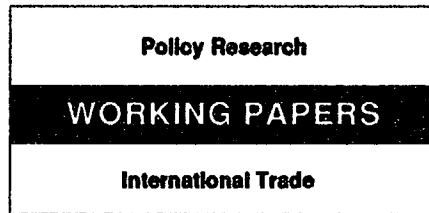


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# OECD Fiscal Policies and the Relative Prices of Primary Commodities

George Alogoskoufis  
and  
Panos Varangis

Here is evidence that macroeconomic policies in the OECD countries have been responsible for at least part of the little-understood decline in primary commodity prices over the past decade. Higher fiscal deficits seem to be associated with lower commodity prices.

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Nonfuel primary commodity prices fell more than 30 percent in real terms between 1984 and 1990, even though global economic growth was reasonably strong. The collapse of international commodity agreements, rapid increases in supply for some crops, and agricultural policies in industrial countries have been responsible for some of the price decline. But all nonfuel primaries—agricultural and nonagricultural—experienced a sharp decline in real prices. That calls for a more general explanation.

Alogoskoufis and Varangis investigate how the relative price of (nonenergy) primary commodities and manufactures depend on fiscal policies in the OECD countries. It has been argued, for example, that expansionary policies in the OECD countries lead to increases in commodity prices. Alogoskoufis and Varangis show that it is not sufficient to establish whether policies are expansionary or contractionary; one must define the policy mix to know what impact it has.

Previous studies have used partial equilibrium models to examine the link between macroeconomic policies and commodity prices. In those studies as in this one, the main channel of transmission of monetary and fiscal shocks is the interest rate.

Alogoskoufis and Varangis use a general equilibrium model of the simultaneous determination of the relative price of commodities and the real world interest rate. The model's logic suggests that OECD fiscal expansion increases the real interest rate and reduces the relative price of commodities to equilibrate world labor, product, and asset markets.

Econometric estimates based on reduced form equations, using annual data since the 1950s, cannot reject the hypothesis that higher fiscal deficits are associated with a lower relative price of commodities. The estimates suggest that when the fiscal deficit of the G-5 rises one percentage point of GDP, the relative price of commodities drops about 2 percent. When the U.S. deficit rises by one percentage point of GNP, the relative price of primary commodities drops about 3 percent.

This evidence provides good reason to believe that macroeconomic policies have been responsible for at least part of the little-understood decline in primary commodity prices over the past decade.

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**INTRODUCTION<sup>1</sup>**

The dependence of the relative price of commodities and manufactures on exchange rates, interest rates and more generally macroeconomic developments and policies in the industrial economies has been the focus of a considerable number of papers since the mid-1970s. The early research looked at the effects of exchange rates and monetary policies on agricultural prices, but gradually the focus shifted to the role of demand and supply shocks and macroeconomic policies in general. A parallel and related statistical literature has used vector-autoregressions, cointegration techniques and other dynamic statistical models to examine the co-movements between commodity prices and monetary variables like money supplies, exchange rates and interest rates, as well as between commodity prices and inflation.<sup>2</sup>

With relatively few exceptions, like the theoretical contributions of Bordo (1980) and Frankel (1986), and those who followed them, the empirical literature has paid scant attention to general equilibrium modelling of the interactions between the manufacturing and the primary-commodity-producing sectors, and the ways in which these interactions are affected by aggregate and relative shocks. The establishment of particular reduced form correlation patterns between relative commodity prices and other macroeconomic variables is not particularly informative. If one is interested in deeper issues like the effects of macroeconomic policies on the relative price of commodities and manufactures, or the implications of shifts to monetary regimes that rely on the behavior of primary commodity prices, then one cannot escape from the need to use "structural" models.

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<sup>1</sup>The authors would like to thank Messrs. Ronald Duncan, Will Martin and Vikram Nehru for their valuable comments on earlier drafts of this paper.

<sup>2</sup>See Boughton (1991), Boughton and Branson (1988), Durand and Blöndal (1988), Gilbert (1990), Moutos and Vines (1988); and Palaskas and Varangis (1990), Durand and Blondal (1988), Moutos and Vines (1988) and Gilbert (1990) among others.

The theoretical work so far has tried to establish a relationship between interest rates and commodity prices based on partial equilibrium models. In these models, commodities are held in a portfolio along with financial assets. A decline in the real interest rate, i.e., decline in the return on bonds, will increase the demand for commodities and result in an increase in commodity prices. Several econometric studies have shown such a negative relationship between commodity prices and real interest rates (Orden, 1986; Palaskas and Varangis, 1989; Tegene, 1990) while there are others that have found no relationship (Powell, 1989).

The paper takes a further step in the direction of the theoretical modeling of the general equilibrium interactions between commodity prices and macroeconomic policies. The proposed model is an extension of Alogoskoufis and Martin (1990) and Alogoskoufis, Martin and Pittis (1990). It uses a sequence of models of "North-South" macroeconomic interactions, under the assumption that the "South" specializes mainly in the production of primary commodities, and the "North" specializes mainly in the production of manufactures.

More specifically, the issue to be investigated is the equilibrium determination of the relative price of commodities and manufactures in a world of instantaneous nominal-wage and price adjustment. The purpose of this investigation is to uncover the nature of the underlying equilibria, and how they are affected by particular shocks. Even in the presence of sluggish price-adjustment, or long-term nominal contracts, the relative price of commodities would be tending towards such equilibria, if only gradually. The properties of such underlying equilibria have been given scant attention in the relevant literature.

The rest of the paper is as follows: In Section I a model of the equilibrium determination of the relative price of primary commodities and manufactures is presented and analyzed. In Section II we use

the equilibrium model of Section I to investigate econometrically the relationship between fiscal policies and commodity prices. The hypothesis we investigate is that the fiscal deficits by the OECD countries, particularly the United States, through their impact on interest rates, have significantly contributed in the decline of commodity prices, particularly during the 1980s. Finally, Section III concludes.

## I. AN EQUILIBRIUM MODEL OF THE DETERMINATION OF THE RELATIVE PRICE OF COMMODITIES AND MANUFACTURES

Assume that the world consists of two regions. The industrial "North", which specializes in the production of manufactures, and the "South", which specializes in the production of primary commodities. Producers in the "North" are monopolistic competitors, while producers in the "South" do not have market power, and operate in competitive markets. Before we proceed with the model, a certain clarification is necessary regarding the terms "North" and "South". "North" defines the group of countries that produce and consume relatively more manufactured goods and less primary commodities than the group of countries classified under "South". Thus, in the "North" not only the traditionally classified industrial countries are included, but also countries such as Korea, Taiwan (China), Singapore and Hong Kong, to name some important ones. In contrast, New Zealand could be classified under "South". So "North" and "South" do not refer to a classification based on the per capita income, but rather, on the percentage of manufactured goods and primary commodities in their total production or consumption. Thus, if relatively more manufactures than primary commodities are in a country's total production or consumption then this country is classified under "North". If less, then the country is classified under "South".<sup>3</sup>

### I.1 A Model of the "North"

The economy of the "North" consists of  $i$  monopolistically competitive firms. The technology of these firms is described by,

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<sup>3</sup>All the countries included under the World Bank's classification of "high-income economies", except the oil producers, are included in the category "North". See World Development Report, 1992.

$$y_i = l_i + \mu_i \quad (1)$$

where  $y_i$  is the log of output of firm  $i$ ,  $l_i$  is the log of employment and  $\mu_i$  is the log of a productivity shock.

Each firm faces a downward sloping demand curve for its product, described by,

$$y_i = d - \eta(p_i - p); \eta > 1 \quad (2)$$

where  $\eta$  is the elasticity of demand.  $d$  denotes the average demand in the "North",  $p_i$  is the log of the price of the product of firm  $i$ , and  $p$  is the average price of manufactures defined by,

$$p = \frac{1}{I} \sum_{i=1}^I P_i \quad (3)$$

Under profit maximization, the optimal price for firm  $i$  is given by,

$$p_i = w_i - \mu_i + v; v = \ln\left(\frac{\eta}{\eta-1}\right) \quad (4)$$

where  $w_i$  is the log of the nominal wage faced by firm  $i$ .

The average price of manufactures is thus given by,

$$p = w - \mu + v \quad (5)$$



Wages are set in  $j$  locations, which may be firms, or collections of firms (e.g., industries or regions). The wage setters in location  $j$  minimize the following quadratic loss function:

$$\frac{1}{2} [w_j - p_c - \tau - w_j]^2 + \frac{\theta}{2} [l_j - n_j]^2 \quad (6)$$

where  $\theta$  is the relative weight given to employment versus real wage objectives,  $\tau$  is the tax-wedge between wage real labor income and real labor costs of firms (i.e., the sum of the income, payroll and indirect tax rates),  $w^*$  is the log of the full-employment wage target,  $n$  is the log of the target employment level, and  $p_c$  is the log of the consumer price index, defined as,

$$p_c = \delta p + (1 - \delta) p_L = p + (1 - \delta) q \quad (7)$$

$\delta$  is the share of industrial goods in the consumption basket of consumers in the "North", and  $p_L$  is the log of the price of primary commodities, denoted in the currency of the "North".  $q$  is the log of the relative price of commodities and manufactures, defined as,

$$q = p_L - p \quad (8)$$

The log of average demand in the "North" depends positively on the fiscal stance of the government  $g$  and the relative price of commodities  $q$ , and negatively on the real interest rate  $r$ .

$$d = g - \beta r + \gamma (1 - \delta) q + X \quad (9)$$

where  $X$  is a shock to aggregate demand.

Minimization of the loss function of wage-setters subject to the demand faced equations and the price setting rule, after aggregation, yields the following equilibrium wage equation.

$$w = \tau + w^* + p + (1 - \delta)q + \phi(y - \mu - n) \quad (10)$$

where  $\phi$  is the response of real wages to unemployment and is defined as,

$$\phi = \theta \left[ \mu + \frac{(\gamma - \eta)(1 - \delta)}{J - \delta} \right] > 0 \quad (11)$$

Consistency between the price-setting decisions of firms (5) and the wage-setting decisions (10) requires that,

$$y = \mu + n + \frac{\mu - v - \tau - w}{\phi} - \frac{1 - \delta}{\phi} \tau \quad (12)$$

According to (12), given productivity and the other exogenous variables, there are two possible ways in which the wage setting decisions can be compatible with the equality of the marginal revenue product of firms with wage costs. The first is for the relative price of commodities to change, inducing changes in the purchasing power of industrial wages, and the other is for employment (and output) to change, inducing wage-setters to adjust their targets for the purchasing power of their wages.

Equilibrium in the product market in the "North" requires that average demand  $d$  is equal to average output  $y$ . Using (9),

$$y = g - \beta r + \gamma(1 - \delta)q + X \quad (13)$$

General equilibrium in the "North" requires that there is both consistency of wage and price setting (labor market equilibrium) and consistency between aggregate demand and supply (product market equilibrium). However, these two aggregate consistency conditions are not sufficient to pin down all the endogenous variables. At most, general equilibrium in the "North" defines a positive relationship between the relative price of commodities and the real interest rate, for given values of the demand and supply shocks and the other demand and supply parameters. From (12) and (13) this relationship is given by,

$$q = \frac{1}{\xi} [(\mu - \nu - \tau - w) + \phi(\mu + n - g - \chi)] + \frac{\beta\phi}{\xi} r \quad (14)$$

where  $\xi = (1 + \gamma\phi)(1 - \delta)$ . Equation (14) suggests that, for given demand and supply parameters, there are two potential relative prices that can adjust to bring about equilibrium. One is the real interest rate, and the other is the relative price of commodities. A rise in the relative price of primary commodities creates excess demand in the product market. A rise in the real interest rate is then required to choke-off this excess demand. On the other hand, a rise in the relative price of primary commodities also produces pressure for wage increases in the labor market, as the consumer price index rises. A sufficient rise in the real interest rate, by reducing output and employment, eliminates this wage pressure and brings about consistency between wage and price setting.

## I.2 A Model of the "South"

Modeling of the production of primary commodities (the "South") will be quite conventional. All markets are assumed competitive. Supply is a positive function of the relative price of primary

commodities and demand is a negative function of the relative price of primary commodities and the real interest rate. These two relationships can be written as,

$$y_L = \bar{y}_L + \sigma q \quad (15)$$

$$d_L = \bar{d}_L - \pi q - kr \quad (16)$$

where (15) is aggregate supply and (16) is aggregate demand in the "South". In equilibrium,

$$q = (\bar{d}_L - \bar{y}_L) / (\pi + \sigma) - \frac{k}{\pi + \sigma} r \quad (17)$$

Equilibrium in the "South" defines a negative relationship between the relative price of commodities and the real interest rate, as an increase in the relative price of commodities produces excess supply as it increases commodity supply and reduces commodity demand. To eliminate this excess supply a reduction in the real interest rate is required to increase the demand for commodities.

### I.3 "North-South" Equilibrium

We can now examine general equilibrium: To determine the equilibrium relative price of commodities and the real interest rate we need to employ the equilibrium condition (13) in the "North", which defines a positive relationship between relative commodity prices and the real interest rate, and the equilibrium condition in the "South", which defines a negative one. The general equilibrium is depicted in Figure 1. NN is the equilibrium condition in the industrial "North", and SS is the equilibrium condition in the commodity-producing "South". The equilibrium is the vector  $\{q^*, r^*\}$  which satisfies both (14) and (17).

It is straightforward to see that the relationship between world real interest rates and relative commodity prices could go either way, depending on the origin or shocks. With demand and supply shocks originating in the "South", there will be a positive statistical relationship between real commodity prices and real interest rates. With demand and supply shocks originating in the "North", the relationship will be negative. A number of comparative statistic exercises illustrate this point.

Consider first a positive demand shock in the "North" (Figure 3a). This could be either a fiscal shock ( $g$ ), or a private demand shock ( $X$ ), say because of financial deregulation. It would shift the NN curve to the right, and in the new equilibrium the world real interest rate would be higher, but the relative price of commodities would be lower. Output and employment in the "North" would be higher. The reduction in the relative price of commodities causes an increase in the living standards of workers in the "North", an increase that would be required in equilibrium in the face of lower unemployment. On the other hand, the increase in the real interest rate reduces the demand for commodities in the "South", and supply adjusts to this reduced demand through the fall in the relative price of commodities and manufactures.

For illustrative purposes we plotted the relations between fiscal deficits in the "North", relative commodity prices and the real rate of interest. For a description of the data series used see Section II below. The lines in the graphs are from the OLS between the two variables on the axes. Chart 5 shows the positive relationship between fiscal deficits and the real rate of interest. Charts 3 and 4 show the negative relationship between relative commodity prices and the real rate of interest and between relative commodity prices and fiscal deficits respectively. These figures provide a preliminary support to the hypothesized relationship between fiscal deficits and the real rate of interest. They also provide support to the model predictions about the relationships between the real interest rate, fiscal deficits and commodity prices.

A positive productivity shock in the "North", or a reduction in marginal tax rates, cause a shift in the NN curve to the left (Figure 3b). This increases the relative price of primary commodities, and reduces the world real interest rate. Output and employment increase in both the "North" and "South".

Consider now a positive demand shock in the "South" (Figure 2a). This shifts the SS curve to the right, and causes an increase in both the relative price of commodities and the world real interest rate. The increase in the world real interest rate reduces aggregate demand, and therefore output and employment, in the "North". Similar effects would arise following a negative supply shock in the "South", such as a crop failure.

Finally, a positive supply shock in the "South" reduces both the equilibrium relative price of primary commodities and the world real interest rate (Figure 2b). Equilibrium output and employment in the "North" increase on account of the lower real interest rates. Similar effects would arise following a negative demand shock in the "South".

## II. EMPIRICAL RESULTS

Ideally, a system of equations consisting of equations (14) and (17) should be estimated. However, while for equation (14) it was easy to find shift variables in order to identify the curve for the "North", it was not for the "South". The shift parameter for the "North" was the fiscal deficits in the "North". The same variable for the "South" was not considered appropriate due to its close and direct relationship to the relative commodity prices. That is, it is observed that fiscal deficits in the "South" tend to increase when commodity prices drop and decline as commodity prices rise. Due to the inherent endogeneity to commodity prices of a large number of shift variables equation (17) could not be identified. Indeed, for a large number of countries characterized under "South" primary commodities consist of a large part of the economic activity, making the variables we tried endogenous to commodity prices.<sup>4</sup>

Another problem facing the empirical estimation of equations (14) and (17) is the measurement of the real interest rate. It is difficult to quantify the real interest rate given the significant role inflationary expectations play in its measurement.

As a solution to the above mentioned problems, we opted to estimate a reduced form equation derived from equations (14) and (17). By equating (14) and (17), and substituting out the real interest rate we derive the following expression.

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<sup>4</sup>Gilbert (1987) also has found a direct relationship between commodity prices and the deficits of primary commodity producing countries.

$$q = \frac{\lambda}{\xi} [\mu - v - \tau - w] + \phi (\mu + \eta - g - X) + \frac{\beta \phi \lambda}{\xi} [(\bar{d}_L - \bar{Y}_L) / (\pi + \sigma)] \quad (18)$$

where:

$$\lambda = 1 + \frac{\beta \phi}{\xi} \cdot \frac{(\pi + \sigma)}{K} \quad (19)$$

Equation (18) indicates that the relative commodity prices (commodity prices divided by manufactured good prices) are influenced positively by productivity shocks in the "North" and negatively to aggregate demand shocks and fiscal deficits in the "North". The second term in equation (18) indicates that the relative commodity prices are positively related to the demand shocks in the "South" and negatively related to supply shocks in the "South".

To estimate equation (18) we used the following variables: For  $q$  we use the relative price of 33 non-energy primary commodities to the unit value of G-5 exports of manufactures. For the variable  $g$  we use the GDP share of government consumption in the G-5 countries. For  $x$ , we used the GDP share of government deficit in the G-5 countries. The G-5 variables have been constructed as weighted averages with weights United States 0.50, Japan 0.21, Germany 0.14, France 0.8, and the United Kingdom 0.7. We also used US data for the last two variables. Finally, we used the real oil price to account for the exogenous oil shocks during 1973 and 1979.

Charts 1 and 2 show the relative price of commodities and government deficits respectively. It is worth observing that during the 1960s government deficits declined and commodity prices increased. After the mid-seventies commodity prices start declining while government deficits increased. This



situation kept throughout the 1980s. Chart 4, plots the commodity prices and G-5 deficits. A negative relationship is indicated.

A preliminary data analysis showed that all variables are non-stationary. The tests employed are the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests and the results are reported in Table 1. So for estimation purposes all variables need to be differenced in order to avoid the problem of spurious regression. After establishing that the variables are non-stationary, the next step was to investigate whether there exists a long-run stationary relationship between them. That is, test whether they are cointegrated. Both the DF and the ADF tests employed did not show the existence of a long-run relationship between the relative price of commodities and the government deficit, government expenditure, and real oil prices (see Table 2).

Equation (18) is estimated on differenced data using G-5 data for the government deficit and consumption variables. The estimation results for the G-5 are reported in Table 3. The results show a strong negative relationship between the government deficits in the "North" and commodity prices. A decrease of 1% in the government deficit of G-5 (as a percent of GDP) will result in a 2.1% increase in the relative commodity prices. The government deficit of G-5 and the real oil price explain 27% of the variability in commodity prices. Including a dummy for 1973 increases the explanatory power of the regression to 53% but the effect of the G-5 deficits on commodity prices remains unaffected.<sup>5</sup> The coefficient increases from 2.1% to 2.3%. The inclusion of the government consumption variable reduces somewhat the magnitude of the effect of G-5 deficits on commodity prices. However, government consumption is not statistically significant. This is mainly due to the collinearity between government

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<sup>5</sup>In addition, the inclusion of the dummy for 1973 corrects the problem of non-normality in the residuals of the regression.

deficits and consumption. All diagnostic tests reported at the bottom of Table 3 showed no problems with the regressions.

Table 4, regresses the change in the relative commodity prices on the US Government deficit and consumption. The results are quite comparable with those obtained using the G-5 data. US Government deficits explain about 23% of commodity price variability, and about 42% if the dummy for 1973 is included. The coefficient of deficit indicates that a 1% decline in the US deficit will result in 3% increase in the relative commodity prices. Again the diagnostic at the bottom of the table indicate no problems.

### Conclusions

This paper investigates the dependence of commodity prices to OECD fiscal policies using a structural "North-South" type of model.

The proposed model is an equilibrium model in which the relative price of commodities and the world real interest rate is determined. By using this model we examined how the relationship between the interest rates and the relative price of commodities is affected by particular shocks. Our analysis shows that expansionary OECD fiscal policies will increase the real interest rate and reduce the relative price of commodities in order to equilibrate world labor, product, and asset markets. Econometric estimates of a reduced form equilibrium equation derived from the model showed that the relative price of commodities responded negatively to an expansion of the G-5 fiscal deficits. More specifically, and based on annual observations from 1950, a 1% increase in the fiscal deficit of the G-5 led to a decline in the relative price of commodities by 2%.

## REFERENCES

- Alogoskoufis, G., and C. Martin, "External Constraint on European Unemployment", CEPR Discussion Paper No. 469, London (1990); and in Alogoskoufis G., L. Papademos and R. Portes, External Constraints on Macroeconomic Policy: The European Experience, Cambridge University Press and CEPR (August 1991).
- \_\_\_\_\_, C. Martin, and N. Pittis, "Pricing and Product Market Structure in Open Economies: An Empirical Test", CEPR Discussion Paper No. 486, London (1990).
- Bordo, M. "The Effects of Monetary Change on Relative Commodity Prices and the Role of Long-Term Contracts", Journal of Political Economy, 88, pp. 1088-1109, (1980).
- Boughton J., "Commodity and Manufactures Prices in the Long Run", IMF Seminar Paper, (1991).
- \_\_\_\_\_, and W. Branson, "Commodity Prices as a Leading Indicator of Inflation", IMF Working Paper No. 88/87, (1988).
- Currie D. and D. Vines, Macroeconomic Interactions Between North and South, Cambridge University Press and CEPR, (1988).
- Dornbusch R., "Expectations and Exchange Rate Dynamics", Journal of Political Economy, 84, 1161-76, (1976).
- Durand, M. and S. Blöndal, "Are Commodity Prices Leading Indicators of OECD Prices?", OECD Working Paper, 10799 (1988).
- Frankel J., "Expectations and Commodity Price Dynamics: The Overshooting Model", American Journal of Agricultural Economics, 344-48, (1986).
- Gilbert, C., "Primary Commodity Prices and Inflation", Oxford Review of Economic Policy, Vol. 6, No. 4, pp. 77-99, (1990).
- \_\_\_\_\_, "The Impact of Exchange Rates and Developing Country Debt on Commodity Prices", The World Bank, Division Working Paper No. 1986-4, March (1986).
- Moutos T. and D. Vines, "Output, Inflation and Commodity Prices", CEPR Discussion Paper No. 271, London, (1988).
- Orden, D., "Money and Agriculture: The Dynamics of Money-Financial Market-Agricultural Trade Linkages", Agricultural Economics Research, Vol. 38, No. 3, pp. 14-28, (1986).
- Palaskas T.B., and P. Varangis, "Primary Commodity Prices and Macroeconomic Variables", The World Bank, PRE Working Paper No. 314, November (1990).
- Powell, A., "Commodity and Developing Country Terms of Trade, What Does the Long-Run Show?", manuscript, Nuffield College, Oxford (1989).

**Tegene, A., "The Impact of Macrovariables on the Farm Sector: Some Further Evidence", Southern Journal of Agricultural Economics, pp. 77-85, (1990).**

**Winters A. and D. Sapsford, Primary Commodity Prices: Economic Models and Policy, Cambridge University Press and CEPR (1990).**

**World Bank, World Development Report, Washington, D.C. (1992).**

**Table 1**  
**Unit Root Tests for Main Variables**

	Sample	DF	ADF
without trend			
$q_t$	1949-90	-0.640 (-2.932)	-0.632 (-2.934)
$q_t^{OIL}$	1949-90	-1.102 (-2.932)	-1.132 (-2.934)
$d_t^{G-5}$	1956-89	-2.002 (-2.950)	-1.780 (-2.953)
$d_t^{USA}$	1951-90	-2.298 (-2.936)	-2.294 (-2.938)
$g_t^{G-5}$	1951-89	-1.803 (-2.938)	-1.695 (-2.940)
$g_t^{USA}$	1951-89	-6.709 (-2.938)	-4.866 (-2.940)
with trend			
$q_t$	1949-90	-3.109 (-3.519)	-3.572 (-3.522)
$q_t^{OIL}$	1949-90	-1.811 (-3.519)	-1.790 (-3.522)
$d_t^{G-5}$	1956-89	-2.143 (-3.547)	-1.808 (-3.551)
$d_t^{USA}$	1951-90	-4.805 (-3.525)	-4.156 (-3.528)
$g_t^{G-5}$	1951-89	-2.009 (-3.528)	-3.120 (-3.531)
$g_t^{USA}$	1951-89	-6.578 (-3.528)	-6.544 (-3.531)

NOTES:  $q$  is the log of the relative price of 33 non-energy primary commodities to the unit-value of G-5 exports of manufactures.  $q(\text{oil})$  is the relative price of oil-exports of LDCs to the unit value of manufacturing exports. Source: The World Bank.  $d$  is the GDP share of the government deficit, and  $g$  the GDP share of government consumption. Superscript USA denotes the United States, and superscript G-5 denotes the group of five industrial economies (USA, Japan, Germany, France and the UK). G-5 variables have been constructed as weighted averages with weights US 0.50, Japan 0.21, Germany 0.14, France 0.8 and UK 0.7. Sources: OECD, IMF. DF is the Dickey-Fuller test and ADF is the Augmented Dickey-Fuller test. 95% critical values for the tests are in parentheses below them.

**Table 2**  
**Cointegration Tests**

Dependent Variable:  $q_t$

Constant	3.585 (1.014)	0.802 (0.258)
Trend	-0.006 (0.006)	-0.015 (0.003)
$d_t^{G-5}$	1.504 (1.376)	
$g_t^{G-5}$	-7.666 (2.874)	
$q_t^{OIL}$	0.222 (0.068)	0.109 (0.034)
$d_t^{USA}$		-4.134 (1.560)
$g_t^{USA}$		0.091 (1.659)
Sample	56-89	50-89
DF Test	-2.939 (-4.873)	-3.215 (-4.814)
ADF Test	-2.381 (-4.887)	-2.749 (-4.825)

NOTES: Asymptotic standard errors are in parentheses below estimated coefficients, and 95% critical values below the DF and ADF cointegration tests.

**Table 3**  
**Commodity Prices and Fiscal Deficits in the G-5**

Dependent Variable:  $\Delta q_t$

	(I)	(II)	(III)
Constant	-0.024 (0.016)	-0.028 (0.014)	-0.034 (0.013)
$\Delta d_t^{G-5}$	-2.137 (0.779)	-1.610 (0.838)	-2.336 (0.636)
$\Delta g_t^{G-5}$		-2.553 (1.946)	
$\Delta q_t^{OIL}$	0.107 (0.055)	0.122 (0.052)	0.085 (0.044)
1973		0.287 (0.078)	0.313 (0.076)
R <sup>2</sup>	0.270	0.558	0.532
s	0.091	0.074	0.075
DW	2.241	2.358	2.283
AR(1)	0.796	1.279	0.728
BJ(2)	13.751	0.067	0.228
HET(1)	0.004	0.498	0.061
ARCH(1)	0.392	0.050	0.763

NOTES: Sample 1956–1989. Asymptotic standard errors are reported below estimated coefficients. R<sup>2</sup> is the coefficient of determination, s is the standard error of estimate and DW is the Durbin–Watson statistic. The other misspecification diagnostics are distributed as  $\chi^2$ , with the degrees of freedom in parentheses. AR(1) is a Lagrange multiplier test of first-order residual autocorrelation, BJ(2) the Berra–Jarque test for normality based on the skeweness and kurtosis of the residuals, HET(1) is a test for heteroskedasticity based on an auxiliary regression of the squared residuals on the squared fitted values, and ARCH(1) is a test for autoregressive conditional heteroskedasticity.

**Table 4**  
**Commodity Prices and the US Fiscal Deficit**

Dependent Variable:  $\Delta q_t$

	(I)	(II)	(III)
Constant	-0.021 (0.014)	-0.024 (0.013)	-0.028 (0.013)
$\Delta d_t^{\text{USA}}$	-2.973 (1.088)	-2.597 (0.972)	-2.823 (0.956)
$\Delta g_t^{\text{USA}}$		-1.331 (1.371)	
$\Delta q_t^{\text{OIL}}$	0.090 (0.054)	0.077 (0.048)	0.072 (0.048)
1973		0.271 (0.082)	0.283 (0.081)
$R^2$	0.227	0.437	0.421
$s$	0.091	0.080	0.080
DW	2.306	2.320	2.246
AR(1)	1.522	1.144	0.807
BJ(2)	4.790	0.336	0.028
HET(1)	0.090	0.130	0.033
ARCH(1)	0.259	0.123	0.309

NOTES: Sample 1951–1990, except (II), 1951–1989. For other details see notes to Table 3.



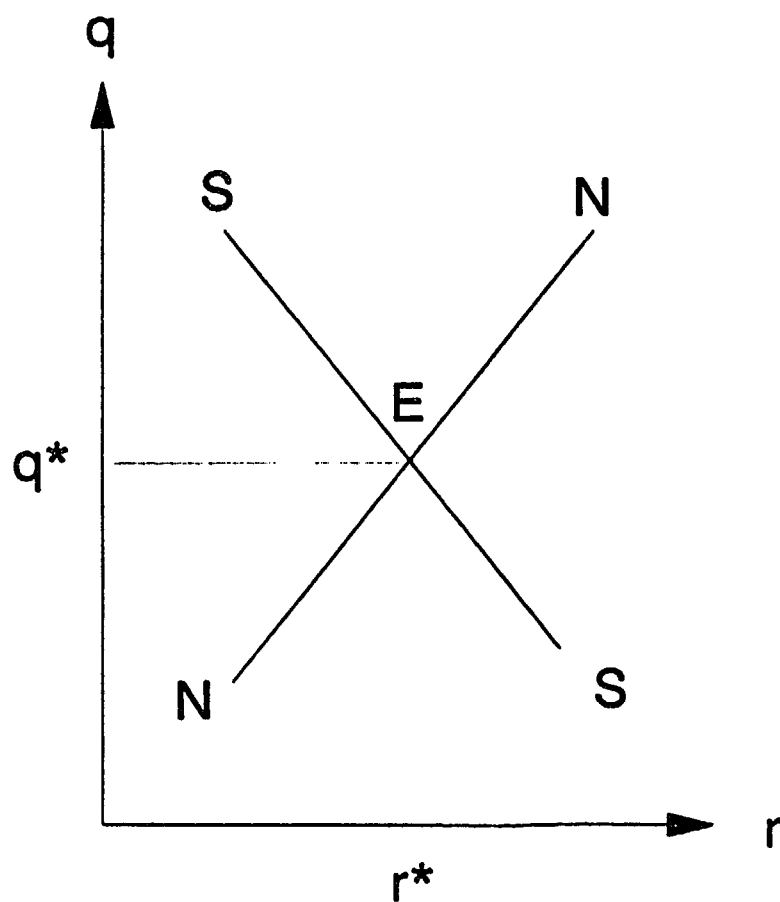


Figure 1  
The Equilibrium Determination  
of the World Real Interest Rate  
and the Relative Price  
of Primary Commodities  
and Manufactures

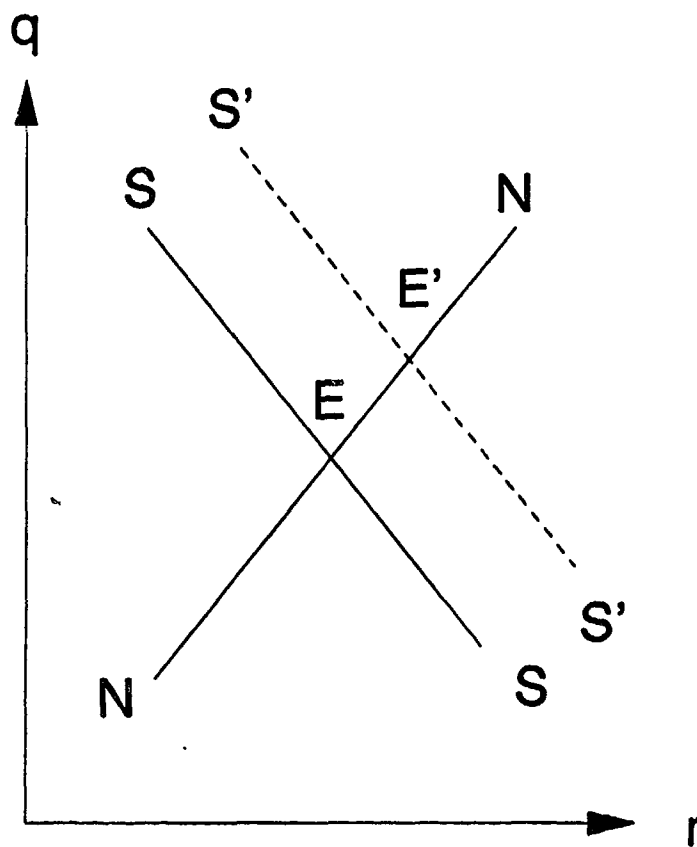


Figure 2a  
A Positive Demand Shock  
in the "South"

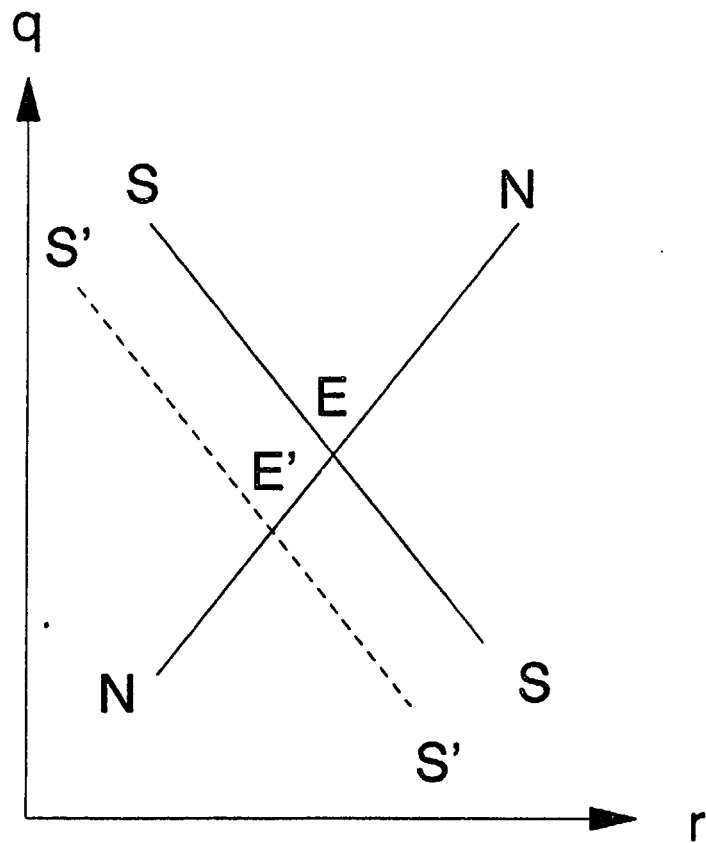


Figure 2b  
A Positive Supply Shock  
in the "South"

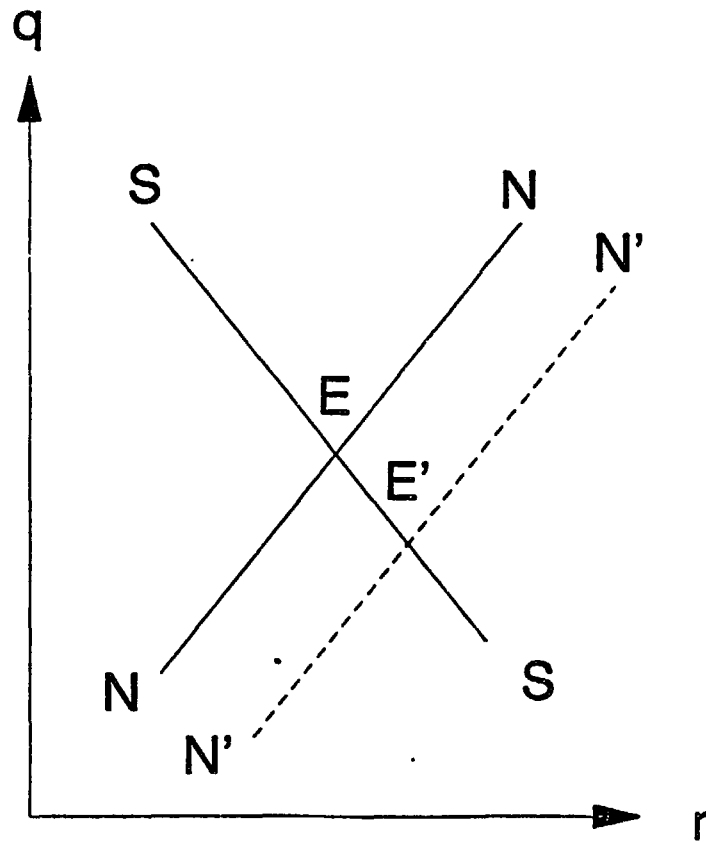


Figure 3a  
A Positive Demand Shock  
in the "North"

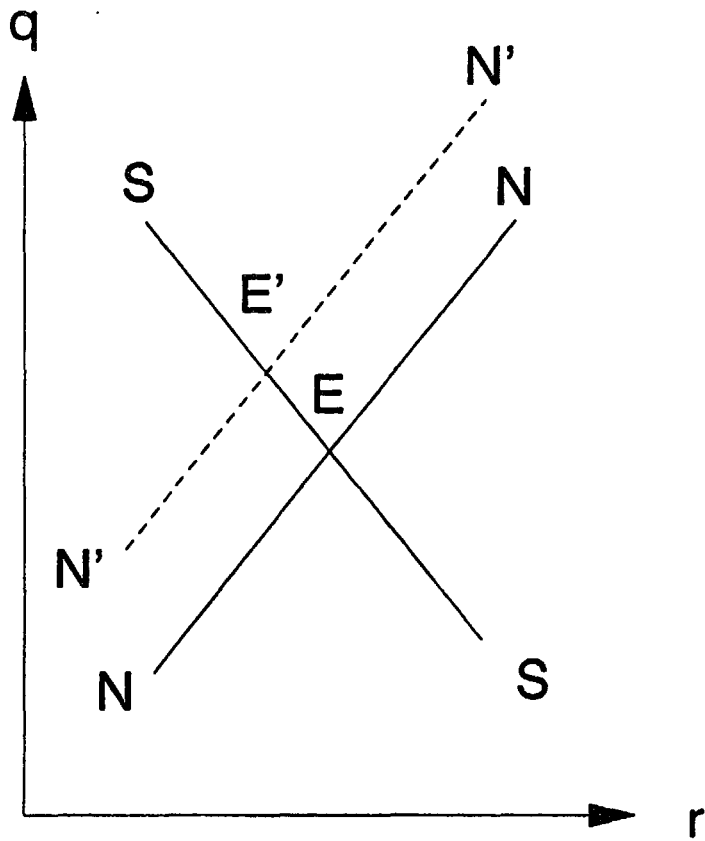


Figure 3b  
A Positive Supply Shock  
in the "North"

Chart 1: Relative Price of Primary Commodities and Manufactures

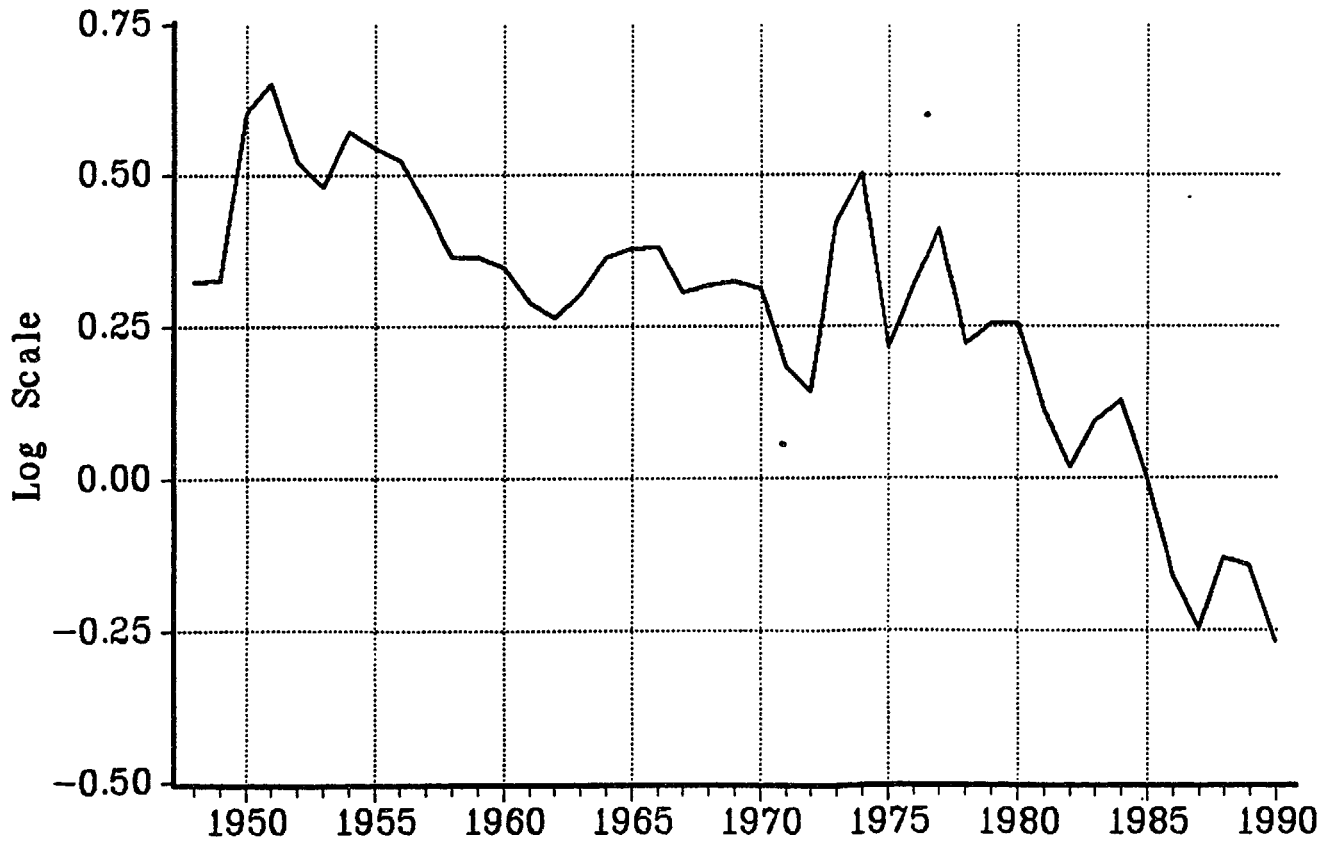


Chart 2: G-5 and USA Government Deficits

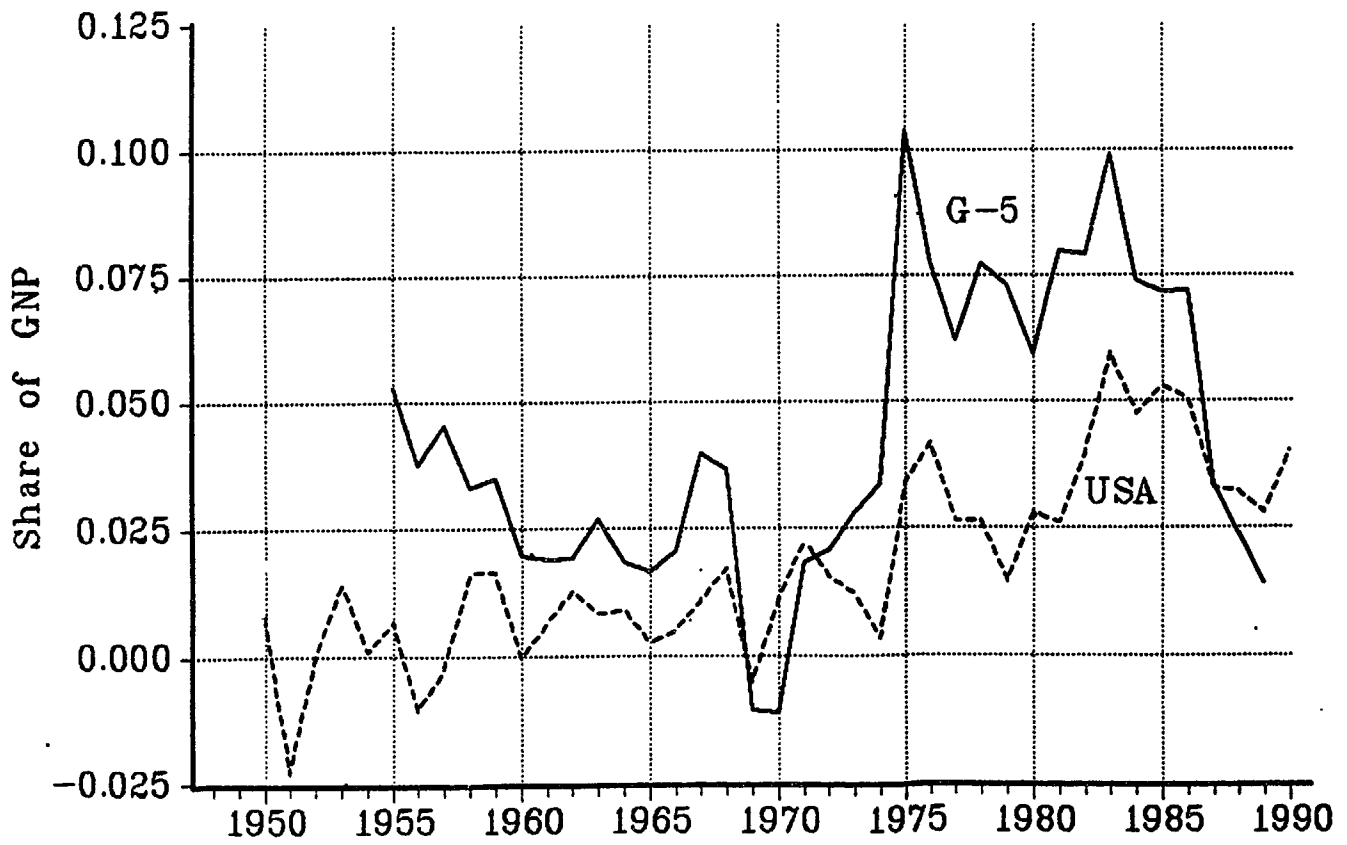


Chart 3: Relative Commodity Prices and the Real Interest Rate

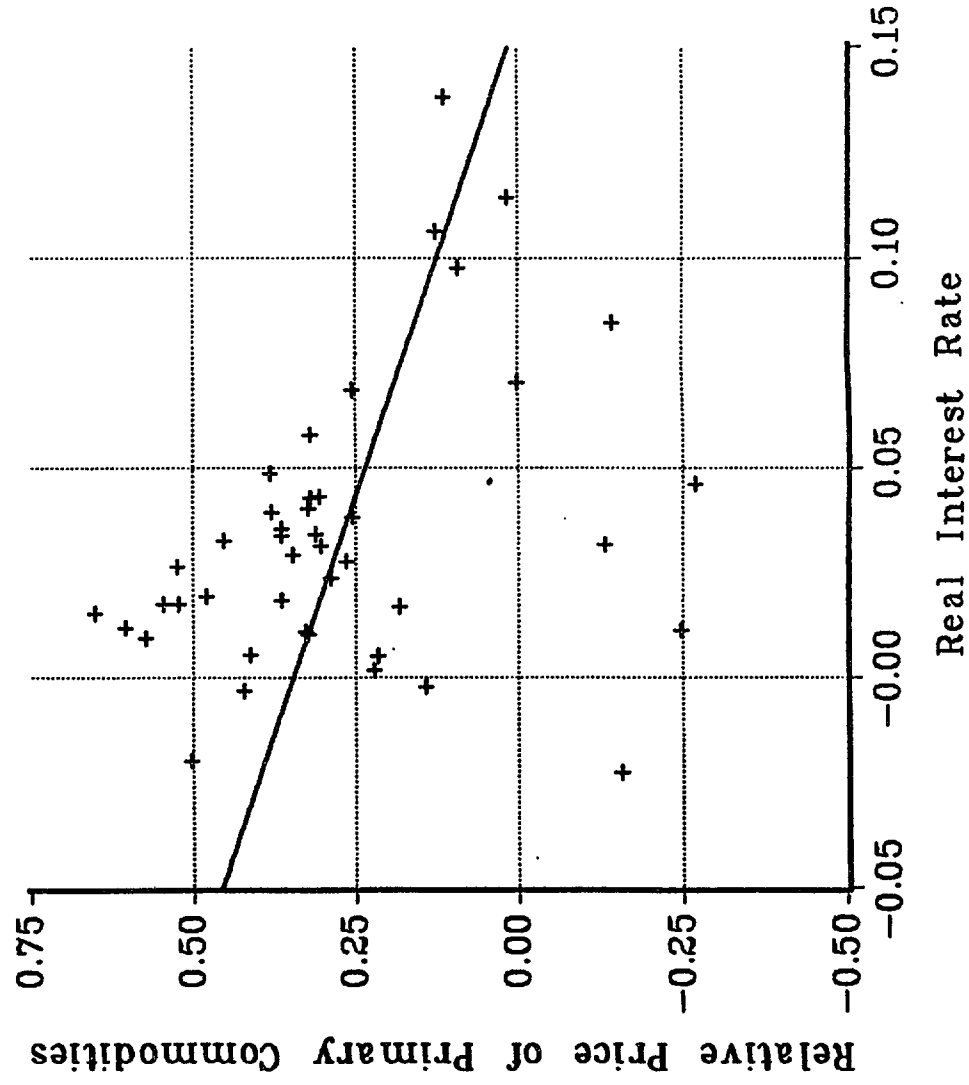




Chart 4: Relative Commodity Prices and G-5 Deficits

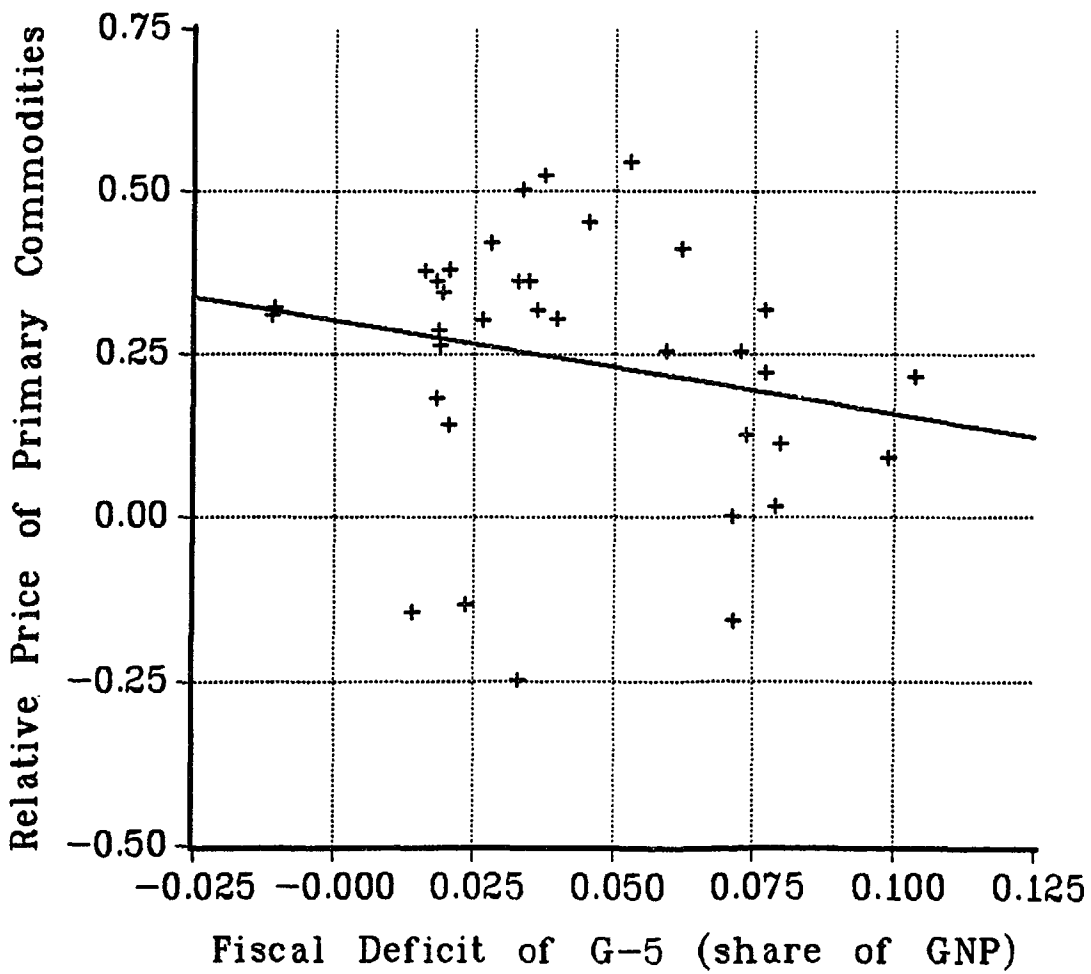
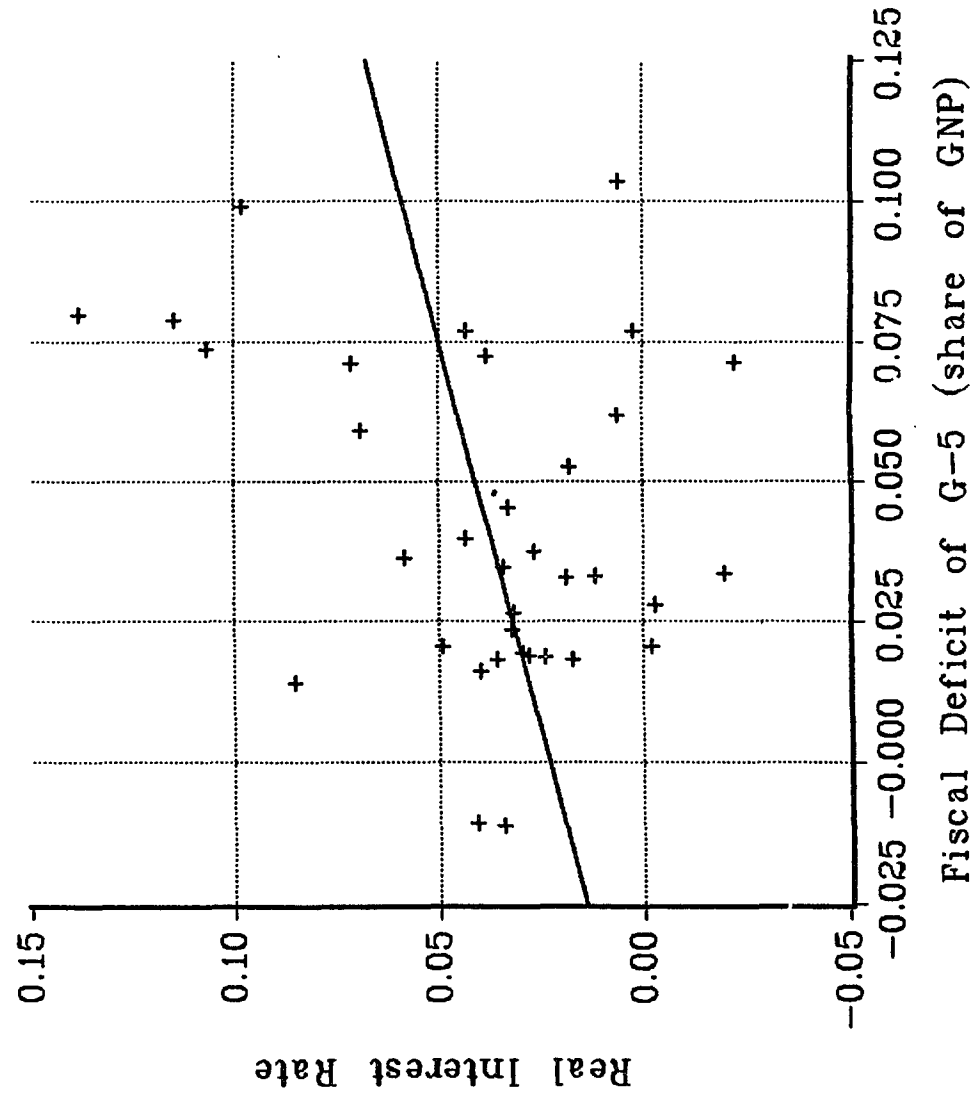


Chart 5: G-5 Deficits and the Real Interest Rate



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