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Authors
Rausser, Gordon C.
Brazelon, Coleman

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LDC DEBT AND POLICY LINKAGES
IN THE DETERMINATION OF WORLD COMMODITY PRICES

by

Gordon C. Rausser
and
Coleman Brazelon

California Agricultural Experiment Station
Giannini Foundation of Agricultural Economics
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The effects of industrial country commodity policies and macroeconomic policies and of LDC external debt on world commodity prices are investigated. A theoretical framework is developed to provide the foundation for an empirical model that is estimated, assessed and then simulated to isolate the effect of debt relief on commodity prices.
**Introduction**

Developing countries historically have been characterized by a higher share of primary commodity trade than have their mature trading partners and more recently by burdensome levels of external debt. They are consequently very sensitive to movements in commodity prices. Between 1980-1987, the IMF food commodities price index fell by one third in nominal terms and almost one half in real terms. This dramatic fall is the result of several different forces interacting on commodity prices. Three notable causes are developed country commodity sector policies, macroeconomic policies (especially in the United States) and the external debt position of the developing countries.

Empirical analysis of the commodity sector policies, macroeconomic policies and external debt linkages has until recently been conducted in separate studies. One stream of the empirical literature focuses on supply and demand conditions underlying individual product prices. Several other studies utilize a complementary approach on aggregate commodity price indices to emphasize the factors that determine investment demand for storable primary goods. Still another group of studies focuses on the effects of macroeconomic variables on aggregate commodity prices, neglecting the fundamental forces of commodity supply and demand. Very few studies have been conducted which isolate the impact of the growing external debt position of LDCs on international commodity prices.

To be sure, there are a large number of forces that potentially impinge upon world commodity prices in addition to agricultural subsidization in OECD countries. The dynamic path of commodity prices will also be influenced by the macro-economic policies of OECD countries, the stock of physical and financial
assets of countries throughout the world, and the pattern and spatial distribution of economic growth.

In many of the CGE examinations of trade liberalization (e.g., Stoeckel and Breckling, 1988, Robinson et al, 1988), a rise in world prices (often 10 percent or so) is assumed when multi-lateral liberalization is examined. Any rise that might occur, however, will be dependent on the macroeconomic policies and growth of OECD countries as well as LDC economic structure and debt burdens. In this paper we will analyze these issues by first examining the mechanisms by which monetary, fiscal, and commodity sector subsidization policies in the industrialized countries can impact developing countries. This descriptive treatment will be followed by a theoretical framework which is employed to determine the qualitative effects of various forces. The theoretical framework provides the foundation for an empirical model which is estimated, assessed and then simulated to isolate the effect of debt relief on commodity prices.

Industrial Country-LDC Policy Linkages

As already noted, industrial country policies can affect developing countries both through macro-economic policies and micro-economic commodity policies. There are four transmission mechanisms.

The first is overall economic growth. Industrial country economic growth has direct effects on the demand for LDC export commodities. In general, business expansions in the industrial nations improve the LDCs terms-of-trade and therefore, the net export position, while recessions are transmitted by a fall off in export demand.

The real interest rate indirectly affects the world's willingness to hold stocks of primary storable commodities. If storable commodities are viewed as a portfolio asset, then real
interest rates are part of the opportunity cost of holding a commodity and will affect the speculative demand for any storable good. Consequently, the relative price of commodities will decline until the expected rate of change in the product's value is equated with the real interest rate (plus insurance and storage costs). The foregoing analysis, known as the "overshooting hypothesis" (Frankel 1986, Rausser, et al, 1986) postulates that the real world commodity prices (i.e. LDC export prices) will remain low as long as the expected future appreciation (from higher real interest rates) remain high. The real interest rate also directly affects the burden of debt service. With approximately 80 percent of major LDC debt under variable rate agreements these LDCs are obviously very sensitive to changes in the interest rate.

The real exchange rate has an immediate effect on a developing country's terms of trade and upon its ability to earn foreign exchange to meet debt servicing requirements. It will also have a direct effect on the overall value of that debt. An appreciation of the dollar will have a one for one increase in the value of dollar denominated debt.

Finally, primary product stocks are another transmission method. Coupled income and price support policies in the industrialized countries lead to larger stocks of agricultural commodities. These larger stocks, whether given away or sold at subsidized prices, put downward pressure on world prices.

Theoretical Framework

In essence, the theoretical formulation presumes an integrated, world market for commodities. These commodities are traded in dollars and are exchanged by countries with various
characteristics, exporter and importer, debtor and non-debtor.

A useful way of initiating the discussion is to consider Dornbusch's (1985) simple model of the world market for a commodity, consisting of the U.S. and the rest of the world. An exogenous and fixed supply of commodities is matched by domestic U.S. demand and by foreign demand, both of which depends on the relative price of commodities and on income. Thus,

\[ S = D(p/P, Y) + D^*(p^*/P^*, Y^*) \]

where * denoted foreign variables, \( Y \) is income, \( p \) are commodity prices in home and foreign currency, and \( P \) is the national price deflators. Dornbusch assumes that commodity prices are perfectly arbitraged such that \( p = e p^* \) where \( e \) is the nominal exchange rate (home currency per unit of foreign currency). The real exchange rate \( \lambda \) then depends on \( P \) and \( P^* \), being the home and foreign GDP deflators, i.e.

\[ \lambda = P/eP^* \]

where, under perfect competition, "exchange rate movements change relative prices one-for-one." Dornbusch then uses (1) and (2) to solve for the real commodity price of the U.S. as a function of income, the real exchange rate, and exogenous commodity supply:

\[ \frac{p}{P} = J(Y, Y^*, \lambda : S) \]

This equation suggests that a real exchange rate appreciation of the U.S. dollar will "lower real commodity prices in terms of the U.S. deflator while raising them in terms of foreign deflators." With a change in the real exchange rate, commodity prices relative to national deflators change but arbitrage ensures that commodity prices themselves are equalized. An increase in the real U.S. exchange rate will decrease real commodity prices by a function of the weighted elasticities of U.S. and foreign demand, as U.S. import prices fall directly and as the relative price of commodities in foreign markets
increases.

We make several modifications to the Dornbusch model so as to apply it to the situation of developing countries. First, the supply of commodities will not be assumed as exogenous and fixed but will be determined within the model. Supply can be thought to hinge crucially on the relative domestic price and on government policy toward agriculture in developing countries, which in turn depends on the size of foreign-currency denominated foreign debt that must be serviced with export revenues. A further addition to the model will be the inclusion of stocks of commodities held world-wide. A rise in stocks in net importing industrial countries indicates the effect of their government transfer programs in closing out the market for imports; a similar rise in stocks in exporting countries also leads to market pressures for a fall in world commodity prices.

There are four cases to be considered, based on the economic position of the developing country to the world commodity market. The first is an exporting debtor nation. We assume a historically determined flow of debt servicing and that government policy will react to maintain these payments. Namely, exogenous shocks that affect a country's ability to service its debt requirements, such as a change in the real exchange or interest rates, result in a changed government policy to increase export proceeds by encouraging the movement of resources into the export sector.

It is important to note that debtor country efforts to increase exports (and thereby preserve its debt payment capacity) in the face of, say, an exogenous terms of trade shock, actually further deteriorates its terms of trade. Thus, government responds to a increase (decrease) in the price of its own exportable with policies that reinforce the direction of that
movement. Governments can therefore exacerbate the world price
instability of their own exports.

Similar effects are also noted for an increase in the
world's interest rate. An increase in the world interest rate
leads to government efforts to expand export supply to increase
foreign currency revenues. At the same time, foreign demand for
commodities drops as a result of the movement of stocks from
storage to the market. An increase in the interest rate then
unambiguously leads to a decline in the price of commodities.
The stock figure is, of course, also dependent on the world's
prevailing rate of interest, the opportunity cost of holding
commodities in stock form.

The second class of countries are net importing debtor
countries. The effects of shocks in this case is the same except
that instead of increasing supply the government reacts to
decrease domestic demand for the primary commodity. The effects
on commodity prices are nevertheless the same.

The third and forth classes are net importing or exporting
countries without a debt burden. The twist here is that the
government does not need to react to the exogenous shocks and
therefore will not exacerbate them. The shocks will however
still have their primary effect on commodity prices.

An implication of the model is that, regardless of the net
trade and external debt position of a country, a real exchange
rate appreciation of the dollar, an increase in stocks, and an
increase in interest rates will decrease commodity prices.
Implications about welfare do not necessarily coincide directly
with the signs, however, as an increase in the real value of the
dollar has a uniform effect on commodity prices with different
implications for exporters and importers of commodities.

**Empirical Results**
As noted above, the macroeconomic impact of growth in the industrialized countries and the real foreign exchange value of the dollar on agricultural prices for major developing country exports has been previously examined. These factors play a major role in determining the quantity of import demand for agricultural goods; the activity variable through the income effect and the exchange rate through the relative price effect.

On balance, developed country agricultural policies have subsidized their own production, thereby decreasing the excess demand to be filled by foreign suppliers. The summary variable used to characterize these policies is the volume of world agricultural stocks of major commodities. An increase in stocks is a signal that agricultural policies in developed countries have reduced foreign market access. These policies have a depressing effect on world commodity prices (i.e. those for developing country exporters) who must face an otherwise lower demand for their products.

Yet under certain conditions, the converse can be argued to hold, namely that a reduction in stocks is indicative of developed country dumping or subsidizing its stockpile onto world markets and thereby depressing world commodity prices. However, up until 1988 world stocks were accumulating, meaning that the direct effect of policies in closing developed country markets for imports was more significant than the secondary effort to reduce those stocks through export subsidization.

The burden of servicing debt has manifested itself in government efforts to expand exports of commodities to earn foreign exchange. In as much as government policy successfully moved resources into the exporting commodity sectors, the increased supply would put downward pressure on commodity prices. This slippage in export earnings would exacerbate the country's
indebtedness if the deficits were financed with increased foreign borrowing.

Once again, the converse can be said to hold: that as commodity prices fell, developing countries borrowed from major private and public lending institutions in an effort to smooth their income and consumption streams. However, this story is not compatible with the stylized facts of the 1970s and 1980s. The accumulation of debt began in the mid-1970s when commodity prices were rising rapidly. The initial increases in debt were not to finance a deficit in export earnings. With the recession in the early 1980s, borrowing to finance further economic expansion came to a halt and servicing the debt became a problem. This, in turn, forced renewed attention toward export growth. This growth was all the more difficult in the face of slower growth in developed countries and a higher real dollar exchange rate, and the consequent effort to expand exports acted to reduce commodity prices even further.

In summary three groups of potential causal forces are examined: macroeconomic policies in the industrialized world as reflected by the real exchange rate for the U.S. dollar and U.S. interest rates; microeconomic agricultural sector policies as reflected by commodity production and stocks; and LDC economic structure as reflected by the external debt of Latin American and African countries. Finally, a counterfactual simulation is run to estimate the effects of reduction in the Latin American and African debt would have on world commodity prices.

We estimated four equations over the 1977:II to 1987:IV period. In the estimated equations we used for wheat prices U.S. no.2 Dark Northern spring, 14 percent, cif Rotterdam; the coarse grains price refers to U.S. no. 3 yellow corn, cif Rotterdam; the rice price is the white fob Thailand price; and cotton prices are
the "A" index from the Cotton and Wool Situation Report, cif Northern Europe. For each of these individual commodities, microeconomic policies in the United States play a significant role in determining the path of production, stocks, and worldwide prices.

Explanatory variables for each of the estimated equations include a measure of the U.S. real effective exchange rate (based on relative value-added deflators in manufacturing); interest rates, measured by the six month commercial paper rate in the U.S.; as a measure of debt, the private sector external liabilities of Latin America and Africa; and the corresponding world production and stock levels of each commodity.

The mathematical specification for all equations was log linear in the variables, except for the interest rate. For each equation we report the immediate impact or short-run flexibilities as well as the long-run stationary state flexibilities.

An interaction effect is allowed between interest rates and the level of commodity stocks, represented by the product of the two. In essence, it admits the possibility that movement in interest rates will have variable effects depending on the level of commodity stocks. If stocks are low the interest rate is expected to have little if any effect on commodity prices. Likewise, if the opportunity cost of holding stocks, the interest rate, is small the level of stocks is expected to have less of an influence on commodity prices.

The estimation method for each of these equations recognizes that the error terms are related. As a consequence a seemingly unrelated regression method was employed. 78 to 87 percent of the variation in the real price series is explained by the explanatory variables. Each equation is also dynamically stable.
For all equations, the real exchange rate effect is insignificant. This result is most likely explained by the importance of the United States as a producer and consumer of the primary agricultural commodities. The more important the U.S. in these markets as a producer and consumer the less is the U.S. dollar price adjustment to movements in the real dollar exchange rate. Also, the less elastic demand is, especially in the United States, the less of an effect exchange rate movements will have on commodity prices.

For most of these equations the stock levels and current production dominate. The effects of interest rates are negative and significant for wheat and coarse grains but insignificant for cotton and rice. In some cases, the interaction between interest rates and stocks is positive and significant and in other cases it is insignificantly negative (rice and cotton).

The external debt variables were negative as expected for wheat and rice, but of the wrong sign for coarse grains and cotton. These results are not really surprising considering that the U.S. produces between one third and one half of the world's corn crop and the U.S. and Soviet Union produce and export over half of the world cotton crop, whereas the U.S. has a smaller share of the world wheat and rice market. Again, the larger the U.S. share in a market, the less the developing world's share, the less of an impact we would expect from LDC debt.

Finally we simulated the price effects of a 50 percent reduction in the Latin American and African debt. The price of wheat is estimated to have been 12.3 percent higher over the sample range; coarse grain prices 11.6 percent lower; rice prices an astounding 53.5 percent higher; and cotton prices a significant 27.1 percent lower. These estimates demonstrate the magnitude of importance of LDC debt in the world commodity
market.

In the future, this analysis needs to be extended to cover more commodities over longer time periods. Any other research done on commodity prices, academic or policy oriented, will have to consider the effects of LDC debt. Clearly, any policy of debt relief will have significant implications for world commodity prices.
## Impact and Long-Run Flexibilities for World Wheat, Coarse Grain, Rice, and Cotton Prices

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Dependent Variables</th>
<th>Constant</th>
<th>Exchange</th>
<th>Interest</th>
<th>Stocks</th>
<th>Output</th>
<th>Debt</th>
<th>Interm</th>
<th>Lag</th>
<th>$R^2$</th>
<th>DW</th>
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<tbody>
<tr>
<td><strong>Wheat Prices</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Impact (standard error)</td>
<td></td>
<td>2.57 (1.72)</td>
<td>0.02 (0.02)</td>
<td>-0.39 (0.13)</td>
<td>-0.94 (0.27)</td>
<td>0.44 (0.41)</td>
<td>-0.10 (0.10)</td>
<td>0.09 (0.02)</td>
<td>0.36 (0.11)</td>
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<td>-1.51</td>
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<td>-1.62</td>
<td>0.14</td>
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<tr>
<td><strong>Coarse Grain Prices</strong></td>
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<td>6.20 (2.69)</td>
<td>0.01 (0.02)</td>
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<td>-0.34 (0.18)</td>
<td>-0.78 (0.48)</td>
<td>0.08 (0.10)</td>
<td>0.03 (0.02)</td>
<td>0.57</td>
<td>0.78</td>
<td>2.2</td>
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<tr>
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<td>4.65 (1.07)</td>
<td>-0.02 (0.02)</td>
<td>0.15 (0.10)</td>
<td>0.35 (0.33)</td>
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<td>0.33</td>
<td>0.87</td>
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<td>0.53</td>
<td>0.50</td>
<td>-0.62</td>
<td>-0.18</td>
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<tr>
<td><strong>Cotton Prices</strong></td>
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<td>2.99 (1.40)</td>
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