits, 1.80 percent on enterprise deposits (transfer balances), 5.04 percent on industrial and commercial loans, and 4.32 percent on agricultural loans.[14]

The authorities until recently have not used interest rates as a conscious tool of credit policy. Since 1953 they have raised commercial and industrial loan rates only in 1959 and 1971. They changed the savings-deposit rate in 1959 and again in 1979 and 1980, raising the rate in the latter two cases in an apparent attempt to fight inflation by attracting a larger volume of savings.

Role of Money

Monetary policy in China, as in the United States, is concerned primarily with control over the growth of the quantity of money. Yet paradoxically, what constitutes money is still an unsettled question in both countries. In China's case, some insight into that question may be obtained by considering the payment system in China — specifically, the difference between the "transfer balance circuit" and the "currency circuit." The former corresponds broadly to the production sector, and the latter to households and farm communes.

Government agencies and enterprises constitute one economic decision-making unit, with all production and distribution activities guided by the nation's economic and financial plans. Within that sphere, all entities must keep "transfer balances" at designated banks and make payments to one another only through credits and debits to those balances. These transfer balances, unlike our familiar demand deposits, are not checkable in the normal sense; that is, depositors cannot draw upon them for making payments to third parties. Rather, each transfer is subject to explicit approval by the bank holding the balance, to ensure that the payment has received prior authorization by the proper authorities (an industrial bureau or a ministry), and that all papers relating to the transaction are in order. In a sense, these payment flows are not unlike intra-company transfers within a giant corporation: in both cases, transfers are subject to the case-by-case scrutiny by accounting personnel.

In contrast to check payments in a market economy, which represent an unconditional transfer of funds, transfer balances in China are good only for payments to government entities and enterprise within the production sector. Cash is required for payments to other entities, such as households and farm communes. In such cases, the payor would have to apply to the relevant bank for approval in order to convert transfer balances into currency.

The "currency circuit," on the other hand, consists of payment flows between households and farm communes on the one hand and government agencies and enterprises on the other. In addition, farm produce and handicraft products can be sold on the "free market" to consumers for cash. ("Free market" prices are in fact subject to some official supervision and control, though to a much lesser degree than official market prices.) Unlike transfer balances, currency is freely transferable and can be used to purchase anything on the market — subject only to the availability of goods or services, and occasionally to ration restrictions for certain "essential goods" (e.g., rice, flour, cooking oil, cloth).

There is little for money to buy except consumer goods, and these have been in perennial shortage. Since all means of production belong to the people, there are no common stocks or land to buy. Until 1981, because of continual government-budget surpluses, there were no bonds or any other kinds of securities to purchase.[15] Houses and gold can be privately owned, but can be sold only to the state; foreign currencies cannot be held privately. In short, money in China has far fewer uses than it does in market economies. For households, the only meaningful alternatives to holding currency are bank savings and time deposits and limited amounts of consumer goods.

Monetary Policy

There are no bank reserve requirements, no security markets, and no discount windows in China, so that all the traditional central-bank policy instruments have no relevance in the Chinese setting. Instead, monetary growth is regulated by explicit financial planning, i.e., through the Budget, the Credit Plan, and the Cash Plan. However, the Cash Plan shows the growth in currency circulation as the difference between household wage incomes and consumption minus increases in household time and saving deposits (see Appendix).[16] Banks presumably could regulate deposits by adjusting deposit interest rates, but they cannot regulate any of the other items in the Cash Plan. Despite the considerable amount of manpower devoted to the monitoring of currency flows — volume and composition by industry, by region, by season, etc. — banks can do little to affect currency flows directly.

But, of course, there is the Credit Plan. Since currency growth is also equal to banks' net lending (i.e., loans minus deposit increases), in principle the currency-growth rate could be determined by targeting a credit-growth rate and a deposit-growth rate. In fact, however, banks cannot always control their own loan volume. In 1980, for instance, the currency issue exceeded its target by 4.6 billion yuan, largely because of a 4.1-billion yuan central government budget overrun,[17] which the People's Bank was obligated to fund. Clearly, monetary policy is not independent of fiscal policy, in that the People's Bank must accommodate any budget surplus or deficit that should arise.

However, even a perfectly accommodative policy does not necessarily imply that the monetary authorities lack control over the nation's money supply. In theory, they could contract credits to enterprises sufficiently to offset any amount of fiscal-deficit accommodation. But the actual practice in 1980 was quite different. The banking system's credit to enterprises in all sectors, including agriculture, increased by 37.5 billion yuan, or 18 percent. Although we have no information on whether, and the extent to which, the increase exceeded the planned amount, official data suggest that these loans contributed at least as much to the excess currency issue in 1980 as the banking system's financing of government budget deficit.[18] Clearly, credit policy was not con-

ducted with a view towards offsetting the impact of fiscal accommodation on the currency issue that year.

Little direct evidence is available of the political pressures on the banking system to expand credit to local governments and enterprises. Some inkling can be found, however, in a major policy directive issued by the State Council in February 1981: "No one is allowed to force banks to make loans, refrain banks and credit cooperatives from recalling matured loans, declare forgiveness of debts, or make unauthorized use of credit cooperatives' funds."[19]

II. Current Issues: The Quantity Equation and Money Management

China's modernization program seeks to correct the errors of an excessively rigid Soviet-type planned economy by providing greater material incentives to workers and more autonomy to enterprises (including farm communes), and by substituting at least some market forces for administrative decrees in the economic decision-making process. Money will inevitably play an expanding role in the economy, but whether money will be a bane or a boon will depend crucially on how it is managed. As the economic structure shifts away from the Soviet model, the premises underlying the nation's Soviet-style monetary system[20] should also require re-examination.

Few observers expect a complete restructuring of the nation's monetary and banking system. A more realistic approach might be to consider what adjustments in monetary and credit policy could be made within the present economic-planning framework, to strengthen ways of achieving macroeconomic stabilization and of improving the efficiency of capital allocation. This calls for a discussion of the usefulness of the quantity equation as a guide to monetary policy and the measurement of money (discussed in this section), and of China's credit-allocation policy (discussed in the following section).

China's monetary authorities have followed the Soviet model for a quarter-century in explicitly planning for monetary growth — foreshadowing the policy of money targeting adopted by the major industrial countries just within the past decade. What criteria do the monetary authorities follow in setting money-growth targets? The answer given in the Chinese economic literature[21] and in official discussions is invariably: the quantity equation.

Quantity Equation

The quantity equation, $MV=PQ$, is a familiar concept in the economic literature of both socialist and market economies. It associates the price level (P) with the quantity of money in circulation (M), the velocity of money circulation (V), and the quantity of goods being traded (Q). In Western economic literature, the equation has been used in two different ways for analyzing the effects of money-supply changes on the national output and the price level.

One approach, generally identified as the "transactions approach" and attributed to Irving Fisher,[22] analyzes the large number of factors that influence P through the three "proximate causes": M, V, and Q. Popular thinking generally has regarded V and even Q as constants, so that P would change proportionately with M, but the leading proponents of the theory — such as Irving Fisher and Edwin W. Kemmerer[23] — explicitly rejected this simplistic interpretation. They maintained that the quantity equation states a condition for market equilibrium, and that proportionality between money and price changes holds only in the long-run equilibrium. The central task of monetary theory, in their view, consists of analyzing the effects of a change in M on all three factors (V, Q, and P) during what Fisher called the "transition period."[24] In the short run, which is what counts most in monetary analysis, the effects are anything but deterministic and mechanical.

Another approach, commonly identified as the "asset approach" or the "Cambridge approach,"[25] also views the quantity equation as a market-equilibrium condition — not for the goods market, as in the Fisherian approach, but for the money market. In other words, it views PQ/V as the market demand for money and M as the supply of money, and studies the adjustments in the public's spending behavior and asset portfolios following a change in the underlying conditions. Thus, the approach calls for an explicit specification of the process of money creation, of the factors determining money demand, and of the process of adjustment towards money-market equilibrium following, say, an increase in the money supply.[26] Again, in this approach, neither V nor Q is considered as fixed in analyzing the process of adjustment towards market equilibrium.

In the Chinese economic literature,[27] the quantity equation also serves as a starting point of monetary analysis. But Chinese economists, unlike Western economists, do not ask how P and Q would be affected by a change in M. Instead, they consider P as given by the targeted price level and Q as given by the planned volume of national output, and then ask about the amount of money circulation, M, that would be consistent with stated price and output objectives, given the velocity of circulation, V. This line of thinking evidently underlies the annual Cash Plan in the national-planning process. Each year, bank officials at local levels must compile a "Resident Currency Receipts and Expenditures Balance Table," estimating the wage incomes, consumption expenditures, savings and time deposits, cash on hand, etc., of different types of residents, and this procedure helps determine the velocity of circulation and the "required" amount of currency for the residents of each city and province. The People's Bank of China aggregates these local financial data — together with data for targeted output, wage rates, and employment — and adjusts them for "financial balance" to determine the planned amount of growth in currency circulation.[28]

In a formal sense, the Chinese approach seems to resemble the Western monetary approach, since both take off from the same quantity equation of money. However, a common starting point means little, since the quantity equation itself is no more than an identity, and as an identity, it can be consistent with widely divergent analytical approaches. Again, both the Fisherian and the Cambridge approaches use the quantity equation only as a market-equilibrium condition; the analysis in each case focuses on the market adjustment after a change in the underlying conditions. Moreover, in the adjustment process, neither V nor Q is considered as fixed. In contrast, in Chinese monetary analysis, adjustments toward market equilibrium are precluded by officially fixed prices and interest rates. With P, Q, and V determined, the analysis never really departs from the quantity equation as an identity. The Chinese approach, unlike its Western counterparts, thus sheds no light on market behavior, and its analytical results cannot be subject to empirical testing.

Nevertheless, Chinese monetary analysis uses the quantity equation only for determining the optimal quantity of money for achieving given price and output objectives. Hence, the only relevant question is how useful the equation is for accomplishing that limited purpose.

To answer that question, let us consider a hypothetical case — which is, incidentally, not far removed from recent reality. Suppose that prices and output are both fixed according to plan, so that one side of the quantity equation, PQ, is a constant. Now, the authorities raise wage rates for a significant portion of the work force and at the same time embark on an ambitious investment program, financing both through bank-credit extensions. As a result, households hold more currency but can buy no more consumer goods; similarly, enterprises have larger transfer balances but can obtain no more producer goods. Obviously, inflation pressure has increased. But since prices are officially fixed, inflation is repressed, and there are disequilibria in both the money and goods markets.

Under such circumstances, does the quan-

tity equation provide a reliable reflection of the repressed inflation pressure? On the surface, the answer might appear obvious. Since, by assumption, PQ remains fixed, any increase in M at given V must mean inflation pressure, whether repressed or open.[29] But the answer is not quite so simple: It depends very much on how money is measured.

Measurement of Money

The official measurement of money includes only currency in circulation, for two reasons. First, the authorities are concerned only with the stability of consumer prices, which have to do with people's livelihood, and not with producer prices, which are merely accounting devices for effecting transfers within the state sector. Hence, they do not worry about increases in transfer balances held by enterprises, especially since enterprises must obtain official approval for the use of these balances. Second, aside from questions of availability of supplies, consumer inflation pressure can arise only from increased currency holdings, because currency is the only means of payment for the purchase of consumer goods. As stated, enterprises cannot use their transfer balances for purchasing consumer goods, and households cannot have checking accounts in banks. Hence, the monetary authorities believe that they need only to control the growth of currency circulation in order to check inflation pressures.

This approach may be examined in terms of the illustrative case presented above. Consider first the consumer sector. As a result of the postulated credit expansion, households now hold more currency, but can buy no more consumer goods, than before. Under the circumstances, households can either hold the extra currency in the form of interest-earning bank deposits, or hold part in deposits and part in idle cash for consumer-goods purchases. In the former case, all the extra cash flows back into the banking system as increased time and savings deposits, with no net increase in currency circulation and no change in velocity; in the latter case, since PQ is a constant, V must decline in proportion to the increase in M. In both cases, the authorities could mistakenly conclude that a credit expansion has had no impact on currency circulation, or that it has produced an enhanced desire to hold currency (i.e., a decline in velocity) exactly offsetting any increase in currency circulation. Thus, the quantity equation, combined with a narrow definition of money, provides little indication of the repressed-inflation pressure in the system.

The failure of this approach can be partly attributed to an inadequate measure of money and partly to a misinterpretation of the velocity of circulation. The narrow definition of money makes a clear distinction between a) cash held for transaction purposes and b) other types of financial assets held in consideration of some returns. The amount of cash the public is willing to hold depends in part on its alternative cost in terms of the interest return foregone by holding cash, and in part on the volume of transactions the holding of cash is intended to facilitate.[30] This assumes that the public is free to choose among consumer goods, cash and other types of financial assets in holding its wealth — which means that the definition makes sense in a market economy. But in a planned economy such as China's, with officially fixed prices and rampant shortages of consumer goods, this narrow definition of money could be seriously misleading. In our illustrative case, a substantial portion of the public's increased holdings of cash and time and saving deposits might be involuntary, because of a mismatch between enhanced money income and limited consumer-goods output. Increased money balances might represent consumer frustration rather than increased confidence in the value of the currency. Since bank deposits can be liquidated at any time with no, or only minor, interest penalties, depositors may regard their funds as a temporary reservoir of purchasing power to be used at any time goods become available. Under these circumstances, the more meaningful definition would include both currency and (at least) savings deposits.

However, this broader definition of money still would not encompass a condition of

repressed inflation. Because prices and output presumably are both fixed according to plan, the increase in money supply (by the broader definition) would be offset by a proportionate decline in the velocity of circulation. Here also, the concept of velocity implies a public demand for money, which is meaningful in a market but not in a planned economy. In a market economy, a decline in velocity means a rise in the public's demand for money holdings, say, on account of lower interest rates. It implies a re-ordering of asset-holders' portfolio choices among goods, cash and other financial assets. In a planned economy, with its widespread shortages, a decline in velocity (in the absence of interest-rate changes), often means simply an increase in consumer frustration.

This velocity phenomenon, combined with a broadened definition of money, suggests a potentially useful way of measuring repressed inflation in an economy such as China's. In our illustrative case, since there is no change in prices, output, and interest rates, the entire decline in velocity accompanying the money-supply increase may be considered involuntary, resulting from insufficient supplies of goods at prevailing prices. Then, the decline in velocity multiplied by the increase in money supply should measure the **increase** in repressed inflation pressure.[31]

This measure could be operationally useful in policy-making. The authorities could select a base year with few symptoms of repressed inflation (e.g., ration coupons, queues in front of stores, bare store shelves). Subsequent declines in velocity multiplied by current year money supply (i.e., currency plus savings deposits) might indicate the amount of repressed inflation occurring since the base year. Given a policy of monetary restraint for reducing inflation, the authorities might attempt to achieve a below-target rate of monetary growth until velocity rises to its base year level — proper adjustments being made to take account of possible changes in velocity attributable to factors such as interest-rate changes and financial innovations.

Finally, enterprises' transfer balances might properly be included in an even broader measure of the money supply.[32] The reasons cited above for their exclusion may have some validity under a rigidly enforced planning regime,[33] but not in a regime where policy-makers introduce more price adjustments into both the producer and consumer sectors and give more financial autonomy to enterprises. In any case, a rise in transfer balances held by enterprises might be as much a symptom of repressed inflation as increases in savings deposits involuntarily held by households. Moreover, as enterprises gain more autonomy in the use of their bank accounts, the "moneyness" of these balances will rise, increasing the need to include them in the measurement of the nation's money supply.

III. Current Issues: Credit Policy

As described earlier, China's bank-credit policy theoretically is guided by two basic principles: the "real bills doctrine" and the "separation principle." In practice the doctrines have not always been followed, and this conflict has given rise to considerable dispute in Chinese economic literature on banking policy.[34] We shall consider these two doctrines in turn in the context of the Chinese economy.

Real-Bills Doctrine

Chinese economists like to stress that the real-bills doctrine is a special feature of socialist finance, in contrast to the bank financing of non-productive, speculative activities common in capitalist economies.[35] In their view, adherence to the doctrine accounts for the Communist success in stablizing prices, while departures from it are a basic cause of inflation.

Conceptually, however, the real-bills doctrine is inconsistent with the quantity theory of money. The latter holds that the quantity of money is a key determinant of eco-

nomic activities, especially the price level; hence, the monetary authorities must actively control the growth of the money supply in order to maintain price stability. But according to the real-bills doctrine, so long as bank credits finance only current production and distribution of goods and services, there can never be an over-issue or under-issue of money. Therefore, an active monetary policy that sets and adjusts the rate of money-supply growth according to the quantity equation (or any other approach) would be superfluous and probably also destabilizing, as the money-growth rate, however determined, would only by chance be identical to the rate required by the real needs of commerce.

The doctrine has had a long history in Western economic thought, dating back at least to Adam Smith in 1776.[36] It suffices to say that as early as 1802 Henry Thornton[37] pointed out that the doctrine is neither necessary nor sufficient for insuring non-inflationary bank finance. It is not necessary because, so long as a credit expansion is offset by savings somewhere in the economy (e.g., fiscal surplus), there is no inflation. It is not sufficient because a credit expansion, even though secured by increased commodity output, gives rise to an expansion in money income — which in turn stimulates demand for more commodities, thus justifying further bank credits to finance production. Thus, a cumulative process could be generated, leading to precisely the type of boom-and-bust conditions the real-bills doctrine is meant to avoid.

However, can this cumulative process occur in a Communist system? Some say not. One Western monetary economist wrote:

> "We must not be too hasty to judge the Communist credit policy on the basis of modern Western monetary theory. In this case, important differences in institutions must be taken into account... The real bills doctrine does not work in a capitalist economy mainly for two reasons. First,... the increase in credit may bid up prices and bid away resources from elsewhere. Second,... the investment multiplier, or the velocity of circulation of money, ... could easily be larger than the gross productivity of the working capital that actually get created. Both these reasons, however, probably do not apply to a Socialist command economy provided it is properly managed. There, as the grant of credit is presumably based upon the planned availability of materials and labor for the investment in working capital at controlled prices, the first reason obviously does not apply. Furthermore, the velocity of circulation of bank balances of enterprises in a Communist country is strictly under control, so that an increase in credit would not necessarily cause aggregate demand to outstrip supply."[39]

This analysis, however, pertains only to the producer sector. In contrast, the cumulative process following a credit expansion also raises household money income, which then creates additional demand for goods and services. Even though material and labor prices can be held fixed in a planned economy, each round of credit expansion would still give rise to a further rise in household money income and hence to increased demand pressure on resources. In the process, enterprises' transfer balances will grow; controlling their use simply means repressing inflation. Restrictive measures, like price and wage controls in market economies, only suppress the symptoms of inflation, and do not abate its latent pressures.

Thus, the real-bills doctrine does not appear to be an effective anti-inflationary bank-credit policy, even in a planned-economy context. By adhering to it, the authorities may ignore the need for controlling the money-growth rate or the national savings-investment balance — the essence of macroeconomic policy. Moreover, the doctrine unnecessarily restricts banking operations, and is in practice both preached and breached. Banks in market economies have long abandoned that principle and engaged in all types of financing, ranging from consumer, equipment, real estate, to government financing — without necessarily giving rise to inflation. Banks in China have also gone beyond commercial-bill financing into

medium-term project financing. Banking theory in this case thus lags behind and sometimes serves as a drag on banking practice.

"Separation Principle"

The "separation principle" is another cardinal rule of socialistic banking which China adopted from the Soviet model in the 1950s. As explained earlier, China makes a crucial distinction between "fiscal funds" and "banking funds." Banks distribute fiscal funds to enterprises, with no interest and repayment obligations, for financing fixed-capital investments and regular ("quota") working-capital needs. In contrast, they lend banking funds to enterprises for meeting transitory, revolving working-capital needs, with definite interest and repayment obligations.

Banks are responsible for watching over the two channels and guarding against the mixing of funds in a manner that would sabotage the separation principle. However, in practice, since funds are notoriously fungible, the two channels are constantly merging. The banks' task is further complicated by the fact that fiscal funds are free, and therefore difficult to obtain. Often, enterprises' capital-investment projects are approved in the state economic plan, but without sufficient appropriations. Thus, to complete certain projects, enterprises must obtain bank loans under the subterfuge of "above quota" working-capital needs, and surreptitiously employ the proceeds for fixed-capital investments, wage and tax payments, and other purposes for which banking funds are ineligible. Banks are aware of their responsibility to stop such practices, even though they know that the enterprises are basically sound and actually need the funds to carry on business. Banks are thus caught in the unenviable position of either ignoring the problem or constantly and fruitlessly complaining about the condition.

As stated, the Chinese advocate the use of this principle for two reasons: banking prudence and non-inflationary credit extension. The banking-prudence argument for the separation principle can be dismissed quickly. According to this argument, banks must meet deposit withdrawals, and prudence thus requires that bank assets be limited to short-term and self-liquidating loans and investments. The falsity of the argument has long been demonstrated by banking experience all over the world. To meet unexpected withdrawals, only a small fraction of a bank's total assets needs to be held in liquid form. The larger the bank's ready access to borrowing facilities, the smaller needs to be the fraction. For a banking system such as China's, with only four banks in the entire nation, all under government control, deposit withdrawals should be the least of problems.

The anti-inflation argument for the separation principle has more substance. According to this argument, through national financial planning the state allocates funds for investment, wage payments, etc., in a manner designed for achieving macroeconomic balance. If enterprises are allowed to tap bank credit for unplanned investment and other types of spending, this extra-plan spending will lead to a breakdown of the macrobalance and thus to inflation.[39]

The argument assumes, however, that aggregate balance between savings and investment had already been attained in national economic planning; then, additional credit expansion for financing investment would certainly be inflationary. But that is tautology. It is an argument against excessive credit expansion, when any credit expansion beyond that set out in the Plan could be considered "excessive." It is not an argument for the separation principle itself.

What is important for stabilization policy is not so much the distinction between sources of funds as the total volume of investment relative to national savings. The separation principle, by providing free funds for more than 70 percent of enterprise investment funds through the fiscal channel, enlarges capital demand and encourages waste and inefficiency in its use. Thus, the intended investment is larger, and the resultant increase in output smaller, when credit is allocated under the separation principle than it would otherwise be.

Within the existing socialist framework of

the economy, there are various alternative ways of allocating capital. One would be a variation of the present practice: collect all enterprise savings into the state treasury, deposit the funds at banks, and let banks lend out the funds to enterprises. Another would be for the enterprises to decide how much of their retained earnings to plough back into their own projects and how much to channel through the banks for investment elsewhere. In the former case, a sufficiently high loan rate would have to be charged to insure efficient use of capital; in the latter case, a sufficiently high deposit interest rate would have to be set to attract funds away from self-financed investments and household consumption to investments with higher returns. Either approach would mean the abandoning of the separation principle and increased reliance on interest rates for attracting savings and for capital allocation.

Already, some movement away from the separation principle towards greater reliance on the market mechanism is discernible. In August 1979, the State Council ordered the Construction Bank to experiment with medium- to long-term loans of five to fifteen years to enterprises on approved capital-construction projects. The interest rate, however, was set at only three percent a year, considerably below the five-percent rate charged by the People's Bank on short-term loans to all industrial and commercial borrowers.[40] In addition, the People's Bank itself has started to make short- to medium-term loans to textiles and other light industries for renovating, upgrading, or enlarging existing facilities.[41]

There was no follow-up, however, to these tentative steps away from the strict Soviet model of credit allocation. Indeed, as inflationary pressures mounted during 1980, the authorities fell back on the old, familiar banking principles to control inflation. In the February 1981 State Council decision on national credit policy, Article 2 declares:

"Restatement of the principle of separation of fiscal capital and bank-credit capital; strict prohibition of any shifting of bank-credit funds for use on fiscal-type expenditures."[42]

IV. Summary and Conclusions

First, the Chinese economy today — including its monetary and banking system — is a socialist planned economy largely patterned after the Soviet model. The "monobank" network supplemented by a few special-purpose banks, the Credit Plan and the Cash Plan, the "transfer balance" and the currency circuits of money circulation — all are Soviet inventions of the early 1930s.

Second, money has a significantly lesser role in this command economy than in a market economy, especially since it provides little purchasing power when goods are unavailable. By the same token, monetary policy has a much more restricted role in national macroeconomic policy than it does elsewhere. China's monetary policy has been circumscribed by: (a) the nearly complete reliance on administrative controls for regulating monetary growth, and (b) the monetary authorities' lack of independence from both central- and local-government authorities with respect to credit allocation. Because of these two factors, policy has necessarily been accommodative. The money-growth rate thus has largely reflected fiscal policy, with monetary stability resulting from a budget balance (or surplus) and inflation resulting from a deficit. Monetary policy in this context has been incapable of making much difference to stabilization efforts.

Third, effective monetary policy means effective control over money-supply growth. Monetary analysis in China has relied on the quantity equation of money for determining the targeted non-inflationary rate of monetary growth. However, a mechanical reliance on the equation — one assuming a given velocity of circulation — appears inappropriate for a situation of rigid prices and pronounced market dis-

equilibria. An alternative approach — still relying on the quantity equation, but using changes in velocity as a measure of the extent of repressed inflation — could provide a workable policy guide for China.

Fourth, we may question the rationale for the official use of the narrow definition of money supply, limited to currency circulation only. In China's institutional environment, the narrow definition could result in a serious underestimate of latent inflationary pressures in the economy. Alternative measures to remedy that underestimate might include household savings and time deposits, as well as "transfer balances" of enterprises and government agencies (excluding the state treasury).

Fifth, in the area of credit policy, official thinking continues to be guided by the "real bills doctrine" and the so-called "separation principle," although banking practice has begun to move away from these guidelines. The theoretical support for these banking principles, however, is found wanting even in the Chinese context, so that the tension between official thinking and banking practice is both unnecessary and distractive from real issues of economic stabilization and banking prudence.

These principles, moreover, require continued reliance on administrative controls for enforcing compliance. Their replacement by a flexible interest-rate policy would not only be more in tune with the spirit of Modernization, but also would help support the development of an effective monetary policy, operating through market forces rather than quantitative controls.

Appendix: A National-Accounts Model of China's Financial Plan

This appendix presents a schematic framework of the structure of China's Financial Plan in terms of sectoral accounts and inter-sectoral financial flows. As explained in the text, the Financial Plan consists of (a) the Government Budget, (b) the Credit Plan, and (c) the Cash Plan. The three parts are interrelated such that, given any two, the third is determined. From the point of view of monetary policy, the Cash Plan is of primary importance, as it determines the money-growth rate. It is constructed on the basis of data on household income and expenditure, and it must also be consistent with planned financial flows of the Government and Banking sectors. That is why China's financial planners place so much emphasis on reconciliation of the various parts of the plan. And that is why monetary policy, as presently constituted, is largely determined by decisions made outside the central bank's jurisdiction.

The national economy may be divided into four sectors, and the sectoral financial transactions during the plan period may be summarized as follows:

Sector	Sources of Fund	Uses of Fund	
Government	$T + B_G$	$= C_G + W_G + I_G + D_G$	(1)
Enterprises	$C_H + C_G + I_G + B_E$	$= W_E + T + D_E$	(2)
Banking	$D_G + D_E + S_H + CU$	$= B_G + B_E$	(3)
Households	$W_G + W_E$	$= C_H + S_H + CU$	(4)

where T designates taxes and profits paid into the state treasury;
B, borrowings from banks;
C, output of, or expenditure on, consumer goods and services;
W, wages and salaries, bonuses, payments in kind, and government subsidies to workers (e.g., housing, health care);

I, investments in plant, equipment, inventories, and land improvement;

D, increase in transaction balances in banks;

S, increase in bank savings and time deposits;

CU, increase in currency circulation.

All items are stated in nominal values, and the subscripts G, E, H designate the Government, Enterprise, and Households sectors respectively.

Equation (1) shows the Government Budget. B_G and D_G are financing items, reflecting the government's position vis-a-vis the banking system. A positive B_G indicates net government borrowing, and a negative B_G net government repayment of bank debt. A positive D_G indicates a net increase in government deposit balances at banks, and a negative D_G a net decrease in such balances. I_G is enterprise capital formation financed by the government, which also appears as a source of funds for the Enterprises sector in equation (2).

Equation (2) shows the sources and uses of funds of the Enterprises sector vis-a-vis the other sectors on a consolidated basis. Both sides of the equation are equal to the sectoral net output. The left-hand side of the equation shows that the net output consists of sales to the Households sector (C_H) and to the Government sector (C_G), "fixed-capital investment plus quota inventory accumulation" financed by the government (I_G), and "above-quota inventory accumulation" financed by bank credit (B_E).

Equations (3) and (4) are straightforward source-and-use-of-fund equations for the Banking and Households sectors, respectively.

The model abstracts from the real world in order to show the essence of China's financial planning. Omitted are foreign-trade flows, changes in foreign assets, retained earnings, and capital-depreciation allowances. These could be added at will, without changing the essence of the analysis.

The model contains all three components of the Financial Plan. The Government Budget, as stated, is equation (1). The Credit Plan is shown in equation (3). The Cash Plan can be derived from equation (4) by showing an increase in currency circulation (CU) as the difference between Households' incomes ($W_G + W_E$) on the one hand and Households' consumption plus increase in Households' time and savings deposits ($C_H + S_H$) on the other hand. In reality, of course, agricultural communes are included in the Households sector insofar as the Cash Plan is concerned.

From equations (1) and (3), it can be shown that

$$(CU + S_H) = (B_E - D_E) + (B_G - D_G). \qquad (5)$$

In other words, an increase in the sum of currency circulation and household time and savings deposits must arise from banks' net lendings to enterprises and the government. Since banks' net lending to the government is the mirror-image of the deficit (or surplus) of the Government Budget, since banks' lending to enterprises embodies the net outcome of the Credit Plan, and since the growth in currency and household time and savings deposits reflects the outcome of the Cash Plan, equation (5) summarizes the interrelationship among all three components of the Financial Plan.

Moreover, equation (5) provides flexibility in the choice of measurement of money. As discussed in the text, the official measurement includes only currency circulation. One can show the sources of its increase by moving S_H to the right-hand side of equation (5). Alternatively, if one wishes to include household time and savings deposits, S_H should remain on the left-hand side of equation (5). An even broader definition of money would include the "transfer balances", in which case D_E would be moved to the left-hand side of equation (5).

FOOTNOTES

1. The interested reader is referred to Jan S. Prybyla, **The Chinese Economy,** Columbia, South Carolina: University of South Carolina Press, 1978; Audrey Donnithorne, **China's Economic System,** New York: Praeger, 1967.

2. Typically, a worker employed by a collective earns less than one employed by the state. In 1980, for instance, the average income of collective workers amounted to 803 yuan, and that of state workers only 624 yuan — a yuan being equivalent to about 68 U.S. cents in 1980. See The State Statistical Bureau, "Communique on Fulfillment of China's 1980 National Economic Plan," **Beijing Review,** No. 19, May 11, 1981, p. 20.

3. Why the authorities wish to achieve stability in both aggregate price level and individual prices is not clear. One possible explanation is that rigid prices are needed so as not to complicate the already immensely complex task of planning the input and output of an entire national economy. One top economic advisor to the planning authority wrote recently: "There are hundreds of thousands, or even more than a million, prices to deal with. For each product, the calculation of production cost would be a very complicated task. The producer and the buyer would each proceed from different angles and engage in interminable arguments. Hence, no price authority, however brilliant and competent, could possibly solve this complex problem through subjective planning." See Xue Mu-quiao, "On Price Adjustments and Reform of the Price Administration System" in his **Certain Problems in Our National Economy Today** (in Chinese), Beijing: People's Publishing Co., 1980, p. 177.

4. See, for instance, Wang Ping, "No Inflation in China: Long-term Stability of Renminbi," **Peking Review,** No. 11, May 23, 1975; and Yang Pei-hsin, "Why China Has No Inflation," **China Reconstructs** (Peking), April, 1975, pp. 4-9.

5. For a painstakingly thorough study on the subject, see Tong-eng Wang, **Economic Policies and Price Stability in China,** Center for Chinese Studies, China Research Monograph No. 16, University of California, Berkeley, 1980. See also Dwight H. Perkins, **Market Control and Planning in Communist China,** Cambridge: Harvard University Press, 1966, pp. 155-159; Audrey Donnithorne, "The Control of Inflation in China," **Current Scene,** April-May, 1978, pp. 1-12.

6. See, for instance, Xue Mu-quiao, **op. cit.,** pp. 164-179.

7. For an analysis of the 1953 and 1956 inflations, see Katherine Huang Hsiao, **Money and Monetary Policy in Communist China,** New York: Columbia University Press, 1971, pp. 234-253. For an account of the 1960-61 episode, see Xue Mu-quiao, **op. cit.,** p. 170. For that of the 1979-80 episode, see Vice Premier Yao Yi-lin's report to the Standing Committee of the National People's Congress reported in **Beijing Review,** March 16, 1981, p. 15.

8. Describing the 1960-61 inflation, a key economic advisor said: "However, beginning in 1959, agricultural output declined, currency circulation increased 1.4 times from 1957 to 1961, free-market prices rose sharply, and the prices of those commodities which were hard for the state to control also climbed. In order to insure people's livelihood, the state resolutely held stable the prices of 18 categories of major consumer goods, but had to raise the prices of a number of high-priced commodities in order to contract currency circulation." See Xue Mu-quiao, **op. cit.,** p. 170. Nearly all the references to price increases involve consumer goods. However, there is evidence that the prices of some producer goods also rose in the 1979-80 inflation. See **Renmin Ribao** (Beijing Daily), June 23, 1981, p. 1, in reference to steel price increases.

9. For an authoritative study of China's financial system and monetary policy, see Katherine H. Hsiao, **op. cit.** Although the data refer to years prior to 1961, the description and analysis remain largely valid today.

10. Information in this and the following paragraphs on China's banking system is based on interviews with officials in mid-1980 and on **Financial Overview of the People's Republic of China** (in Chinese), Planning Bureau, The People's Bank of China, June 1980. (This is also available in English in a special translation by Foreign Broadcast Information Service, Washington, D.C.) See also Katherine H. Hsiao, **op. cit.,** and Liu Hong-zu, **Issues of Money and Banking Under Socialism** (in Chinese) Beijing: China Financial and Economic Publishing Co., 1980; Dick Wilson, "How Banks Work in China," **The Banker,** January 1980, pp. 19-27; Audrey Donnithorne, **op. cit.,** pp. 402-433.

11. See "Report on the Readjustment of the 1981 National Economic Plan and State Revenue and Expenditure," **Beijing Review,** March 16, 1981, p. 15.

12. There is also the People's Insurance Corporation of China. However, organizationally it appears to be a mere appendage of the People's Bank.

13. A clear and full exposition of this theory is presented in Liu Hong-zu, **op. cit.,** pp. 201-211.

14. All interest rates were annual rates compounded from monthly rates. See People's Bank of China, Planning Bureau, **op. cit.,** pp. 23-24.

15. In March 1981, the Government announced plans for the sale of up to five billion yuan in treasury bonds — the first bond issue in China since the 1950s — following government budget deficits of 17 billion yuan in 1979 and 12 billion yuan in 1980. The bonds were denominated from 10 yuan to one million yuan, carrying an annual interest rate of 4 percent and repayment in installments over the 1987-90 period. Since the terms of the bonds were not particularly favorable in view of the high inflation rate, the government made subscriptions mandatory for selected state enterprises, local governments, army units, and wealthy communes. See report in **The New York Times,** March 8, 1981.

16. For a fuller list, see Sho-Chieh Tsiang, "Money and Banking in Communist China," in **An Economic Profile of Mainland China,** studies prepared for the Joint Economic Committee, U.S. Congress, Washington: Government Printing Office, 1967, Vol. I, p. 336; and Katherine Hsiao, **op. cit.,** p. 170.

17. See Vice Premier Yao Yi-lin's report, **Beijing Review,** March 16, 1981, p. 15.

18. Information in this paragraph is based on Chinese monetary statistics released for the first time and published in **People's Daily** (in Chinese), July 4, 1981, p. 2. The data indicate that the currency issue increased by 7.8 billion yuan, or 29.3 percent, in 1980, which, coupled with the data cited in the preceding footnote, implies an increase 142 percent larger than the planned amount. The data also indicate that in 1980 the banking system increased its credit to the Government by 8.0 billion yuan, while the Government's deposits in the banks rose by 1.3 billion yuan. Thus, the currency issue attributable to budget deficit amounted to 6.7 billion yuan. During the same year, the banking system's loans to enterprises rose by 37.5 billion yuan, which was offset by 30.5 billion yuan increase in deposits held by all non-Government sectors, thus contributing 7.0 billion yuan to the currency expansion that year. The two sources together accounted for more than the 7.8 billion yuan increase in the currency issue in 1980 — the difference being attributable to a 2.9 billion yuan decrease in foreign-exchange reserves, a 2.7 billion yuan increase in the banking system's capital and surplus, and 0.1 billion yuan to unspecified others.

19. See "State Council's Decision on Strengthening Credit Administration and Strictly Controlling Currency Issue," **China Finance** (in Chinese), April 1981, p. 2.

20. For authoritative studies of the Soviet monetary system, see George Garvy, **Money, Banking, and Credit in Eastern Europe**, Federal Reserve Bank of New York, 1966; and his **Money, Financial Flows, and Credit in the Soviet Union**, Cambridge, Mass.: Ballinger, 1977.

21. See, for instance, Liu Hong-zu, **op. cit.,** pp. 159-162. Also, Xian Yu-tai, "On the Inter-relation Between Capital Flows and Money Circulation" in Lin Qi-keng, ed., **Issues of Currency Circulation Under the Socialist System** (in Chinese), Beijing: China Financial and Economic Publishing Co., 1964, pp. 97-99, and other authors in the same volume: Yu Zueh-xian, pp. 104-109; Zhou Quin, pp. 122-132; Zhao Zheming, pp. 142-53; Lin Qi-keng, pp. 154-169.

22. See Irving Fisher, **The Purchasing Power of Money,** New York: Macmillan, 1911.

23. See Edwin W. Kemmerer, **Money and Credit Instruments in their Relation to General Prices,** New York: Holt, Rinehart and Winston, 1907.

24. See Irving Fisher, **op. cit.,** Chapters 5 and 6. Kemmerer stressed that the velocity of circulation varies with business conditions. See Edwin W. Kemmerer, **op. cit.,** p. 20. See also Joseph A. Schumpeter, **History of Economic Analysis,** New York: Oxford University Press, 1954, pp. 1095-1106.

25. Following the writings of Professor Alfred Marshall, Cambridge University. See Alfred Marshall, **Money, Credit and Commerce,** London: Macmillan, 1923.

26. See Milton Friedman, "The Quantity Theory of Money: A Restatement," in M. Friedman, ed., **Studies in the Quantity Theory of Money** (Chicago: University of Chiago Press, 1956). For a more recent survey, see David E. W. Laidler, **The Demand for Money,** (New York: Dun-Donnelley, 2nd edition, 1977).

27. See references cited in note 21 above.

28. See a handbook prepared by the People's Bank for its staff, **Certain Problems in Research Work on Currency Circulation** (in Chinese), Publications Bureau, People's Bank of China, Beijing: Finance Publishing Co., 1957, esp. pp. 14-18 and 35-76; and **Currency and Credit** (in Chinese), Textbook Editorial Commission, People's Bank of China, Beijing: China Financial and Economic Publishing Co., 1964, esp. pp. 115-26.

29. See Katherine H. Hsiao, **op. cit.,** pp. 234-251, for an empirical study of the extent of open and repressed inflation in China during the 1952-57 period.

30. See William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretical Approach," **Quarterly Journal of Economics,** November 1952, pp. 545-56.

31. I am indebted to this issue's editorial committee for suggesting this point.

32. The suggestion was also made by a number of Chinese economists in the early 1960s and more recently in 1980. See Huang Da, "Bank Credit and Currency Circulation," in Lin Qi-keng, ed., **op. cit.,** pp. 40-55, and other articles in the same volume; also Liu Hong-zu, **op. cit.,** pp. 162-67.

33. See Lin Qi-keng, "On the Role of Monetary-Circulation Principles Under Socialism," **Economic Research** (in Chinese), February 1963, reprinted in Lin Qi-keng, **op. cit.,** pp. 56-71.

34. See, for instance, articles in **China Finance** (in Chinese), April 1981, pp. 28-29.

35. Thus, a prominent chinese economist wrote: "In capitalist economy, banks frequently require commodity pledge as a security for insuring repayment of a loan. However, in the course of capitalist economic growth, banks have engaged in security transactions (such as common stocks, bonds, etc.) in large volumes by extension of loans on such securities or investing in these securities for speculation. Thus, capitalist bank credit has become more and more separated from commodity flows. In our socialist countries, things are different. Bank credit. . . applies primarily to the production and distribution of commodities, and loans must be secured by commodities. We require the complete matching of credit flow and commodity." See Liu Hong-zu, **op. cit.,** p. 215.

36. See Lloyd W. Mints, **A History of Banking Theory,** Chicago: University of Chicago Press, 1945, pp. 25-27. For the development of the doctrine since Adam Smith, see Lloyd W. Mints, **op. cit.**; and Jacob Viner, **Studies in the Theory of International Trade,** New York: Harper, 1937, pp. 148-54 and 234-43.

37. See Joseph A. Schumpeter, **op. cit.,** pp. 721-4.

38. See Sho-Chieh Tsiang, **op. cit.,** pp. 334-335.

39. For a lucid statement of this argument, see Wang Lan and Liu Hong-zu, **Issues of Socialist Bank Credit,** (in Chinese) Beijing: China Financial and Economic Publishing Co., 1964, pp. 49-52.

40. See Liu Hong-zu, **op. cit.,** p. 247.

41. See People's Bank of China, Planning Bureau, **op. cit.,** (in Chinese), p. 13.

42. See **China Finance** (in Chinese), April 1981, p. 2.

The Influence of Real Factors on Exchange Rates

Charles Pigott*

One of the oldest controversies in international economics concerns the extent to which real factors affect exchange rates. Real factors are influences, such as tastes and technology, which affect the supply and demand for commodities and thereby their relative price in a persistent way. The present dispute is not over whether such changes in relative prices actually occur (the most casual observation confirms that they do) but, rather, whether in recent years they have significantly affected the value of one nation's currency in terms of another's.

The doctrine of "purchasing power parity" (PPP) reflects a widely held and traditional view of this issue. This asserts that the foreign exchange value of a nation's currency is determined by the level of its domestic prices relative to the level of prices abroad — that is, by the **PPP value** of the domestic currency. Since the level of a country's prices is (mainly) determined by the level of its money stock, relative to the demand for it, the PPP doctrine implies that exchange-rate changes largely reflect monetary, rather than real, factors. This theory traditionally concerns long-run currency values, but it has recently been incorporated in short-run exchange-rate models which allow for **temporary** departures from PPP due to interest-rate fluctuations.

Models which explain international patterns of trade and industrial specialization provide a rather different perspective on exchange-rate determinants. These models commonly imply that factors which cause changes in the relative prices of commodities can lead to changes in exchange rates. For example, a decline in demand for a country's traded goods — one leading to a fall in their prices relative to those abroad — might result in a depreciation of the home country's currency. Thus, in contrast to PPP theories, these models imply that real factors affect exchange rates.

Clearly, the influence of real factors on exchange rates is of interest to those concerned with explaining and predicting the value of the dollar and other currencies. But real factors can also be critically important for a number of policy issues. For example, should the authorities reduce domestic money growth if a nation's currency falls suddenly and sharply on the foreign exchanges, as some academics have proposed (McKinnan, 1980) — and as happened in the U.S. in November 1978 and October 1979? Such a policy can be appropriate if the currency decline reflects domestic inflationary pressures; in this case, the reduction in money growth helps stabilize exchange rates and domestic prices. But suppose the currency decline reflects real factors which will ultimately lower the relative prices of domestic versus foreign goods. If the authorities now prevent the exchange rate from declining — say by reducing domestic money growth — this fall in relative home-foreign commodity prices can only be accomplished through a decline in the domestic price level. Thus, a policy of stabilizing the exchange rate in the face of "real" disturbances may actually lead to more instability in domestic prices than would occur under a policy of fluctuating exchange rates.[1]

Similarly, the proposal by several European economists (OPTICA, 1976) for using foreign-exchange intervention to keep exchange rates within a band about their PPP values may be appropriate if long-run mone-

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tary factors mainly determine currency values. But if real factors are important, such a policy of "enforcing" PPP may reduce efficiency in trade and production by delaying needed changes in relative prices.

This paper presents evidence on the influence of real factors on the exchange value of the U.S. dollar since 1973, the beginning of the floating exchange-rate regime. As explained in Section I, nominal exchange rates can be divided into two components, one of which reflects the ratio of national price levels, while the other reflects "real" or "terms-of-trade" (TOT) influences. (The latter is simply a weighted average of the relative prices of individual commodities.) Real factors alter relative commodity prices in the long-run, and hence affect the **long-run** value of the TOT component of the nominal exchange rate. But other factors, such as fluctuations in real interest rates, also may produce temporary variations in this component. Hence, the post-1973 influence of real factors on exchange rates should be reflected in variations in the long-run TOT, more so than in fluctuations in the observed TOT. As we will see in Section II, the evidence indeed suggests that real factors have played a very substantial role in exchange-rate variations in recent years.

I. Real Factors and Exchange Rates

Real factors normally refer to conditions affecting the supply and demand for commodities and services, and thus their relative prices. In principle, these could include purely temporary influences on relative product prices, arising, say, from strikes or bad harvests, as well as more "fundamental" factors determining relative prices in the long-run. However, because we are concerned mainly with the ultimate influence of relative price changes on exchange rates, we identify real factors only with "fundamental" conditions. That is, real factors are those which **persistently** affect product demands and supplies, and so determine their **long-run** relative prices.

The most obvious real factors are (real) factor-input costs, productivity levels, tastes, and other direct commodity supply-demand determinants. But real factors could include conditions which, while not originating in commodity markets, nonetheless permanently affect their relative prices. For example, a monetary policy shift that reduced domestic investment by adding to uncertainty about future inflation would qualify as a real factor (because it lowers domestic commodity supplies) even though its source is in financial, rather than product, markets. Thus, evidence that real factors have substantially affected the dollar would very strongly suggest —although not conclusively prove — that we must look beyond variations in financial-asset supplies and demands in explaining exchange rates.[2]

How, then, can real factors affect exchange rates, which are the prices at which different national monies are bought and sold for one another? The answer lies in the fact that exchange rates influence the supplies of and demands for commodities and services. For example, the greater the dollar cost of foreign currency, the more costly are foreign imports to Americans and the less of those imports they are likely to buy. Thus, exchange rates must attain levels in the long-run that are consistent with supply-demand equilibrium in product markets — and, for that reason, factors causing commodity supplies or demands to change can alter "equilibrium" exchange rates.[3]

This section explains how and through what channels real factors can influence exchange rates, as well as how their impact may be measured. As explained below, any exchange rate contains a **real** component, which reflects the value of domestic goods and services in terms of their foreign components. Real factors are those which alter the long-run value of the real component, and hence affect exchange rates generally. However, as we will

see, temporary changes in this component can arise from (real) interest rate fluctuations or (possibly) other transient factors. For this reason, the task of measuring the impact of real factors on exchange rates primarily involves separating the persistent and transient portion of their real components.

Real Components of Exchange Rates

Real factors can affect exchange rates because the price at which individuals will exchange one money for another depends in part upon the amount they will pay for foreign versus domestic commodities and services. As an example, consider a car buyer choosing between two cars of equal quality — a compact American car selling for $5,000 versus a German Volkswagen costing 10,000 marks (DM), including U.S. delivery. Then, the purchaser will buy the American car if a DM costs more than 50 cents, but will buy the German car if one mark sells for less than 50 cents. Now, suppose the German dealer offers an "extra" at **no** additional cost (in DM) that enhances the attractiveness of a VW relative to its American competitor. Plainly, all other factors the same, the buyer will now be willing to pay more than 50 cents per DM to purchase the German car.

As this example suggests, the price of foreign currency is affected by the amount individuals are willing to pay for foreign versus domestic goods and services. This amount depends, of course, upon individuals' tastes and their perceptions about quality, dependability and other determinants of product attractiveness. However, it depends as well upon factors determining the relative **supplies** of U.S. and foreign goods. For example, if productivity falls in the German auto industry, German workers will produce fewer Volkswagens and prospective buyers of now scarcer VWs will find them more expensive relative to their American competitors. But in either case, the more individuals are willing to pay for foreign versus domestic goods, the more costly (all other factors the same) will be foreign currency.

Equally plainly, the cost in dollars of U.S.-produced goods versus the prices of foreign products in their **own** currencies also affects the exchange value of the dollar. If the dollar prices of U.S.-produced goods rise by 10 percent, individuals who are now just willing to purchase American products will switch to foreign imports **unless** their price in dollars also rises by 10 percent. But, given the foreign-currency price of imports, this means that the dollar price of foreign currency must rise by 10 percent. Likewise, if (foreign currency) prices abroad fall by 10 percent, the cost to Americans of purchasing foreign currency will have to rise by the same amount if the dollar prices of U.S. imports (relative to those of competing domestic goods) are to remain the same as before.

More formally, let "e" stand for the logarithm of the price of foreign currency, "p" and "p_f" for the log of the U.S. and foreign price levels, respectively, and "x" for the log of the "price" at which foreign products can be exchanged for U.S. goods and services. Then, the above example shows, we can decompose the nominal exchange rate into two components,

$$e = x + (p - p_f) \qquad (1)$$

The first, or "real," component of the exchange rate, x, represents the "terms-of-trade" (TOT) because it denotes the proportion in which individuals, in effect, give up foreign for domestic goods.[4] The second compotent, $(p - p_f)$, is commonly known as "purchasing power parity" (PPP) because it is the exchange-rate level corresponding to a fixed relative price, or "parity," among foreign versus domestic goods.

In practice, the amount individuals will pay for foreign currency depends upon their choices among many foreign and domestic goods and services. For this reason, the "prices," p and p_f, composing the PPP component, as well as the TOT, should be viewed as averages of the prices of many individual commodities. In particular, the TOT, x, represents the rate at which "baskets" of foreign and domestic goods exchange for one another — that is, a weighted average of many relative

commodity prices.[5] Generally, also, the products used to define these components should include **non-traded** as well as traded goods and services. Non-traded goods can affect the amount individuals will pay for foreign currency by influencing the supplies of and demands for traded goods (and, thus, their relative prices) as well as their prices in domestic and foreign currency. (The more exact rationale for including non-traded products — which derives from the monetary theory of price-level determination — will become apparent shortly.)

Plainly, since real factors — by definition — affect relative commodity prices, their influence will, in a sense, be reflected in the TOT. As the chart shows, the TOT component of the dollar has varied nearly as much as the dollar itself since 1973 — reflecting, apparently, the very great influence of real factors.

In fact, however, two additional questions must be answered before firm conclusions can be drawn from the observed behavior of the TOT. Recall that real factors alter long-run relative prices so that, strictly speaking, only the TOT; now the **long-run** TOT would unambiguously reflect their influence. This suggests distinguishing between the long-run TOT, x^*, and the "transient" TOT, x', in the original decomposition:

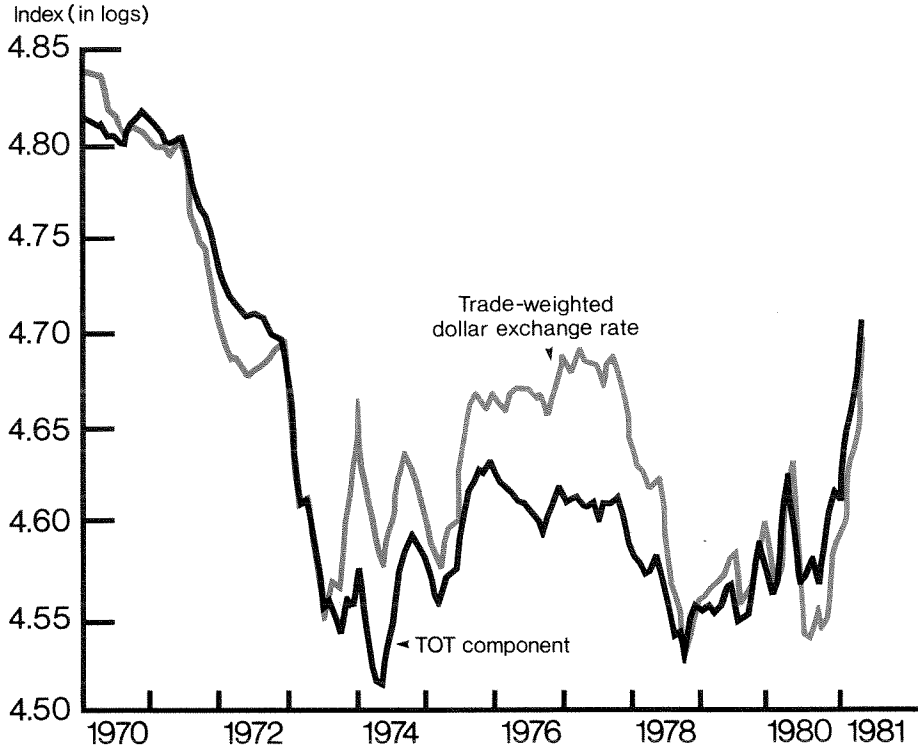
$$e = x^* + x' + (p - p_f);\ x' = x - x^* \qquad (2)$$

The distinction is illustrated in figure (i). At any given time, the TOT can be viewed as approaching a long-run path; x^* is the TOT's current value if it were on this long-run path, while x' is the difference between the actual TOT and its long-run value.

Thus, in measuring the importance of real factors, we must consider what determines the transient TOT, as well as how it can be dis-

Chart 1

Trade-Weighted Dollar and its TOT Component
(in log terms)



tinguished from its long-run counterpart, x^*. But first, we must answer a more fundamental question about the transmission of real factors. To date, we have only established the link between real factors and one component of the nominal exchange rate, the TOT; now we must also ask how they affect national price levels, and hence the PPP component. As we will see, the monetary theory of price-levels determination (and inflation) supplies the precise answer to the earlier question, "How can various changes in relative commodity prices affect the relative prices of national monies?"

Impact of Real Factors

To understand the importance of real factors, consider an increase in the quality of foreign-produced goods that makes them more attractive to Americans and foreigners alike. The result is likely to be a rise in demand for foreign goods at the expense of home-produced goods, and consequently a rise in the relative prices of foreign versus U.S. products. But this increase in the TOT component could be accomplished in several different ways. The shift in demand could lower the prices of U.S. goods and raise those of foreign goods in an offsetting manner, so that the exchange rate itself remains unchanged. This, of course, would lower the U.S. price level and raise the foreign price level, with the resulting fall in the PPP component exactly offsetting the rise in the TOT component. Or the price of foreign currency could rise just enough to obviate any change in the dollar prices of U.S. goods, leaving the U.S. price level (and hence the PPP component) unaffected; in terms of relation (1), this means that the exchange rate would bear the entire adjustment to the altered TOT. Or this shift might be accomplished by adjustments in price levels **and** in the exchange rate.

Which of these cases is most likely to occur depends critically upon the determinants of domestic and foreign price levels. According to the increasingly accepted monetary theory of inflation, the price level is determined by the supply of money available in relation to the "real" demand for that money, which is simply the value in terms of goods and services of the money individuals and businesses want to hold. Thus, if the supply of money rises with no change in demand, its value in terms of goods or services must fall, which means that the price **level** must rise.[6]

Moreover, the real demand for money depends, first, on real income and real wealth, which determine how much (in real terms) individuals and businesses collectively want to spend on goods and services; and second, on institutional factors, such as the average lag between payments and receipts, which determine the rate at which money "turns over" in the process of carrying out transactions.[7] Together, these determine the amount of money (in real terms) individuals and businesses need to carry out their desired expenditures.

This suggests that changes in relative commodity prices will normally have little or no impact upon the demand for money. That is, a rise in the price of one domestic good relative to that of another may raise the real incomes of some, but it will lower the real incomes of others; **aggregate** real income should be little affected. Likewise, the rate at which money "circulates" in transactions probably would not be affected perceptibly. In short, a shift in relative prices should not significantly influence the aggregate level of transactions carried out by individuals, and the amount of money needed to undertake them — and hence should not affect the real demand for money.[8] Relative price shifts, with a given money supply, thus should leave unaffected the average level of prices at which these transactions are carried out. Note however that this proposition applies **only** to price-level measures that are representative of transactions carried out by the country as a whole; such indices almost certainly will include nontraded as well as traded goods.

These arguments imply that, with given domestic and foreign money "paths," shifts in relative commodity prices will have little or no impact on the PPP components of exchange rates corresponding to **these price-aggregates.** In the context of relation (2), this suggests that when exchange rates vary freely, real factors will affect the dollar precisely to the extent

that they affect the long-run TOT component (again, as defined in terms of the above price-level measures). If so, variations in the long-run TOT, x^*, should provide a fairly accurate indication of the ultimate impact of real factors on exchange rates under a floating-rate regime.[9]

It should now be clear why the PPP and TOT components encompass a wide variety of traded and non-traded goods and services, and in particular why prices of non-traded products can easily affect exchange rates. According to the monetary theory, the level of domestic money effectively constrains the average level of prices at which agents' purchases — of traded **and** non-traded products — are carried out. For this reason, changes in the prices of non-tradeables will generally lead to variations in tradeables' prices — and so to changes in exchange rates. To illustrate, suppose demand for U.S. housing services increases, ultimately increasing their price relative to those of other U.S. products, but with no impact upon relative domestic/foreign traded-goods prices. If the U.S. money stock remains constant, U.S. housing prices can rise only with a fall in prices of other domestic goods, including tradeables. But this means that the dollar must appreciate to keep the relative costs of (U.S. versus foreign) traded goods fixed. More generally, the impact of a given relative price change on the dollar depends upon its importance in domestic and foreign money transactions; and the structure of these transactions largely determines how real factors influence (freely floating) exchange rates.[10]

Transient Influences on the TOT

While variations in the long-run TOT tend to reflect the influence of real factors on exchange rates, the same cannot be said of variations in the actual, or observed, TOT. As has become increasingly evident, this is because conditions in money and financial markets can temporarily affect relative commodity prices, and thus the **transient** TOT, even though their long-run impact is generally negligible.

In part this is because exchange rates tend to react much more quickly than commodity prices to changes in the supply or demand for money or other financial assets, since commodity prices are often constrained in the short-run by contracts (both implicit and explicit) and other institutional rigidities. Consider, for example, the effects of a rise in domestic money growth that is expected to persist. For the reason cited, domestic commodity prices would need time to adjust in proportion to the increased money growth. There are no impediments to the immediate adjustment of exchange rates, however. Because holders of the domestic currency know that its value must ultimately fall to reflect higher domestic prices — that is, its purchasing-power-parity value must decline — they have an incentive to sell it now, to avoid a capital loss. Thus, exchange rates tend to fall immediately following a rise in domestic money growth, while domestic prices lag behind for some time. As a result, the relative price of domestic versus foreign goods (expressed in the same currency) falls — that is, the TOT declines initially. Then, as domestic prices respond, the TOT tends back to its original value as the nominal exchange rate and its purchasing-power-parity value converge in the long-run.[11]

Transient variations in the TOT also can arise out of fluctuations in credit demand leading to temporary changes in real interest rates — that is, nominal interest rates **relative** to anticipated inflation. For example, an increase in U.S. real interest rates due to a surge in credit demand will attract capital to our shores because investments in dollars will then pay a higher return, **after inflation,** compared to investments abroad. As a result, the dollar will tend to rise on the foreign exchanges along with its (transient) TOT component. But generally, these effects will be only temporary, in part because such transient credit imbalances normally have little impact on domestic prices, but also because real interest rates and the TOT will fall back to their original values as capital flows into the U.S. to ease the financial imbalance.[12]

Thus, the substantial variability in the actual TOT exhibited by the chart does not

necessarily indicate any substantial impact of real factors on exchange rates. How, then, can the transient and long-run components of the TOT be distinguished to obtain an appropriate gauge of the importance of real factors? The persistence of the variations in the observed TOT provides one indication of the relative importance of variations in its long-run component. Again, the association between fluctuations in real interest rates and the transient TOT provides another indication. Indeed, it can be shown that the long-term U.S.-foreign real-interest differential provides at least an approximate measure of the transient TOT as it is perceived by investors.[12] As we will see, this relation provides an alternative way of measuring the importance of real factors.

Importance of Different Factors

Our analysis has identified three sets of factors affecting nominal exchange rates: differential inflation rates causing movements in PPP; real interest rates or (possibly) other influences on the transient TOT; and real factors that lead to variations in the long-run TOT. Most models of exchange-rate determination emphasize either the first or second explanations (or both). For example, simple monetarist models attribute exchange-rate fluctuations mainly to variations in PPP levels. Other models have focused on variations in supplies of interest-bearing assets, which can affect the transient TOT by causing real interest rates to fluctuate.[14] The present analysis is largely concerned with whether the comparative neglect of real factors in most models is justified.[15]

What, then, determines the relative importance of the various influences affecting exchange rates? Clearly, the answer does not hinge primarily upon the substitutability of foreign and domestic traded products. As we have seen, variations in the relative prices of non-traded goods could lead to substantial exchange-rate variations even if tradeables' relative prices were fixed.[16]

More generally, the relative importance of various exchange-rate components is likely to be less a function of the structure (e.g., elasticities) of the relevant supply and demand relations, than of the size, duration, and frequency of the disturbances causing shifts in these relations. For example, it would hardly be surprising if, during hyperinflations, exchange-rate movements arose mainly from changes in PPP. Hyperinflations are, after all, periods of **exceptionally** high and variable inflation. But the last decade has witnessed unusually sharp variations in the relative prices of certain basic commodities, with oil being the most obvious, but certainly not the only, example. Surely, real factors may have played a prominent role in exchange-rate determination over this period.[17]

These observations suggest that, normally, a wide variety of factors — reflected in variations in all three components — will affect exchange rates. Moreover, the relative importance of various influences can be expected to vary over time and across countries, with alterations in policies and other aspects of the economic environment. In this sense, the following empirical examination is an "historical" analysis, in that the results in large part reflect the economic conditions prevailing during the period in question. As with history, certain general lessons can be drawn, but we should not expect current patterns to be replicated exactly in other periods or for other countries.

II. Evidence on the Influence of Real Factors

The above arguments suggest that measuring the impact of real factors on exchange rates involves answering two empirical questions. First, what has been the relative importance of variations in the PPP and TOT components of actual exchange rates? And second, to what extent have actual changes in the TOT been transient, that is, offset in the long-run? The earlier discussion implies that the influence of real factors will be greater, the larger are the fluctuations in the TOT versus the PPP components, **and** the more persistent are the fluc-

tuations in the TOT component.

This section discusses evidence on these questions for the floating-rate period beginning with May 1973 and ending with August 1980.[18] These tests are carried out with the use of consumer-price indices to measure the PPP and TOT components. Such indices are more reflective of the entire range of money transactions carried out here and abroad, than are indices of traded-goods prices alone, or even wholesale price indices. Thus, the CPI-based measures are more likely than alternatives to capture the real factors affecting exchange rates.[19] In addition, both the text and the Appendix (Table A-3) present evidence (supporting the theoretical argument advanced earlier) suggesting that long-run TOT changes have mainly affected nominal exchange rates, with little or no impact on national price levels, and hence their PPP components.[20]

Trends and Deviations

In interpreting the evidence, it is important to distinguish between **trends** in exchange rates (and their components) and deviations from those trends. In terms of Figure (1), the trend in an economic variable simply refers to the **slope** of its long-run path, that is, to the **average** rate at which it changes over time.

Movements in e( ) at a greater or faster rate than the trend represent variations in the deviation from trend. These deviations may be either permanent — that is, reflect movements in the **level** of the long-run exchange-rate path (i.e., shifts in e* ()) — or transient (changes in e').

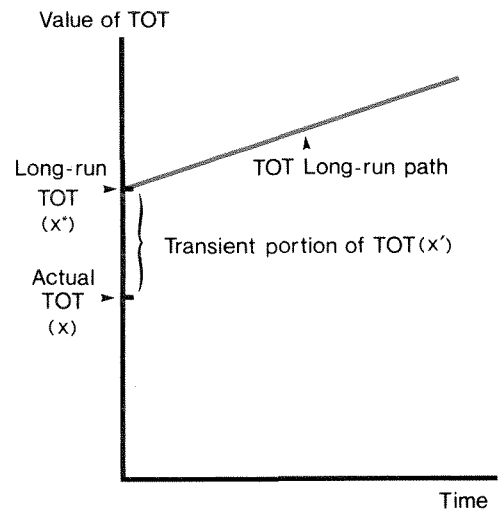
We distinguish between trend and deviations in the exchange rate (and its components) because their relative importance to international traders and investors, as well as policy-makers, will vary with the types of activities they are engaged in, and particularly with their time horizon. Consider an investor who takes an open position in foreign currency, thereby risking loss if the future exchange rate should differ from that now expected. Although neither the trend nor the deviation component of future exchange-rate changes can be predicted perfectly, the latter is likely to pose the greatest risk to short-term investments. The reason is that, over a short interval, the deviations are likely to account for considerably more of the exchange rate's movement than is the trend. But the biggest risk of exchange loss on long-term investments is likely to arise from the risk of a change in trend, because the trend — unlike the deviations — produces continuous, systematic changes in the exchange rate in the same direction over many periods.

Furthermore, real factors may influence trend movements and deviations in differing degrees. In fact, considerable evidence indicates that variations in the exchange-rate trend across countries and over time result mainly from differences in the **PPP trend.** This does not mean that real factors have no influence at all on the exchange-rate trend — a glance at Table 1 suggests otherwise — but rather suggests that they are not the major source of shifts in this trend.[21]

For this reason, and because the determinants of the exchange-rate trend have been extensively analyzed in the literature, the

Figure 1

Permanent and Transitory Components of the Terms of Trade (TOT)



following analysis focuses on the impact of real factors on the **deviations** of exchange-rate changes. This is in no sense only a minor aspect of the matter. As Table 1 indicates, the average magnitude of these deviations is considerably greater, on a monthly basis, than the trend rate of change of the exchange rate. Furthermore, much of the policy controversy about exchange rates centers about the deviations, in large part because these are generally the least predictable and least understood components of exchange-rate variations.

Variability of Exchange Rates

The post-1973 floating exchange-rate regime has been marked — remarkably, and certainly unexpectedly —by a very high variability of nominal exchange rates in relation to fluctuations in relative national price levels. Also remarkably, there has been a relatively low correlation between monthly or quarterly changes in exchange rates and the contemporaneous change in their PPP components. These empirical observations have stimulated the formulation of some new theories of exchange-rate determination in recent years.[22]

In the 1973-80 period, the standard deviations of the TOT (percentage) changes are remarkably high in absolute terms — they substantially exceed the **average** monthly, or trend, change — but they are also far greater than those of the corresponding changes in PPP levels (see Table 1). Moreover, the correlation between changes in nominal exchanges rates and changes in relative national price levels is very low and, indeed, statistically insignificant in all cases. The main point, however, is that fluctuations in nominal exchange-rate changes about their trend are dominated by variations in the TOT; indeed, the standard deviations of the real and nominal changes are virtually the same. Thus, explaining nominal exchange-rate fluctuations essentially means explaining variations in TOT.

There are at least two possible explanations of the results. First, disturbances in financial markets, reflected in real interest rates, could be responsible for the relatively high variability of the TOT, and consequently for the low correlation of the nominal rate and its **contemporaneous** PPP component. Alternatively, the volatility of the TOT component could simply reflect high variability in real factors. Either explanation can thus account for the basic features of Table I. But the first also

Table 1
Variance of Nominal Exchange Rates and Their Components
(May 1973-August 1980)

	Canada	France	Germany	Japan	U.K.	Italy
1) **Nominal exchange rate**[1]						
Average change (%)[2]	-.17	.10	.53	.18	-.07	-.42
Standard deviations[2]	1.34	3.14	3.52	3.09	2.78	2.84
2) **PPP component**[1]						
Average change (%)[2]	.01	-.14	.33	-.06	.42	-.55
Standard deviation[2]	.33	.33	.36	.83	.75	.56
3) **TOT component**[1]						
Average change (%)[2]	-.18	.25	.20	.24	-.49	.14
Standard deviation[2]	1.42	3.18	3.57	3.07	2.86	2.83
Memo:						
a) Correlation of (1) and (2)	-.11	-.07	-.07	.15	.02	.12
b) Correlation of (2) and (3)	-.34	-.17	-.17	-.12	-.24	-.08

[1]Nominal exchange rates are the dollar values of foreign currency; the PPP component is the ratio of the (seasonally adjusted) U.S. to foreign CPI: the TOT component is the exchange rate divided by the PPP component.

[2]Both the average changes and standard deviations are calculated from monthly **changes** in the logarithm of the variable in question, expressed in percentages.

implies that the fluctuations in the TOT are largely transient, while the second requires that they persist in the long run. To decide between these two explanations, we must determine the extent to which actual variations in the TOT represent changes in its transient (x') versus its long-run (x*) element. (Although the following analysis is unavoidably technical, a non-technical summary of the final results and their implications is given at the end of this section.)

Transient or Permanent?

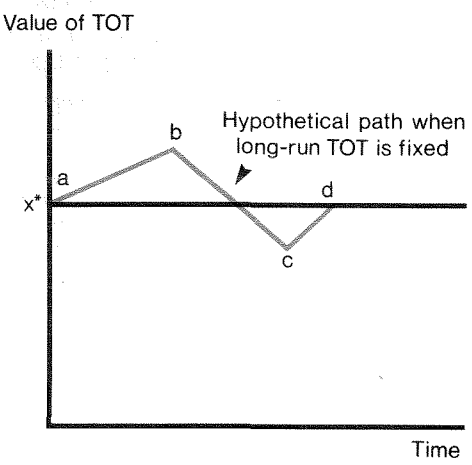
By definition, a transient fluctuation in the level of the TOT is one which disappears over time. This can be seen from Figure (2), which shows a long-run path for the TOT — the slope or trend is taken to be zero. Suppose the **level** of this path remains constant over time, so that there are no changes in the long-run TOT, x*. Then all observed TOT changes will follow a pattern (a-b-c-d in the Figure 2) whereby a movement away from the path is subsequently offset by movements in the opposite direction that bring the TOT back on path. Hence, if all fluctuations are transient, **changes** in the TOT about trend will tend to be fully offset in the future. On the other hand, if all TOT variations represent shifts in the long-run value — that is, real factors — a current change will not, on average, be offset at all in the future.

More generally, the importance of real factors can be measured by the fraction of changes in the actual TOT which, on average, tends to persist. This fraction in turn can be measured by analyzing the pattern of changes in the series itself (that is, without introducing explicitly any additional explanatory variables). Specifically, we assume that the TOT in a given period is affected by a collection of (unobserved) real and financial disturbances, which then may set off further responses over time. A general model of this form can be written as,

$$\Delta x(t) = c + a_0 z(t) + a_1 z(t-1) + \ldots a_n z(t-n) + b_1 \Delta x(t-1) + b_2 \Delta x(t-2) + \ldots b_m \Delta x(t-m) \quad (3)$$

Figure 2

Path of Terms of Trade (TOT)



This is an essentially equivalent, but more convenient, form of the regression,

$$\Delta x(t) = c + e_1 \Delta x(t-1) + e_2 \Delta x(t-2) + \ldots + z(t) \quad (3')$$

and can be estimated in an analogous way.[23] In either case, z( ) represents the **collective** impact of all (unobserved) financial and real disturbances initially causing the TOT to vary. Subsequent changes can then be calculated from past changes using either of the above.

Now, the change in the long-run TOT resulting from a disturbance z( ) is equal to the **cumulative** changes it sets off in the actual TOT. Let "g" refer to the cumulative change set off by a disturbance equal to one percent, which is simply the fraction of the disturbance **persisting** in the long-run. This fraction then can be written in terms of the coefficients of (3) as,

$$g = (a_0 + a_1 + \ldots a_n) / (1 - b_1 - b_2 - \ldots b_m) \quad (4)$$

It follows that the standard deviation of changes in the long-run TOT, $S(\Delta x^*)$, is equal to this fraction times the standard deviation of the disturbance, S(z),

$$S(\Delta x^*) = gS(z) \quad (5)$$

Estimates of these can be obtained from the estimates of (3).

This procedure, though simple, fails to account explicitly for the various influences on the TOT. This could lead to instability in the estimated model if the time pattern of variation in these influences changes over time.[24] Alternatively, then, we could attempt to account, at least partially, for transient TOT variations by introducing proxies for changes in the foreign-U.S. real interest differential into (3). (Recall that such differentials should reflect transient TOT changes to the extent they are perceived by investors.)

$$\begin{aligned}\Delta x(t) = c &+ d_0\Delta r(t) + d_1\Delta r(t-1) \\ &+ \ldots d_k\Delta r(t-k) + b_1\Delta x(t-1) \\ &+ \ldots b_m\Delta x(t-m) + z(t) \\ &+ a_1 z(t-1) + \ldots a_n z(t-n) \qquad (6)\end{aligned}$$

Here, $\Delta r(\,)$ is the estimated change in the **3-month** foreign-U.S. real interest differential, derived from estimates of anticipated U.S. and foreign inflation.[25] This short-term real differential is used as a proxy for the long-term real interest differential.[26] As before $z(\,)$ is the regression residual, or portion of $\Delta x(t)$ that cannot be "explained" by changes in the real interest differential **or** by past changes in real exchange rates. Now however, z stands for all real influences on the TOT as well as any other (temporary) influences not reflected in the real interest differential. (Of course, z is not directly observable but is estimated along with the regression parameters.) As before, the trend or average change in the TOT will be assumed fixed, which implies that the **average** real interest differential is also constant over time. This implies further that interest fluctuations about the mean do not affect the long-run TOT, so its variability can still be measured with the use of relations (4) and (5).[27]

This second model — unlike the first — can help account explicitly for at least some of the influences on the TOT. It has a practical drawback, however: since no direct observations of real interest rates are available, admittedly imperfect proxies must be used. Unfortunately, if these proxies are poor measures of actual real interest rates, the estimates derived from (6) may be seriously biased. Bias could also arise if the authorities were to vary real interest rates in **response** to changes in real exchange rates. (Then $\Delta r(\,)$ would be endogenous relative to Δx.)[28] Moreover, both methods fail to analyze explicitly the sources of the real influences on the TOT. Such a procedure is necessary for our study, because the sources of real influences on the exchange rate may be highly varied and hence difficult to identify. But as a consequence, we can obtain only indirect evidence on the impact of real factors. And the evidence must, in any case, be regarded as tentative.

Estimation

Table 2 summarizes the results of estimating relations (3) and (6) and the Appendix provides further details. In estimating the **univariate** models (3), lags of 1-6 and 12 months were allowed for the "exogenous" disturbances (z), plus 1 and 2 months lag for the TOT changes (i.e., the lagged dependent variable). The real interest rate proxies used for the second (regression) model (6) were obtained by subtracting a proxy for anticipated inflation over a 3-month period from the 3-month Eurocurrency interest rate observed at the beginning of the period. The expected-inflation measure was derived by regressing actual CPI inflation on its lagged values; thus, anticipations of inflation presumably are at least approximated by an average of observed past inflation (see Appendix for further details). To avoid estimating excessive numbers of parameters, lagged-error (moving average) terms were confined to 1-4 and 12 in this second case, along with the current and three-lagged values of the changes in the real interest differential (and the two lags for the dependent variable).[29]

Taken as a whole, the Table 2 evidence suggests that real factors have been a major influence — in some cases the dominant influence — on variations in the TOT, and hence the nominal exchange rate, under a regime of floating exchange rates. And in the majority of cases, at least half, and generally more, of a "typical" disturbance to the TOT persists in

the long-run. Moreover, the estimated variability of the long-run TOT ($S(\Delta x^*)$) is generally at least half the standard deviation of the actual TOT changes **and** of changes in the nominal exchange rates. These conclusions seem firmest for Japan and the U.K., where either model suggests that virtually all TOT changes ultimately persist.[30] Also, the results for Canada and Italy imply that less than half of a TOT change is subsequently offset. Thus, in these four cases, TOT changes appear to reflect primarily the influence of real factors, which points to real factors as the major source of exchange-rate fluctuations since 1973.

The results for France and Germany are more questionable, as the two models yield contradictory results, with the univariate model suggesting that TOT variations are mainly transient, while the regression model suggests they largely persist. Indeed, the univariate models in these cases tend to be quite sensitive to the exact specification and sample period, indicating the results are not very robust.[31] Because the regression model attempts to account explicitly for some of the potential factors affecting the TOT, its implications **may** be more reliable, particularly for France where this seems to fit the data better than does the univariate relation. If so, real factors also appear to have dominated fluctuations in the TOT (and the exchange rate) in the case of France, although the results for Germany remain inconclusive. It is also worth recalling that there is no **a priori** reason to expect that real factors will affect exchange rates to the same degree for all countries. For example, the (apparently) relatively greater importance of transient variations in the TOT for Germany could simply reflect a relatively high variability of German real interest rates or other temporary influences on the TOT.

Thus, while sampling variability inevitably makes the exact estimates somewhat imprecise, the general conclusion remains that real factors have played a substantial, and perhaps central, role under floating exchange rates. In particular, the substantial variability of the TOT does **not** appear, as some theories have assumed, to be mainly the **temporary** result of financial-market imbalances. Rather, these fluctuations seem mainly the consequence of real-factor induced shifts in long-

Table 2

Summary Evidence on the Persistence of TOT Changes

		"Univariate" Model[1]					Regression Model[1]				
	$S(\Delta x)$	F^2	R^2 (unadjusted)	S(z)	g	$S(\Delta x^*)$	F^2	R^2 (unadjusted)	S(z)	g	$S(\Delta x^*)$
Canada	1.43	4.3*	.34	1.23	72%	.89	3.7*	.38	1.21	62%	.75
France	3.10	2.9*	.25	2.83	36%	1.02	3.2*	.30	2.77	98%	2.71
Germany	3.36	2.2*	.21	3.16	0%	.00	2.2*	.24	3.13	64%	2.00
Japan	3.12	2.6*	.23	2.89	113%	3.26	2.5*	.32	2.91	142%	4.13
U.K.	2.88	3.9*	.32	2.52	120%	3.02	3.4*	.33	2.52	96%	2.42
Italy	2.85	2.2*	.21	2.68	83%	2.22	1.7	.23	2.68	60%	1.61

1. The effective period for the univariate and regression models is July 1973-August 1980, except for Japan, where the starting point is July 1974 for the regression model.

2. Test of the hypothesis is that all the estimated parameters (except the constant) are zero. An asterisk (*) indicates that the hypothesis (based on an asymptotic "F" distribution for the test statistic) can be rejected at a 5 percent (or better) significance level.

3. The percentage of the residual (z) persisting in the long-run is computed as $\sum_0^N \hat{a}_j/(1-b_1-b_2)$ where a and b refer to the estimates (see relations 3 and 6).

4. S(z) is estimated standard error of the disturbance; g is percentage of z persisting in the long-run; $S(\Delta^*)$ is the estimated standard deviation of changes in the long-run TOT; $S(\Delta x)$ is standard deviation of Δx.

run relative commodity prices. Given the high variability of TOT changes in recent years, this suggests that real factors may have been the **single** largest source of nominal exchange-rate variations about trend for several major countries. These conclusions are supported by the finding, summarized in Table A-3 of the appendix, that shifts in the long-run TOT apparently had little or no impact on PPP levels, but instead led to nearly proportionate changes in the nominal exchange rate.

Implications of Results

Taken as a whole, our results strongly suggest that real factors have strongly affected nominal exchange rates during the current regime of floating exchange rates. This conclusion follows from the following findings:

1) Most of the fluctuations in nominal exchange rates about their trend are attributable to variations in the TOT component. The variability of this component substantially exceeds the trend rate of change of the exchange rate, indicating that changes in the TOT about its trend are an important source of cumulative exchange-rate movements over periods of a year and perhaps longer.

2) In the majority of cases, fluctuations in the TOT appear largely to persist in the long-run, suggesting the strong influence of real factors. Except in the cases of Germany, and perhaps France, it is difficult to avoid concluding that real factors dominate fluctuations in the TOT.

3) The nominal exchange rate, and not the **level** of prices, generally adjusts to relative price changes induced by real factors. This and the other findings suggest that for Japan, the U.K., Italy, and Canada (and possibly France), real factors have been the **major** source of fluctuations in exchange rates about their trend. Partial evidence suggests that real factors may have substantially affected the German exchange rate as well.

These conclusions are highly tentative, particularly as they are based on indirect evidence. More precise measures of the impact of real factors will require explicit identification of their various sources. Moreover, the results certainly do not rule out the possibility of monetary and other financial influences on relative commodity prices, and hence on the TOT component.[31] But at the least, the evidence cited here suggests that a better understanding of exchange-rate fluctuations depends upon a better understanding of the real sector of the foreign and domestic economies.

III. Summary and Conclusions

Over the last several years, analysts have become aware that exchange rates resemble asset prices more than commodity prices. Like stock and bond prices, exchange rates are free to vary immediately as new information becomes available about inflation and other relevant developments. In contrast, commodity prices often must "wait" for existing contractual agreements to expire before they respond to new information. However, the fact that asset prices are determined in financial markets does not mean that they are unaffected by real factors originating in commodity markets. Indeed, the stock market provides an obvious illustration of a financial market in which real factors, such as technical innovation and demand, profoundly influence prices.

Our analysis suggests strongly that real factors critically affect exchange rates as well. As we have seen, fluctuations in nominal exchange rates about their trend largely represent variations in TOT. And, for the floating-rate period as a whole, variations in TOT, in most cases, have largely reflected real-factor influences. Thus, real factors have represented a major source — in some cases the single largest source — of exchange-rate fluctuations over the last eight years.

This conclusion, although tentative, suggests that models of exchange-rate determination which consider only financial-market conditions will inevitably miss an important aspect of actual exchange-rate behavior. Interpretations and policies based upon such models may then be seriously inadequate. For this reason,

further research into the determinants of long-run real components of exchange rates is needed for a better understanding of the causes and effects of nominal exchange-rate changes. One question, not addressed here, is what types of relative price changes — e.g., of traded goods, or of traded relative to non-traded goods — show up in variations in real exchange rates. Identification of various types of relative price changes causing TOT shifts could provide useful clues as to the ultimate sources of real factors affecting exchange rates.

Finally, the importance of real factors makes the task of interpreting actual exchange-rate movements very difficult indeed. This is particularly the case as neither real interest rates nor the long-run factors influencing relative commodity prices are directly observable. This suggests an important policy lesson. Increasingly in recent years, U.S. officials have used foreign-exchange market conditions as a major policy guide. Their actions have largely reflected a belief that these markets convey early signals of developing inflation pressures, while providing an indicator of investor confidence in U.S. policies; the experiences of November 1978 and October 1979, when a sharp fall in the dollar convinced U.S. officials of the need to do more to contain inflation, seemed to confirm this belief. But our analysis indicates that exchange-market signals normally are highly ambiguous, reflecting as they do a variety of factors. Since the appropriate response to one source of exchange-rate variation may be inappropriate in another case, policy-makers at the least should be very cautious in using foreign-exchange market developments as a regular guide to policy.

Table A-1
Parameter Estimates from Univariate Model

Variable	Canada	France	Germany	Japan	U.K.	Italy
$\Delta x(t-1)$	.29(.12)	.87(.15)	1.14(.16)	-1.34(.27)	.43(.02)	-.64(.05)
$\Delta x(t-2)$	-.64(.12)	-.29(.13)	-.58(.14)	.64(.27)	-.94(.03)	-.91(.05)
z(t-1)	.44(.15)	1.13(.16)	1.42(.19)	-1.43(.30)	.52(.10)	-.56(.13)
z(t-2)	-.64(.15)	-.66(.23)	-.92(.25)	-.78(.38)	-1.16(.12)	-.93(.14)
z(t-3)	-.16(.13)	.13(.18)	.30(.21)	-.22(.20)	.15(.17)	.11(.15)
z(t-4)	.11(.13)	-.15(.17)	-.08(.21)	-.42(.21)	.02(.17)	.11(.16)
z(t-5)	-.18(.12)	.04(.18)	.16(.19)	-.38(.22)	-.26(.12)	.05(.14)
z(t-6)	.06(.10)	.31(.12)	-.04(.12)	-.05(.15)	.12(.11)	.08(.12)
z(t-12)	.40(.09)	.05(.08)	.16(.06)	-.10(.06)	-.21(.06)	.02(.08)
Standard error	1.23	2.82	3.16	2.89	2.53	2.68
Q-orig.[2]	16.7	8.7	10.1	5.3	15.0	3.0

1. The $\Delta x(\ )$ are the autoregressive terms; the z are the moving average elements. Asymptotic standard-error estimates are in parentheses.

2. Q-orig. is the (Box-Pierce) test statistic for the first 12 autocorrelations of the original series (the 5 percent critical value is 21.0).

3. The coefficients of the moving average terms correspond to $-a_1$, $-a_2$, etc. as defined in expression (3) of the text ($a_0=1$).

Table A-2
Parameter Estimates of the Regression Model

Variable[2]	Canada	France	Germany	Japan	Italy	U.K.
$\Delta r(t)$	.11(.15)	-.15(.15)	.83(.12)	-.22(.20)	-.02(.06)	-.12(.12)
$\Delta r(t-1)$	.28(.16)	.23(.15)	-1.60(.15)	.23(.28)	.02(.06)	.14(.13)
$\Delta r(t-2)$	-.08(.17)	-.05(.16)	1.35(.24)	.42(.30)	.08(.07)	-.07(.14)
$\Delta r(t-3)$	.29(.17)	-.01(.16)	-.24(.20)	.57(.22)	.00(.07)	.06(.14)
$\Delta x(t-1)$	.21(.17)	.04(.22)	1.29(.08)	-.89(.08)	.45(.12)	.38(.07)
$\Delta x(t-2)$	-.44(.13)	-.65(.12)	-.77(.08)	-.70(.09)	-.55(.15)	-.85(.04)
$z(t-1)$	.34(.16)	.25(.16)	1.62(.08)	-1.09(.04)	.56(.14)	.38(.12)
$z(t-2)$	-.38(.15)	-.82(.16)	-1.30(.10)	-1.03(.07)	-.68(.16)	-1.03(.04)
$z(t-3)$	-.18(.12)	.15(.12)	.32(.13)	-.24(.11)	.14(.12)	.28(.11)
$z(t-4)$	.0(.11)	-.20(.11)	.04(.09)	-.04(.10)	.04(.12)	.00(.06)
$z(t-12)$	.46(.10)	.05(.09)	.01(.04)	-.26(.07)	.26(.10)	-.07(.04)
Regression standard error	1.21	2.77	13.3	2.91	2.68	2.52

1. Period is July 1973-August 1980 except for Japan, where the starting point is October 1974. $\Delta r(\,)$ is change in the estimated 3-month foreign-U.S. real-interest differential; $z(\,)$ is moving-average term; $\Delta x(\,)$ is change in the log of the real exchange rate.

2. The moving-average coefficients correspond to $-a_1$, $-a_2$, etc. as defined in relation (6) in the text ($a_0 = 1$). Figures in ( ) are asymptotic standard error estimates.

Table A-3
Estimated Long-Run Impact of TOT Residulas[1]

	Impact on U.S./Foreign CPI		Impact on Nominal Exchange Rate	
	Long-run[2]	R^2 (unadjusted)	Long-run[2]	R^2 (unadjusted)
Canada	.05	.35	.84	.74
France	.01	.07	.92	.92
Germany	.04	.17	.67	.76
Japan	.14	.18	1.07	.72
U.K.	.12	.20	.91	.88
Italy	-.06	.20	.91	.92

[1]The regressions from which these were taken were of the form,

$$\Delta v(t) = c + \sum_{i=0}^{3} f_i z(t-i) + g_1 \Delta v(t-1) + g_2 \Delta v(t-2)$$

where $v(\,)$ refers either to the PPP component (first column above) or to the nominal exchange rate, e (second column). The z are the estimated residuals from the regression relation (6). Details of the estimates will be supplied upon request.

[2]Calculated as $\sum_{i=0}^{3} f_i \,/\, (1 - g_1 - g_2)$

FOOTNOTES

1. This is simply the "international" analogue of the well-known proposition that stabilizing interest rates in the face of "real" shocks is destabilizing for nominal income and the price level. See also Darby (1981).

2. For a more formal illustration of how financial policies can have real implications, see Sweeney (1978). A practical reason for excluding temporary influences on relative prices is that is easier to separate the transient and persistent components of the TOT than to identify their sources. In addition, persistent changes in relative prices generally have different implications for policy than do transient changes.

3. This statement is *not* inconsistent with the "modern" view that exchange rates vary to maintain continuous *short-run* equilibrium in asset markets. Conditions in commodity markets affect demands for and supplies of financial assets, and so asset markets cannot be in long-run equilibrium until goods markets are. In this sense, the "asset" view of exchange-rate behavior does not alter traditional views about their *long-run* determinants.

4. In international-trade literature, the TOT has a narrower meaning, referring to the rate at which one country's traded goods exchange for another's. Here x refers to the amount an individual could obtain by "selling" a "typical" bundle of home goods for home

currency, and then trading that currency for foreign currency to purchase a "typical" bundle of foreign goods — where these bundles may include non-traded goods. We use the term "terms-of-trade" (admittedly a bit loosely) because it is intuitively more informative than the more common name given to x, the "real" exchange rate.

5. More precisely, let $p = \Sigma w_i p_i$ and $p^f = \Sigma w_i^f p_i^f (\Sigma w_i = \Sigma w_i^f = 1)$ where p_i (p_i^f) are the logarithms of prices of the individual commodities, "i." Then we can write,

$$x = \Sigma w_i^f (p_i^f + e - p_i) + \Sigma (w_i^f - w_i)(p_i - p)$$

That is, x is a weighted average of the relative prices of foreign versus domestic commodities expressed in a common currency *plus* an average of the relative prices of domestic goods; the latter term disappears if the weights in the two price indices are the same. Generally, then, virtually any change in relative commodity prices can cause the TOT to vary, even if the relative prices of foreign versus domestic commodities are fixed.

6. Of course, this heuristic argument is essentially true by definition. The theory underlying the monetary approach involves the demand for money, as is explained in the text.

7. In addition, the availability of money substitutes and the level of interest rates — which affect individuals' willingness to hold money — influence the rate at which money circulates. Since we are concerned with long-run effects, we ignore factors leading to business cycle fluctuations in money demand. The discussion in the text largely ignores long-run impacts of interest rates on the demand for money, partly because changes in long-run rates mainly reflect inflation, and partly because studies suggest that the impact (elasticity) is fairly small.

8. This argument does not strictly apply to relative price shifts that alter real income or wealth for the country as a whole. For example, a rise in oil prices represents a real income loss for the U.S. and could, for this reason, lower real money demand and raise the price level, even with a fixed money stock. In this case, relative price changes have an impact on exchange rates *in addition to* any impact on price levels.

9. The "ceteris paribus" conditions assumed for this argument cannot be overemphasized. In particular, the arguments do not rule out *correlations* of changes in the TOT and PPP components that could arise if the authorities varied domestic money in *response* to exchange-rate developments. Also, where monetary policies affect long-run relative prices, we might expect some correlation of price levels and relative prices. Indeed, it is largely because of these potential complications that we have attempted to estimate the relations between PPP components and shifts in the TOT. These results, which are reported in the Appendix, suggest that TOT changes have little if any long-run impact on PPP levels — that it is reasonable to measure the impact of real factors on exchange rates from TOT variations alone.

10. Suppose, instead, that the TOT & PPP components were defined using the price of a single traded good — say, wheat — the dollar price of which is the same in all countries (that is, the "law of one price" applied). Since the TOT component would be fixed in this case, real influences on the exchange rate would be reflected in movements in the dollar versus the foreign currency price of wheat. As we will see, this is an inconvenient way to measure real influences.

11. Dornbusch (1976) provides an excellent description of how variations in money growth can influence real interest rates and cause the TOT to deviate from its long-run value.

12. See Keran and Pigott (1980).

13. This follows from two assumptions: that the long-run nominal interest differential (id) is equal to the (percentage) difference between the spot exchange rate, e, and its long-term foward value, f; and that the forward value is equal to the value of the exchange rate currently anticipated to prevail in the long-run, e*. The first of these conditions holds very closely in the Eurocurrency markets; while there is some evidence that the second is not strictly correct, it may be a reasonable approximation. Let y refer to the current PPP value and y* to the value expected in the long-run. Then, by assumption,

$$id(t) = e(t) - e^*(t)$$

But the real interest differential ir(t), is defined as,

$$ir(t) \equiv id(t) - (y^*(t) - y(t))$$

Since the latter term is the amount of inflation anticiplated between now and the long-run it follows immediately that,

$$ir(t) = (e(t) + y(t)) - (e^*(t) + y^*(t)$$

which is simply (minus) the expected change in the TOT component, $x(t) - x^*(t)$.

14. See Dornbusch (1976) and Bransen, Haltunnen and Mason (1977).

15. Important exceptions are the work of Stevens, *et. al.* (1979), and Hooper and Morton (1980). However, even these approaches generally use proxies (e.g., the current account) for the TOT, or ignore variations in the prices of non-traded to traded goods.

16. This proposition is often mistakenly referred to as the 'law of one price'; the law in fact asserts only that the dollar prices of *identical* goods will be the same after transport costs are taken into account. But it should be apparent that either proposition is nearly irrelevant to the theoretical impact of real factors on exchange rates.

17. In particular, some evidence suggests that the revision in Federal Reserve operating procedures initiated in October 1979 has been associated (at the least) with greater variability in real interest rates than before. If so, the relative importance of real factors versus real interest rates as a source of exchange-rate fluctuations may have changed. See Keran & Pigott (1980) for a further discussion of this possibility, as well as Truman, et. al. (1981).

18. The possibility that the relative importance of real factors has changed since October 1979 is discussed in another paper; we focus here on the period as a whole.

19. GNP deflators might be preferable to CPIs, but they are available on a quarterly basis only. Darby (1980) has carried out time-series tests similar to the univariate estimates presented here using WPIs, CPIs, and deflators, with fairly compatible implications that are quite similar to those discussed in the text.

20. Again, the main reason for empirically examining the relation between the TOT and PPP is to evaluate the empirical importance of correlations induced by money "reactions" to exchange rates, or long-run relative price variations resulting from monetary policies. The results imply that shifts in the long-run TOT are associated with little, if any, change in the long-run PPP components. This suggests that the impact of real factors is, as hypothesized, mainly confined to the long-run TOT.

21. For a review of evidence on this issue, see Pigott and Sweeney (1980).

22. As illustrated by any recent review of exchange-rate models; see Dornbusch (1980).

23. More precisely, (3) is an autoregressive representation. Strictly speaking, the latter exists only if there are some variations in the long-run TOT, that is, if the level of the actual TOT is non-stationary in the sense that it has a time-varying (unconditional) mean. The evidence from Darby (1981) and Pigott and Sweeney (1980) so strongly support this argument that we have not tested for stationarity here. The models (3) and (6) are estimated using standard maximum-likelihood techniques with the University of Wisconsin's multi-variate ARMA software package.

24. This is because the "dynamic" responses of the TOT to transient factors generally will not be the same as the response to real factors. Thus, a shift in the relative importance of transient and real influences is likely to change the serial correlation pattern of changes in x, and hence the univariate model (3).

25. The argument in the text shows that we can write,

$$\Delta x(t) = \Delta r(t) + \Delta x^*(t)$$

here $\Delta x^*(t)$ is the change in the long-run real exchange rate *as it is perceived* by investors, and r(t) is the long-run real interest differential. Rewriting,

$$\Delta x(t) = \Delta \tilde{r}(t) + \Delta x^*(t) + (\Delta r(t) - \Delta \tilde{r}(t))$$

where $\Delta \tilde{r}(t)$ is the *proxy* for the change in the real interest differential actually used in the estimation, and the last term is the error in measuring it. This measurement error will be correlated with $\Delta \tilde{r}(t)$ and so constitutes one potential source of bias in the estimates. A second bias would arise if the perceived change in the long-run real exchange rate were correlated with the real interest proxy (or lagged changes in the actual real exchange rate).

26. Thus we use an *estimate* of the short-term differential as a proxy for the long-term real interest differential. This could be justified if expectations about future short-term rates were based on current and past rates, because the long-term real interest rate is (approximately) an average of current and anticipated future short rates. The relation between the long-rate and current and past short-rates is then implicit in the lag-structure of relation (6).

27. A *permanent* change in the real interest differential would correspond to a shift in the *slope* of the long-run path for the TOT, that is, to a shift in its trend. We ignore such shifts here, and so assume that any observed change in the real interest differential will be offset by future changes in the opposite direction, its impact on the TOT "washing out" in the long-run. In effect, we attempt to measure variations in the *level* of the long-run TOT path.

28. To obtain the expected inflation proxy, we regressed CPI inflation over a 3-month period on its values over the past 3-21 months (i.e. lagged 3-month inflation over the past 3-18 months) for 1973-80. Details of these estimates will be supplied upon request. We ignore the possibility that there may be "feedback" from TOT variations to real interest rates, that is, that the latter are endogenous with respect to the TOT. The results do not appear to be greatly affected if only lagged interest rates are included, however.

29. In the case of Japan as well as Italy, the autocorrelations of the changes in TOT, as well as the results, suggest fairly strongly that TOT changes are essentially random. The same result for Japan is reported in Darby's (1980) univariate estimates for the 1971-78 period.

30. This is also true to some extent of the univariate models for the other countries. This may be due in part to the fact that relatively large numbers of parameters are estimated. We have estimated a fairly general model — at the obvious risk of "over-fitting" — in order to avoid "losing" small effects that might not show up as statistically significant. When we follow the more usual procedure of allowing lags only where the corresponding autocorrelations are relatively significant, half or more of TOT changes appear to persist in the long-run in virtually *all* cases. On the whole, the general conclusion regarding the importance of real factors is reasonably robust except for Germany and France.

31. However, if financial factors causing inflation were substantially responsible for *long-run* TOT variations, we would expect to find a strong association between the PPP and long-run TOT components. The results given in Table A-III of the appendix suggest this is *not* the case, providing indirect evidence that financial factors are not *primarily* responsible for relative price changes.

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Effectiveness of Exchange-Rate Changes on the Trade Account: The Japanese Case

Kenneth Bernauer*

Many economists have criticized adherents of flexible exchange rates for overestimating the effectiveness of exchange-rate changes on redressing external imbalances. The critics argue that, since the advent of generalized floating in May 1973, large and persistent trade-account imbalances have occurred despite substantial swings in exchange rates. The issue, however, is not a new one among international economists.

According to traditional theory, an exchange-rate depreciation will improve the trade account of a devaluing country by increasing its price competitiveness in world markets. For example, a dollar depreciation can correct a trade deficit because it lowers the price of U.S. exports in terms of foreign currencies and raises the dollar price of imports in the U.S. market. Because U.S. goods become relatively cheaper to foreigners and imported goods more expensive to Americans, a dollar depreciation will improve the price competitiveness of U.S. export industries and likewise import-competing industries. The improved price competitiveness will boost U.S. export sales while reducing foreign sales in the U.S., leading to an improvement in the trade account.

In the past, many economists and policy makers doubted that these exchange-rate effects would be great enough to eliminate payment shortfalls. In their view, the volume effects of a dollar depreciation might not be large enough to produce an improvement in the U.S. trade balance. For analyzing this question, economists estimate price elasticities, which measure the degree of responsiveness of the quantity demanded to changes in its price. Numerically, a price elasticity of demand for exports (imports) of -2.0 indicates that a 1-percent rise in export (import) prices will lead to a 2-percent drop in the quantity demanded of exports (imports). A devaluation will improve the trade account in both domestic and foreign currency if the sum of the demand elasticities for exports and imports after reversing signs exceeds unity (the Marshall-Lerner condition). This assumes that an exchange-rate depreciation will lead to a proportional decline in the foreign-currency price of exports and a proportional rise in the home price of imports — and that the trade account will initially be in balance.

Many studies during the 1940s argued that the measured price elasticities were substantially less than one, so that a devaluing country would experience a worsening of its trade account. Such elasticity pessimism consequently led policymakers to consider policies other than relative-price changes to correct trade imbalances. However, the state of the art for empirical research improved considerably in the 1950s and 1960s. This, in turn, led to higher estimated price elasticities of demand, and contributed to renewed optimism about the success of a devaluation. In this view, the volume effects (higher exports, lower imports) would offset the adverse movement in the terms of trade and thus would lead to an improvement in the trade account.

The focus of the debate has subsequently shifted. While many critics do not dispute that a currency depreciation will eventually improve the trade account, they argue that the long time lags between changes in prices and

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changes in quantities diminish its usefulness as an instrument of adjustment. That is, it takes time for buyers and sellers to recognize changes in competitive situations and act accordingly. In the case of a dollar devaluation, Americans in the meantime will be spending more dollars on imported goods and foreigners will be spending less of their own currency on U.S. goods. An exchange-rate change thus is likely to lead to an initial deterioration (and a subsequent improvement), in the trade account of the country with a depreciating currency, and to an improvement in the trade balance of the country with an appreciating currency. The initial deterioration and subsequent improvement in the depreciating country's trade account resemble the letter J when the trade account is plotted on the vertical axis against time on the horizontal axis.

Some critics also have argued that the pricing behavior of exporters has changed with the adoption of flexible exchange rates, with exporters changing their profit margins rather than their prices in order to maintain sales. Hence, a depreciation simply tends to increase the home-currency price of exports and to lower the foreign-currency price of imports, leaving the devaluing country's competitive position unchanged.

The contentious debate about the ability of a freely floating exchange rate to restore price competitiveness has surfaced most recently in the controversy over the Japanese-U.S. automobile trade. That particular conflict has been resolved temporarily through the imposition of "voluntary" quotas on Japanese cars. But Japan has been running a persistently high surplus not only with the U.S. but also with the European community, and this has brought forth protectionist pressures against Japanese products.

This paper is designed to investigate the effectiveness of exchange-rate changes on the Japanese trade account. The view that exchange-rate movements will be completely passed forward into export and import prices can no longer be taken for granted. Thus the first stage of our analysis considers the impact of an exchange-rate change on the prices of exports and imports, and the second stage considers the effects of these price changes on the quantities demanded of exports and imports.[1] This two-stage procedure allows us to trace out the J-curve measuring the effects of a yen depreciation on the Japanese trade account.

Sections I and II provide the theoretical and empirical framework for measuring the effects of exchange-rate changes on export and import prices. Section III discusses the responsiveness of trade volumes to changes in relative prices, and Section IV describes the derivation of the J-curve. The paper concludes with a discussion of the policy implications.

I. Determination of Export and Import Prices

In the traditional view of trade adjustment, an exchange-rate depreciation will lead to a proportional decline in the foreign-currency price of exports and a proportional rise in the domestic-currency price of imports. The effectiveness of a devaluation thus will depend upon whether or not the absolute value of the sum of the price elasticities of demand is greater than one.

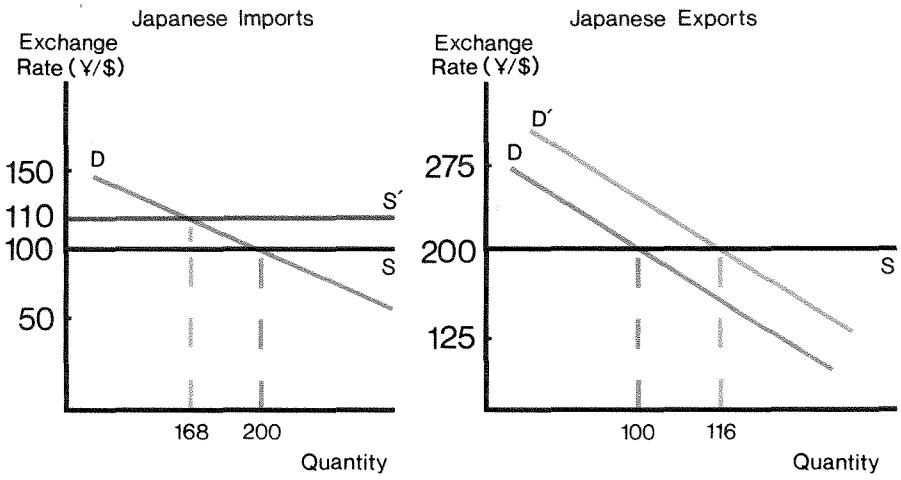
To illustrate, consider the impact of a yen depreciation on the Japanese trade account (Chart 1). Suppose a yen depreciation of 10 percent vis-a-vis the dollar leads to a proportional rise in the yen price of U.S. goods in the Japanese market. (In this example, the average price of an American good rises from 100 yen to 110 yen.) The rise in price makes American goods less attractive to Japanese buyers. Assume a demand elasticity of -1.6. The 10-percent price increase prompts a 16-percent fall in the quantity demanded of U.S. goods by Japanese importers. This is illustrated diagrammatically by a shift in the supply schedule from ss to s's'. The quantity demanded of U.S. goods falls from 200 million to 168 million units. The lower volume of American goods demanded more than offsets the price increase, so that the value of

Japanese imports in yen falls in response to a yen depreciation. In this example, the yen value of Japanese imports (price x quantity) declines from 20 billion yen to 18.48 billion yen. With the dollar price unchanged, the value of Japanese imports in dollars falls by the percentage change in the quantity demanded (16 percent).

Conversely, on the export side, a 10-percent yen depreciation produces a fall in the dollar price of Japanese exports, improving the price competitiveness of Japanese goods in the U.S. market. The greater demand stemming from the price decline is illustrated by a rightward shift in the demand schedule from DD to D'D'. Again, assume a demand elasticity of -1.6. The fall in the dollar price of Japanese exports boosts the quantity demanded by Americans of Japanese goods by 16 percent. With the yen price unchanged, the yen value of Japanese exports rises in direct proportion to the percentage increase in the quantity demanded. In dollars, the higher volume of Japanese exports more than compensates for the price decline, so that the dollar value of Japanese exports rises following a yen depreciation.

Chart 1

Impact of 10-Percent Yen Depreciation on the Japanese Trade Account



Impact of a 10-Percent Yen Depreciation on Japanese Trade Account (quantities in millions of currency units)

	Pre-10% yen depreciation*		Post-10% yen depreciation†	
	Yen	Dollars	Yen	Dollars
Trade balance (in millions)	0	0	4720	21.5
Exports (in millions)	20,000	100	23,200	105.5
Imports (in millions)	20,000	100	18,480	84.0
Export price	200	1.0	200	0.91
Import Price	100	0.5	110	0.50
Export quantity (in millions)	100	100	116	168
Import quantity (in millions)	200	200	168	168
Exchange rate	200	0.005	220	0.00455

*$1 = ¥200, or ¥1 = 0.50 cents
† $1 = ¥220, or ¥1 = 0.455 cents

On balance, the value of Japanese exports rises in both yen and dollars following a yen depreciation, while import value falls in both currencies. This is, however, predicated on the assumptions that the demand elasticities are greater than unity, and that import and export prices both adjust to the full extent of exchange depreciation.

In the short run, export and import quantities tend to be unresponsive to price changes. That is, buyers and sellers need time to recognize changes in competitive positions and act accordingly. In fact, an exchange-rate change initially is likely to lead to a deterioration in the trade account of the country with a depreciating currency.

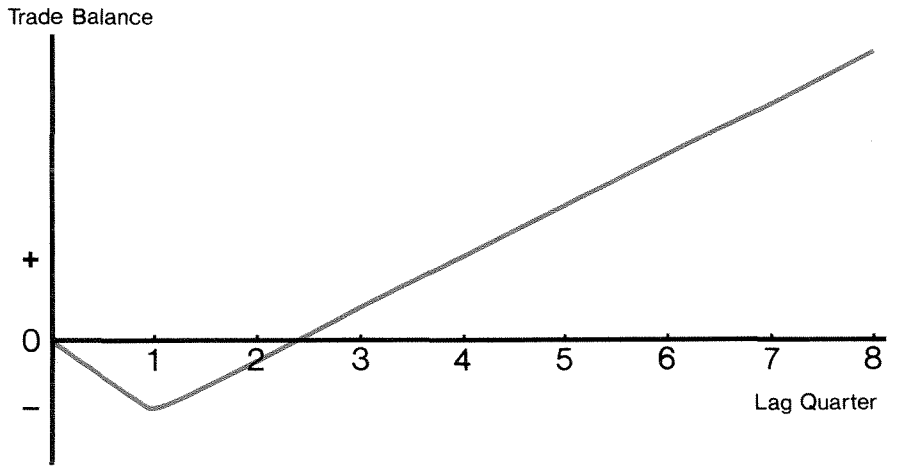
We may assume, as above, that the long-run price elasticities of demand are -1.6 for both exports and imports — and that their responses are uniform over time, so that export and import volume each decline 0.2 percent per quarter for eight quarters following a yen depreciation. In this case, the Marshall-Lerner condition is met only in the third quarter following the exchange-rate change. This movement in the trade account is depicted graphically in Chart 2, illustrating the so-called J-curve phenomenon.

Separately, various observers have argued that exchange-rate changes are totally ineffective in eliminating trade imbalances, because exporters will absorb those changes into higher or lower profit margins so as to maintain sales. For example, a yen depreciation (appreciation) will prompt Japanese exporters to raise (lower) their yen prices by the same percentage amount. This implies that Japanese exporters set their prices on the basis of foreign-competitor prices measured in yen, and not on the basis of domestic cost considerations.

Export prices in yen would rise by the full amount of the depreciation only when supply is fixed or the demand schedule is perfectly horizontal. The former condition may be relevant for a country which is operating at full capacity and has a large export sector relative to total output. In the one case, the full utilization of resources would not permit export firms to increase supply. In the second case, their ability to increase supply would depend upon bidding away resources from the nontradeable goods sector, and this capacity would be limited if the export sector is large relative

Chart 2

J-Curve Effects of Yen Depreciation



to the total economy.

Japanese firms meanwhile would face a horizontal demand schedule only if their product cannot be differentiated from foreign products and their supply represents a small part of total world production. In the case of undifferentiated products — such as silver, tin and copper, but not motor vehicles — buyers are indifferent to the country from which they purchase. Thus, the law of one price holds and no one exporter can sell at a different price. At the same time, if the quantity supplied by the firm or country is small relative to total world supply, then its own output will have little effect on price. Under these two conditions, the export price is given exogenously and the quantity of exports is determined in the long-run via a supply curve.

In the Japanese case, its exports represent a small proportion of total domestic production but loom large relative to European and American exports of manufactured goods. Consequently, the supply of Japanese exports should be highly sensitive to prices and should strongly influence international prices in turn. Moreover, Japanese producers should have a certain amount of control over price, because their exports are composed largely of finished goods with a high degree of product differentiation. With this information, one would expect Japanese export prices to be jointly determined by cost conditions and foreign competitor prices.

In contrast, Japanese imports are heavily weighted with basic commodities (primary raw materials) which are noted for a high degree of homogeneity. As a consequence, Japan should largely be a price taker on the import side; that is, a yen depreciation should lead to a proportional rise in Japanese import prices in yen. This proposition will be tested below.

II. Specification of Export and Import Price Equations

The rise in export prices in response to an exchange-rate change may be tested empirically. Here we specify a chain of causation running from exchange rates to prices to export quantities.[2] For clarity of exposition, we assume that export quantities do not adjust to prices immediately,[3] since the literature indicates that long lags are involved.

In measuring the pass-through effect, we consider four export commodity groupings: machinery and equipment, metal products, chemicals, and textiles. Recent empirical research (e.g., Spitaller, 1980) has attributed no significance to domestic-cost variables in the setting of export prices. The result may simply reflect aggregation bias, and not the determination of domestic prices by international prices. Separate equations thus may be estimated for each price series, which in turn permits us to determine the responsiveness (and time lag) of export prices to exchange-rate changes.

Within individual product categories, the extent of the pass-through depends upon the nature of the product and the cost characteristics of the industry. As a proxy for domestic costs, researchers have generally relied upon unit labor costs. However, this measure fails to account for the dramatic recent rise in raw material prices, which suggests the need to utilize a more comprehensive measure, such as the wholesale-price index. Another consideration is the tendency for a higher level of capacity utilization to limit the supply response of exporters, causing them to allocate output by raising prices instead.[4]

We hypothesize, then, that Japanese exporters set prices on the basis of 1) the yen exchange rate, 2) the prices of foreign competitor goods expressed in local currency, 3) the level of capacity utilization, and 4) labor and other input costs (proxied by wholesale prices). The general form of the specification can be written as:

$$XP = f(WP, EX, CP, CU)$$

where XP = export prices,
WP = wholesale prices,
CP = foreign competitive prices,
CU = capacity utilization,
EX = exchange rate.

In contrast, Japanese imports (as noted) are heavily weighted with basic commodities with a high degree of homogeneity. The "law of one price" thus should hold, so that a depreciation of the dollar leads to a proportional fall in imported commodity prices in yen terms. For example, the 36-percent depreciation of the dollar against the yen between the first quarter of 1976 and the fourth quarter of 1978 paralleled a 32-percent decline in the yen price of oil over that period. The prices of Japanese imports in yen terms will be related to the yen/$ exchange rate and to the world commodity-price index denominated in dollars[5]. A coefficient value of one attached to the yen/$ exchange rate would be consistent with complete pass-through. This proposition will be tested with respect to food, fuels, raw materials, and metals — categories accounting for 75 percent of all imports.

The next step after estimating price equations is to determine the effects of changes in the terms of trade (export prices over import prices) on the quantities of exports and imports. That is, having established the extent and duration of the price response to an exchange-rate change, we must next relate export and import quantities to their respective prices. By substituting the price equations into the respective volume equations, the estimated time path between an exchange-rate depreciation and its impact on export and import quantities can thereby be derived.

III. Determination of Export and Import Quantities

The theory of consumer demand provides a basis for analyzing the demand for exports and imports. As for imports, the quantity of a good that a consumer wants to purchase depends upon his income and the price of competing substitutes. A higher level of income increases the consumer's ability to purchase more goods. The allocation of his income among foreign and domestic goods depends upon their prices and their degree of substitutability. At the national level, a rise in real income translates into increased demand for domestic and foreign goods. The allocation of income among domestic and foreign goods depends upon the prices of foreign goods relative to import-competing substitutes. The demand for imports can therefore be written as a function of domestic real income[6] and the prices of imported goods relative to domestic goods. The general model is:

$$MV = f(Y, PM/WP)$$

where MV = import volume,
Y = Japanese industrial production
PM = import prices,
WP = wholesale prices.

The same reasoning applies to exports. A higher level of income abroad will increase the demand for a country's exports. An increase in the price of the export good relative to foreign competitors' goods will diminish the demand for it. Moreover, an increase in demand for a good may not bring forth a supply response due to production bottlenecks. An exporter faced with supply constraints thus may decide to allocate his output by slowing delivery times instead of raising prices. The waiting time imposes a cost on the buyer which is not incorporated into the price of the product. In the general form, we can write the export-volume equation[7] as follows:

$$XV = f(Y, PX/WPX, CU)$$

where XV = export volume,
Y = real GNP abroad,
PX = price of exports,
WPX = foreign competitor prices (in yen),
CU = capacity utilization in Japan.

IV. Empirical Results

Our results (Table 1) indicate that only about 38 percent of an exchange-rate change is passed forward into export prices expressed in foreign currency.[8] That is, Japanese exporters respond to a 10-percent depreciation (appreciation) of the yen by raising (lowering) their yen prices by about 6 percent. They respond slightly more to changes in foreign competitor prices expressed in foreign currency, matching on average about 66 percent of competitors' price increases.

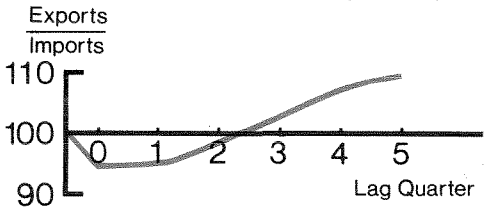
Contrary to some earlier empirical evidence, domestic cost variables have played a role in setting Japanese export prices, for three of the four commodity categories. These variables proved insignificant only in the case of machinery and equipment, which suggests that further disaggregation was necessary. Overall, export prices of Japanese manufacturers were jointly determined by domestic cost considerations and foreign competitor prices.

Estimated price equations for different import categories tend to confirm that Japan is a price taker on the import side (see Table 2). That is, an exchange-rate appreciation (depreciation) will lead to a proportional fall (rise) in the domestic currency price of Japanese imports. This result, combined with the estimated pass-through on the export side, suggests that a 10-percent yen depreciation will lead to about a 3.8-percentage-point deterioration in the terms of trade. With no change in export and import quantities, this terms-of-trade effect will lead to an initial deterioration in the trade account. The duration of the worsening trade balance — the duration of the first segment of the J-curve — will depend upon the time lag between movements in quantities and prices, and upon the size of the export and import elasticities.

The long-run price elasticities of demand were estimated at -0.35 for imports and at -2.5 for exports (Table 3). The price responsiveness of Japanese imports extended over a four-quarter period, whereas on the export side, the price effect was fully absorbed within five quarters.

Chart 3

J-Curve Effects with 10-Percent Yen Depreciation (domestic currency units)



On the basis of both volume and price equations, a depreciation of the yen will worsen the trade balance during the first half year (see Chart 3). Between the second and third quarters, the trade balance will show an improvement in both domestic and foreign currency units, and the maximum improvement will occur during the fifth quarter following the depreciation. At the maximum point, the value of Japanese exports and imports in yen[9] would have risen by 15.9 percent and 6.5 percent, respectively. The time lag between an exchange-rate change and a trade-account improvement would be considerably less than the four to five years generally suggested in the literature.

Simulation, 1980-1981

Using the parameter estimates obtained from the model, we performed several experiments to measure the impact of exchange-rate movements on Japan's trade account in 1980 and 1981. In this connection, we cannot ignore the effects of oil-price hikes on Japan's recent trade performance. From the fourth quarter of 1978 through the fourth quarter of 1979, Japan's trade balance shifted from a surplus of ¥842 billion to a deficit of ¥916 billion. The marked deterioration largely reflected the concurrent run-up in oil prices from $12.80 to $24.28 a barrel, which was then followed by a further rise to $33.81 a barrel in the fourth quarter of 1980. Moreover, economic growth during 1980 increased at a 3.6-percent rate in

Table 1
Effects of Movements in the Exchange Rate, Foreign Competitive Prices, and Wholesale Prices on Export Unit Values of Japanese Manufactured Goods

Commodity Category	Percentage Change in Japanese Export Prices from One-Percent Change in: Value of Yen (depreciation)	Foreign Competive Prices (in foreign currency)	Foreign Competive Prices (in domestic currency)[3,4]	Domestic Wholesale Prices
Machinery and equipment[1]	0.46***	0.50***	0.48***	0.00
Metal Products	1.11**	1.64***	1.32***	1.02*
Chemicals	0.58**	0.58**	0.58**	1.57***
Textiles	1.22***	0.53	0.89***	1.06***
All Manufactured Goods[5]	(0.62)[2]	(0.72)[2]	(0.66)[2]	(0.34)[2]

*Signifies coefficient is significantly different from zero at an alpha level of 0.10;** for alpha level of 0.05;*** for alpha level of 0.01.

1. Tests of significance in the machinery-and-equipment equation should be viewed warily, because of first-order autocorrelation in the residuals.

2. The elasticity of export prices with respect to the exchange rate, foreign competitive prices and wholesale prices was calculated as a weighted average of the elasticities for each commodity category, with weights proportional to the share of each commodity in total manufacturing exports. The weights are 0.698 for machinery and equipment, 0.184 for metal products, 0.058 for chemicals and 0.054 for textiles. These calculated elasticities are shown without parentheses.

3. The elasticity of export prices with respect to foreign competitive prices, measured in domestic currency units, was calculated as a weighted average of the elasticities of export prices with respect to the exchange rate and foreign competitive prices, denominated in foreign currency units. The weights were proportional to the standard errors of the coefficients.

4. The tests for significance refer to F-tests for the joint influence of the exchange rate and foreign competitive prices. The null and alternative hypotheses were:

H_0: $B_1 = B_2 = 0$

H_A: $B_1 = B_2 = 0$

where & = 0.05. this was the case for machinery and equipment, metal products and textiles.

5. In 1980, manufacturing exports constituted 90 percent of all exports.

Table 2
Effects of Movements in the Dollar/Yen Rate on the Prices of Imported Commodities[3]

Import Prices in Yen for	Exchange Rate: Constant	EX$[1]	Export Prices	R^2	D.W.
Food	-0.24	0.736*	0.294	0.56	0.47
Fuels	-3.81**	0.979*	0.849*	0.96	1.21
Raw Materials	-5.00**	1.045*	0.960*	0.83	0.74
Metals[2]	-5.00	0.919*	1.168*	0.69	1.28

*Denotes significance to 0.05 level. However, because of first-order autocorrelations in the residuals, tests of significance should be viewed warily due to biased standard errors of coefficients.

1. The coefficient attached to the exchange rate for each commodity category was insignificantly different from one.
2. The metals equation was corrected for first-order correlation.
3. The four commodity categories constituted over 75 percent of all imports.

Table 3
Distributed Lag of Relative Prices on Japanese Export and Import Volumes

Dependent Variable	Current Quarter	Volumes: t-1	t-2	t-3	t-4	t-5	Sum
XV	0.79	-0.10	-0.68	-0.97	-0.95	-0.62	-2.53
MV	0.03	-0.07	-0.11	-0.12	-0.08	—	-0.35

Japan while stagnating in the U.S. and major European countries. The growth differential in Japan's favor should have stimulated faster growth in Japanese imports relative to exports. When combined with the oil-price rise, a substantial widening of the trade deficit thus should have been realized in 1980. On the contrary, the Japanese trade account showed a ¥216-billion surplus in the fourth quarter of 1980, a turnaround of ¥1132 billion over the year. The explanation for this paradoxical turnaround may be found in a review of our regression equations.

We noted earlier that a yen depreciation will tend to raise the yen prices of Japanese exports and imports, while a yen appreciation will have the opposite effect. The yen's trade-weighted exchange rate (the effective exchange rate) depreciated by 29 percent during 1979, but then appreciated by 14 percent during 1980 (fourth quarter to fourth quarter). Largely reflecting these movements, Japanese exporters raised their yen prices by 22 percent during 1979 but by little more than zero in 1980. With an estimated offset coefficient of 0.62, exchange-rate movements contributed 18 percentage points to the 1979 price rise (0.62 times effective yen depreciation of 29 percent) but reduced the 1980 price rise by almost 9 percentage points (0.62 times effective yen appreciation of 14 percent). The marked deceleration in export prices during 1980 thus was consistent with the evidence presented in the text.

On the import side, the 1979 yen depreciation should have inflated the yen prices of imports while the subsequent appreciation of 1980 should have had the opposite effect. Reflecting the oil-price hikes, Japanese import prices in yen actually rose by 70 percent during 1979 and by 8½ percent during 1980. According to the regression model, exchange-rate movements contributed almost 26 percentage points to import prices in 1979 while lowering import prices by almost 12 percentage points in 1980. As before, recent data thus bear out the empirical evidence in the text.

Overall, movements in the terms of trade attributable to exchange-rate changes made a relatively modest contribution to the trade account. The reverse J-curve effects stemming from the 1980 yen appreciation contributed about ¥350 billion to that year's trade surplus. The improvement in trade volumes was more important to this turnaround. Movements in exchange rates, particularly the 33.6-percent effective yen depreciation between the third quarter of 1978 and the first quarter of 1980, can more than account for the 16.3-percent growth in export volume and 6.8-percent drop in import volume. On balance, the outside sample estimates indicate that movements in effective exchange rates made a positive contribution to the Japanese trade account of ¥3100 billion between 1979IV and 1980IV — more than offsetting the oil-price rise and the activity effect (higher economic growth in Japan than abroad).

In 1981, the effective exchange rate of the yen remained fairly stable. However, much to the consternation of Japan's trading partners, the trade surplus continued to expand — to a ¥400-billion quarterly surplus in the first three quarters of 1981, compared with a ¥900 billion deficit in the corresponding 1980 period. For one reason, the terms of trade have improved due to a fall in import prices, reflecting weakness in world commodity prices. On the other hand, export volume has increased while import volume has fallen. In the first nine months of 1981, export volume rose 12.8 percent above the corresponding 1980 figure. While less robust than the 1980 gains, these export increases are nonetheless substantial, reflecting as they do the relative price changes of the preceding year. From the model's outside-sample estimates, about two-thirds of the 1981 export-volume increase can be attributed to movements in the yen's effective exchange rate, which in 1980 produced a 6.4-percent improvement in Japan's price competitiveness as measured by relative export prices of manufactures. In fact, the 29-percent rise in Japanese export volume since 1979 can, according to the model's results, be attributed to exchange-rate movements. (The estimated contribution was 31 percent.) In particular, movements in the yen's exchange rate more

than accounted for the 13.5-percent fall between 1978 and 1980 in the relative prices of Japanese manufactured-goods exports. Moreover, foreign activity contributed little if any impetus to export volume growth, reflecting the virtual stagnation in U.S. and European economic activity in the 1980-81 period.

On the import side, exchange-rate movements would have predicted a 1.0 percent fall in import volume over the last two years. This compares with an 8.8-percent actual decline in the first three quarters of 1981 compared to the corresponding period of 1979. Energy conservation, stemming from the oil-price rise, apparently made the major contribution to falling import quantities over this period.

V. Policy Implications

The size of the Japanese trade surplus with the U.S. and the European Economic Community (E.E.C.) has seriously impaired trade relations among the three major trading partners. The E.E.C. trade deficit with Japan is estimated at roughly $10 billion for 1981, and the U.S. bilateral trade deficit is expected to approach $15 billion. E.E.C. policymakers thus are calling on Japan to take appropriate measures to redress the imbalance — just as U.S. policymakers did when pressing for Japanese curbs on auto exports. Without voluntary restraint, the Brussels Commission has said that it would consider curbing Japanese access to E.E.C. markets for motor vehicles, TV sets and machine tools over the next five years.

The Japanese Government has announced certain short-term measures to reduce the trade deficit, such as increasing Government stockpiles of crude oil and possibly increasing imports of nickel, cobalt, and other metals. But these moves are unlikely to placate Americans and Europeans, since their deficits vis-a-vis Japan are mainly concentrated in manufactured-goods trade.

The empirical estimates in the text suggest that Japan's expanding surplus vis-a-vis the U.S. and Europe could have been expected in light of recent exchange-rate movements. The yen depreciated by 33.6 percent against the U.S. dollar and major European currencies between 1978III and 1980I, apparently prompted by the concurrent run-up in oil prices. With oil representing 40 percent of Japanese imports, the sharp rise in oil prices greatly enlarged Japan's import bill, requiring additional financing to erase the shortfall through higher export growth. As a result, the yen exchange rate depreciated, improving the price competitiveness of Japanese goods and thereby creating the foreign demand for a higher level of Japanese exports. The increased exports found their way into the U.S. and E.E.C. markets, raising Japan's market share during a period of widespread recession and unemployment.

The empirical results show that Japanese exporters offset about 62 percent of a yen depreciation (appreciation) by raising (lowering) their yen prices. Despite less than 40-percent pass-through into export prices, the yen's effective exchange rate declined substantially, producing a 13.6-percent decline in the relative prices of Japanese manufactured-goods exports between 1978 and 1980. With an estimated price elasticity of demand of -2.52, the fall in the yen rate and the related improvement in price competitiveness can more than account for a 29-percent growth in Japanese export volume between 1979 and 1981 (first three quarters). Further contributing to the improvement in the Japanese trade account was a fall-off in import volume. But because of the small price elasticity of demand of -0.35, the resulting reduction in import quantities was modest by comparison. Overall, the empirical results indicate that movements in the yen's effective exchange rate contributed substantially to Japan's trade performance in the 1980-81 period.

According to the empirical findings, the growing controversy between Japan and its major trading partners does not stem from the

ineffectiveness of exchange-rate changes to produce adjustments in the trade account. On the contrary, the yen depreciation following the oil-price hikes may have gone too far. Japan's 1981 trade surplus more than offset its traditional deficit on services and transfers, placing the current account in surplus.

The signs are particularly ominous for the U.S. While the effective exchange rate remained fairly stable during most of 1981, the yen depreciated by 9 percent against the dollar over the first three quarters of the year — and by 22 percent since 1978IV. Japan's price competitiveness vis-a-vis the U.S. also increased because of higher U.S. inflation, as U.S. export prices in 1981 rose an estimated 3.4 percentage points more than Japanese export prices measured in local currency. Given the U.S. inflation and given the dollar's appreciation against the yen, the U.S. thus has suffered a marked erosion of its competitive position vis-a-vis Japan. This portends an expanding bilateral trade deficit in 1982. This situation, coupled with rising U.S. unemployment, almost insures continued tensions in the trade relations of these two countries in the foreseeable future.

Appendix A

Data Series and Sources

The data come from numerous sources, including various issues of the Bank of Japan's Economic Statistics Monthly, the Monthly Statistics of Japan published by the Statistics Bureau, The National Institute of Economic and Social Research Review, IMF International Financial Statistics and the UN Bulletin of Statistics. Estimation period extends from Q1, 1974 to Q4, 1979.

1) **Exchange Rate** — The exchange-rate variable was defined in yen per foreign currency units, and included the currencies of the U.S., Germany, Britain, France and Italy. In constructing the index, we weighted each exchange rate by that country's share in total manufactured-goods exports.[10] In the index, 1975 = 100.

2) **Foreign Competitor Prices** — Unit-value indices of manufactured-goods exports were used as a proxy for foreign competitor prices in each of the four product categories. An index was calculated with 1975 as the base period. The countries involved and the weights are identical to those employed for the exchange-rate index.

3) **World Export Prices for Basic Commodities** — We used a weighted average of commodity-price indices, expressed in dollars, taken from various UN publications. The base period was 1975, and weights were calculated on the basis of shares in Japanese imports for each product category.

4) **Foreign Real Income** — We used a weighted average of real GNP for the same countries used in calculating the exchange-rate and foreign-competitor price indices. The base period was 1975, and the weights present world-trade shares.

Appendix B: Export Price Equations

Machinery and Equipment

$$\underset{\quad}{\text{Ln}(PX)} = \underset{(0.22)}{-0.31} + \underset{(2.23)}{0.464}\text{Ln}(EX) + \underset{(3.97)}{0.505}\,\text{Ln}(CP)_t + e_t$$

$R^2 = 0.54$

$S_e = 0.04$

D.W. = 0.95

Textiles

$$\underset{(4.8)}{\text{Ln(PX)} = -2.03} + \underset{(4.11)}{1.06\,\text{Ln(WP)}} + (4.22)\text{Ln(EX)} + \underset{(1.11)}{0.53\,(\text{CP})_t} + \underset{(4.80)}{0.44\,(\text{CU})_t} + e_t$$

$R^2 = 0.79$
$S_e = 0.029$
D.W. = 2.0
Q(22) = 6.9

Chemicals

$$\underset{(-3.66)}{\text{Ln(PX)} = -2.34} + \underset{(4.11)}{1.57\,(\text{WP})_t} + \underset{(1.74)}{0.58\,\text{Ln(EX)}_t} + \underset{(1.74)}{0.58\,\text{Ln(CP)}_t} + \underset{(3.03)}{0.42\,\text{Ln(CU)}_t} + \underset{(0.43)}{0.07\,\text{Ln(CU)}_t} + e_t$$

$R^2 = 0.86$
$S_e = 0.036$
D.W. = 1.81
Q(22) = 6.9

Metals

$$\underset{(-2.19)}{\text{Ln(PX)} = -0.05} + \underset{(1.34)}{1.05\,\text{Ln(WP)}_t} + \underset{(2.58)}{1.11\,\text{Ln(EX)}_t} + \underset{(2.51)}{1.64\,\text{Ln(CP)}_t} - \underset{(-1.82)}{0.134\,\text{Ln(PX)/WP)}_{t-1}} + e_t$$

$R^2 = 0.84$
$S_e = 0.029$
D.W. = 2.01

where t-statistics are in brackets below the estimated parameters.

Variable Names:

PX = export prices (machinery and equipment, textiles, chemicals, metals, and manufactured goods).
EX = trade-weighted exchange rate (yen per foreign currency unit)
CP = trade-weighted competitor prices
CU = capacity utilization (textiles and chemicals)
WP = wholesale prices (textiles, chemicals, and metals).

Notes on Export Price Equations

Machinery and Equipment

1) Wholesale prices and capacity utilization for machinery and equipment proved to be insignificant and were dropped from the equation. Thus, pricing decisions of machinery and equipment manufacturers were almost entirely influenced by external factors rather than domestic cost considerations. However, these results may be tentative, since further disaggregation may be required to pick up the effects of domestic costs on export prices.

2) Across export product categories, only the machinery and equipment equation exhibited first-order autocorrelation. This result is consistent with the actual behavior of the export-price series of machinery and equipment, which was also identified as a first-order autoregressive process.

Textiles

1) The equations for textiles, metal products, and chemicals were estimated in first-difference form, although either levels or first differences would be theoretically sound.

2) Of all the variables, only foreign competitor prices proved to be insignificant. But this may simply reflect the downward bias associ-

ated with errors in variables stemming from the much broader coverage of the competitor-price series.

3) A one-percent depreciation of the yen will lead to a 1.22-percent increase in domestic currency prices of Japanese exports. This implies more than complete passthrough. However, the coefficient on the exchange-rate term is not significantly different from one. As a consequence, it would be better to say that Japanese exporters raise (lower) their prices by the same percentage amount as the exchange rate.

Chemicals

1) The coefficient values on Ln(EX) and Ln(CP) and their respective t-statistics are the same, reflecting the merging of Ln(EX) and Ln(CP) into a single variable, referred to as foreign-competitor prices expressed in yen. This composite variable was used because of the strong correlation among the independent variables in the estimating equation, yielding inconclusive results. The hypothesis of equality between the coefficients on the exchange-rate variable (EX) and the foreign-competitor price term (CP) could not be rejected at the 0.5 level of significance. For the purposes of measuring pass-through, a coefficient value of 0.58 is used for the exchange rate. With this result, only 42 percent of an exchange-rate change is passed forward into foreign currency prices of Japanese chemical exports.

Metals

The specification for metal products is similar to the equations for chemicals and textiles, but with several modifications. In particular, the capacity utilization rate was dropped because of its insignificance. As a result, the change in metal-product export prices is a function of changes in metal wholesale prices, the exchange-rate index, and foreign-competitor prices denominated in foreign currency. Moreover, disequilibrium effects were incorporated into the specification, as exemplified by lagged ratios of export prices to foreign competitors' prices and to wholesale prices. Estimation of the model with either one or both of the ratio variables yielded a significant value only for the variable with wholesale prices in the denominator. The model has the long-run property that export prices are determined by domestic cost considerations (See Davidson, 1978).

Manufactured Goods

We estimated a separate equation relating the prices of all manufactured goods to the exchange rate (EX) and foreign competitor prices measured in foreign currency (CP). The specification was the same as for the machinery-and-equipment equation. The results are not reported here because of the equation's low explanatory power ($R^2=0.16$) and the insignificance of the exchange-rate term (EX). Moreoever, wholesale prices and capacity utilization proved to be insignificant when added to the model. These results justify the disaggregated approach adopted here. In fact, the insignificance of domestic cost variables and the autocorrelation in the residuals suggest that further disaggregation should have been undertaken for machinery and equipment.

Appendix C: Export and Import Volume Equations

Variable Names:

XV = export volume
D1, D2, D3 = seasonal dummies
WGNP = world GNP
CU = capacity utilization
PX = price of exports
CP = competitor prices
EX = exchange rate
MV = import volume
IP = Japanese industrial production
PM = import prices
WPI = Japanese wholesale prices

Export Volume Equation

$$LN(xv)_t = 27.5 - 0.19\,D1 - 0.17\,D2 - 0.39\,D3 + 1.85\,LN\,(WGNP)_t - 8.66\,LN\,(CU) - 2.52\,LN\left(\frac{PX}{CP \cdot EX}\right)_{t-k} + e_t$$

(1.79) (-1.52) (-1.21) (-1.83) (2.08) (2.43) (-2.29)

Lag(k)	Coefficient on $LN\left(\frac{PX}{CP \cdot EX}\right)_{t-k}$	t-statistic
0	0.79	1.11
1	-0.10	-0.52
2	-0.68	-2.14
3	-0.97	-1.89
4	-0.95	-1.79
5	-0.62	-1.75
Sum	-2.52	-2.29

$R^2 = 0.67$, $S_e = 0.148$, D.W. = 1.74
$Q(18) = 11.4$, $n = 19$

Import Volume Equation

$$LN(MV)_t = 1.80 + 0.01D1 + 0.01\,D2 + 20.03\,D3 + 0.61LN(IP)_t - 0.35\,LN\left(\frac{PM}{WPI}\right)_{t-k} + e_t$$

(3.81) (1.00) (0.71) (3.13) (6.01) (-3.74)

Lag(k)	Coefficient on $LN\left(\frac{PM}{WPI}\right)_{t-k}$	t-statistic
0	0.03	1.25
1	-0.07	-3.21
2	-0.11	-3.88
3	-0.12	-3.79
4	-0.08	-3.71
Sum	-0.35	-3.74

$R^2 = 0.98$, $S_e = 0.169$, D.W. = 1.53, $Q(19) = 9.9$
$n = 20$

Notes on Trade Equation

The price elasticities of demand for exports and imports were estimated by the Almon lag technique, to offset the limited sample size and strong correlation between lagged independent variables. The relative price terms Ln(PX/CP EX) and Ln(PM/WPI) were entered as second-degree polynomials constrained at the far endpoint. The number of lags were determined sequentially by the addition of lagged terms until they turned insignificant.

The long-run price elasticities of demand were estimated at -2.52 for exports and -0.35 for imports, both of which appear reasonable. Almost all Japanese exports are manufactured goods, while imports are mainly basic commodities. Low price elasticities are generally associated with goods with few available substitutes. In natural-resource starved Japan, a rise in prices of imported commodities will bring little reduction in demand due to the unavailability of domestic substitutes. By comparison, manufactured goods should have a much larger price elasticity. For example, a higher price for Sony stereos should lead U.S. consumers to buy domestic substitutes or comparable European models instead.

The contemporaneous price effect on export and import volumes apparently has a perverse sign. But this result could be expected, since others have also found a positive price elasticity in the short run (see, for example,

Wilson and Takacs). This reflects the fact that trade volumes depend not only upon actual prices but also on expected prices. For example, a Japanese petroleum importer who expected oil prices to rise would accelerate his purchases to avoid later price increases. The central question concerns how expectations are formed. If, for example, buyers expected price one quarter ahead is equal to the current price (P_t) plus a positive fraction of the price change from the preceding quarter ($P_t - P_{t-1}$), then a direct relationship between prices and trade volumes should be observed contemporaneously. A rise in price will generate expectations of higher prices in the future, leading buyers to speed up their purchases from supplying countries.

The real-income variable in the export-volume equation is a weighted average of real GNP for the countries used in constructing the indices of foreign competitor prices and exchange rates. Several weighting schemes were tried, including shares of a country's imports from Japan as a proportion of total Japanese exports, shares of a country's imports of manufactured goods as a proportion of world manufacturing trade, and shares of a country's net exports of manufactured goods in relation to the total trade in manufactures. All weighting schemes were normalized to sum to one. These real-income series proved to be highly correlated with lagged values of the relative price term, yielding insignificant values for both variables. The only weighting schemes that did not produce high correlation between the activity and relative-price effects were the export-share weights used in the exchange-rate and foreign-competitor price series. Our export-volume equation estimates incorporate the real GNP variable with these export-share weights.

FOOTNOTES

1. The induced price and income effects resulting from exchange-rate changes will largely be ignored here. For example, a yen depreciation, by increasing the price competitiveness of Japanese export and import-competing industries, will produce a shift in demand towards Japanese products. The higher level of production will generate increased demands for imported goods. At the same time, the exchange-rate depreciation will raise the cost of imported goods which serve as intermediate goods in the production of exports. This, in turn, will put upward pressure on export prices, partially offsetting the effects of exchange-rate changes. Moreover, imported goods are part of the consumption bundle whose price forms the basis for union wage demands. Higher import prices stemming from currency depreciation will require higher nominal wage settlements to maintain the same pattern of real wage gains. The increase in labor costs would produce a deterioration in price competitiveness. Since these secondary effects will tend to offset (partly or fully) the impact of an exchange-rate depreciation on the trade account, the estimates presented here represent upper-bound estimates of its effectiveness in reducing trade imbalances.

2. The cause-and-effect relationship, as specified in the basic model, runs from wholesale prices, exchange rate and foreign competitor prices to export prices. This chain of causation is necessary for estimating the price equations, even though (according to purchasing-power parity) the predicated cause-and-effect relationship runs from prices to the exchange rate in a period of freely fluctuating rates.

3. The time interval before export quantities start adjusting can be subdivided, according to Magee, into currency contract and pass-through periods. The discussion so far has emphasized the latter. The former stems from statistical deficiencies inherent in using unit-value indices. That is, unit-value indices refer to prices at the time of delivery and not at the time of contract negotiation. Because of time lags between orders and deliveries, the pricing behavior of exporters and importers immediately following a devaluation may not be contemporaneously incorporated into the index. However, this does not necessarily mean that unit-value indices will fail to reflect contemporaneous movements in exchange rates. For example, suppose that 50 percent of Japanese exports are invoiced in dollars; a ten-percent appreciation of the yen vis-a-vis the dollar then will translate, everything else held constant, into a five-percent decline in Japanese export prices. Moreover, suppose that Japan sells 30 percent of its exports to Germany and that 50 percent of these contracts are invoiced in marks; then, a ten-percent appreciation of yen relative to the DM will lower export prices by 1.5 percent. The higher the proportion of contracts invoiced in foreign currency, the greater will be the effect of an exchange-rate change on the unit-value index measured in domestic currency.

4. Any general effects of capacity utilization on the price level should already be incorporated in the wholesale-price index. The use of capacity utilization in conjunction with wholesale prices simply measures whether export prices respond differently to the former than to the latter.

5. The composition of Japanese imports within each commodity category will differ from the product mix in the international price index for that commodity. Otherwise, the relationship would be an identity and no coefficient estimates would be obtainable.

6. Since basic commodities account for most Japanese imports, industrial production would be a more appropriate argument for import demand than real GNP. A higher level of industrial output will require larger inputs of raw materials, leading to increased demand for imported commodities.

7. In 1980, manufactured goods accounted for 90 percent of Japanese exports. As a reasonable approximation, the estimated coefficient measuring the effects of exchange-rate changes on manufactured-goods prices will be used to measure the pass-through of an exchange-rate change on aggregate export prices.

8. The estimated pass-through of an exchange-rate change into export prices was obtained by weighting each one of the pass-through coefficients for different commodity groupings by their respective share in Japanese exports.

9. Exports-import movements are virtually the same in foreign currency as in yen. The trade balance in foreign currency improves following an exchange-rate change between the second and third quarters. The maximum improvement occurs during the fifth quarter, where the rise in export value in foreign currency would be 5.8 percent, compared with a 3.2-percent decline in import value.

10. The index is weighted by world export shares instead of bilateral trade values. This reflects the geographical distribution of Japanese trade. That is, about 50 percent of Japan's exports go to the Far East and OPEC, as compared with a 4-percent share taken by Germany. However, Japan faces considerably more competition from Germany in third markets than do other suppliers. As a consequence, the use of bilateral-trade weights may seriously understate the importance of exchange-rate movements between two countries that specialize in the same goods but do little trade with each other, such as Germany and Japan. World-trade weights thus seem most appropriate for Japan.

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