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Commodity Prices: Cyclical Weakness or Secular Decline?

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Primary commodities still account for the bulk of exports in many developing countries. However, real commodity prices have been declining almost continuously since the early 1980s. The appropriate policy response to a terms of trade shock depends importantly on whether the shock is perceived to be temporary or permanent. Our results indicate that the recent weakness in commodity prices is mostly secular, stressing the need for commodity exporting countries to concentrate on export diversification and other structural policies. There is, however, scope for stabilization funds, and the use of hedging strategies, since the evidence also suggests commodity prices have become more volatile. [JEL C22, E3, E61]

PRIMARY COMMODITIES still account for the bulk of exports in many developing countries. In effect, the reliance on primary commodities as the main source of export earnings has not diminished for many countries, particularly in Africa, where manufactures often account for less than 15 percent of merchandise exports (see Table 1). However, real commodity prices have been declining almost continuously since the early 1980s.[1] Since their short-lived recovery in 1984, real commodity prices

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[1] Unless otherwise noted, real commodity prices refer to the IMF all non-fuel commodity price index deflated by the IMF index of manufacturing export unit values (MEUV) of industrial countries. Both indices are in U.S. dollars.

Table 1. *SlrUCWreof Merchandise Exports: Selected Developing Countries*

(As percent of merchandise exports)

Country	1965			1990		
	Fuels, minerals, and metals	Other primary commodities	Manufactures	Fuels, minerals, and metals	Other primary commodities	Manufactun.:s
Africa						
Burundi	–	94	6	–	98	2
C6le d'ivoire	2	93	5	10	80	10
Kenya	13	77	10	19	70	11
Mauritania	94	5	1	81	13	6
Senegal	9	H8	3	22	56	22
Tanzania	1	86	13	5	84	11
Asia						
Malaysia	34	60	6	19	37	44
Pakistan	2	62	36	1	29	70
Philippines	11	84	5	12	26	62
Sri Lanka	–	99	1	6	47	47
Thailand	11	86	3	2	34	64
Latin America						
Argentina	1	93	6	6	59	35
Bolivia	93	4	4	69	27	14
Brazil	9	83	8	16	31	53
Colombia	18	75	7	32	42	26
Mexico	22	62	16	43	13	54
Uruguay	–	95	5	–	60	40

Source: World Bank, *World Developmelll Report, 1992.*

Table 2. *Real Export Earnings'*
(Average annual percent change)

Country	1970–79	1980–92
Africa		
Burundi	3.7	-3.7
C6te d'Ivoire	6.1	-8.2
Kenya	-3.0	-5.4
Mauritania	-6.6	13.2
Senegal	-0.9	3.6
Tanzania	-2.7	-5.6
Asia		
Malavsia	8.9	8.1
Pakis"tan	2.6	6.1
Philippines	3.8	3.5
Sri Lanka	1.2	5.9
Thailand	9.9	10.7
Latin America		
Argentina	2.5	2.2
Bolivia	9.1	-0.7
Brazil	7.4	4.6
Colombia	7.4	8.5
Mexico	11.3	5.6
Uruguay	0.5	4.3

. Sources: International Monetary Fund. *World Economic Outlook,* various Issues.

~Real export earnings are defined as the value of exports deflated by import umt values.

have fallen by about 45 percent., translating into a sharp deterioration in the terms of trade for most commodity exporters. Not surprisingly, the performance of real export earnings for many developing countries during the 1980s and 1990s has been closely linked to the countries' success in diversifying their export base. [2] As Table 2 indicates for a selected group of countries. the Asian experience is characterized by a marked shift toward the export of manufactures and strong increases in real export earnings; at the other extreme. Africa can be generally described as a

[2] Export diversification is not the only factor explaining the marked regional differences in export performance. however. As will be discussed below, the volume of exports of agricultural commodities surged in Asia during the 1970s and 1980s while it declined in Africa during the same period.

situation in which continued reliance on primary commodity exports has resulted in a marked and persistent deterioration in real export earnings.

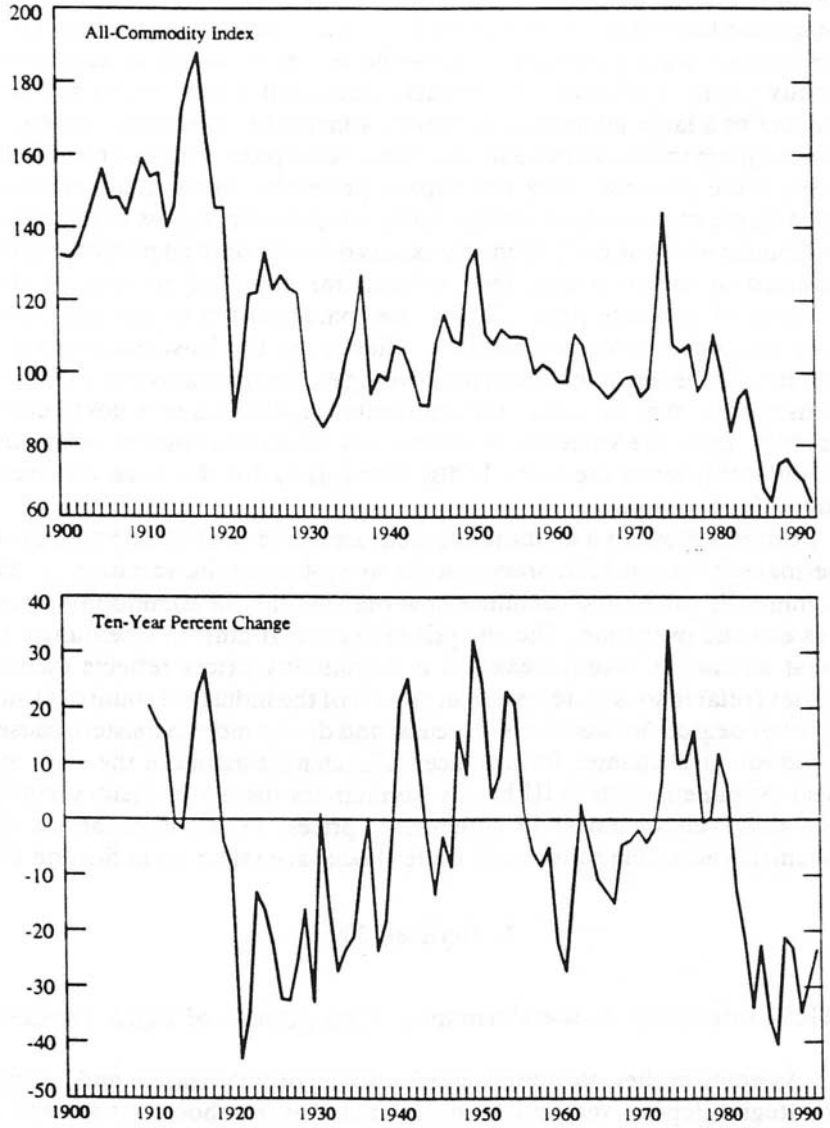
As Figure 1 illustrates. during 1992 the prices of commodities relative to those of manufactures reached their lowest levels in over 90 years.) Thus. a casual perusal of the evolution of real commodity prices seems to support the Prebisch-Singer hypothesis, which posits that the long-term trend of the prices of primary commodities relative to the prices of manufactures is negative. Empirical evidence of the Prebisch-Singer hypothesis is. thus far. not conclusive, and this issue has been addressed in a number of papers, including Cuddington and Urzua (1989), Powell (1991). and Ardeni and Wright (1992). Some studies point to the presence of a downward trend. whereas others argue that prices have been subject to one or more structural breaks in which average prices were permanently lower following the break(s). Of more practical concern to the policymaker. the presence of a negative trend or a series of downward shifts in prices implies that efforts to stabilize the incomes of commodity producers for an extended period must take into account the fact that real commodity prices have not shown signs of fluctuating around a constant mean.

The aim of this paper is to provide the general stylized facts about the behavior of commodity prices that may be useful in formulating the policy response to commodity price shocks. For instance, as noted by Cuddington and Urzua (1989) and Deaton (1992), the usefulness of a stabilization fund will depend crucially on whether the shocks to commodity prices are primarily temporary or permanent. . Further, even if temporary shocks playa dominant role, the ability to stabilize will depend on the persistence of shocks and the duration of cycles. Similarly, as Ghosh and Ostry (1994) argue, the benefits that can be obtained from stabilization funds, or more generally, from precautionary savings will be greater in a more volatile an<:luncertain environment. . The more uncertain a country's export revenue stream, the greater is the value to that country of accumulat:ng assets to insure itself against future shocks. Hedging strategies alSO acquire greater importance as volatility and uncertainty increase.

This paper examines these issues using quarterly data for 1957:1-1993:II for some of the major commodity groupings: an all non-oil

)The sustained decline predates our sample period of 1900-92. Using a different commodity index that beginsin 1854, Boughton (1991) documents the decline of real commodity prices during the second half of the ninetee!1thcentury. The source of the data plotted in Figure 1 is Grilli and Yang (1988) for 1900-86 and was updated by the authors for 1987-92.

Figure 1. *Real Non-Oil Commodity Prices: Long-Term Developments*



Sources: Grilli and Yang (1988) and International Monetary Fund.

Note: Commodity prices are deflated by the expon unit values of manufactured goods.

commodity basket, beverages, food. and metals. A number of empirical regularities emerge from the analysis. First, alternative methods of decomposing time-series into their secular (trend) and cyclical (temporary) components yield a common result-the recent weakness in real commodity prices is primarily of a secular, persistent nature and is not the product of a large temporary deviation from trend. The above observation suggests that a rebound in real commodity prices to their pre-1980s level, while possible, does not appear probable. Second, the relative importanct: of permanent shocks varies considerably across commodity groupings: whereas permanent shocks account for only 30 percent of the variance of metals prices. they account for about 85 percent of the variance of beverage prices. Third. the characteristics of the cycle also vary markedly across commodities. Shocks are the least persistent for metals and the most persistent for beverages. The previous two observations suggest that the scope for stabilization policies is very commodity specific. Last, the volatility in commodity prices has risen steadily and considerably since the early 1970s, particularly for the once relatively stable food grouping.

Section I presents a quantitative measure of the relative importance of permanent (versus temporary) shocks in explaining the variation in real commodity prices and examines how the volatility of commodity prices has evolved over time. The analysis in Section II aims to disentangle to what extent the recent weakness in commodity prices reflects cyclical forces (related to, say, recession in several of the industrial countries) and to what degree the weakness is secular and due to more persistent causes (technological change, for instance). The characteristics of the cycle are also examined. Section III briefly summarizes the major factors behind the observed weakness in commodity prices. Policy implications for countries adjusting to terms of trade shocks are taken up in Section IV.

I. Stylized Facts

How Important Is the Permanent Component of Price Shocks?

As noted earlier. the design and feasibility of stabilization and hedging strategies depend very much on the nature of the shock. At the risk of oversimplifying, income stabilization policies and hedging are useful in dealing only with temporary and, preferably, short-lived shocks. Permanent shocks require adjustment and, possibly, the implementation of structural policies. To determine how important a role, if any, permanent shocks play in explaining the variability in commodity prices, we proceed

in two steps. First, we establish the time-series properties of the various commodity indices via the standard Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) unit root tests under two alternative hypotheses: the first of these assumes no structural breaks occurred within the sample; the second allows for a one-time break in both the mean and the trend at a pre-specified point in time (see Perron (1989)).[4] If the series is stationary, all shocks are temporary and the null hypothesis of a unit root is rejected. If the null hypothesis is not rejected, the series has a permanent component of unknown size. Second, to determine the size of the permanent component we employ Cochrane's (1988) methodology, which provides a measure of the persistence of shocks to a variable by examining the variance of its long differences.

The form of the ADF test employed, given by equation (1), allows for both the presence of a constant (nonzero mean) and a constant deterministic drift. To ensure that the regression residuals are serially uncorrelated, past differences of the variable (denoted by Δ) are also included. As suggested by Campbell and Perron (1991), we begin by induding a generous number of lags; if the past differences do not enter significantly, these lags are dropped sequentially. The PP test, which allows for more general forms of heteroskedasticity, also allows for constant and drift terms:

$$\Delta Y_t = \alpha + \beta t + \alpha Y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-i} + e_t. \qquad (1)$$

The results of the unit root tests, which are summarized in Table 3, uniformly indicate that, when no breaks are assumed, for the log of the price series examined the null hypothesis of a unit root could not be rejected at standard confidence levels.[5] Perron (1989), however, has suggested that it is important to model large "shocks" that may result in a one-time break in either the level or the slope (or both of these) of macroeconomic time-series when testing for unit roots. He shows that standard unit root tests have little power to distinguish between nonstationarity and stationarity around a broken trend. The 1973 oil price shock, for instance, may have had persistent effects on real commodity prices.

To examine this possibility, the deterministic component was modeled

[4] As will be shown later, commodity prices exhibit heteroskedastic behavior in the sample considered. Hence, the PP test, which can handle more general forms of heteroskedasticity, is the more appropriate unit root test.

[5] The unit root hypothesis could be rejected for metals at the 10 percent confidence level.

Table 3. *Unit Root Tests, 1957:I–1993:II*

Alternative hypothesis: no structural breaks

Regression: $\Delta Y_t = \mu + \beta t + \alpha Y_{t-1} + \sum_{j=1}^{k} \theta_j \Delta Y_{t-j} + e_t$

Series	k	(τ-statistic on α (ADF statistic)	Phillips-Perron statistic
All commodities	5	-2.1353	-2.6112
Beverages	5	-2.5308	-1.4472
Food	3	-1.8665	-2.4743
Metals	1	-3.3555	-3.2849
Critical values (percent)	1	5	10
150 observations	-3.73	-3.46	-3.16

Alternative hypothesis: one-time structural break occurring at T_B

Alternative Hypothesis: $Y_t = \mu_1 + \beta_1 t + (\mu_2 - \mu_1)DU_t + (\beta_2 - \beta_1)DT_t + e_t$,

where $DU = DT = 0$ if $t \leq T_B$ and $DU = 1, DT = (t - T_B)$ if $t > T_B$

Regression: $\Delta Y_t = \alpha Y_{t-1} + \sum_{j=1}^{k} \theta_j \Delta Y_{t-j} + e_t$

Series	T_B	T-statistic α (ADF)	Phillips-Perron	λ	Critical values (percent)b 1	5	10
All commodities	73:1	-6.449	-3.659	0.4	-4.81	-4.22	-3.95
Beverages	76:1	-3.353	-3.955	0.5	-4.90	-4.24	-3.96
Food	73:1	-4.082	-3.949	0.4	-4.81	-4.22	-3.95
Metals	74:III	-4.558	-4.306	0.5	-4.90	-4.24	-3.96

a The cmical values are taken from Guilkev and Schmidt (1989). The number of observations in the sample period is 146..

bThese are taken from Perron (1989). Figure A.1 plots the fitted broken trends to the data.

to incorporate a single structural break, at which time both the level and the slope of the deterministic component changed; the dummy variables DU and DT capture the shifts in the average price and the slope of the time trend, respectively. As in Perron (1989), the sample behavior of the data was allowed to indicate where the "potential" break (denoted in Table 3 by T_B) occurred. These breaks are timed closely with the oil shock for all commodities, food, and metals. For beverages, the coffee boom that was caused by frost damage came to an end in 1977 and appears the best candidate for a behavioral change. The exact time of the break is shown in the first column of the bottom panel of Table 3. Under the

alternative hypothesis. $DU = DT = 0$ if $t \leq T_B$ and $DU = 1$, $DT = t$ if $t > T_B$. Prices and their respective deterministic broken trends are plotted in Figure A.I..

The Perron test proceeds in two steps: the first estimates the parameters associated with the deterministic components (the μ_j and β_i); in the second step the ADF (drift and trend terms are omitted) is performed on the de-trended series, denoted by y in Table 3. The appropriate critical value will depend on the time of the break relative to total sample size, λ. As Table 3 shows. the results of the Perron unit root tests indicate that the metal index is stationary around the broken trend whereas for the food and beverages indices. the unit root hypothesis cannot be rejected. The results for all commodities are ambiguous. but the more powerful Phillips-Perron tests indicate nonstationarity. However, the power of the Perron tests has recently come into question (see Zivot and Andrews (1992)), and these results should therefore be interpreted with care. Given (1) the ambiguities about the exact time-series properties of some of the commodity price indices (all commodities and metals), (2) the more general concerns about the power of the Perron test, (3) the lack of consensus in the literature about the existence and timing of breaks, we proceed under the hypothesis that the series in question has a unit root component.[6]

However, as the unit root tests are silent on the size and relative importance of the permanent component, we proceed to shed light on this issue by employing the methodology proposed by Cochrane (1988). Specifically, if the variable y has the following representation,

$$Y_t = \theta Y_{t-1} + \epsilon_{0t}, \quad \text{where} \quad \epsilon_{0t} \sim N(0, \sigma^2), \tag{2}$$

if $\theta = 1$ and the disturbance term, ϵ_0, is white noise. then y follows a random walk and the variance of its k-differences grows linearly with the difference

$$var(y_t - y_{t-k}) = k\sigma^2. \tag{3}$$

If $\theta < 1$, so Y is a stationary process, the variance of its k-differences is given by

$$var(y_t - y_{t-k}) = \sigma^2(1 - \theta^2)/(1 - \theta^2). \tag{4}$$

[6] As discussed below. the main stylized facts that emerge, as well as the policy implications, will not change considerably if the Perron test results are taken at face value and the indices for all commodities and metals are treated as stationary around a broken trend. For the food and beverage indices, this is not an issue. as all the test results uniformly indicate the existence of a unit root.

Therefore. the ratio *(llk)var(y, - Y'_k)/var(y, - Yt-I)* is equal to one if *y* is a random walk. If *y* is stationary, all shocks eventually die out.. so the variance ratio converges to zero. If *y* is a more general 1(1) process, which has both permanent and temporary (stationary) components, the ratio will converge to the ratio of the variance of the permanent shock to the total variance of *y*. Thus, the closer that ratio is to unity, the larger is the size of the unit root component, and the lower is the relative importance of temporary shocks. In the limiting case, where the ratio converges to unity, there would be *no* scope for stabilization policies, since all shocks are permanent. . The presence of an important temporary component, however, does not guarantee that price and/or income stabilization policies will be feasible. since persistence in the temporary component may be so high as to make stabilization extremely costly. Hence, as regards stabilization policies, "temporariness" is a necessary but not sufficient condition.

Table 4 summarizes the main results. The values of *k* range between 1 and 20 years. For each of the four commodity indices, permanent shocks play a role in explaining the variance of commodity prices. However, their relative importance varies considerably across commodity groupings and just as much within groupings (see Cuddington (1992»). Permanent shocks are least imponant for metals (29 percent of the variance of yearly changes) and most important for beverages (85 percent). The index for all commodities, reflecting the differing characteristics of its components, falls in the middle of the range, with permanent shocks accounting for about 45 percent of the variance of yearly changes.[7] For the two price indices with the largest unit root component-beverages and food-the ratio took the longest number of years to converge, possibly indicating that even the temporary component of these series exhibits a high degree of persistence.

As this methodology is based entirely on the univariate behavior of the variable. it does not discriminate among types or sources of temporary shocks. For example, it does not distinguish between a temporary shock owing to a recession in :he industrial countries and a temporary shock owing to a bumper crop. Such a distinction would require a structural model of commodity prices (see Borensztein and Reinhart (1994»).

[7] This result is in line with the findings of Cuddington and Urzua (1989), who. using annual data for this index for 1900-83, find that about 39 percent of the shocks to real commodity prices are permanent.

Table 4. *1/k Times the Variance of k-Differences, 1957-92"*

l/k«J:I<T~) for various *k* (years)					
2	4	8	10	12	20
All commodities					
1.032	0.465	0.524	0.448		
(0.007)	(0.013)	(0.022)	(0.026)		
Beverages					
1.176	1.220	0.904	0.998	1.260	0.846
(0.007)	(0.013)	(0.025)	(0.029)	(0.033)	(0.039)
Food					
1.188	0.816	0.682	0.613	0.731	
(0.007)	(0.013)	(0.021)	(0.024)	(0.027)	
Metals					
1.099	0.481	0.333	0.287		
(0.007)	(0.013)	(0.022)	(0.026)		

• Annual data were used. All commodity price indices are deflated by the export unit values of manufactures. Standard errors are in parentheses. The standard errors were tabulated from Monte Carlo simulations (600 replications) for n = 35 and k = 10, 12, and 20 under the null hypothesis of a random walk.

Rising Volatility of Commodity Prices

In addition to assessing whether a commodity price is driven primarily by permanent or transitory shocks, other aspects of the nature of the shocks have to be considered when designing policy. For instance, even if the price is stationary around a deterministic trend (so all shocks are temporary), there are relatively few gains from setting up a stabilization fund and/or hedging if the variance of prices is small and large shocks are rare. The benefits to be obtained from stabilization funds, or, more generally, from precautionary savings will increase in a more volatile and uncertain environment, because greater uncertainty in a country's export revenue stream increases the value to that country of accumulating assets to insure itself against future shocks (Ghosh and Ostry (1994». Similarly, hedging strategies acquire greater importance as volatility increases and the probability of large destabilizing shocks is high. To examine these issues, we focus on the sample moments of the price series of interest.

Table 5. *Changing Variance of Commodiry Prices: Tests for Heteroskedasticiry, 1959:1-1993:Ir*

ARCH test	$X^2(1) = 7.683$ (0.005)
Breusch-Pagan test	$I(3) = 6.377$ (0.095)
White's test	$I(5) = 11.034$ (0.051)

• Owing to the nonstationarity of the data, the tests were performed on the log-differences of the real all-commodity price index.

To examine the issue of rising volatility, we first test for the presence of heteroskedastic disturbances and then review the descriptive statistics of commodity prices over different sample periods. The tests for heteroskedasticity on the log-differences of real commodity prices (the results for all commodities are reported in Table S) uniformly reject the null hypothesis that the shocks to commodity prices are identically distributed during the sample period.[8]

These results are consistent with the picture that emerges from Table 6, which presents the evolution of the basic descriptive statistics of the real commodity indices over three subsamples. Several features are worth noting. First, the average price is markedly lower during the most recent sample, consistent with the presence of a negative trend. Second, there is a sustained and sharp increase in the variance of commodity prices.[9] This increase is evident in all the indices but is most pronounced in the all commodities and food groupings.[10] The coefficient of variation rises sharply as prices become more volatile around a falling mean: for food the increase in the coefficient of variation is sixfold. Figure 2. which plots the coefficients of variation (based on a moving IS-year sample) for I972:I-1993:II, also highlights the marked rise in volatility. Not SllrpriS-

8The same tests performed on the entire 1900-92 period do not indicate heteroskedastic disturbances. Volatilitywas high in the pre-World War II period. diminished drastically during the 1950sand 1960s, and rose again in the early 1970s. Henc.e, shocks to commodity prices were relatively small only in a subs~ple Wlthin a penod of 90 years. Not surprisingly, the tests for heteroskedastlCltydo not find that shocks to commodity prices were smaller at the begInnmg of the sample than at the end.

9This feature has also been discussed in Deaton (1992) and Deaton and Laroque (1992).

10 For a rational expectations model that is capable of generating predictions that match some .of the o~~erved characteristics of commodity price behavior descnbed here (high volatlhty, skewness. and excess kurtosis), see Deaton and Laroque (1992).

exchange system and on the heels of the first oil shock. However, volatility has remained high during the 1980s and 1990s. Stuctural models often link oil prices and the U.S. real exchange rate to real commodity prices (see, for instance. Borensztein and Reinhart (1994». Hence, the changing structure of the oil industry since the early 1970s-which has contributed to sharp increases in the volatility of oil prices-and the switch to a floating exchange rate regime-which has increased the volatility of other key relative prices such as real exchange rates (see Mussa (1986)}—are likely to be important factors in explaining the more volatile behavior of commodity prices since the early 1970s. Last, the evidence on the probability of large shocks is mixed: the distributions of commodity prices were characterized by excess kurtosis (fat tails) during the 1970s, as large shocks became more commonplace. [11] However, the more recent sample is characterized by relatively infrequent realizations of large shocks.

II. Temporary Weakness or Secular Decline?

The aim of this section is to give some idea of how much the recent weakness in commodity prices is associated with reversible cyclical forces, or how much it is part of a longer-term secular decline. We employ alternative methodologies to address this issue, and the main reason for such an eclectic approach is to determine whether the results are sensitive to the choice of technique. The persistence and other features of the cycle are also examined.

Trend-Cycle Decompositions

If a unit root is present, admissible ways of disentangling trend from cycle are either by the methodology proposed by Beveridge and Nelson (1981) or by the structural time-series approach associated with Harvey (1985), as both of these approaches allow for the presence of a stochastic trend. We next apply, in turn, both of these approaches.

First, employing the Beveridge-Nelson (B-N) technique (Beveridge and Nelson (1981)) as modified by Miller (1988), we decompose the real

[11] This issue is not trivial, as excess kurtosis increases the value of precautionary saving. For example. for a level of consumption sufficiently close to subsistence. a large adverse shock in the absence of precautionary saving could have devastating effects.

commodity price into its "permanent" (or steady-state) component and its "temporary" (or cyclical component), denoted by z and c, respectively. As discussed above, the identifying criteria for this technique is that the former captures the nonstationary component of the variable, while the latter captures its stationary element. Hence,

$$y_t = z_t + c_t. \tag{5}$$

The evolution of the permanent component is given by

$$az, = \sim + \frac{(1 - e_1 \sim, e\sim - \ldots '-6_q)}{(1 - \langle P1 - \langle P2 - \ldots -\langle pp)} \tag{6}$$

where e and ⟨I⟩ are the parameters describing the ARMA process. Using the estimates of e, ⟨I⟩, and ~. the path of the permanent component is constructed. The cyclical component is calculated residually as the difference between the estimated permanent component. z, and the actual values of y.[12]

Using the Box-Ljung Q statistic as a guideline. the ARMA processes were selected to whiten the error. In general the longer ARMA processes provided the best fit.[13] At the quarterly frequency, an ARMA(20,4) process was fitted to the all commodities and beverages groupings, while food and metals were characterized by ARMA(16,4) processes. Table 7 reports the full estimation results for the annual frequency and the main diagnostics of the quarterly estimation. Figure 3 plots the actual series along with the estimated permanent component. For example, large deviations from trend were evident in the indices for all commodities. food, and metals during 1973, at the time of the first oil shock. For beverages. the largest deviations from trend during the sample took place during 1977 and are associated with a supply shock.[14] As Figure 3 illustrates. except for the metals basket. for which the actual price has been below trend since late 1990, actual prices for all other indices are close to their permanent trend component. Figure 3 also illustrates that the evolution of the permanent component changes considerably during the course of the sample. Whereas during the 1960s and up to the first oil shock all prices were relatively stable. the trend has become markedly negative since the mid-1970s (somewhat later for beverages).

An alternative approach to decomposing a time-series into its stochastic trend and cycle is associated with Harvey (1985). This structural

12For additional details see Beveridge and Nelson (1981) and Miller (1988).

13For a discussion of the problems associated with fitting low ARMA processes to macroeconomic data. see Cochrane (1988).

14Since coffee has a large weight in the beverage index, this price spike is associated with a severe frost in Brazil.

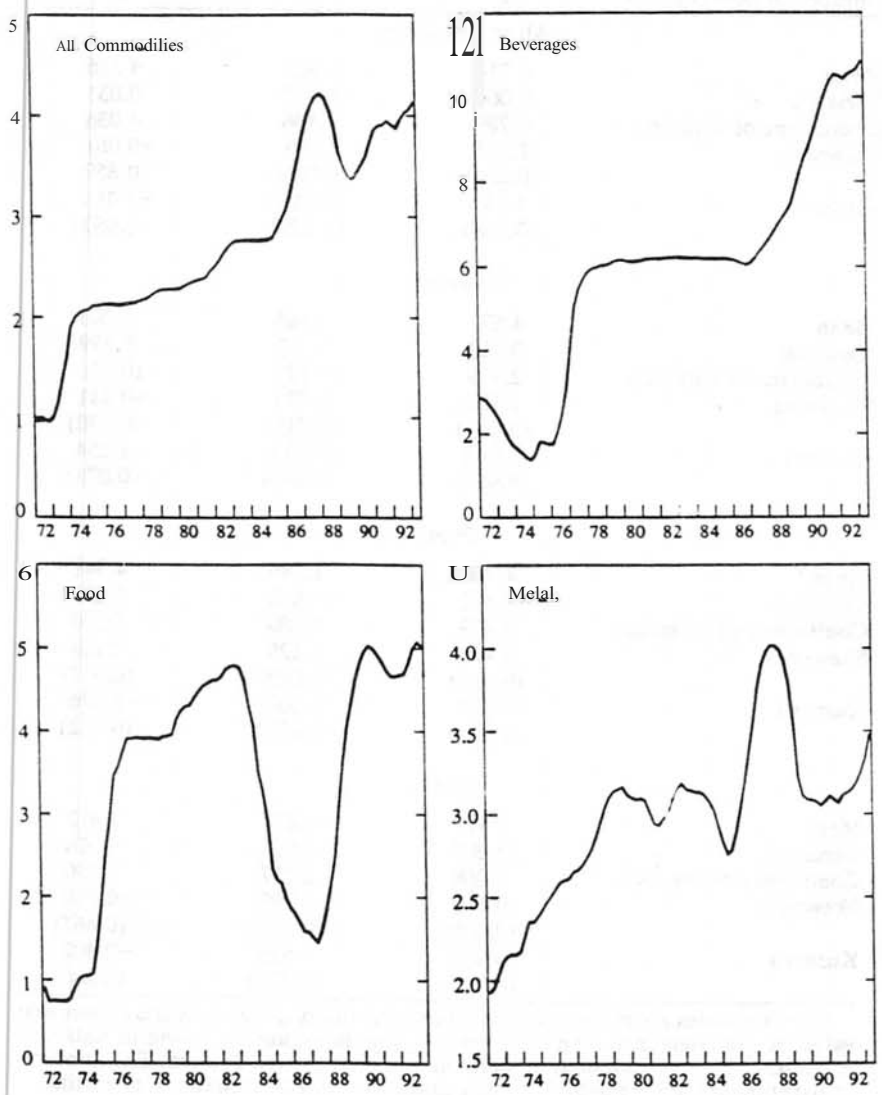
Table 6. *Descriptive Statistics. 1957:1-1993:Ir*

Sample period Number of observations	1957:1-1969:IV 52	1970:1-1979:IV 4D	1980:I-1993:1I 54
	All commodities		
Mean	4.714	4.705	4.386
Variance	0.001	0.017	0.031
Coefficient of variation	0.789	2.806	4.036
Skewness	1,275	1,291	-0.061
	(0.000)	(0.001)	(0.859)
Kurtosis	1,939	1,019	-1.386
	(0.008)	(0.229)	(0.052)
	Beverages		
Mean	4.573	4.668	4.203
Variance	0.018	0.112	0.199
Coefficient of variation	2.974	7.178	10.611
Skewness	1,152	0.979	-0.411
	(0.001)	(0.015)	(0.230)
Kurtosis	0.083	0.396	-1.254
	(0.909)	(0.640)	(0.078)
	Food		
Mean	4.766	4.789	4.341
Variance	0.002	0.042	0.053
Coefficient of variation	0.839	4.280	5.300
Skewness	0,428	1,129	0.138
	(0.221)	(0.005)	(0.687)
Kurtosis	-0.096	0.338	-1.526
	(0.901)	(0.690)	(0.032)
	Metals		
Mean	4.819	4.677	4,412
Variance	0.008	0.016	0.024
Coefficient of variation	1,868	2.737	3,490
Skewness	0.619	1,299	-0.250
	(0.039)	(0.001)	(0.467)
Kurtosis	-0.280	1,638	-0.802
	(0.700)	(0.053)	(0.260)

• The variables are the logs of the commodity index deflated by the export unit value of manufactures. The statistics are sample moments; owing to potential nonstationarity, the population moments may not be well defined. The numbers in parentheses are probability values under the null hypothesis of normality.

ingly, the sharpest increases in volatility appear to have taken place during the early 1970s following the breakdown of the Bretton Woods

Figure 2. *Rising Volatility in Real Non-Oil Commodity Prices*
(Coefficients oi variation)



Sources: *IMF.lntem.'l·ioTUJl FiTUJncial Statistics.* and the authors.

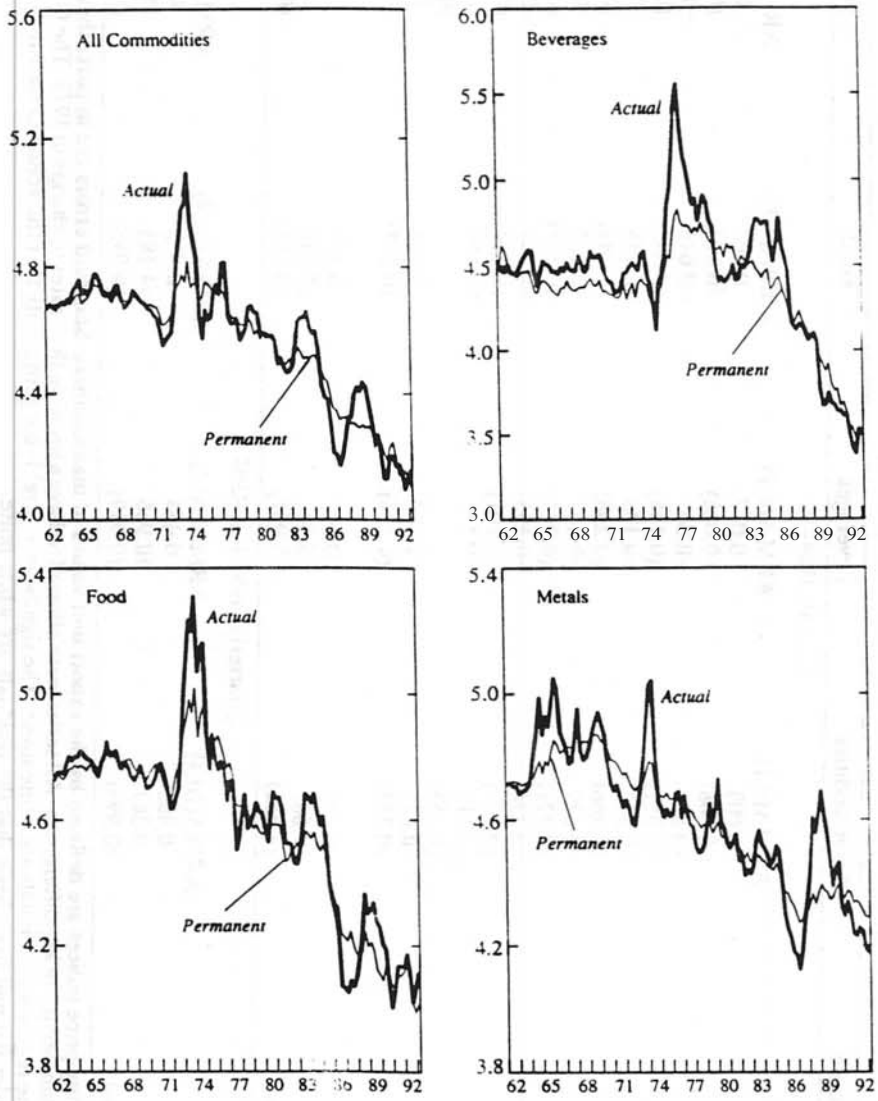
Note: The coefficier.~ -t variation is based on IS-year moving averages and IS-year standard deviations that .::c backward looking; the observation for 1972:1. for instance. is based on data from 1957:I1-1972:I.

Table 7. *Beveridge-Nelson Decompositions Modeling Change in Permanent Component as an ARMA Process*[a]

Dependent variable	All commodities	Beverages	Food	Metals
		Annual: 1964-92		
ARMA(p,q)	ARMA(5,1)	ARMA(4,1)	ARMA(4,!)	ARMA(5,l)
Constant	0.003	0.017	0.002	0.007
	(0.008)	(0.026)	(0.013)	(0.007)
AR(!)	-0.880	-0.567	-0.646	-1.203
	(0.351)	(0.146)	(0.646)	(0.191)
AR(2)	-0.912	-0.128	-0.535	-0.832
	(0.266)	(0.298)	(0.247)	(0.278)
AR(3)	-0.629	-0.167	-0.420	-0.942
	(0.371)	(0.271)	(0.476)	(0.263)
AR(4)	-0.374	-0.195	-0.295	-0.645
	(0.269)	(0.101)	(0.149)	(0.288)
AR(5)	-0.118	••••••	▪▪▪▪▪▪	-0.315
	(0.253)			(0.236)
MA(l)	0.817	1,352	11754	1,476
	(0.333)	(0.386)	(0.554)	(0.439)
R^2	0,469	0.341	fUll	n.n!7
Q statistic	9.085	5.981	13.842	6.267
Significance level	(0.826)	(0.967)	(0.461)	(0.959)
		Quarterly: 1962:1-1993:11		
ARMA(p,q)	ARMA(20,4)	ARMA(20,4)	ARMA(!6,4)	ARMA(16,4)
R^2	0,465	0,454	0.393	0.371
Q statistic	8.567	10.966	14.183	15.560
Significance level	(0.999)	(0.999)	(0.998)	(0.996)

• All commodity price indices are deflated by the export unit values of manufactures. Standard errors are in parentheses. The models were estimated using log-differences. All series were allowed to have a break in their rates of change in 1973. The Q stiltistic tests whether the regression residuals are white noise. The significance level is the probability that the actuill Q statistic value will be observed under the null hypothesis that the residuals are white noise.

Figure 3. *Real Non-Oil Commodiry Prices: Trends and Cycles Beveridge-Nelson Decomposition*



Sources: IMF, *International Financial Statistics*, and the authors.

time-series approach relies on the Kalman filter. In this trend plus cycle model, the stochastic trend or permanent component, z, can be modeled as[15]

$$\begin{aligned} z_t &= z_{t-1} + \beta_{t-1} + \eta_t, & \eta_t &\sim \text{nid}(0, \sigma_\eta^2) \\ \beta_t &= \beta_{t-1} + \varepsilon_t, & \varepsilon_t &\sim \text{nid}(0, \sigma_\varepsilon^2), \end{aligned} \tag{7}$$

where η_t and ε_t are mutually independent, normally distributed white-noise disturbances. The cycle is given by

$$\begin{bmatrix} c_t \\ c_t^* \end{bmatrix} = \rho \begin{bmatrix} \cos\lambda & \sin\lambda \\ -\sin\lambda & \cos\lambda \end{bmatrix} \begin{bmatrix} c_{t-1} \\ c_{t-1}^* \end{bmatrix} + \begin{bmatrix} \kappa_t \\ \kappa_t^* \end{bmatrix}, \tag{8}$$

$$0 \le \lambda \le \pi, \quad 0 \le \rho \le 1,$$

where, as before, c_t is the cyclical component, κ_t and κ_t^* are uncorrelated white-noise disturbances, and c_t^* appears by construction (see Harrison and Akram (1983)). The parameters λ and ρ describe the frequency of the cycle and the damping factor on the amplitude of the cycle, respectively. Using the Kalman filter, the parameters $(\lambda, \rho, \sigma_\kappa^2, \sigma_\eta^2, \sigma_\varepsilon^2)$ are estimated by maximum likelihood (ML) in the time or frequency domains.

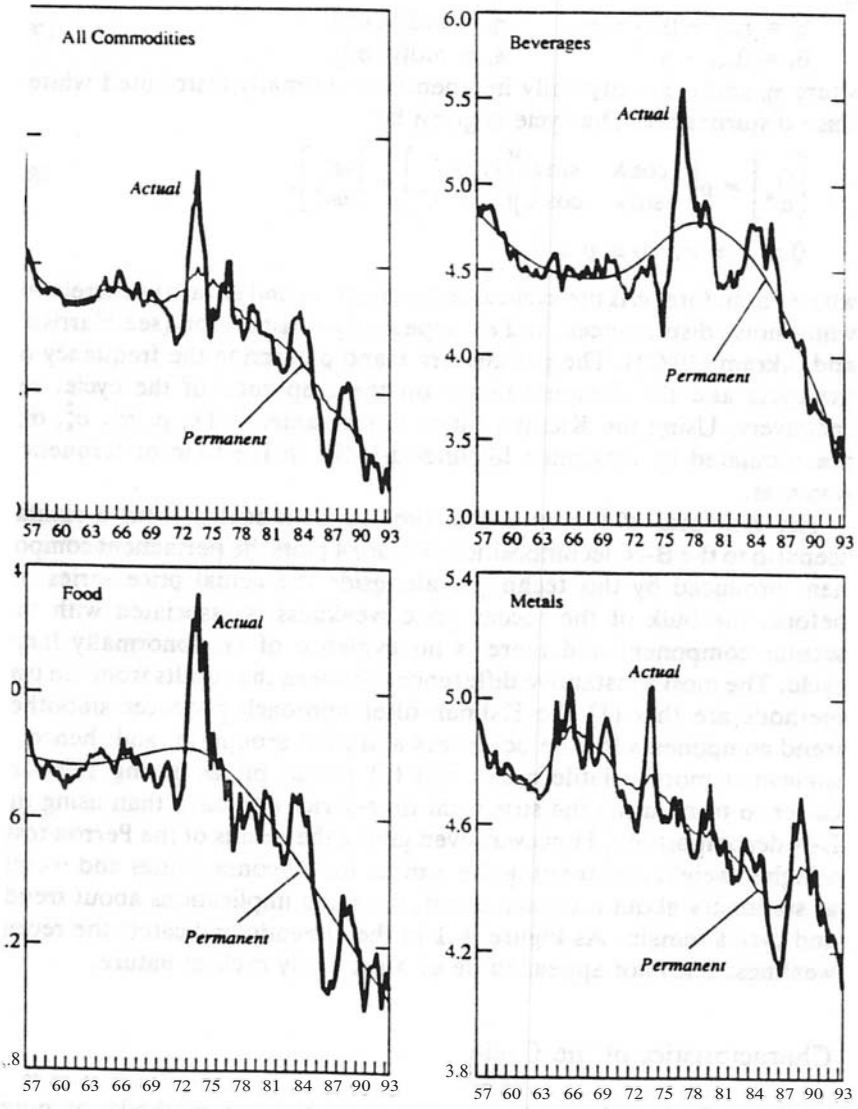
The estimates of the structural time-series model present a similar scenario to the B-N decomposition. Figure 4 plots the permanent component produced by this technique alongside the actual price series; as before, the bulk of the recent price weakness is associated with the secular component and there is no evidence of an abnormally large cycle. The most substantive differences between the results from the two methods are that (1) the Kalman-filter approach produces smoother trend components for the beverages and food groupings, and, hence, a somewhat more volatile cycle, and (2) metals prices during 1993 are closer to trend using the structural time-series approach than using the B-N decomposition. However, even giving the results of the Perron tests a higher weight and treating the indices for all commodities and metals as stationary about a broken trend, the main implications about trends and cycles remain. As Figure A.1 in the appendix indicates, the recent weakness does not appear to be of a primarily cyclical nature.

Characteristics of the Cycle

Figure 5 plots the cycles generated by the two methods: as noted earlier, the similarities are strong. In effect, the pairwise correlations

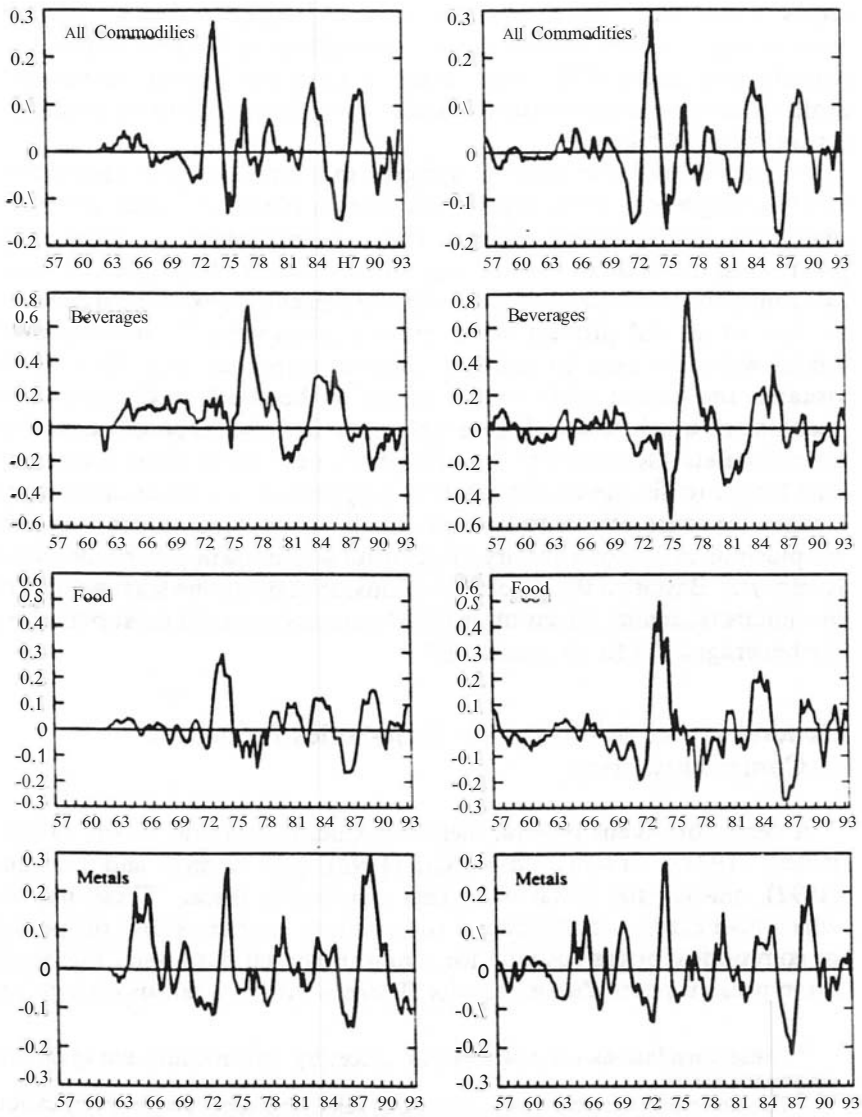
[15] We have assumed there is no irregular component.

Figure 4. *Real Commodity Prices: Trends and Cycles*
Structural Time-Series Decomposition



Sources: IMF, *International Financial Statistics*, and the authors.

Figure 5. *Real Commodity Prices: Cycles*
(Beveridge-Nelson Cycle (left panel) versus Kalman Filter Cycle (right panel))



Sources: IMF, *International Financial Statistics*, and the authors.

between the cycles generated by the two approaches are quite high: 0.95 for all commodities, 0.87 for beverages, 0.90 for food, and 0,87 for metals. [16] It is also evident from these figures that the cycles are correlated across commodity groupings. showing the high degree of CO-ii:.ovement in commodic ~rices. Cycles in all commodities are highly correlated (correlations ≤J.iJove0.80) with cycles in food and metals. Beverages exhibit the most idiosyncratic behavior. as cycles appear to be primarily driven by supply shocks.

As noted earlier, the temporary shocks that drive the cycle can exhibit differing degrees of persistence. Stabilization funds are better suited to smoothing out short-lived shocks: the more persistent the shock. the greater are the costs of maintaining an "artificially" high internal price (assuming the shock had tended to depress prices). To examine this issue. we first fit an AR process to the cyclical component.[17] The estimated model was then used to generate impulse responses that allow us to visualize the time it takes for the effects of the shock to disappear (or become arbitrarily small). Figure 6 plots the impulse responses based on the estimated AR processes. [18]Although the full effects of the shock may take longer to disappear. for practical purposes we will focus on the time it takes for these effects to become smaller than some arbitrary cutoff. say plus/minus 0.02 of a unitary shock. after which the impact of the shock is minimal.. Based on these considerations. shocks are the least persistent for metals (reaching the cutoff in 6 to 7 quarters) and the most persistent for beverages (12 to 13 quarters).[19]

General Observations on the Time-Series Properties of Commodity Prices

A series of recent papers. including Cuddington and Urzua (1989). Powell (1991). Ardeni and Wright (1992). and Deaton and Laroque (1992). analyze the behavior of real commodity prices. These papers. which give careful consideration to modeling the time-series properties of commodity prices (usually for long-run annual data-see Figure 1), often present contradictory results. There is little consensus on whether

16,These co~elations are *not* spurious, since. by construction. the cycles are statlonarv senes.

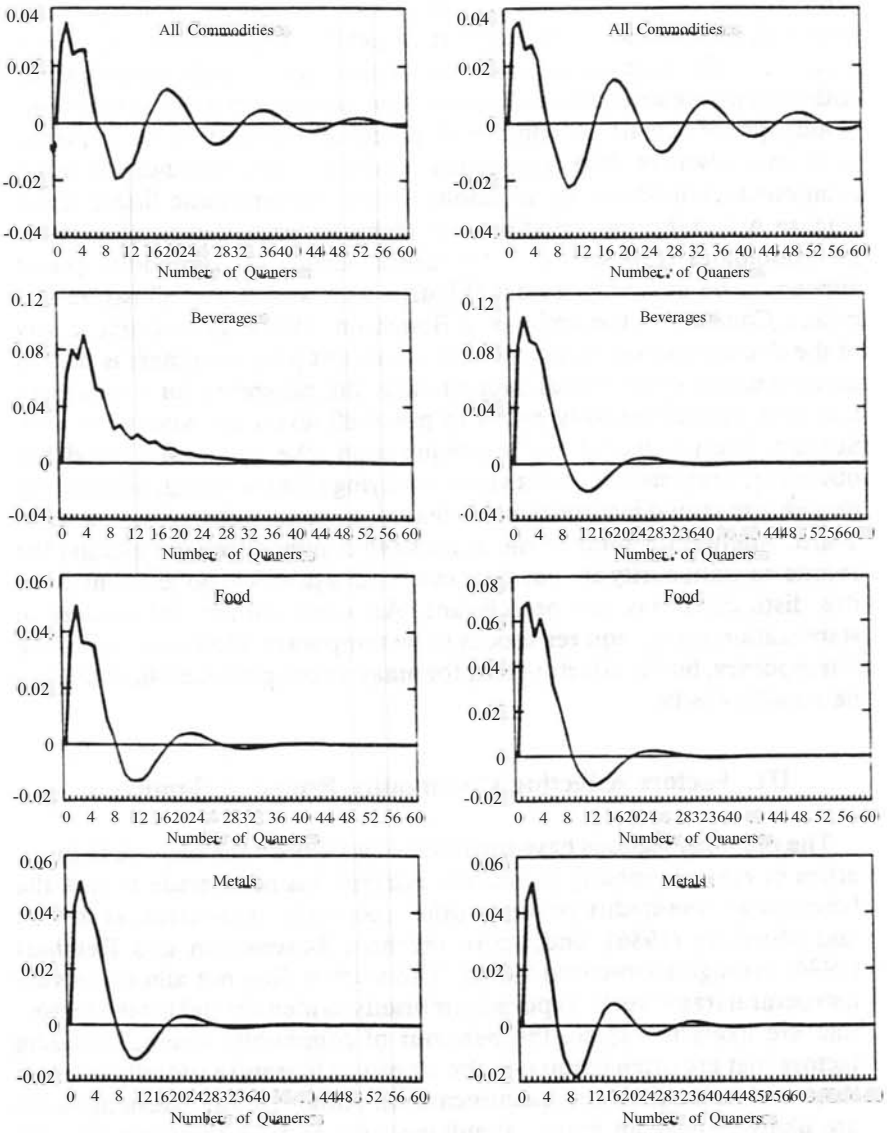
17 The Schwarz criterion was employed to select the appropriate specification.

18The estimated AR processes are not reported. but the results are available from the authors.

19 The scaies in the panels of Figure 6 are not uniform, across commodities. with beverages having the widest scale (reflecting the higher variance of its cycle) and all commodities having the narrowest.

Figure 6. *Impulse Responses: Persistence in the Cycle*

Beveridge-Nelson Cycle (left panell versus Kalman Filter Cycle (right panell



Note: These impulse responses are based on the estimated AR processes.

real commodity prices are stationary or not or when, if any, structural breaks have taken place.

Similar ambiguities arise from the analysis of the quarterly postwar data used in this study. There is, however, one robust finding in the empirical work-real commodity prices exhibit a high degree of persistence, and the high autocorrelation in the data is well documented. Although ambiguities about the exact time-series properties of real commodity prices remain, a number of practical implications still emerge from an analysis of their time-series behavior. First, whether the trend component is modeled by a simple broken deterministic linear trend (Figure A.1 in the appendix) or by a stochastic process using alternative methodologies (this section), the recent decline in commodity prices appears to be primarily secular (Figures 3. 4, and A.1 all illustrate this point). Contrary to the findings of Boughton (1991), no evidence in any of the decompositions indicates that the recent price weakness is part of an anomalous cycle, which suggests that the prospects for a sharp recovery in real commodity prices to pre-1980 levels are somewhat dim. Second, irrespective of the technique used, the downward trend has obviously steepened in recent years, implying that the design of stabilization efforts should incorporate this feature of commodity price behavior. Third, whereas for some of the indices (all commodities and metals) the results on stationarity are not clear cut, from a practical policy standpoint this distinction may not be relevant. As noted earlier, the success of stabilization funds requires shocks to be temporary. However, if a shock is temporary, but its effects persist for many years, price stabilization may be equally costly.

III. Factors Affecting Commodity Prices: A Summary

The previous sections have focused exclusively on the univariate properties of real commodity prices. No attempt has been made to link the behavior of commodity prices to other economic time-series, as in Chu and Morrison (1986), and, more recently, Borensztein and Reinhart (1994) through a structural model. This section does not aim to provide a structural framework; its purpose is briefly to identify and list the factors that are likely to explain the behavior of commodity prices, including factors that are often ignored in the empirical literature (usually because they are less amenable to quantification). Although some developments are likely to have an impact simultaneously on both the trend and the cycle of real commodity prices, an attempt is made in this section to identify which factors are likely to be linked primarily to the trend

(specifically, the persistent weakness since the late 1970s) and which are predominantly associated with the cycle.

Secular Developments

Economic Growth and the Demand for Commodities

Analyses of commodity market developments have usually focused on the macroeconomic conditions in industrial countries as the principal factor affecting commodity prices. Given the role of many commodities as inputs for production by manufacturing industries, their demand is closely related to the level of industrial economic activity, the major part of which takes place in industrial countries. Therefore, the trend decline in real commodity prices is at least partially related to the marked and secular slowdown in the growth of output in the industrial countries in the early 1970s, with 1973 constituting the end of the strong postwar expansion phase for most countries.[20]

In addition to the slowdown in growth, a declining intensity of resource use in industrial countries has contributed to reduced rates of growth in the demand for commodities, particularly metals. TIlton (1990) has shown that this pattern holds for a large number of countries of the Organization for Economic Cooperation and Development.

Various explanations have been put forward for the trends observed in the intensity of metals use in the industrial countries. Some of these stress the changing composition of output: the shift from manufacturing to services; the declining share in GDP of gross domestic investment, which is more metal intensive than other components of expenditure; and, more recently, declines in the defense-related industries. Other explanations focus on the role of resource-saving technologies and the process of materials substitution.

Much less is known about intensity of metals use outside the industrial countries. For the countries of the former Council for Mutual Economic Assistance (CMEA), Dobozi (1990) shows that the period of growing metals consumption and rising intensity of use also came to an end in the mid-1970s as output growth in these countries also slowed. As regards developing countries, the rapid pace of industrialization in the Asian region and in parts of Latin America in the 1960s through the early 1980s has been linked with a rising intensity of resource use and appears

[20] For a discussion of the factors behind the slowdown in growth, see, for example, Adams, Fenton, and Larsen (1987).

to be related to the high levels of gross domestic investment during this period. The subsequent picture, however, is mixed, as external financing difficulties lowered investment and growth rates in many developing countries, particularly in Africa and Latin America.

Surge in Supply

As shown in Borensztein and Reinhart (1994), supply conditions have played a key role in explaining the weakness in commodity prices, particularly since the mid-1980s. In part, the reasons for the supply response in the 1980s can be found in the debt crisis and the need to adopt adjustment policies that, among other things, aimed at increasing export earnings by expanding export volumes. However, perhaps the most important factors behind the sharp and sustained increases in the supply of numerous commodities during the past decade are the trends in technology, information diffusion, and factor productivity. Although quantification is often difficult, a number of important examples show where these technology-driven shift factors can be important.

The diffusion of information about prices, techniques, and marketing opportunities can cause significant increases in overall commodity supplies by bringing new entrants into international markets. The emergence during the 1980s of first Malaysia and then Indonesia as major cocoa producers is one of the prime examples of this phenomenon. Whereas producers other than these two countries on aggregate increased production by about 15 percent between 1980-81 and 1991-92, Malaysia and Indonesia increased their combined raw cocoa output by 500 percent. During the 1970s, the larger plantations in Malaysia became aware that the rise in real cocoa prices would make production profitable; decisions were made to move into cocoa, and the rate of plantings accelerated accordingly. Rising production levels and export earnings in Malaysia did not go unnoticed by the authorities and agricultural companies in Indonesia. As a result, plantings there grew rapidly through the mid- and late-1980s, and Indonesia rose from producing a small amount of specialty "fine" cocoa to producing 167,000 tons of mostly bulk cocoa in 1991-92. Although declines in cocoa prices since the mid-1980s have had an effect on other (higher-cost) producers, cocoa production remains profitable in Indonesia owing to high productivity.

Minerals and metals are also examples of how the accumulation of knowledge and technological progress have led to significant shifts in long-run supply curves. However, the most remarkable examples of information diffusion and technologically driven productivity growth are found in agriculture. Despite demand growth-particularly, owing to high rates of population growth in developing countries-the rise in produc-

tion has been such that real food prices have. except for a brief episode in the mid-1970s, declined significantly in the postwar period. Whereas land under cultivation has increased in many parts of the developing world, a sustained increase in yields over time has played a major role in the agricultural supply-demand equation. Cereals are the premier example, but other crops have also registered significant increases in yields. Advances in agroscience that have led to the development of higher-yield and more disease-resistant varieties, the increased use of fertilizers and pesticides, and the spread of irrigation are the principal factors cited for the increases in agricultural yields (see Figure 7).

The improvements in technology are likely to be "irreversible" and are not limited to a few commodities. These developments have had widespread effects and have led to improved yields for many types of crops, including beverages (cocoa, coffee, tea), oilseeds, vegetables, and agricultural raw materials such as cotton. Innovation and information diffusion win probably continue to playa significant role in increasing agricultural yields still further (particularly in light of recent major advances in biotechnology).

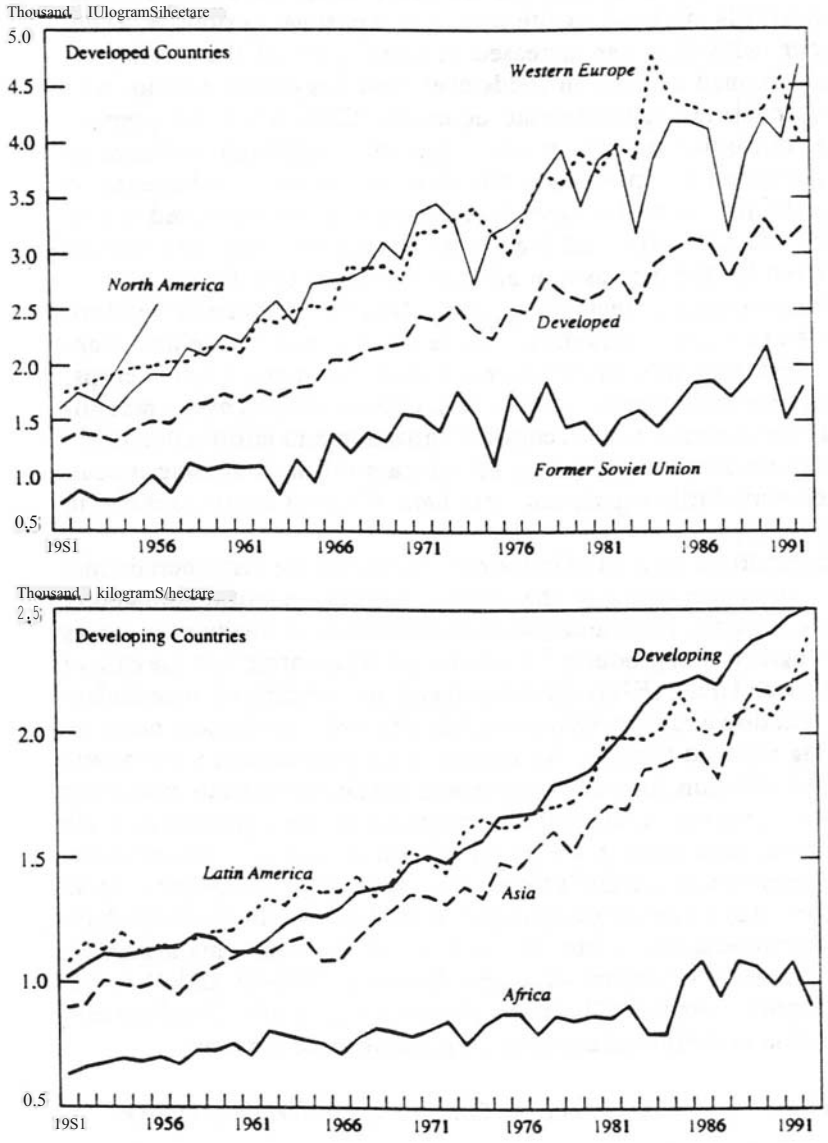
The agricultural policies of industrial countries have also undoubtedly been an important factor in the rapid expansion in world commodity supplies during the 1980s and have contributed to the weakness in prices of many agricultural products.[21] National (or transnational in the case of the European Union (EU)) agricultural policies typically act to stimulate output and discourage consumption, thereby reducing import needs or increasing supplies available for export. Such government intervention has been a common feature in industrial countries in the post-World War II period; however, a marked deterioration in the agricultural trade environment took place in the 1980s. Wheat is an instructive example. Price support under the EU's Common Agricultural Policy has been so "effective" that wheat supplies surplus to the Union's requirements have grown over time and have had to be sold on world markets, made possible by the provision of export subsidies. Between 1980-81 and 1991-92, wheat exports from the EU rose by 55 percent, to nearly 22 million tons (an increase in market share from 14 percent to 20 percent).

Institutional Factors: International Commodity Agreements (ICAs)

Part of the blame for weakening commodity prices during the 1980s and 1990s is often attributed to the international community's failure to abide

[21] Most partial and general equilibrium models suggest that real prices for most agricultural products would rise if reforms were implemented by the industrial countries. See Goldin and Knudsen (1990).

Figure 7. *Cereal Yields by Region*



Source: Food and Agriculture Organization, *Production Yearbook.*

by and support commodity agreements designed to help stabilize prices and ensure a "fair" return to commodity producers. Several such agreements were in effect during the 1970s and early 1980s. In June 1984 the agreement covering sugar collapsed. Thereafter, other agreements followed suit or became economically moribund: tin (October 1985), cocoa (February 1988), coffee (July 1989), and natural rubber (April 1993). The immediate impact on price of a breakdown in a commodity agreement may have a large "temporary" component as prices spike downward; for instance, beverage prices fell well below trend from mid-1987 to mid-1989 (Figures 3- 5).[22] However, the effects of the breakdown are likely to have an important "permanent" component as the behavior of exporters adjusts to the more competitive regime. In effect. the evidence suggests that, in addition to agricultural policies in industrial countries and the technological innovations discussed above. the breakdown of the numerous agreements has been a factor behind the sharp expansion in world commodity supplies in recent years. In part, however, the breakdown of a number of agreements reflects the difficulties of trying to influence prices by managing output or other means in the face of developments (such as productivity increases acting to foster an expansion in supplies).

Cyclical Factors

Weak Economic Performance in Recent Years in Industrial Countries

The lackluster economic performance of the industrial countries has been cited as contributing to the recent weakness in real commodity prices. As noted in the empirical literature (see, for example, Chu and Morrison (1986)), industrial production in the developed countries is a key determinant of commodity prices, with estimated elasticities generally clustered in the 1.0-2.0 range. Although the current environment is not characterized as a deep recession, industrial production in the industrial countries has been flat since 1989. However, as noted throughout this paper, the bulk of the weakness in commodity prices appears to be secular. A sizable negative cycle component in commodity prices, such as those characterizing the 1975 and 1982 recessions in the United States and other industrial countries (see Figure 5), is not currently present. Further, Borensztein and Reinhart (1994) show that only a small fraction of the variability in real commodity prices in 1989-92 is attributable to output developments in industrial countries. Their analysis indicates that

[22] Unless the breakdown of the IEA was fully anticipated, in which case prices would have already reacted.

developments in the former Soviet Union (discussed below) can account for a more important share of the recent variability in commodity prices.

Falling Demand and Supply Shocks from the Former Soviet Union

The recent output collapse in the former Soviet Union (it is assumed. for purposes of this discussion that the bulk of the decline is "temporary," although evidently quite persistent) has depressed demand for a number of imported commodities such as cocoa, corn, and tea. Further, demand within the krmer Soviet Union for metals is reported to have fallen sharply, pamcularly as armament production has declined. Hence, the response by commodity producers in the former Soviet Union to this shift in demand and the dislocation accompanying reform has caused supply shocks in international commodity markets. This has been particularly evident in the metals markets where, for example, zinc exports from the former Soviet Union rose by nearly 700 percent during 1989-92. Exports of metals to Western markets offered a ready means of raising large amounts of much-needed forei~n exchange. However, although shortages of foreign exchange led :..;; official sanctioning of increased metal exports to Western markets. the failure to liberalize domestic metals prices fully in Russia and the other republics also created huge arbitrage opportunities.[2J]

Hence. coupled with adverse cyclical conditions in the West, the surge in the exports of metals from the former Soviet Union appear to have contributed significantly to the weakening of commodity prices. particularly metals prices. on international markets.

IV. Policy Issues

Both the volatility in real comfTlndity prices and the sustained decline experienced over recent years pn.::,..;.lt serious challenges for many member countries of the Fund and the World Bank because of the impact on export earnings, domestic incomes (and hence private savings and investment), and government budgetary positions. The response to volatility in commodity prices, however, raises issues that are quite different from those emanating from secular changes in the average level of prices. It is therefore crucial to interpret correctly market developments in each

[2J] Effective early in 1993. domestic prices for metals were liberalized and other steps were also taken to reduce the scope for illegal trading.

case to be able to elaborate the appropriate policy response or, in fact, to consider whether a policy response is even warranted.

Temporary Price Shocks and the Role of Government in Smoothing Income

Temporary shocks to commodity prices affect both the private and public sectors in the commodity producing countries. When facing temporary changes in income, the optimal response by individual consumers is to use saving and borrowing in an attempt to smooth the path of consumption. Similarly, governments facing temporary changes in revenue should adjust their spending to make it consistent with sustainable levels.

A traditional argument for government to absorb the effects of commodity price fluctuations is based on microeconomic considerations relating to the behavior of private agents.[24] If private agents bear all the commodity price risk, they will tend to face variable and unpredictable income streams over time, with possibly very limited opportunity to smooth consumption. Therefore, it may be best for the government to intervene to stabilize the prices received by private agents and thus enhance the welfare of risk-averse individuals by permitting smoother income and consumption streams.

Empirical evidence on savings behavior in developing countries is far from conclusive, but it does suggest that consumption smoothing may well take place more than is traditionally assumed.[25] At the microeconomic level, the evidence suggests that agents do react to commodity price instability in a manner consistent with theory. Rice farmers in Thailand, for example, smooth their consumption quite successfully both within and between harvest years.[26] Also, an analysis of the coffee boom of 1976-79 in Kenya found that as much as 60 percent of boom income went into private savings; farmers were aware that the boom was due to frost damage in Brazil and that their income gains were largely a windfall.[27] In contrast, governments in a number of countries have found it difficult to manage the proceeds of temporary windfall gains well. Thus, the evidence suggests that governments may be well advised to reassess their intervention strategies and the responsibility they assume for managing commodity price risk at the country level.

24 See Deaton (1992).
25 See Ostry and Reinhart (1992).
26 See Paxson (1993).
27 See Bevan, Collier, and Gunning (1987).

Intervention Strategies

With fluctuations in international commodity prices affecting the domestic economy, the types of intervention employed have been varied: the strategies most often used and their problems are outlined below.

Stabilization Funds and Agricultural Boards

Stabilization funds have been designed to deal with the impact of commodity price volatility on government revenues, especially in countries heavily dependent on metals and minerals. These funds act as a buffer for government expenditures and financing and have at least two appealing features. First. they impose a rule on governments. designed to use resources optimally from a long-term perspective. The rule should lessen the risk that governments may be tempted to increase spending excessively during temporary booms. Second, the funds are an institutional device through which governments can even out their expenditures, since countries, as well as individuals, may be limited in their ability to smooth spending because of lack of access to international financial markets.

The other principal type of institutional structure fe; government intervention has been the state-owned agricultural board or fund. These institutions are usually charged with a domestic price stabilization function, the transfer of explicit export taxes to the central government, and a role in determining the extent to which operating surpluses are channeled into a formal stabilization fund or are transferred directly to the central government (or to other uses). The experience with these types of funds or boards raises a number of issues about their desirability. First. stabilization schemes that transfer most of the effects of commodity price fluctuations to the government may tend to exacerbate a country's fiscal management problems. For some countries the exercise of sufficient control over government expenditure (particularly during boom periods) is likely to pose serious difficulties. Also, to achieve a significant amount of income smoothing, a fund may have to hold a relatively high level of foreign reserves or be able to borrow from international capital markets for stabilization purposes during downturns in commodity prices. A relatively high level of foreign reserves (on average) is necessary because temporary commodity price shocks are quite persistent and revert slowly to trend, and many developing countries do not enjoy a credit rating enabling them to obtain substantial resources from private foreign sources.

In addition, such schemes are not easily implemented. For stabilization funds, one major problem is to set an appropriate benchmark price to

determine at what rate the fund should make disbursements. Agricultural boards face a similar problem. as they are vulnerable to the difficulty of ascertaining ex ante the appropriate price level around which incomes should be stabilized. Both schemes require an evaluation of the temporariness of price shocks, and, as the earlier analysis indicates, such an evaluation may be particularly difficult because the underlying trend in prices seems to be time varying. Indeed, the difficulties that many stabilization schemes experienced from the mid-1980s onward can be traced to a failure to take into account the negative and variable trend in commodity prices.

International Commodity Agreements

As volatility in international commodity prices affects the economies of all primary product exporters, the notion of some kind of cooperative commodity agreement to try to achieve greater stability in international commodity prices is obviously well based. Two aspects of ICAs should be differentiated. First, ICAs may attempt to increase the average price of a commodity by in some way restricting its supply. Second, ICAs may simply limit price variability, for example, by allowing recourse to buffer stocks. However, ICAs run the risk of trying to stabilize prices around the "wrong" (nonmarket clearing) price, which can quickly lead to financial non viability or to the collapse of output-sharing arrangements. As the experience of the 1980s and 19905 shows, the prospects for ICAs to playa role in addressing the issues raised by recent international commodity price behavior appear poor.

External Compensatory Finance

Another means of trying to smooth the effects of negative temporary commodity price shocks for credit-rationed developing countries has been external finance from the IMF under the compensatory financing facility and subsequently the compensatory and contingency financing facility and from the EU under the STAB EX scheme.[28] The compensatory element of the compensatory and contingency financing facility is designed to work when export earnings are hit by a temporary price shock; the destabilizing impact of the shock can then be offset in part by drawing under the facility, subject to early identification of the shortfall, access limits, and an appropriate policy response. Similarly, the contingency element of the facility is designed, through a mix of financing and

[28] Such comfensatory finance is a loan or a grant to the monetary authority or government o the country. It need not therefore necessarily find its way to those most directly affected by an export shortfall.

adjustment to help prevent member countries' programs supported by Fund resources from being thrown off course by unanticipated shocks to key exogenous variables such as commodity prices. Clearly, the design of policy responses and the form of Fund assistance to eligible countries should take into account the nature of the commodity price shock, which involves ascertaining ex ante its temporariness.

Market-Related Instruments

In addition to the possibility of reacting ex post to commodity price changes, countries may be able to trade away much of the commodity price risk by using financial securities such as futures and options. Producer countries can then limit their exposure to unanticipated price changes while investors in other countries assume it.

The volatility of commodity prices rose sharply in the early 1970s, and although the problem does not seem to have worsened appreciably in recent years, this feature of commodity price behavior has increased the attractiveness of hedging instruments. In addition to well-developed futures and options markets with short-dated instruments for commodities, financial innovation has led to developments in other instruments (commodity swaps, commodity options, commodity-linked bonds, forwards), which have increased the scope for hedging commodity risk (see Claessens and Duncan (1994)). Nevertheless, establishing a coherent hedging strategy is not a straightforward proposition, and the use by developing countries of futures and derivative markets has increased slowly.

Several factors explain developing countries' limited use of these instruments. For instance, maturities tend to be limited to one to two years and market thinness is a problem for the longer-dated maturities. There are also the costs of hedging in the form of brokerage fees and the like. Creditworthiness considerations make it considerably more difficult for many developing countries to gain access to other financial markets, particularly for nonstandard contracts and longer-dated instruments. Nevertheless, access to such markets could be improved if exchange controls and other barriers to hedging risk in commodity exporting countries were removed.

Government Policies for the Longer Term

As well as international commodity price variability, commodity exporting countries in recent years have also faced a downward trend in real commodity prices. It may well be unwise to base policies on the assump-

tion that the weakness in real commodity prices will be quickly overcome. A stronger economic recovery in the industrial countries would certainly help, as would continuing high rates of growth in the newly industrializing countries. Some supply-side factors may ease over time (such as recent shocks to metals markets from the former Soviet Union), but other factors (such as structural changes in exporting countries and productivity gains owing to technical progress) seem unlikely to be reversed. The decline in commodity prices poses the question of what-if any-are the appropriate structural policies for exporting countries, in particular with regard to resource allocation and international trade.

The lessons from the experience in Latin America with inward-looking development strategies are that whereas a negative terms of trade shock is certainly an adverse development from an exporting country's viewpoint, adding distortions to the domestic economy does not improve the situation. The increasing body of evidence on cross-country growth performance indicates that distortions to international trade and market-oriented resource allocation can have adverse effects on economic efficiency and growth.

The experience of the fastest growing developing countries shows that their export structures have evolved over time toward greater diversification (Table I). The recent review of the high-performing Asian economies provides some guidance on how such diversification was achieved. [29]

First, whereas agriculture's share of output and employment in these economies has declined significantly over time, growth in agricultural output and productivity was much higher than in other developing countries. The governments of these high-performing Asian economies supported the agricultural sector through extension services. agricultural research. pilot schemes. significant investment in irrigation and rural infrastructure (roads. bridges, electricity, and water supplies). and non-punitive crop taxation. The experience of these economies indicates that establishing a dynamic agricultural sector is an important phase in the diversification process; for lower-income countries the message is that failure to attach sufficiently high priority to agriculture in favor of other sectors is likely to be counterproductive.

Second, in addition to policies that generally provided a stable macroeconomic environment, the high-performing Asian economies facilitated

[29] The review of the performance of these economies provides a detailed assessment of the reasons and policies behind their growth performance. See World Bank (1993).

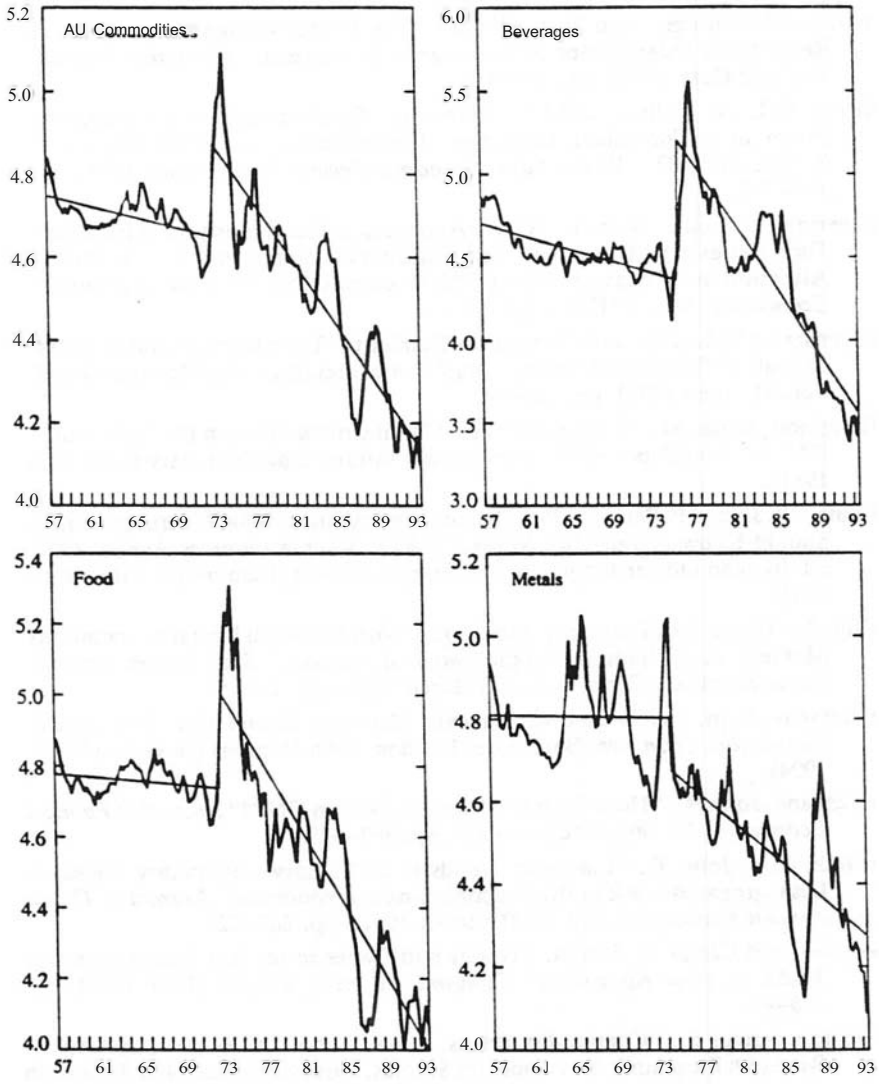
the more general process of diversification by public investment and institution building, by opening up their economies, by dismantling many of the regulatory barriers to resource reallocation, and by adopting policies or reforms that produced fewer distonions than in many other developing countries.

V. Concluding Remarks

The empirical regularities that have characterized the behavior of commodity prices in recent years highlight the imponance of structural policies that facilitate the diversification of the expon base and foster increases in productivlty in the primary commodity producing sector: the high volatility of commodity prices stresses the imponance of precautionary savlng and hedging. Further, our results suggest that the design of stabilization funds should take into account the presence of a variable downward trend in the relative prices of most commodities and the fact that even temporary shocks tend to persist over several years.

APPENDIX

Figure A.I. *Real Comrrwdity Prices: Testing for a Break in Trend*
1957:1-1993:11



Sources: *IMF, International Financial Statistics,* and the authors.

Notes: The broken straight line is a fitted trend (by OLS) that allows for a change in intercept and slope at 1973:1 for the all-commodity and food indices. For beverages and metals. the breaks occur at 1976:1 and 1974:III. respectively.

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