WP/99/155

INTERNATIONAL MONETARY FUND

Research Department

Booms and Slumps in World Commodity Prices

Prepared by Paul Cashin, C. John McDermott, and Alasdair Scott[1]

Authorized for distribution by Peter Wickham

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IMF WORKING PAPER

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Abstract

This paper examines the duration and magnitude of commodity-price cycles. It finds that for most commodities, price slumps last longer than price booms. How far prices fall in a slump is found to be slightly larger than how far they rebound in a subsequent boom. There is little evidence of a consistent 'shape' to commodity-price cycles. For all commodities, the probability of an end to a slump in prices is independent of the time already spent in the slump, and for most commodities, the probability of an end to a boom in prices is independent of the time already spent in the boom.

JEL Classification Numbers: E32, Q11

Keywords: Commodity prices, booms and slumps, cycles, duration, amplitude.

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I. Introduction

While much has been learnt about the properties of world commodity prices, there still remain big gaps in economists' understanding of why commodity prices move as they do. Empirical evidence has generated several stylized facts about real commodity prices: they are often dominated by long periods of doldrums punctuated by sharp upward spikes (Deaton and Laroque (1992); they have a tendency to trend down in the long run (Grilli and Yang (1988)); shocks to commodity prices tend to persist for several years at a time (Cashin, Liang and McDermott (1999)); and unrelated commodity prices may move together (Pindyck and Rotemberg (1990)).[2] Some of these stylized facts are summarized by Deaton (1999) and Borensztein et al. (1994).

Unfortunately, there is little empirical evidence relating directly to the properties of commodity-price cycles. Yet cycles are a dominant feature of commodity prices, and the consequences of rapid (and often unexpected) transitions from a period of price boom to a period of price slump are one of the most challenging issues facing policymakers in the many developing countries which continue to be reliant on exports of commodities.[3] In particular, reliable estimates of the duration and magnitude of commodity price cycles are essential when considering the efficacy of counter-cyclical stabilization policies in commodity-exporting countries. Knowledge of several features of cycles would further our understanding of the nature of commodity price booms and slumps. It is not known whether booms in commodity prices are typically shorter or longer in duration than slumps in commodity prices. It is also not known how far prices fall in a slump, or how far they tend to rebound in a subsequent boom. Finally, it remains an open question whether the likelihood of an end to a price slump increases with the age of the slump.

This paper will enquire into the nature of commodity price movements by examining cycles in world commodity markets, employing techniques hitherto used to study cycles in real economic activity. In particular, we will study statistics constructed from the turning points of a series, using a business cycle-dating algorithm set out by Bry and Boschan (1971). An advantage of the Bry-Boschan algorithm is that it provides a tractable

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[2] Recent work by Cashin, McDermott and Scott (1999) suggests that Pindyck and Rotemberg's (1990) finding of correlated commodity prices is a phenomenon largely attributable to the oil shocks of the 1970s, and does not appear in more recent data. The correlation of unrelated commodity prices should not therefore be treated as implying comovement.

[3] The World Bank's *World Development Indicators* (1999, pp. 204-06) indicates that the ratio of primary commodity exports to total merchandise exports for low- and middle-income countries as a group was 38 percent in 1997, down from 75 percent in 1980 and 48 percent in 1991. For sub-Saharan African countries, this ratio fell less rapidly during the 1980s, moving from 64 percent in 1980 to 53 percent in 1991.

means of applying an objective cycle-dating rule to a large dataset. Correspondingly, a disadvantage of using the algorithm is that it removes from the cycle-dating process the detailed knowledge and judgement of an experienced observer of commodity prices. This algorithm has been previously used to automate the dating of the business cycle (see King and Plosser (1994), Watson (1994), Harding and Pagan (1999) and McDermott and Scott (1999)). Pagan (1999) has also applied the algorithm to date bull and bear markets in equity prices. Accordingly, we adapt the Bry-Boschan algorithm to perform a similar task for commodity prices—that is, to determine when commodity markets are in a boom or in a slump. Once the turning points are established, then several stylized facts of these periods of boom and slump (also denoted as phases) can be identified.

Our key findings are fourfold. First, for the majority of commodities, price slumps last longer than price booms. Second, the magnitude of price falls in a slump is slightly larger than those of price rises in subsequent booms. Third, there is little evidence of a consistent 'shape' to the cycles in commodity prices. Fourth, for all commodities, the probability of an end to a slump in prices is independent of the time already spent in the slump, and for most commodities, the probability of an end to a boom in prices is independent of the time already spent in the boom.

Section II of the paper defines what we mean by a boom and slump in commodity prices, and gives a brief description of the Bry-Boschan algorithm used to date these booms and slumps. It also comments on how we have adapted the Bry-Boschan algorithm to analyze cycles in commodity prices. Section III outlines the measures used to summarize the features of commodity-price cycles, and presents the empirical findings. Section IV offers some concluding comments.

II. Dating Booms and Slumps

While it is easy to imagine what a booming or slumping market is, and despite such terms being frequently used to describe the state of commodity markets, there is no formal definition in the literature. One definition would describe a boom (slump) in commodity markets as a period of generally rising (falling) commodity prices. Accordingly, we work with a definition of booms and slumps in commodity prices which emphasizes movements in the level of commodity prices between local peaks and troughs. This approach is in line with the business cycle literature going back to Burns and Mitchell (1946). The definition essentially implies that a commodity market has shifted from a boom phase to a slump phase if prices have declined since their previous (local) peak. Such a definition does not rule out sequences of price falls during a boom or price rises during a slump, but there are constraints on the extent to which these sequences of price reversals can occur and yet still be considered part of any given boom or slump.

This definition, first implemented by Burns and Mitchell and still used by the National Bureau of Economic Research (NBER) today, allows us to use the Bry-Boschan algorithm to isolate patterns in the data by following a sequence of rules. The first step in the algorithm determines the location of potential peaks and troughs. This is done by the application of a turning point rule, which finds points that are higher or lower than a window of surrounding points. The rule defines a local peak in series y as occurring at time t whenever $\{ y_t > y_{t\pm k} \}$, k=1, ..., K, while a local trough occurs at time t whenever $\{ y_t < y_{t\pm k} \}$, k=1, ..., K. The second step enforces the condition that peaks and troughs must alternate. The third step measures the duration between these points, and a set of censoring rules is then adopted which restrict the minimum length of any phase as well as those of complete cycles. There are further rules designed to avoid spurious cycle dating at the ends of series (for details see Appendix I). When the peaks and troughs in each of the time series have been dated, key features of these cycles can be measured.

As the algorithm is basically a pattern-recognition procedure, the philosophy underlying it is relevant to any time series. However, the nature of commodity prices is sufficiently different from real quantities as to suggest that some modification may be needed in the manner that the task of pattern recognition is performed.

Our first deviation from the original Bry-Boschan algorithm concerns changes to the rule for deciding the minimum time the commodity can spend in any phase (boom or slump) or cycle. In business-cycle dating this rule is usually a 6-month period for expansions or contractions, and a 15-month period for cycles. We selected a minimum phase of 12 months due to the dominance of the annual production process in many agricultural commodities. For example, a shortfall in supply for an annual crop would affect prices until the next harvest, which are typically 12 months apart. While this annual production cycle does not apply for many nonagricultural commodities, when we experimented with shorter minimum phase rules, this resulted in some false turning points. For similar reasons, the minimum cycle length needs to encompass at least two harvests, which is the minimum time necessary for the occurrence of both a good and a bad harvest (for annual crops). While it could be argued that different phase and cycle lengths would be more appropriate for certain commodity price series, for the sake of a systematic examination of commodity prices, we prefer to maintain a consistent rule.

Our second deviation from the Bry-Boschan algorithm is that we do not smooth any of the series. This modification is made because while smoothing and the removal of outliers may help identify turning points in real quantities (such as data on economic activity), it may actually suppress some of the most important movements in commodity price data (Pagan (1999)).

Implementation of the Bry-Boschan algorithm accords us some technical advantages. First, the nature of the algorithm means that the dating of turning points in the series will be largely independent of the sample used.[4] Second, the peaks and troughs identified using the algorithm are derived from a definition of the cycle which allows us to deal with the data in levels, hence avoiding the somewhat subjective choice of which detrending method to use (see, inter alia, Canova (1998)). Price slumps are then described as periods of absolute decline in the series, not as a period of below-trend growth in the series.

III. SALIENT FEATURES OF COMMODITY PRICE BOOMS AND SLUMPS

The monthly data used in this study cover 36 real commodity price series taken from the International Monetary Fund's *International Financial Statistics* database for the period 1957:1-1999:8 (see Appendix II for a detailed discussion of the sources and definition of the data). The results of the application of the Bry-Boschan algorithm can be seen for several commodities in Figure 1. Clearly, not all the movements in the respective series are identified as peaks and troughs. The cycles are demarcated by peaks (solid lines) and troughs (dashed lines), with periods from peaks to troughs being slumps, and periods from troughs to peaks being booms. For example, the first peak in real cotton prices is dated as 1958:1, the second peak is dated as 1964:6, while the first trough in cotton prices is dated as 1963:6—this makes the period 1958:1 to 1963:6 the first slump phase for cotton prices, and the period 1963:6 to 1964:6 the first boom phase for cotton prices.

Having determined the cycles in each commodity price series using the Bry-Boschan algorithm, we present six descriptive statistics that summarize important features of the cyclical properties of each commodity (Table 1). The statistics are: the number of completed cycles (dated as the maximum of the number of completed peak-to-peak or trough-to-trough cycles, column 1); the percentage of the sample period during which the commodity is in a slump phase (which indicates whether price changes are symmetric in duration, column 2); the maximum amplitude (percent change) of price slumps, and the dates during which this slump occurred (which indicates the severity of price slumps, columns 3-5); and the maximum amplitude (percent change) of price booms, and the dates during which this boom occurred (which indicates the severity of price booms, columns 6-8). Two additional statistics (Spearman rank correlation coefficient) measure whether there is any relationship between the severity of price slumps and booms and their duration (columns 9 and 10, respectively). In addition to the above, Table 1 also provides information on the higher moments of the commodity price series, in particular the extent of skewness and excess kurtosis present in the price data (columns 11 and 12, respectively).

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[4] To the extent that the end points of these commodity-price series need to be treated differently from the rest of the series (see Appendix I), the addition of new observations may see the final peak or trough date revised, but all preceding turning points in the series will remain unchanged.

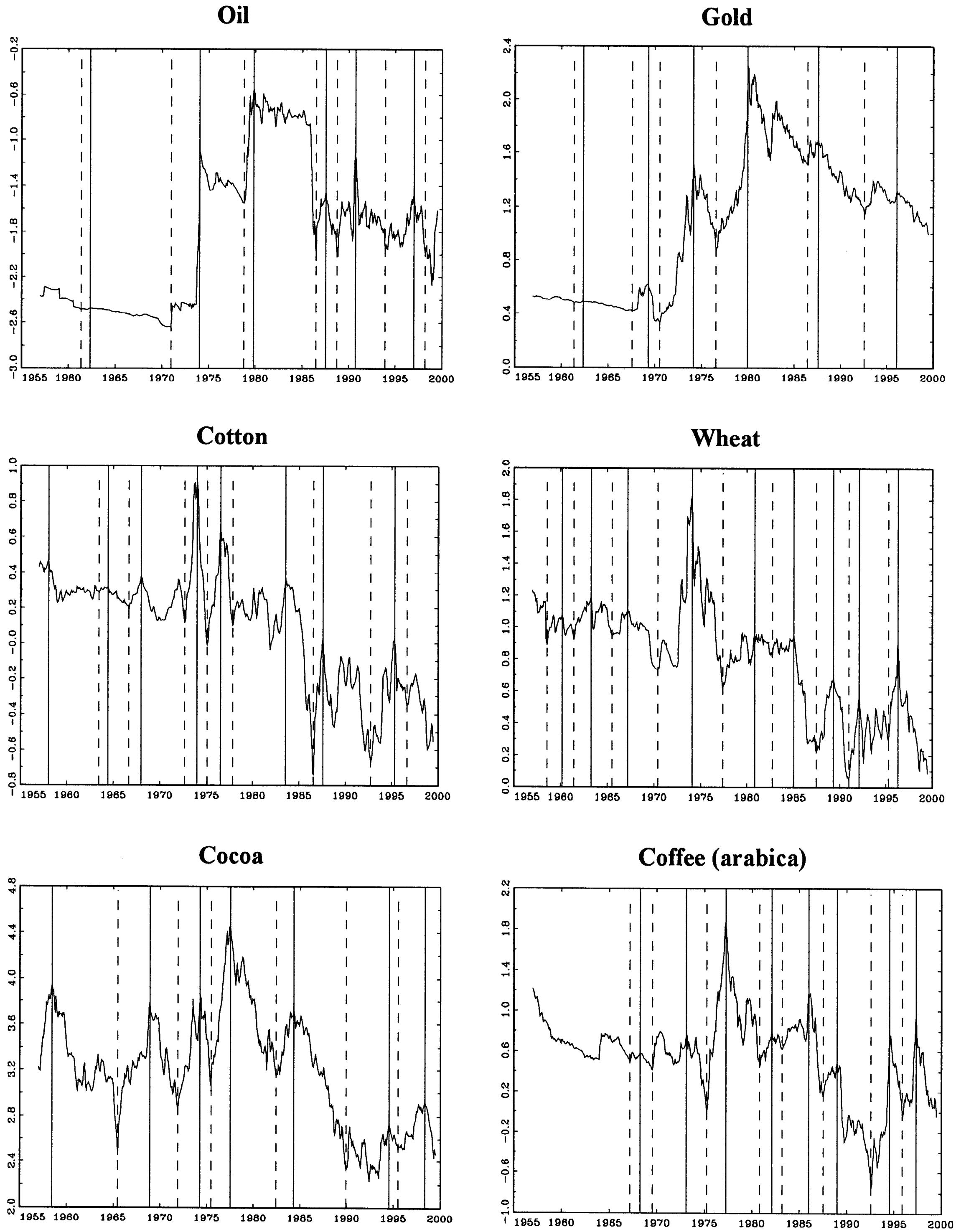
Table 1. Descriptive Statistics of Commodity Price Cycles and Commodity Prices, 1957:1-1999:8

				Dates			Dates					
	Cycles	Time	Max PT	From	To	Max TP	From	To	Corr (PT)	Corr (TP)	Skewness	Kurtosis
Aluminum	7	58.3	-72.3	1988:06	1993:11	64.6	1985:11	1988:06	0.29	-0.12	-3.6	29.7
Bananas	3	62.8	-69.5	1991:03	1994:06	61.6	1994:06	1997:03	0.40	-0.40	2.2	10.7
Beef	9	50.7	-65.4	1973:08	1975:02	46.0	1963:02	1966:04	-0.15	-0.32	-1.5	10.8
Cocoa	5	56.2	-77.2	1958:06	1965:07	75.6	1975:06	1977:07	1.00*	-0.43	3.4	2.8
Coconut oil	9	44.0	-87.9	1984:06	1986:08	78.1	1972:09	1974:03	0.38	-0.05	4.7	12.4
Coffee (arabica)	7	63.4	-76.0	1977:04	1980:11	84.4	1975:04	1977:04	0.86*	0.50	5.2	21.5
Coffee (robusta)	5	70.7	-85.0	1986:01	1992:08	84.2	1975:05	1977:04	0.10	0.60	6.0	21.8
Copper	6	49.9	-67.3	1974:04	1975:06	74.7	1958:02	1966:04	0.14	0.36	-4.2	11.9
Cotton	7	57.0	-66.9	1983:08	1986:08	55.5	1972:09	1974:01	-0.31	-0.14	2.8	11.2
Fishmeal	10	55.2	-79.4	1973:07	1975:06	74.9	1972:01	1973:07	0.67*	0.69*	-0.8	24.8
Groundnut oil	8	50.9	-70.6	1984:06	1987:11	63.0	1983:03	1984:06	-0.07	-0.45	10.6	34.1
Gold	5	66.0	-52.6	1980:01	1986:06	75.2	1976:08	1980:01	0.30	0.54	14.7	62.0
Hides	6	51.5	-83.0	1972:11	1975:01	82.2	1975:01	1979:03	0.04	0.61	1.7	14.6
Iron ore	4	69.7	-50.0	1982:11	1988:11	42.5	1973:12	1976:05	0.80	0.10	-12.0	255.5
Lamb	7	37.4	-46.1	1981:05	1983:02	43.9	1995:09	1997:01	-0.24	0.11	2.4	8.1
Lead	8	54.8	-64.3	1990:03	1993:09	62.9	1962:08	1965:03	0.67*	0.43	1.3	10.6
Maize	5	57.5	-61.9	1981:01	1987:02	53.9	1992:08	1996:05	0.80*	0.26	-1.2	19.4
Nickel	5	59.9	-77.4	1989:02	1993:09	78.7	1987:01	1989:02	0.31	-0.14	22.7	108.2
Oil	5	70.7	-77.7	1979:11	1986:07	78.4	1971:01	1974:01	-0.20	0.26	33.1	170.8
Palmoil	7	58.7	-82.7	1984:05	1986:08	68.5	1972:02	1974:02	0.29	0.12	1.0	13.8
Phosphate rock	4	68.3	-48.2	1985:01	1987:12	50.3	1973:12	1976:05	0.20	0.60	86.9	833.0
Rice	5	59.1	-73.7	1981:06	1986:12	73.1	1971:01	1974:04	0.90*	0.43	1.7	12.8
Rubber	7	57.0	-63.5	1974:01	1975:05	65.0	1971:12	1974:01	0.26	0.26	3.3	8.4
Soybean	6	58.3	-82.6	1973:07	1975:02	78.4	1971:12	1973:07	0.37	-0.64*	-13.0	77.9
Soybean meal	7	65.6	-76.1	1974:10	1983:02	68.1	1972:08	1974:10	-0.20	-0.70	1.2	38.2
Soybean oil	4	60.9	-70.9	1973:06	1975:12	71.8	1969:09	1973:06	0.75*	-0.07	3.9	10.4
SugarEU	6	63.8	-56.8	1975:01	1981:06	70.2	1973:12	1975:01	0.57	-0.32	14.8	413.3
SugarISA	5	46.4	-91.8	1980:10	1985:06	95.4	1966:12	1974:11	1.00*	0.60	3.2	5.7
SugarUSA	4	43.4	-85.1	1974:11	1977:10	81.0	1964:11	1974:11	-0.20	0.90*	4.3	46.0
Tea	6	66.5	-76.5	1984:01	1987:06	67.3	1973:08	1977:04	0.71*	0.89*	5.0	21.1
Tin	7	61.8	-72.6	1978:10	1986:09	46.1	1973:01	1974:04	0.54	0.02	-9.3	32.4
Tri superphosphate	6	62.6	-81.8	1974:09	1978:12	82.1	1971:06	1974:09	0.77*	0.79*	17.2	78.5
Wheat	8	56.4	-70.0	1974:02	1977:06	66.4	1970:06	1974:02	0.64*	-0.05	12.4	74.7
Wool (coarse)	7	67.9	-65.5	1973:03	1975:02	67.2	1971:10	1973:03	0.21	0.52	-0.2	13.6
Wool (fine)	6	61.8	-75.5	1973:03	1979:01	77.2	1971:04	1973:03	0.94*	0.32	-1.4	38.8
Zinc	8	57.5	-80.9	1973:12	1978:02	76.6	1971:02	1973:12	0.90*	0.65*	-1.2	15.9

Source: Authors' calculations.

Notes: Cycles denotes the number of completed cycles (the maximum of the number of peak-to-peak or trough-to-trough cycles completed). Time denotes the percentage of total time spent in a slump (contraction) phase of the commodity price cycle. Max PT is the maximum amplitude of all price slumps (peak-to-trough (PT) movements), and the dates of this maximum. Max TP is the maximum amplitude of all price booms (trough-to-peak (TP) movements), and the dates of this maximum. Corr (PT) reports the Spearman rank correlation coefficient between the (absolute) amplitude of price slumps and the duration of price slumps, and Corr (TP) reports the Spearman rank correlation coefficient between the (absolute) amplitude of price booms and the duration of price booms. The null hypothesis is no rank correlation between the amplitude of a phase and its duration. An asterisk (*) indicates that the null hypothesis is rejected (using a one-tailed test) at the 5 percent level of significance. Skewness and kurtosis report the Kiefer-Salmon statistics (as described in Davidson and MacKinnon (1983)) for the higher-order moments of each commodity price series, calculated from the residuals of a deterministic trend regression for each series—these statistics are distributed as a $N(0,1)$ under the null of normality. Using a 5 percent critical value for a two-tailed test, any result greater than 1.96 (in absolute value) indicates skewness and excess kurtosis in the commodity price series.

Figure 1. Datings for Peaks and Troughs, Six Commodities, 1957:1-1999:8
(Logarithm of real price indices)



Sources: IMF, *IFS* and Authors' calculations.

Notes: Commodity price peaks are denoted by solid lines; commodity price troughs are denoted by dashed lines. Periods from peaks to troughs are slumps, while periods from troughs to peaks are booms.

The statistical properties of the commodity price cycles are as follows. Averaging across all commodities, there are typically just over 6 completed cycles, ranging between bananas (3) and fishmeal (10). Averaging across all commodities, about 58 percent of the sample is spent in a slump phase, ranging between lamb (37 percent) and arabica coffee (71 percent). The average amplitude of all the maximum commodity price slumps is a fall of 72 percent, while the average amplitude of all the maximum commodity price booms is a rise of 69 percent. On average, the period during which the greatest slump in commodity prices occurred was between 1979:1 and 1983:1, while the biggest boom occurred between 1974:5 and 1977:4. Not surprisingly, the biggest boom period for oil occurred between 1971:1 and 1974:1, while the greatest slump in arabica coffee prices occurred between 1977:4 and 1980:11.

The rank correlation statistic measures whether there is a significant relation between the amplitude of the phase and its duration. If we think of the duration and amplitude of a phase as two sides of a right-angled triangle, then we can view this as a test of whether the phases consistently have the same shape. Averaging across all commodities, the correlation between the severity (absolute amplitude) of slumps and their duration (0.48) is marginally larger than that between the severity of booms and their duration (0.40). In addition, for most individual commodities there is little evidence that there is a relationship between the severity of commodity price slumps (booms) and the duration of price slumps (booms), and so there is little evidence of a consistent 'shape' to the cycles. However, the null hypothesis that the severity of price slumps is not correlated with their duration is rejected for 13 of the 36 commodities, while the hypothesis that the severity of price booms is not correlated with their duration is rejected for 6 of the 36 commodities. These results are consistent with earlier findings in the literature, in particular of commodity prices declining at a steady rate, interspersed with sharp booms (Deaton and Laroque (1992)). Finally, and again consistent with Deaton and Laroque (1992), about two-thirds of the commodity price series display significant skewness, while all commodity prices display significant leptokurtosis.

In addition to information on the attributes of commodity-price cycles, we also report on the salient features of movements in commodity prices between these turning points (Table 2). For each of the 36 commodity price series, the table splits the data into two phases—slumps and booms. For each phase, we present results for: the average duration (in months) of the phase; the average amplitude of the aggregate phase movement in prices (in percent change); and the average monthly amplitude (amplitude divided by the duration). A comparison of the time plots of the commodity-price series, and of their associated peaks and troughs, will also allow us to assess whether recent cycles in commodity prices are atypical, or whether there is a consistent pattern in the evolution of the cycles.

We also examine whether there is any tendency for booms and slumps in individual commodity prices to maintain a fixed duration. If true, this would imply duration dependence—the longer the market for a given commodity remains in a boom or a slump,

Table 2. Average Duration, Amplitude and Test of Duration Dependence in Commodity Prices, 1957:1-1999:8

	Slumps				Booms			
	Duration	Amplitude	Monthly Amplitude	Brain-Shapiro Test	Duration	Amplitude	Monthly Amplitude	Brain-Shapiro Test
Aluminum	34.8	-33.3	-1.1	-0.28	22.5	29.3	1.5	1.58
Bananas	73.3	-58.4	-1.4	0.78	41.8	52.5	1.3	0.62
Beef	24.0	-33.9	-1.6	-0.11	25.2	30.6	1.4	-0.27
Cocoa	45.5	-60.2	-1.8	-0.08	34.3	53.8	1.8	0.71
Coconut oil	22.5	-53.0	-2.5	1.05	26.6	53.5	2.4	0.66
Coffee (arabica)	25.0	-50.5	-2.1	0.54	23.4	46.1	2.1	0.65
Coffee (robusta)	54.0	-60.1	-1.3	-0.76	25.0	50.4	2.3	1.20
Copper	34.4	-48.7	-2.0	1.20	31.7	46.1	2.1	2.17
Cotton	36.4	-37.8	-1.6	0.07	24.7	35.7	2.0	2.17
Fishmeal	25.0	-43.3	-1.8	-0.97	20.8	41.8	2.3	2.84
Groundnut oil	26.4	-45.8	-1.9	-0.22	24.3	45.2	2.2	0.04
Gold	48.6	-35.0	-1.0	-0.72	29.0	32.9	1.0	-0.46
Hides	35.6	-56.3	-2.3	1.48	34.3	59.4	2.4	2.08
Iron ore	49.5	-35.9	-0.7	0.38	31.0	26.8	0.9	-0.69
Lamb	23.9	-33.1	-1.5	1.06	38.9	33.0	1.1	0.71
Lead	27.8	-47.3	-1.8	-0.98	25.7	40.8	1.8	-0.40
Maize	41.0	-41.7	-1.2	-0.09	36.2	34.6	1.3	0.24
Nickel	43.0	-42.7	-1.2	0.08	31.3	39.3	1.6	1.37
Oil	51.3	-44.8	-1.5	0.29	22.3	47.7	2.4	0.61
Palmoil	30.9	-55.7	-2.2	1.07	26.4	51.5	2.1	1.85
Phosphate rock	53.0	-37.8	-1.0	0.62	22.4	29.9	1.3	0.56
Rice	49.8	-58.2	-1.2	0.27	34.8	48.1	1.5	1.45
Rubber	34.3	-46.1	-1.7	0.46	23.4	41.1	1.9	0.21
Soybean	39.3	-44.8	-1.6	1.95	30.4	40.8	1.8	0.34
Soybean meal	59.0	-56.1	-1.2	0.90	40.0	45.8	1.6	-0.01
Soybean oil	40.3	-50.8	-1.6	1.36	22.0	46.4	2.2	-1.67
SugarEU	42.1	-20.6	-0.6	1.79	22.3	19.6	1.2	0.31
SugarISA	37.4	-70.4	-1.9	0.08	45.7	64.7	1.6	0.07
SugarUSA	39.0	-49.7	-2.2	1.32	49.0	48.9	1.2	1.07
Tea	40.8	-55.3	-1.6	0.46	24.4	46.9	2.0	1.39
Tin	35.4	-36.9	-1.3	1.65	24.4	32.3	1.5	0.34
Tri superphosphate	37.3	-39.9	-1.2	0.57	27.3	33.7	1.2	1.28
Wheat	28.9	-34.2	-1.2	-1.17	24.8	31.8	1.5	0.30
Wool (coarse)	39.7	-41.2	-1.2	0.89	20.5	33.2	1.8	1.58
Wool (fine)	44.3	-50.4	-1.4	-0.83	27.9	43.1	1.9	0.99
Zinc	31.8	-41.2	-1.4	0.06	24.1	43.2	2.0	0.79

Source: Authors' calculations.

Notes: For each of the two phases (boom and slumps), and for each of the 36 commodities, four results are presented. First, the average duration (in months) of the phase. Second, the average amplitude of the aggregate phase movement in prices (in percent change). Third, the average amplitude per month (amplitude divided by the duration). The fourth statistic (Brain-Shapiro test) is an examination of duration dependence in commodity prices. The null hypothesis of the Brain-Shapiro statistic is that the probability of exiting a phase is independent of the length of time a series has been in that phase. Using a five percent critical value for a two-tailed test, any test result greater than 1.96 (in absolute value) indicates duration dependence in the commodity price series.

the more likely it is to switch to the other phase. Accordingly, we follow Diebold and Rudebusch (1990) and calculate the Brain-Shapiro (1983) statistic for duration dependence, which tests whether the probability of ending a boom or slump is dependent on how long a commodity market has been in that boom or slump.[5] The Brain-Shapiro test also complements the rank correlation test discussed earlier. One does not imply the other—it is possible to have no significant rank correlation but duration dependence, and vice versa. However, it is another way of looking at the 'triangular' properties of the cycles. Significant rank correlation implies that the phases are well described by triangles of the same shape (angles). Significant duration dependence denotes that the triangles tend to have the same length of the hypotenuse—that is, they are periodic.

A. Stylized Facts for Average Commodity Price Booms and Slumps

The results in Table 2 imply that an important stylized fact of commodity-price cycles is that they are asymmetric—price slumps are longer in duration than price booms, except in 5 cases (sugarUSA, sugarISA, beef, lamb and coconut oil). Averaging across all commodities, the typical length of price slumps (39 months) is over 10 months longer than the typical length of price booms, giving an average cycle (peak-trough-peak movement) of about 68 months.

This asymmetry in duration can be more clearly seen in Figure 2, which orders the commodities by the duration of slumps. The duration of the phases varies quite dramatically across the 36 commodities, ranging from an average slump of over 70 months for banana prices to an average slump of less than 25 months for the price of coconut oil. The lengths of durations of commodity-price cycles are broadly consistent with earlier findings on the persistence of shocks to world commodity prices found in Cashin, Liang and McDermott (1999). For example, the length of a typical slump in oil prices is in excess of 4 years (Figure 2), while the earlier persistence results showed that oil shocks were permanent (Cashin, Liang and McDermott (1999)). Importantly, the fact that the duration of slump phases is heterogeneous across the commodities reinforces the results of Cashin, McDermott and Scott (1999), who found that commodity prices do not have a tendency to rise and fall together.

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[5] The null hypothesis of the Brain-Shapiro statistic is that the probability of exiting a phase is independent of the length of time a series has been in that phase. The two possible alternatives are that either: (i) the longer a boom or slump in commodity prices persists, the greater the likelihood that the boom or slump will end; or (ii) the longer a boom or slump in commodity prices persists, the greater the likelihood that the boom or slump will feed upon itself (be self-perpetuating), and hence the lower the likelihood that the boom or slump will end. The distribution of the Brain-Shapiro statistic is asymptotically $N(0,1)$, which it quickly approaches even in quite small samples.

For individual commodities, the amplitude (percent change) measure shows that the average price decline during commodity price slumps is in most cases slightly larger than average price rise during commodity price booms. This differing amplitude can be seen in Figure 3, which orders the commodities by the amplitude of price slumps. The average price fall across all commodities is 46 percent during slumps, while the average price rise across all commodities is 42 percent during booms. A particular example of this differing amplitude is wheat—the price of wheat falls on average by about one-third (34.2 percent) during slumps, and rises on average by a slightly smaller amount (31.8 percent) during booms (Table 2). This differing relative amplitude results in an overall downward trend in the price of wheat. A similar finding exists for many commodities, and indicates that existing price trends are caused by the differing relative amplitude of booms and slumps.

The speed with which commodity prices change in booms in comparison with slumps can be determined by examining the relative monthly amplitude. Averaging across all commodities, the monthly amplitude of commodity price rises in booms (1.7 percent a month) is slightly faster than the monthly amplitude of commodity price declines in slumps (1.5 percent a month). For some commodities, the difference in the speed of price rises and falls is quite large. For example, the rise in oil prices in booms averages 2.4 percent a month, while the fall in oil prices in slumps averages 1.5 percent a month. In contrast, the monthly amplitude of cocoa prices in booms and slumps are exactly the same—on average, prices decline (rise) in a slump (boom) by 1.8 percent a month (Table 2).

The Brain-Shapiro test results show that, for every commodity, the probability of ending a slump is independent of the time already spent in the slump (Table 2).[6] For the majority of commodities, the probability of a boom ending is independent of the time spent in the boom, with the exception of four commodities: copper, cotton, hides and fishmeal. All four of the exceptions have positive duration dependence, which implies that booms have a tendency to feed upon themselves (the probability of ending a boom decreases the longer the boom lasts). Duration dependence in fishmeal prices in the 1990s probably emanates from the duration dependence effects of El Niño weather patterns on the supply of fish. For both

[6] Using a 5 percent critical value for a two-tailed test, any test result greater than 1.96 (in absolute value) indicates duration dependence in the commodity price series.

Figure 2. Average Duration of Booms and Slumps in Commodity Prices, 1957:1-1999:8
(Boom (dark shading), Slump (light shading))

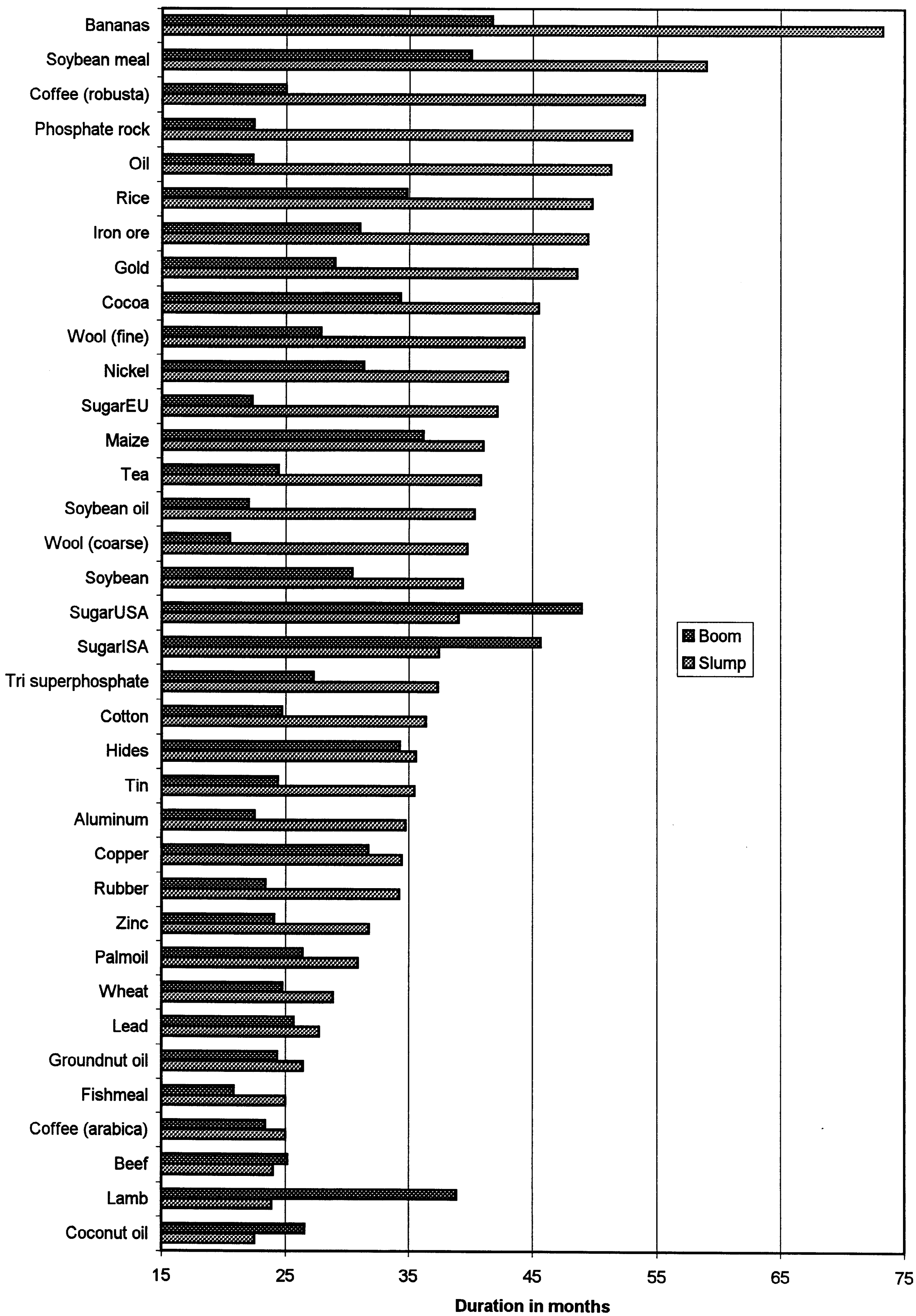
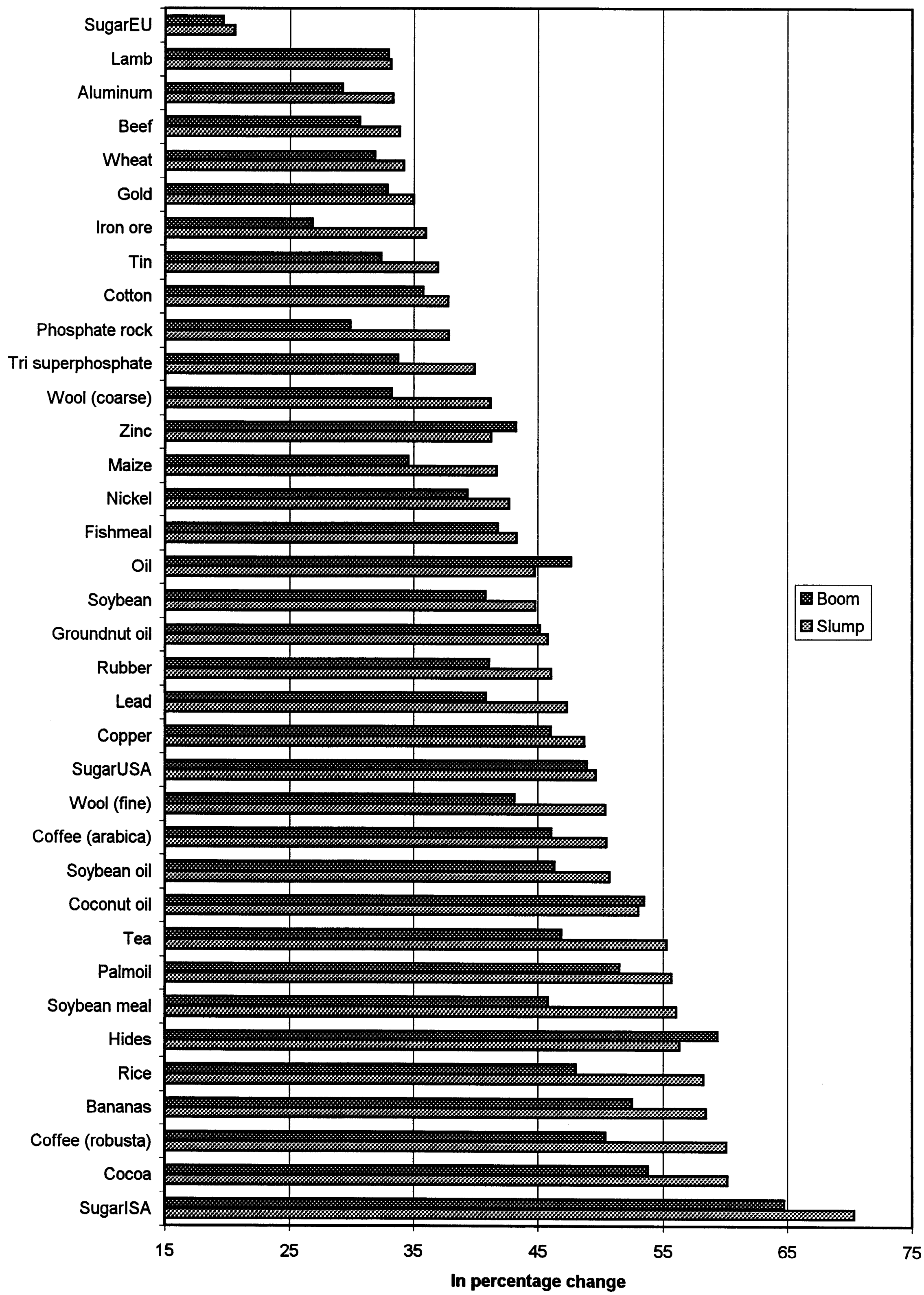


Figure 3. Average Amplitude of Booms and Slumps in Commodity Prices, 1957:1-1999:8

(Boom (dark shading), Slump (light shading))



cotton and hides the Bry-Boschan algorithm has dated a particularly long boom for the early 1980s, which does not concur with our subjective judgement.[7]

B. How Well Do the Stylized Facts Represent Booms and Slumps in Specific Commodities?

The analysis of the previous section examined average booms and slumps for each of the commodities in our sample. However, the variance of these booms and slumps could be such that the averages give a poor representation of booms and slumps. Accordingly, we examine in greater detail the individual boom and slump episodes for six important commodities in world trade and financial markets: oil, gold, cotton, wheat, cocoa and coffee (Figure 1 and Table 3).

For oil, the first slump phase (lasting 104 months) is likely to be an artifact of the erosion of price gains (of the Seven Sisters oil oligopoly) in the late 1950s following the Suez crisis. The second and third boom phases clearly emanate from the first and second Organization of Petroleum Exporting Countries (OPEC) oil shocks—oil prices rose by 78 percent in 36 months during the former, and by a very rapid 63 percent in only 13 months during the latter. The third slump phase (lasting 80 months) is largely attributable to the breakdown of OPEC's supply management practices, and is followed during the rest of the 1980s by consecutive booms and slumps as OPEC's effectiveness in constraining supply waxed and waned (IMF (1986)). The fifth slump phase is largely due to industrial country recession of the early 1990s and the runup to the Gulf War, followed by a recovery in activity during the fifth boom phase. While the sixth boom phase (lasting 37 months) is due to excess demand for oil, the sixth slump phase (distinguished by a rather sharp fall in prices of 2.8 percent a month) is largely due to weak Asian demand for oil and excess supply (World Bank (1999)).[8] As a measure of the variability of the duration of booms and slumps in the price of oil, the mean absolute deviation is 10 months for booms and 29 months for slumps. Accordingly, there is quite a deal of variability in the duration of booms and slumps in oil prices.

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[7] While the Bry-Boschan algorithm does date a few commodity-price cycles differently from our judgement, the clear majority of the cycles it dates are identical to our judgement. This is consistent with the experience of researchers who date business cycles. King and Plosser (1994) report that Bry and Boschan found that in comparing the turning points of over 50 series of monthly U.S. economic activity covering the period 1947-66, 90 percent of the turning points selected by the Bry-Boschan algorithm were identical to those selected by the NBER staff. In that case, a systematic discrepancy arose because the Bry-Boschan algorithm tended to find about 15 percent more turning points than the NBER staff.

[8] For oil, the Bry-Boschan algorithm has ended the last slump phase earlier than our subjective judgement would dictate, and this was caused by the end-of-sample censoring rule (see Appendix I for details).

Table 3. Duration and Amplitude of Specific Booms and Slumps for Selected Commodity Prices, 1957:1-1999:8

Slumps				Booms			
Period	Duration	Amplitude	Monthly Amplitude	Period	Duration	Amplitude	Monthly Amplitude
			Oil				
1962:05-71:01	104	-15.4	-0.2	1961:05-62:05	12	1.3	0.1
1974:01-78:10	57	-35.3	-0.6	1971:01-74:01	36	78.4	2.2
1979:11-86:07	80	-77.7	-1.0	1978:10-79:11	13	63.1	4.9
1987:07-88:10	15	-42.8	-2.9	1986:07-87:07	12	44.6	3.7
1990:10-93:12	38	-58.2	-1.5	1988:10-90:10	24	60.1	2.5
1997:01-98:03	14	-39.2	-2.8	1993:12-97:01	37	38.7	1.0
			Gold				
1962:05-67:08	63	-6.8	-0.1	1961:05-62:05	12	1.3	0.1
1969:05-70:07	14	-24.5	-1.8	1967:08-69:05	21	18.3	0.9
1974:03-76:08	29	-47.9	-1.7	1970:07-74:03	44	69.0	1.6
1980:01-86:06	77	-52.6	-0.7	1976:08-80:01	41	75.2	1.8
1987:08-92:08	60	-43.2	-0.7	1986:06-87:08	14	17.4	1.2
				1992:08-96:02	42	15.8	0.4
			Cotton				
1958:01-63:06	65	-16.1	-0.3	1963:06-64:06	12	2.3	0.2
1964:06-66:09	27	-11.7	-0.4	1966:09-68:01	16	17.1	1.1
1968:01-72:09	56	-23.4	-0.4	1972:09-74:01	16	55.5	3.5
1974:01-75:02	13	-60.7	-4.7	1975:02-76:07	17	48.7	2.9
1976:07-77:11	16	-42.4	-2.7	1977:11-83:08	69	22.9	0.3
1983:08-86:08	36	-66.9	-1.9	1986:08-87:08	12	53.9	4.5
1987:08-92:10	62	-50.1	-0.8	1992:10-95:05	31	49.9	1.6
1995:05-96:09	16	-31.0	-1.9				
			Wheat				
1960:03-61:06	15	-13.9	-0.9	1958:07-60:03	20	16.5	0.8
1963:04-65:07	27	-21.5	-0.8	1961:06-63:04	22	23.5	1.1
1967:03-70:06	39	-31.8	-0.8	1965:07-67:03	20	15.6	0.8
1974:02-77:06	40	-70.0	-1.8	1970:06-74:02	44	66.4	1.5
1980:11-82:10	23	-14.6	-0.6	1977:06-80:11	41	29.2	0.7
1985:02-87:07	29	-51.5	-1.8	1982:10-85:02	28	12.2	0.4
1989:05-91:01	20	-46.8	-2.3	1987:07-89:05	22	37.4	1.7
1992:02-95:04	38	-23.4	-0.6	1991:01-92:02	13	39.8	3.1
				1995:04-96:05	13	45.8	3.5
			Cocoa				
1958:06-65:07	85	-77.2	-0.9	1965:07-68:12	41	73.8	1.8
1968:12-71:12	36	-60.6	-1.7	1971:12-74:04	28	62.9	2.2
1974:04-75:06	14	-54.9	-3.9	1975:06-77:07	25	75.6	3.0
1977:07-82:06	59	-73.1	-1.2	1982:06-84:05	23	43.1	1.9
1984:05-89:12	67	-74.9	-1.1	1989:12-94:07	55	32.8	0.6
1994:07-95:07	12	-20.4	-1.7	1995:07-98:05	34	34.6	1.0
			Coffee (arabica)				
1968:04-69:07	15	-15.2	-1.0	1967:03-68:04	13	7.9	0.6
1973:02-75:04	26	-54.2	-2.1	1969:07-73:02	43	31.6	0.7
1977:04-80:11	43	-76.0	-1.8	1975:04-77:04	24	84.4	3.5
1982:02-83:03	13	-16.7	-1.3	1980:11-82:02	15	31.1	2.1
1986:01-87:07	18	-64.6	-3.6	1983:03-86:01	34	43.3	1.3
1989:01-92:08	43	-70.5	-1.6	1987:07-89:01	18	27.7	1.5
1994:07-95:12	17	-56.4	-3.3	1992:08-94:07	23	77.9	3.4
				1995:12-97:05	17	64.7	3.8

Source: Authors' calculations.

Notes: For each of the two phases (boom and slumps), and for each of the six commodities, four results are presented. First, the dates of each peak-to-trough movement (for slumps) and trough-to-peak movement (for booms). Second, the duration (in months) of each phase. Third, the amplitude of the aggregate phase movement in prices (in percent change) for each phase. Fourth, the monthly amplitude (amplitude divided by the duration) for each phase.

As for the price of gold, the first slump phase is characterized by a slow decline in its real price, as the nominal price was fixed at US$35 per ounce during much of this period. Gold prices rose by 1.6 percent a month in the third boom phase, driven largely by strong demand for the metal in the inflationary environment of the 1970s accentuated by the first oil price shock. Conversely, the fourth (lasting 77 months) and fifth slump phase (lasting a further 60 months) both occurred in the less inflationary environment of the 1980s. These slumps were followed by the sixth boom phase, then a continued fall in the price of gold after 1996:2. As with oil, there is quite a deal of variability in the duration of booms and slumps in gold prices. The mean absolute deviation is 17 months for booms and 22 months for slumps, which indicates that gold booms (slumps) are longer (shorter) in duration than booms (slumps) in oil prices. Interestingly, there is a great deal of overlap in the timing of booms in oil and gold prices (five of the six boom periods in these commodities occur essentially at the same time). This similarity in the turning points for oil and gold is indicative of two commodities which have prices that typically move together (see Cashin, McDermott and Scott (1999)).

World cotton prices were relatively stable until the mid-1970s, when prices rose sharply during the third boom phase, largely due to the jump in the price of synthetic petroleum-based fibers, a cotton substitute, accompanying the first oil price shock. The following phase (fourth slump phase) saw prices fall sharply (by 4.7 percent a month), in the wake of the recession in the world economy. The fourth boom phase and fifth slump phase, centered on mid-1976, largely reflected world consumption greater (then less) than world production of cotton. Similarly, a relative shortage of world cotton contributed to the rapid rise in prices during the sixth boom phase, while booms and slumps since the mid-1980s appear to be chiefly caused by periods of imbalance between world cotton consumption and production (IMF (1986), World Bank (1999)). There is again quite a deal of variability in the duration of booms and slumps in cotton prices—the mean absolute deviation is 16 months for booms and 20 months for slumps.

In the case of wheat, each boom episode and each slump episode look broadly similar, meaning that wheat's average boom and average slump (as set out in Table 2) is a good representation of the phases in the wheat market. The fourth boom phase is largely due to adverse supply shocks to world wheat production, while the subsequent fourth slump phase was largely caused by excess supply. Similar to cotton, subsequent booms and slumps appear to be chiefly caused by periods of imbalance between world wheat consumption and production (IMF (1986), World Bank (1999)). The mean absolute deviation is 8 months for booms and 7 months for slumps, which is much less than for cycles in oil, gold and cotton prices.

Booms and slumps in the prices of cocoa and coffee have had important consequences for economic development, particularly in the commodity-exporting countries of sub-Saharan Africa (Bevan et al. (1987)). The beverage boom of the late 1970s (driven largely by adverse weather conditions during a period of relatively low production) is picked up in the third boom phase for cocoa and the third boom phase for arabica coffee, when prices rose by 76 percent in 25 months and by 84 percent in 24 months, respectively. Conversely, the fourth and fifth slump phases for cocoa (caused largely by world production above the level of consumption) were long-lived, while the similarly-caused yet short-lived fifth and seventh slump phases for coffee saw prices falling sharply by 3.6 and 3.3 percent a month, respectively.[9] While these slumps in coffee prices were largely reversed by its seventh and eighth boom phases, there was only a slow recovery of cocoa prices in its boom phases of the 1990s (IMF (1986), World Bank (1999)).[10]

An advantage of objectively dating turning points in commodity prices using the Bry-Boschan algorithm is that, for a given phase rule, different researchers using the same data will select the same turning point dates. Collier and Gunning (1999) present case studies from a range of developing countries on the economic effects of booms and slumps in commodity prices. While the case study approach has its advantages in bringing to bear local information, an important difficulty with case studies is the subjective nature of the required prior identification of cycles in commodity prices. As noted by Deaton and Miller (1996), such identification of boom and slump periods is not always obvious or uncontroversial. The facility with which we are able to relate the phases identified by the algorithm to known historical episodes in the evolution of prices for the six commodity price series gives us confidence in its performance.

IV. Conclusion

A key characteristic of the evolution of commodity prices is their cyclical behavior. These cyclical movements in prices have important implications for the many developing countries which are dependent on commodity exports, as booms and slumps in prices can induce wide fluctuations in earnings from commodity exports. In this paper we examined the

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[9] The long-lived fifth slump phase for cocoa and sixth slump phase for coffee included the breakdown of international commodity agreements designed to stabilize world prices through buffer stock purchases (International Cocoa Agreement (suspended in February 1988)) and export quotas (International Coffee Agreement (suspended in July 1989)).

[10] The mean absolute deviation for coffee is 8 months for booms and 12 months for slumps, which indicates that, similar to wheat, coffee's average boom and average slump (as set out in Table 2) are good representations of the phases in the coffee market. In contrast, the mean absolute deviation for cocoa is 25 months for booms and only 9 months for slumps.

properties of cycles in the prices of 36 individual commodities, and found four important features of commodity price booms and slumps. First, there is an asymmetry in commodity-price cycles, as the duration of slumps exceeds the duration of booms by nearly a year. Second, the magnitude of price falls in a slump is slightly larger than the magnitude of price rebounds in a subsequent boom, while the rate of change of prices in booms is typically faster than the rate of change of prices in slumps. Third, there is little evidence of a consistent 'shape' to the cycles in commodity prices. Finally, for all commodities the probability of a slump in prices ending is independent of the time already spent in the slump. This finding of no duration dependence in slumps also holds for most commodities in boom periods.

There is an important implication of our finding of no duration dependence in commodity prices. If market participants do not take account of the nonexistence of duration dependence, there is a danger that they may misperceive the nature of commodity-price cycles. On the one hand, they may mistakenly believe that because prices have been in a boom period for a long time, that there is a new paradigm, so that cycles are no longer relevant. Conversely, they may also mistakenly believe that the longer adverse movements in prices continue, the more likely it is that this period of falling prices is about to end. However, we show that the probability a boom or a slump will end actually remains constant. Future models of commodity price movements will need to take account of the stylized facts set out in this paper, which should also be a useful input into the debate over the efficacy and design of stabilization policies in commodity-dependent economies.

Bry-Boschan (1971) Algorithm

Our adaptation of the Bry-Boschan algorithm for the selection of turning points (peaks and troughs) in the commodity price data is as follows.

Step 1: Make first pass at dating peaks and troughs

The algorithm picks an initial selection of peaks and troughs, where a peak is located at the highest point in the series using a window two months either side of that point, and vice versa for troughs.

Step 2: Enforce alternation of peaks and troughs

The algorithm checks that none of the peak dates and trough dates are shared.

Step 3: Censor dates

(i) The algorithm enforces the restriction that cycles (peak-to-peak and trough-to-trough) are at least 24 months long.

(ii) The algorithm censors the dates at the end of the series by eliminating turns within 12 months of both ends of the series, and by eliminating peaks (troughs) at both ends which are lower (higher) than values closer to the end.

(iii) The algorithm again checks the restriction that cycles (peak-to-peak and trough-to-trough) are at least 24 months long.

(iv) The algorithm eliminates phases whose duration is less than 12 months long.

Step 4: Statement of final turning points

The algorithm selects the final peak and trough dates.

Specification for Commodity Prices

The data for the 36 primary commodities are taken from the International Monetary Fund's *International Financial Statistics* (IFS) database, for the period 1957:1 to 1999:8, and are defined below, with the unit of the index given in parentheses.

In forming real commodity prices, each nominal commodity price series was deflated by the unit value index (in U.S. dollars) of manufactures exported by 20 developed countries (base 1990=100), with country weights based on the countries' total 1990 exports of manufactures, taken from the IMF's *IFS*.

Nominal Price Indices

Aluminum	London Metal Exchange, standard grade, spot price, minimum purity 99.5 percent, c.i.f. U.K. ports (Wall Street Journal, New York and Metals Week, New York). Prior to 1979, U.K. producer price, minimum purity 99 percent, (U.S. $/Mt) 1/
Bananas	Central American and Ecuador, first class quality tropical pack, Chiquita, U.S. importer's price, f.o.r. U.S. ports (Direccion Ejecutiva de la Union de Paises Exportadores de Banano, FAX UPEB, Panama, Panama). Beginning January 1987, prices were estimated based on the average wholesale price at New York City and Chicago. Up to December 1986, ($/40lb). 2/ U.S. Bureau of Labor Statistics.
Beef	Australian and New Zealand, frozen boneless, 85 percent visible lean cow meat, U.S. import price f.o.b. port of entry. Prior to December 1975, 90 percent visible lean meat, (Cents/lb). 1/. (Chicago, Illinois: The Yellow Sheet, Urner Barry Publications).
Cocoa beans	International Cocoa Organization daily price. Average of the three nearest active futures trading months in the New York Cocoa Exchange at noon and the London Terminal market at closing time, c.i.f. U.S. and European ports, ($/Mt). 1/ (The Financial Times, London).
Coffee (arabica)	International Coffee Organization (New York) price. Average of El Salvador central standard, Guatemala prime washed and Mexico prime washed, prompt shipment, ex-dock New York, (Cents/lb). 1/ (Bloomberg Business News).
Coffee (robusta)	International Coffee Organization (New York) price. Average of Côte d'Ivoire Grade II and Uganda standard, prompt shipment, ex-dock New York (Bloomberg Business News). Prior to July 1982, arithmetic average of Angolan Ambriz 2 AA and Ugandan Native Standard, ex-dock New York. (Cents/lb) 1/
Coconut oil	Philippine/Indonesian, bulk, c.i.f. Rotterdam, ($/Mt), (Oil World, Hamburg).
Copper	London Metal Exchange, grade A cathodes, spot price, c.i.f. European ports, (Cents/lb). 1/ (New York: Wall Street Journal, New York and Metals Week). Prior to July 1986, higher grade, wirebars, or cathodes.
Cotton	Middling 1-3/32 inch staple, Liverpool Index "A", average of the cheapest five of fourteen styles, c.i.f. Liverpool (Cotton Outlook, Liverpool). From January 1968 to May 1981 strict middling 1-1/16 inch staple. Prior to 1968, Mexican 1-1/16, (Cents/lb). 2/
Fishmeal	Any origin, 64-65 percent protein, c.i.f. Hamburg (Oil World, Hamburg), ($/Mt). 2/ Prior to 1964, Peruvian meal, (FAO Estimate).

Groundnut oil	Any origin, c.i.f. Rotterdam (Oil World, Hamburg). Prior to 1974, Nigerian bulk, c.i.f. U.K. ports. ($/Mt). 2/
Gold	UK 99.5 percent Fine, PM Fixing, Average daily. ($/oz)
Hides	U.S., Chicago packer's heavy native steers, over 53 lbs., wholesale dealer's price, (formerly over 58 lbs.), f.o.b. shipping point (New York: Wall Street Journal), (Cents/lb) 1/ Prior to November 1985, (Washington: U.S. Bureau of Labor Statistics).
Iron ore	Brazilian, Itabira standard sinterfeed, 64.3 percent iron, contract price to Germany, f.o.b. Tubarao, (Cents/DMTU). 4/ (Brazil, Rio de Janeiro: Companhia Vale do Rio Doce).
Lamb	New Zealand, PL, frozen, wholesale price at Smithfield Market, London (New Zealand Meat Producers Board, Washington, D.C.; prior to October 1985, The Financial Times, London). Prior to October 1976, New Zealand D's (The Financial Times, London). 2/ From Oct. 1996, New Zealand, UK wholesale price, medium fat content, (Cents/lb). (The National Business Review).
Lead	London Metal Exchange, 99.97 percent pure, spot price, c.i.f. European ports, ($/Mt). 1/ (New York: Wall Street Journal, New York and Metals Week)
Maize	U.S. No. 2 yellow, prompt shipment, f.o.b. Gulf of Mexico ports, ($/Mt). 1/ (Washington: USDA, Grain and Feed Market News).
Nickel	London Metal Exchange, melting grade, spot price, c.i.f. Northern European ports (Wall Street Journal, New York and Metals Week, New York). Prior to 1980 INCO, melting grade, c.i.f. Far East and American ports, ($/Mt). 1/ (London: Metal Bulletin).
Oil	Average of: U.K. light, Brent Blend 38o API, spot price, f.o.b. U.K. ports; Dubai, medium, Fateh 32o API, spot price, f.o.b. Dubai; and U.S., West Texas Intermediate 40o API, spot price, f.o.b. Midland Texas (Bloomberg Business News). Prior to 1984, Middle East Light 34o API, spot price, ($/bbl). 1/ (New York: Petroleum Intelligence Weekly).
Palm oil	Malaysian/Indonesian, c.i.f. Northwest European ports (Oil World, Hamburg). Prior to 1974, UNCTAD. ($/Mt) 2/
Phosphate rock	Moroccan, 70 percent BPL, contract, f.a.s. Casablanca (The World Bank, Washington). Prior to 1981, 72 percent BPL, f.a.s. Casablanca. ($/Mt) 2/
Rice	Thai, white milled, 5 percent broken, nominal price quotes, f.o.b. Bangkok (Arkansas, Little Rock: USDA, Rice Market News). ($/Mt) 2/
Rubber	Malaysian, No. 1 RSS, prompt shipment, f.o.b. Malaysian/Singapore ports, (Cents/lb). 1/ (London: The Financial Times).
Soybeans	U.S., c.i.f. Rotterdam (Oil World, Hamburg). ($/Mt). 2/
Soybean meal	Arg., 45/46 percent protein, c.i.f. Rotterdam (Oil World, Hamburg). ($/Mt)
Soybean oil	Dutch, f.o.b. ex-mill (Oil World, Hamburg). Prior to April 1973, Dutch crude oil, ex-mill. ($/Mt). 2/
SugarEU	EU import price, unpacked sugar, c.i.f. European ports. Negotiated price for sugar from ACP countries to EU under the Sugar Protocol, (Cents/lb). 1/ (EU Office in Washington).
SugarISA	International Sugar Organization price. Average of the New York contract No. 11 spot price, and the London daily price, f.o.b. Caribbean ports (International Sugar Organization, London and The Journal of Commerce). Prior to 1976, New York contract No. 11, spot price, f.o.b. Caribbean and Brazilian ports. (Cents/lb). 1/

SugarUSA	CSCE contract No. 14, nearest futures position, c.i.f. New York, (Wall Street Journal and Dow Jones). Prior to June 1985, U.S. spot import price, contract No. 12, c.i.f. New York (New York: Journal of Commerce, New York and Weekly Review of the market, Coffee Sugar and Cocoa Exchange, Inc.,). (Cents/lb) 1/
Tea	From July 1998, Mombasa auction price, for best PF1, Kenyan tea (International Tea Committee, London). Prior to July 1998 is London auctions, average price received for good medium, c.i.f. U.K. warehouses, (Cents/kg). 2/ (London: The Tea Brokers Association, The Financial Times).
Tin	London Metal Exchange, standard grade, spot price, c.i.f. European ports (Wall Street Journal, New York, New York). From December 1985 to June 1989 Malaysian, straits, minimum 99.85 percent purity, Kuala Lumpur Tin Market settlement price. Prior to November 1985, London Metal Exchange (New York: Wall Street Journal, New York and Metals Week). (Cents/lb). 1/
Triple super-Phosphate	U.S. bulk, spot price, f.o.b. Gulf of Mexico ports, ($/Mt). 1/ (England, London: Fertilizer Week, CRU International Ltd).
Wheat	U.S. No. 1 hard red winter, ordinary protein, prompt shipment, f.o.b. Gulf of Mexico ports, ($/Mt). 1/ (Washington: USDA, Grain and Feed Market News).
Wool (coarse)	48's clean, dry combed basis. Prior to January 1987, 50's, (Cents/kg). 2/ (London, England: Commonwealth Secretariat).
Wool (fine)	64's clean, dry combed basis, (Cents/kg). 2/ (London, England: Commonwealth Secretariat).
Zinc	London Metal Exchange, high grade 98 percent pure, spot price, c.i.f. U.K. ports, ($/Mt). 1/ (New York: Wall Street Journal and Metals Week). Prior to January 1987, standard grade.

Source: International Monetary Fund.
1/ Average of daily quotations.
2/ Average of weekly quotations.
3/ Monthly quotations.
4/ The price is quoted in cents per 1 percent Fe dry metric ton f.o.b. (DMTU). For 64.3 percent Itabira fines, a price of 28.6 cts/DMTU is equal to US$18.38 per metric ton.

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