FROM BOOM TO BUST:
A TYPOLOGY OF REAL COMMODITY PRICES IN THE LONG RUN

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## ABSTRACT

This paper considers the evidence on real commodity prices over 160 years for 30 commodities representing 7.89 trillion USD worth of production in 2011. In so doing, it suggests and documents a complete typology of real commodity prices, comprising long-run trends, medium-run cycles, and short-run boom/bust episodes. The findings of the paper can be summarized as follows: real commodity prices of both energy and non-energy commodities have been on the rise from 1950 across all weighting schemes; there is a consistent pattern, in both past and present, of commodity price super-cycles which entail decades-long positive deviations from these long-run trends with the latest set of super-cycles likely at their peak; these commodity price super-cycles are punctuated by booms and busts which are historically pervasive and becoming more exacerbated over time. These last elements of boom and bust are also found to be particularly bearing in determining real commodity price volatility as well as potentially bearing in influencing growth in commodity exporting economies.

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# I. Introduction

Once—maybe twice—in every generation, the global economy witnesses a protracted and widespread commodity boom. And in each boom, the common perception is that the world is quickly running out of key materials. The necessary consequence of this demand-induced scarcity is that economic growth must inexorably grind to a halt. While many in the investment community acknowledge this as a possibility, they also suggest that in the meantime serious fortunes are to be made in riding the wave of ever increasing prices. On the other hand, economists are often quick to counter that such thinking is somehow belied by the long-run history of real commodity prices. Building on an extensive academic and policy literature chartering developments in the price of commodities relative to manufactured goods in particular, this side of the debate argues that the price signals generated in the wake of a global commodity boom are always sufficiently strong to induce a countervailing supply response as formerly dormant exploration and extraction activities take off.

What is missing from this discussion is a consistent body of evidence on real commodity prices and a consistent methodology for characterizing their long-run evolution. To that end, this paper considers the evidence on real commodity prices over 160 years for 30 commodities. Individually, these series span the entire range of economically meaningful commodities, being drawn from the animal product, energy product, grain, metals, minerals, precious metals, and soft commodity sectors. What is more, they collectively represent 7.89 trillion USD worth of production in 2011. Even accounting for potential double-counting and excluding potentially idiosyncratic sectors like energy, the sample constitutes a meaningful share of global economic activity.

Furthermore, this paper suggests and documents a complete typology of real commodity prices from 1850. This typology argues for real commodity price series as being comprised of long-run trends, medium-run cycles, and short-run boom/bust episodes. As such, there a few key findings of the paper. First, perceptions of the trajectory of real commodity prices over time are vitally influenced by how long a period is being considered and by how particular commodities are weighted when constructing generic commodity price indices. Applying weights drawn from the value of production in 2011, real commodity prices have increased by 252.41% from 1900, 191.77% from 1950, and 46.23% from 1975. Drilling down even further, extensions of this approach which exclude energy products and precious metals as well as apply equal weights reveal that real commodity prices have collectively been on the rise—albeit sometimes quite modestly—from at least 1950 across all weighting schemes. This suggests that much of the conventional wisdom on long-run trends in real commodity prices may be unduly "pessimistic" about their prospects for future appreciation or unduly swayed by events either in the very distant or very recent past. It also suggests a potentially large, but somewhat underappreciated distinction in between "commodities to be grown" which have evidenced secular declines in real prices versus "commodities in the ground" which have evidenced secular increases in real prices.

Second, there is a consistent pattern of commodity price super-cycles which entail decades-long positive deviations from these long-run trends in both the past and present. In this paper as in others it follows, commodity price super-cycles are thought of as broad-based, medium-run cycles corresponding to upswings in commodity prices of roughly 10 to 35 years. These are demand-driven episodes closely linked to historical episodes of mass industrialization and urbanization which interact with acute capacity constraints in many product categories—in particular, energy, metals, and minerals—in order to generate above-trend real commodity prices

for years, if not decades on end. Significantly, this paper finds that fully 15 of our 30 commodities are in the midst of super-cycles, evidencing above-trend real prices starting from 1994 to 1999. The common origin of these commodity price super-cycles in the late 1990s underlines an important theme of this paper: namely that much of the recent appreciation of real commodity prices simply represents a recovery from their multi-year—and in some instances, multi-decade—nadir around the year 2000. At the same time, the accumulated historical evidence on super-cycles suggests that the current super-cycles are likely at their peak and, thus, nearing the beginning of the end of above-trend real commodity prices in the affected categories.

Third, this paper offers a consistently applied methodology for determining real commodity price booms and busts which punctuate—and help identify—the aforementioned commodity price super-cycles. These boom/bust episodes are found to be historically pervasive with a few clear patterns: periods of freely floating nominal exchange rates have historically been associated with longer and larger real commodity price boom/bust episodes with the last 40 years in particular having witnessed increasingly longer and larger real commodity price booms and busts than the past.

Finally, these last elements of boom and bust are also found to be particularly bearing in determining real commodity price volatility. Simply by neglecting periods associated with commodity price booms and busts as determined above generates counterfactual levels of volatility which, on average, stand at 60-80% of their observed levels. Here, we also draw motivation from a long-standing literature which has documented a distinct correlation between higher commodity price volatility and lower economic growth. One of the key outputs of this paper, then, is providing long-run series on commodity-specific price booms and busts which

may be of interest to other researchers looking for plausibly exogenous shocks to either domestic economies or global markets.

To illustrate this idea, the paper considers the case of Australia and constructs a country-specific indicator of boom/bust episodes based on export-share weighted sums of commodity-specific booms and busts for the period from 1900 to 2012. The paper then relates this index to deviations in Australian GDP from its long-run trend, finding that the transition from relatively placid conditions in global commodity markets for Australian exports to a full-blown commodity price boom is associated with a positive and significant 6.47% deviation in GDP from its long-run trend while the opposite transition to a full-blown commodity price bust is associated with a negative and significant 8.22% deviation in GDP from its long-run trend. Undoubtedly, much more work could and should be done on the front connecting commodity price booms and busts and their potentially asymmetric linkages to economic growth. However, this exercise at the very least points one way forward in using the dating of commodity price booms and busts presented in this paper as the raw material for a more rigorous treatment of the nexus among commodity price booms and busts, commodity price volatility, and economic growth.

The rest of the paper proceeds as follows. Section II sets out the underlying data and addresses the themes of long-run trends and short-run variability in real commodity prices. Section III provides the evidence on (medium-run) super-cycles in real commodity prices. Section IV introduces one of this paper's unique contributions in the form of characterizing real commodity price booms and busts. Section V considers the implications of these boom and bust episodes for commodity price volatility in general and economic growth over the business cycle for commodity-exporting nations in particular. Section VI concludes.

**II. Long-run Trends in Real Commodity Prices**

A long-standing view in the literature holds that in real terms commodity prices do little better than tread water, exhibiting either non-discernible or decidedly downward trends. This seems to be true regardless of whether the window of observation runs in the mere handful of decades or across entire centuries (Harvey *et al*., 2010). Another well-known fact is the pronounced short-run movement of commodity prices around these long-run trends. It is this extreme inter- and intra-year volatility against a backdrop of exceedingly slow evolving dynamics which lead Cashin and McDermott (2002) to typify the long-run behavior of commodity prices as "small trends and big variability". Or as Deaton (1999, p. 27) put it: "What commodity prices lack in trend, they make up for in variance." A less appreciated fact is the potential existence of cycles in real commodity prices spanning decades associated with key events in economic development over time. What the subsequent sections set out to do is reassess the conventional wisdom on long-run trends as well as introduce new perspectives on commodity price cycles in the medium run.

The data used in this study comprise long-run annual prices for commodities with at least 5 billion USD worth of production in 2011. Consistent and reliable data collection begins for the majority of price series in 1850 while no price series enters the data set later than 1900. All told, this paper considers the evidence on 30 individual commodity price series which are drawn from seven product categories (animal products, energy products, grains, metals, minerals, precious metals, and soft commodities) and which are enumerated in Table 1.

As Table 1 also demonstrates, the data series are not only large in number, but also economically significant representing 7.89 trillion USD worth of production in 2011.[1] Finally, the individual price series (being expressed in US dollars) were deflated by the US CPI

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[1] Neglecting energy products, these production values are still in excess of 4.25 trillion USD.

underlying Officer (2012), supplemented by updates taken from the BLS. The choice of the CPI as deflator—although not entirely uncontroversial—is a fairly standard practice in the literature.[2] In what follows, none of the results are materially altered by the consideration of alternative measures of economy-wide prices such as the US GDP deflator or the US PPI. Appendix I details the sources for the individual series.

Figures 1 through 7 document the evolution of real commodity prices from 1850 to 2012. All series have been converted into index form with real prices in 1900 set equal to 100. A simple visual inspection of these series reveals the previously noted "big variability" of real commodity prices. Using one common measure of volatility, namely the standard deviation of annual changes in logged real prices yields an average value of 0.1938 for all commodities and a range of (0.1249, 0.2957) across commodities. Somewhat curiously, this measure of volatility is itself fairly narrowly distributed with the vast majority of all observations falling in a much tighter range defined by 0.1959 +/- 0.04. For better or worse, no clear patterns emerge with respect to volatility across product categories, except for slightly lower average volatility for metals and slightly higher average volatility for soft commodities.

However, with respect to long-run trends in the real commodity price data, there are clear patterns across product categories. Notwithstanding some common global shocks like the peaks in real prices surrounding World War I, the 1970s, and, to a lesser extent, the late 2000s as well as the troughs in the 1930s and 1990s, there is a clear divergence in between those commodities mired in a perpetual downward trend and those exhibiting a perpetual upward trend. Table 2

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[2] Naturally, to the extent that the quality of commodities has remain unchanged over time (which is highly likely), any upward bias in the US CPI induced by insufficient correction for changes in quality over time will lead to a downward bias in the calculation of increases in real commodity price documented below.

draws out this divergence across categories more clearly. Here, real prices in 2012 are compared to those in 1850, 1900, 1950, and 1975.[3]

It will come as no surprise that energy products have uniformly registered increases in real prices since 1900. Slightly more surprising is the presence of precious metals as well as steel and its related minerals—chromium, iron ore, and manganese—in the same category. On the opposite end of the spectrum, soft commodities have been in collective and perpetual decline since 1850.[4] Indeed, a broader interpretation of soft commodities often includes grains and hides which suffer from the same fate. The list of perpetual decliners is rounded out by aluminum—and the related mineral of bauxite—as well as zinc. This leaves six commodities with a more mixed performance over the past 162 years: beef and tin which demonstrate a long-run upward trend, but which have eased off somewhat from their all-time highs in the 1970s; copper and potash which have a consistent upward trend from 1950; and lead and nickel which have essentially been trendless from 1975. Thus, energy products, minerals, and precious metals are clearly in the "gainer" camp, grains and soft commodities are clearly in the "loser" camp, and metals are left as contested territory.

Interestingly, the combination of Tables 1 and 2 suggest that if anything real commodity prices are on the rise if evaluated on the basis of the value of production. Applying weights drawn from the value of production in 2011 suggests that real commodity prices have increased by 252.41% from 1900, 191.77% from 1950, and 46.23% from 1975. Of course, this result is largely driven by energy products. Applying weights drawn from the value of production in 2011 but which exclude energy suggests that real commodity prices have still been on the rise, having

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[3] Appendix II presents the results of a related exercise which considers the cumulative changes in long-run trends in real commodity prices as estimated below. A cursory review suggests that the results presently discussed remain broadly unaffected.

[4] The only exception to this statement is the rise in the real price of rubber from 1975 to 2012. However, this result is more a function of the absolute collapse in rubber prices from the early 1950s and their partial recovery: the index value stood at 31.96 in 1951, at 7.16 in 1975, and at 10.59 in 2012.

increased by 7.76% from 1900, 58.44% from 1950, and 1.97% from 1975. Applying weights drawn from the value of production in 2011 but which exclude both energy and precious metals suggests that real commodity prices have a more mixed record, declining by 3.94% from 1900, increasing by 39.91% from 1950, and declining again by 10.97% from 1975. Finally, applying equal weights (but including both energy and precious metals), real commodity prices have increased 2.01% from 1900, have increased 44.18% from 1950, and have decreased by 3.93% from 1975. Cumulatively, the picture emerging from this exercise is a clear pattern of rising real commodity prices from at least 1950.

How then are these results reconciled with the conclusions of Cashin and McDermott (2002), for instance? First, Cashin and McDermott among others rely on generic commodity price indices which apply equal weights to individual commodities, so many of the long-run trends for "gainers" are washed out by those of "losers". Second, there is a slightly different composition of commodities with only 11 of their 16 commodities matching the 30 under consideration in this paper. Finally and most importantly, there is a massively different composition of product categories: their index only spans the metals and soft commodities categories. Although metals are somewhat of a mixed bag, soft commodities—both broadly and narrowly defined—have been the biggest of "losers" over the past 150 years. This suggests that much of the conventional wisdom on long-run trends in real commodity prices may be unduly pessimistic about their prospects for future appreciation or unduly swayed by events in both the very distant and the very recent past. It also suggests a potentially very large, but somewhat underappreciated distinction in between "commodities to be grown" versus "commodities in the ground".

### III. Medium-Run Cycles in Real Commodity Prices

In recent years, the investing community has run with the idea of commodity price super-cycles (Heap, 2005; Rogers, 2004). In this view, commodity price super-cycles are broad-based, medium-run cycles corresponding to upswings in commodity prices of roughly 10 to 35 years, implying that a full trough-to-trough cycle is roughly twice that length. These are demand-driven episodes closely linked to historical episodes of mass industrialization and urbanization which interact with acute capacity constraints in many product categories—in particular, energy, metals, and minerals—in order to generate above-trend real commodity prices for years, if not decades on end.

At the same time, a burgeoning literature in identifying commodity price super-cycles has emerged in the research community (cf. Cuddington and Jerrett, 2008; Erten and Ocampo, 2012; Jerrett and Cuddington, 2008). The common theme of this literature is that commodity price super-cycles can be detected in the data by use of asymmetric band pass filters which decompose the natural log of the real price of commodity $i$ in time $t$, $\ln(P_{it})$, into three components: a long-run trend in excess of 70 years in duration, $\ln(P_{it})\_LR_t$; a super-cycle of 20 to 70 years duration, $\ln(P_{it})\_SC_i$; and all other shorter cyclical components, $\ln(P_{it})\_CC_t$. This entails estimating three orthogonal components for the log of real commodity price series:

1.) $\ln(P_{it}) \equiv \ln(P_{it})\_LR_t + \ln(P_{it})\_SC_t + \ln(P_{it})\_CC_t$

Procedurally, this simply entails taking the logarithmic transformation of the real price indices reported earlier, estimating a long-run trend (that is, all cyclical components with periods in excess of 70 years), calculating the deviations of log real prices from this trend, and using these deviations to identify commodity price super-cycles (that is, all cyclical components with periods in excess of 20 to 70 years). The reader is referred to the work of Christiano and Fitzgerald

(2003) for details of the asymmetric band pass filter used in this paper (and the previously cited papers) to identify both the long-run trends and the medium-run commodity price super-cycles.

Figure 8a displays the log of real beef prices from 1850 to 2012 and its estimated long-run trend. Figure 8b displays the detrended real beef price and the super-cycle component evident in the former. The scaling on the left-hand-side of the figure is in logs, so a value of 1.00 in Figure 8b represents a 174% deviation from the long-run trend. Thus, the cyclical fluctuations in beef prices are sizeable. The complete super-cycles for beef prices which deliver deviations from trend above 20% can be dated from 1890 to 1929, from 1929 to 1953, and from 1953 to 1999. Figures 9a through 37b replicate the same exercise for the 29 remaining real commodity price series at our disposal. Evidence of large deviations from trend is apparent in almost all series as is the existence of numerous super-cycles over the past 163 years.[5]

Tables 3 through 9 enumerate six features of commodity price super-cycles across the seven products categories, namely their start dates, peak dates, trough dates, years to peak, complete cycle length, and peak value (the largest positive deviation from trend in real prices). All told, 68 complete commodity price super-cycles with positive price deviations from trend of at least 20% are identified.[6] In an attempt to characterize systematic differences in these super-cycles across time, a battery of regressions were run using three of these features (years to peak, cycle length, and peak value) as dependent variables and a set of indicator variables capturing three different time periods, namely from 1914 to 1949 (interwar), from 1950 to 1971 (Bretton Woods), and from 1972 to 2012 (post-Bretton Woods). Thus, the period from 1850 to 1913 (pre-World War I) acts as the omitted category. Only two statistically significant results emerge from

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[5] Curiously, although subject to wide fluctuations in its real price (both in absolute terms and relative to trend), tobacco is the only commodity for which no super-cycle can be detected. This result does not, however, preclude the existence of multiple booms and busts in real tobacco prices as will be demonstrated below.
[6] An additional 31 incomplete commodity price super-cycles are also identified with an indeterminate start date (that is, pre-1850) or an indeterminate end date (that is, post-2012).

this exercise: the post-Bretton Woods era has given rise to a lower value for the years to peak at

15.88 years $(\hat{\beta}_0 + \hat{\beta}_{PBW} = 19.67 - 3.79)$ and for the length of cycles at 34.72 years

$(\hat{\beta}_0 + \hat{\beta}_{PBW} = 40.00 - 5.28)$.[7]

Figures 38 through 43 display the histograms for all six features of the 68 commodity

price super-cycles pooled across the seven product categories. Briefly summarizing, we find that

the 1890s, 1930s, and 1960s gave rise to the majority (40) of the start dates for commodity price

super-cycles while the 1910s, 1950s, and 1970s gave rise to the majority (38) of the peak dates

and the 1930s, 1960s, and 1990s gave rise to the majority (44) of the end dates. Collectively, this

suggests a big role for not only American industrialization/urbanization in the late 19$^{th}$ century

and European/Japanese re-industrialization/re-urbanization in the mid-20$^{th}$ century but also the

World Wars in determining the timing of past super-cycles. Rounding things out, Figures 41

through 43 respectively suggest that the majority (49) of super-cycles peak within 10-20 years of

their start date, the majority (44) of super-cycles also evidence complete cycle lengths of less

than 40 years, and the majority (45) of super-cycles are associated with positive deviations of 20-

50% from trend.

Curiously, as Figures 38 through 43 exclude incomplete cycles, they are silent about

currently evolving super-cycles: fully 15 of our 30 commodities demonstrate above-trend real

prices starting from 1994 to 1999; of these, 9 are in the energy products, metals, and precious

metals categories (with chromium and iron ore critically also making appearances). The common

origin of these commodity price super-cycles in the late 1990s underlines an important theme of

this paper: namely that much of the recent appreciation of real commodity prices simply

represents a recovery from their multi-year—and in some instances, multi-decade—nadir around

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[7] Similar regressions across commodities suggest there is no evidence that commodity price super-cycles differ
systematically across product categories.

the year 2000. A further insight comes from combining these results with Figure 41 which suggests that we are also likely nearing the beginning of the end of above-trend real commodity prices in the affected categories.[8]

Thus, we have been able to establish a consistent pattern of evidence supportive of: 1.) the contention that real commodity prices might best be characterized by upward trends, especially when evaluated on the basis of the value of production and over the years from 1950; 2.) the notion of commodity price super-cycles in the historical record and present day as well as for a broader range of commodities than has been previously considered in the literature. What is missing, however, is any sense of short-run movements in real commodity prices which may be particularly bearing in determining real commodity price volatility and potentially bearing in determining economic growth. It is to these themes which the following sections turn.


**IV. Short-run Boom/Bust Episodes in Real Commodity Prices**

Up to this point, we have confronted the standing literature on long-run trends and medium-run cycles through a consideration of 163 years of real commodity price data, finding some results which can be aligned with the received wisdom on commodity price super-cycles, but which offers a slightly contrarian view of the long-run course of real commodity prices. Next, we turn to exploring the short-run dynamics of real commodity prices, in particular, the widely appreciated phenomena of commodity booms and busts.

Naturally, one important question looms large in this context: how exactly should real commodity price booms and busts be characterized? Admittedly, there are a number of ways

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[8] Indeed, for at least one commodity, natural gas, real prices have already registered their largest deviation from trend (in 2006). It remains to be seen whether this is symptomatic of other commodity price super-cycles or whether it simply reflects idiosyncratic features of the natural gas industry, in particular, recent breakthroughs in extraction technology.

forward, but one of the most natural is to build on what we have already seen before. Here, we follow the lead of Mendoza and Terrones (2012) and will take as our basic input the deviations from the long-run trend in logged real prices for commodity $i$ in time $t$, calling this component $d_{it}$. Let $z_{it}$ represent the standardized version of $d_{it}$—that is, for any given observation, we simply subtract the sample mean of all $z_i$'s and divide by their standard deviation. Commodity $i$ is defined to have experienced a commodity price boom when we identify one or more contiguous dates for which the boom condition $z_{it} > 1.282$ holds (as the value of 1.282 defines the threshold for the 10% upper tail of a standardized normal distribution). A commodity price boom peaks at $t^*_{boom}$ when the maximum value of $z_{it}$ is reached for the set of contiguous dates that satisfy the commodity boom condition. A commodity price boom starts at $t^s_{boom}$ where $t^s_{boom} < t^*_{boom}$ and $z_{it} > 1.00$ and is the smallest, positive observation satisfying this condition in a 5-year centered window. A commodity price boom ends at $t^e_{boom}$ where $t^e_{boom} > t^*_{boom}$ and $z_{it} > 1.00$ and is the smallest, positive observation satisfying this condition in a 5-year centered window.

Highly symmetric conditions define the opposite set of circumstances as well. Commodity $i$ is defined to have experienced a commodity price bust when we identify one or more contiguous dates for which the bust condition $z_{it} < -1.282$ holds (as the value of -1.282 defines the threshold for the 10% lower tail of a standardized normal distribution). A commodity price bust troughs at $t^*_{bust}$ when the minimum value of $z_{it}$ is reached for the set of contiguous dates that satisfy the commodity bust condition. A commodity price bust starts at $t^s_{bust}$ where $t^s_{bust} < t^*_{bust}$ and $z_{it} < -1.00$ and is the largest, negative observation satisfying this condition in a 5-year centered window. A commodity price bust ends at $t^e_{bust}$ where $t^e_{bust} > t^*_{bust}$ and

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$z_{it} < -1.00$ and is the largest, negative observation satisfying this condition in a 5-year centered window.

For illustration purposes, the reader is referred to Figure 44 which presents the evidence on price booms and busts for beef. Again, the log of real beef prices from 1850 to 2012 is chartered along with the episodes of boom and bust determined by the algorithm given above. This indicates the presence of four booms (in green) and three busts (in red) for real beef prices over the past 163 years. Notably, the booms occurred from 1915 to 1919, from 1942 to 1944, from 1966 to 1974, and from 1978 to 1980 while the busts occurred from 1922 to 1924, from 1949 to 1958, and from 1995 to 2003, suggesting that in this context real commodity price booms do not mechanically generate real commodity price busts, nor vice versa. This pattern—or lack thereof—is repeated in Figures 45 through 73 which replicate the same exercise for the 29 remaining real commodity price series at our disposal. Evidence of both common and idiosyncratic real commodity price booms and busts is readily apparent.

Just as in the case of commodity price super-cycles, we provide a full enumeration of the various commodity price booms and busts underlying these figures in Tables 10 through 16. There, six features of commodity price super-cycles across the seven product categories are documented, namely their start dates, peak/trough dates, end dates, years to peak/trough, boom/bust lengths, and deviations from trend (the cumulative deviations from the long-run trends in real prices from the beginning of the boom/bust to the peak/trough). All told, 140 commodity price booms and 135 commodity price busts are identified.

As before, we attempt to characterize systematic difference in these commodity price booms/busts across time. First, considering commodity price booms alone, a battery of regressions were run using three of their features (years to peak, cycle length, and cumulative

deviation from trend) as dependent variables and a set of indicator variables capturing three different time periods, namely from 1914 to 1949 (interwar), from 1950 to 1971 (Bretton Woods), and from 1972 to 2012 (post-Bretton Woods). Thus, the period from 1850 to 1913 (pre-World War I) acts as the omitted category. In terms of statistically significant results, the interwar and post-Bretton Woods eras gave rise to higher values for the years to peak at 1.45 and 1.57 years, respectively $(\hat{\beta}_0 + \hat{\beta}_{IW} = 0.84 + 0.61; \ \hat{\beta}_0 + \hat{\beta}_{PBW} = 0.84 + 0.73)$. Likewise, the interwar and post-Bretton Woods eras witnessed longer boom lengths at 2.66 and 3.05 years, respectively $(\hat{\beta}_0 + \hat{\beta}_{IW} = 1.82 + 0.84; \ \hat{\beta}_0 + \hat{\beta}_{PBW} = 1.82 + 1.23)$. As to the cumulative increase in real prices from the beginning of the boom to the peak, this variable has witnessed a fairly dramatic increase over time $(\hat{\beta}_0 = \hat{\beta}_{PWWI} = 66.39, \ \hat{\beta}_{IW} = 33.98, \ \hat{\beta}_{BW} = 11.72, \hat{\beta}_{PBW} = 52.75)$. These results immediately suggest two things: periods of freely floating nominal exchange rates have historically been associated with longer and larger real commodity price booms and the last 40 years have witnessed increasingly longer and larger real commodity price booms than the past.[9]

Figures 74 through 79 display the histograms for these six features of the 140 complete commodity price booms pooled across the seven product categories. Briefly summarizing, we find that the 1900/10s, 1950s, and 1970/80s gave rise to the majority (87) of the start, peak, and end dates for commodity price booms. Collectively, this suggests much shorter years to peak and cycle lengths than in the case of commodity price super-cycles as demonstrated in Figures 77 and 78 with the majority (114) of commodity price booms peaking 0-2 years from their start and the majority (91) of commodity price booms being 0-2 years in length. What is also very clear is

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[9] There is also clear evidence that commodity price booms in the energy and animal product categories display longer years to peak $(\hat{\beta}_0 = \hat{\beta}_A, \ \hat{\beta}_A + \hat{\beta}_E = 2.67 + 2.08)$ and longer boom lengths $(\hat{\beta}_0 = \hat{\beta}_A, \ \hat{\beta}_A + \hat{\beta}_E = 3.89 + 2.86)$. What is more, the energy product category alone—but perhaps not surprisingly—evidences significantly larger deviations from trend $(\hat{\beta}_0 = \hat{\beta}_A, \ \hat{\beta}_A + \hat{\beta}_E = 85.33 + 51.41)$.

that commodity price booms are associated with much more pronounced deviations from long-run trends in real prices than would be suggested by the evidence on commodity price super-cycles alone: the majority (78) of booms are associated with spikes in real prices of 50-100% with values in excess of 500% not being unheard of.[10]

Turning to the evidence on commodity price busts, another battery of regressions were run using three of their features (years to trough, cycle length, and cumulative deviation from trend) as dependent variables and the same set of indicator variables capturing the three different time periods with the period from 1850 to 1913 (pre-World War I) acting as the omitted category. Once again, the post-Bretton Woods era distinguishes itself with significantly longer years to trough at 2.63 years $(\hat{\beta}_0 + \hat{\beta}_{PBW} = 1.04 + 1.59)$ and cycle length at 4.65 years $(\hat{\beta}_0 + \hat{\beta}_{PBW} = 2.46 + 2.19)$. The post-Bretton Woods era along with the interwar period also distinguished themselves with lower associated values for the cumulative deviation from trend at -45.86% and -45.66%, respectively $(\hat{\beta}_0 = -37.32; \hat{\beta}_{IW} = -8.54; \hat{\beta}_{PBW} = -8.34)$. Thus, the last 40 years have witnessed longer and larger real commodity price busts—in addition to booms—than the past.[11]

Figures 80 through 85 display the histograms for these six features of the 135 commodity price busts pooled across the seven product categories. Briefly summarizing, we find that the 1920/30s and 1990s gave rise to the majority (72) of the start dates for commodity price busts while the 1920/30s and 1990s/2000s gave rise to the majority (81) of the trough dates and end

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[10] We also note that currently nine commodities are currently experiencing a boom: copper, corn, gold, iron ore, lead, palm oil, rubber, silver, and wool.

[11] There is a little evidence that commodity price busts differ systematically across product categories. Precious metals demonstrate longer years to trough $(\hat{\beta}_0 = \hat{\beta}_A, \hat{\beta}_A + \hat{\beta}_P = 1.30 + 3.10)$; grains, precious metals, and soft commodities also demonstrate different cycle lengths than other commodities $(\hat{\beta}_0 = \hat{\beta}_A, \hat{\beta}_A + \hat{\beta}_G = 4.10 - 1.82, \hat{\beta}_A + \hat{\beta}_S = 4.10 + 4.50, \hat{\beta}_A + \hat{\beta}_S = 4.10 - 1.47).$

dates. Figures 83 and 84 suggest similar dynamics as with commodity price booms with the majority (73) of commodity price busts troughing 1-2 years from their start and the majority (81) of commodity price busts being 1-4 years in length. What is also very clear is that commodity price busts are likewise associated with very pronounced deviations from long-run trends in real prices: the majority (85) of busts are associated with a cratering in real prices of 30-50%.[12]

In sum, this consideration of commodity price booms and busts gives rise to a much more turbulent view of commodities than provided from the lofty perspective of the medium- and long-run, subject as these real commodity price booms and busts are to manic price increases and depressive price declines. And this is seemingly a situation which has only exacerbated over time and, thus, promises to do so in the future.


**V. Implications for Commodity Price Volatility and Economic Growth**

In light of these results, it may be worth our while to consider the broader implications of commodity price booms and busts, in particular their relation to commodity price volatility and economic growth. Admittedly, the nexus between volatility and growth is a well-tread path (see Jacks, O'Rourke, and Williamson, 2011 on this point), and this paper does not make any claims to originality in this respect. However, one of the problems with this literature is that there has been very little work on distinguishing between episodes of commodity price volatility where real prices are in a boom as opposed to episodes when real prices in a bust. Rather than take the correlation between higher commodity price volatility and lower economic growth as given, in this section, the aim is to associate commodity price booms and busts with periods of acute commodity price volatility and present some suggestive evidence relating commodity price booms and busts to economic growth.

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[12] There is only one commodity currently experiencing a bust: natural gas.

To begin, we can consider once again the deviations from the long-run trend in logged real prices estimated in section II. Taking the standard deviation of these values over the entire span of prices available for each series, we arrive at the figures reported in column (A) of Table 17. There, we can see that the average volatility of these deviations stands at 0.3048 (with a low of 0.1717 for tea and a high of 0.4586 for rubber). Next, we calculate the standard deviation of these values over the entire span of prices still available for each series, once we exclude periods of time associated with commodity booms and busts as defined in section III. Thus, we arrive at the figures reported in column (B) of Table 15 with the average volatility of these deviations at 0.1766 (and a low of 0.1030 for tobacco and a high of 0.2647 for rubber). Finally, taking the ratio of (B) to (A), we find that simply by neglecting periods associated with commodity price booms and busts generates levels of volatility which, on average, stand at 58% of their actual levels (with an associated range of 40% for silver and 72% for gold—that is, every commodity demonstrates lower levels of volatility in the absence of commodity price booms and busts).

Of course, this may be an unsatisfying exercise for some in that commodity price booms and busts were defined as those deviations in log prices from their long-run trend which exceeded a certain threshold. Therefore, the association between boom and bust and volatility as defined above may seem mechanical. Table 18 repeats the same exercise but with a different metric for commodity price volatility. Here, we return to a standard measure in the literature, namely the standard deviation of annual changes in logged real prices. Column (A) again reports the value of this metric over the entire span of data by commodity, reporting an average value of 0.1938 (and a low of 0.1249 for gold and a high of 0.2957 for sugar). Column (B) again reports the value of this metric over the entire span of data by commodity, once we exclude periods of time associated with commodity booms and busts as defined in section III. Thus, we arrive at an

average value of 0.1610 (and a low of 0.0965 for gold and a high of 0.2260 for rubber). Finally, taking the ratio of (B) to (A), we find that simply by neglecting periods associated with commodity price booms and busts generates levels of volatility which, on average, stand at 83% of their actual levels (with an associated range of 68% for nickel and 96% for tin—again, every commodity demonstrates lower levels of volatility in the absence of commodity price booms and busts).

In combination then, it is hard to escape the conclusion that commodity price booms and busts as defined in this paper are associated with heightened levels of commodity price volatility, variously defined. But can we push these results even further and more closely examine the presumed link between commodity price volatility and economic growth? Here, things become a little murkier in that the share of any one commodity in the value of exports—much less to say aggregate production—is typically small apart from some very rare instances. Thus, with booms and busts necessarily being defined at the commodity level, more work is needed in: 1.) determining the patterns of commodity production across countries and time; and 2.) determining what constitutes an economy-wide commodity price shock, whether boom or bust.

In this regard, the following pieces of antipodean evidence are submitted for consideration. Currently, aluminum, beef, copper, cotton, iron ore, lead, natural gas, nickel, petroleum, sugar, tin, wheat, wool, and zinc represent 112.55 billion AUD, or roughly 43%, of Australian goods and services exports.[13] What is more, these are also the mainstays of Australian exports historically speaking. Thus, it is possible to combine information on Australian exports shares over time with the previously described indicators of real commodity price booms and

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[13] We exclude gold and silver in this instance. Gold, in particular, is and has been a very large Australian export, reaching a peak export share in our sample of 48% in 1903 and a contemporary export share of 14% in 2012. However, the official and widespread revaluation of gold in the 1930s generates a simultaneous spike in its export share and a consequent indication of a commodity price boom for Australia in the same period. This "false positive" is, of course, vastly at odds with what we know of conditions in global commodity markets at this time.

busts.[14] Specifically, we define an economy-wide commodity price shock as the export-share weighted sum of commodity booms and busts which ranges from 0 to 1 by construction. Figure 86 plots these series from 1900 to 2012. There, we find that over the past 113 years Australia has experienced four large commodity price booms (roughly, from 1916 to 1919, from 1950 to 1951, from 1973 to 1980, and from 2009 onwards) and four large commodity price busts (roughly, 1921, from 1930 to 1933, 1938, and from 1998 to 2003).

Supplementing the data from Barro and Ursua (2008) on the evolution of GDP per capita from 1900 to 2009, we can also document deviations of GDP from its long-run trend over this same period. Thus, Figure 87 depicts the evolution of this series, capturing both the long sub-par growth experience initiated by the Great Depression from 1930 to 1960 and the pre-World War I and post-1960 above-trend growth episodes. Informally then, the timing of commodity price booms and busts seems to correspond to upswings and downswings in these deviations from trend growth. Taking a more formal approach, we can simply regress the deviations in GDP from its long-run trend on the series for commodity price booms and busts. Doing so yields a coefficient on commodity price booms of 0.0647 with a standard error of 0.0327 and associated p-value of 0.051 and a coefficient on commodity price busts of -0.0822 with a standard error of 0.0446 and associated p-value of 0.068.

Taken literally, these results suggest that the transition from relatively placid conditions in global commodity markets for Australian exports to a full-blown commodity price boom is associated with a positive 6.47% deviation in GDP from its long-run trend of 3.44%, or a 9.91% growth rate in real GDP. Likewise, the transition from relatively placid conditions in global commodity markets for Australian exports to a full-blown commodity price bust is associated

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[14] These exports shares were calculated from Lougheed (2007) and the Australian Bureau of Agricultural and Resource Economics and Sciences.

with a negative 8.22% deviation in GDP from its long-run trend of 3.44%, or a -4.78% growth rate in real GDP. Undoubtedly, much more work could and should be done on connecting commodity price booms and busts and their potentially asymmetric linkages to economic growth. At the very least, however, the previous exercise at least points one way forward in using the dating of commodity price booms and busts presented in this paper as the raw material for a more rigorous treatment of the nexus among commodity price booms and busts, commodity price volatility, and economic growth.

## VI. Conclusions and Future Prospects

Drawing motivation from the current debate surrounding the likely trajectory of commodity prices, this paper has sought to forward our understanding of real commodity prices in the long-run along two dimensions. First, the paper has provided a consistent body of evidence on real commodity prices for 30 economically significant goods since 1850. Second, the paper has provided a consistent methodology for thinking about their long-run evolution.

In so doing, it suggests and documents a complete typology of real commodity prices, comprising long-run trends, medium-run cycles, and short-run boom/bust episodes. The findings of the paper can be summarized as follows. First, real commodity prices of both energy and non-energy commodities have been on the rise from 1950 across all weighting schemes. Second, there is a consistent pattern, in both past and present, of commodity price super-cycles which entail decades-long positive deviations from these long-run trends with the latest set of super-cycles likely at their peak. Third, these commodity price super-cycles are punctuated by booms and busts which are historically pervasive and becoming more exacerbated over time. These last elements of boom and bust are also found to be particularly bearing in determining real

commodity price volatility as well as potentially bearing in influencing growth in commodity exporting economies.

At the same time, this paper remained relatively silent about real commodity prices as they relate to future prospects for the global economy. However, there are two consistent messages on this issue which emerge from this paper. First, much of the academic and policy literature has tended to over-emphasize the behavior of real commodity prices in both the very distant and very recent past. For all the differences in periodization, this literature has cumulatively arrived at the conclusion that real commodity prices exhibit little trend and what trend they do exhibit is distinctly in the downward direction. In this regard, the experience of the 1990s and early 2000s should be put in perspective: the levels of real commodity prices seen in this period are anomalous as they represent multi-year—and in some instances, multi-decade—lows. It should always be borne in mind that the past was a much more expensive place and the future promises to likely be the same.

Finally, greater volatility is a slightly more certain prospect for real commodity prices in the future. As this paper has clearly documented, periods of freely floating nominal exchange rates in general, but the last 40 years after the fall of the Bretton Woods system in particular, have been associated with longer and larger real commodity price booms and busts. And these booms and busts were, in turn, strongly associated with higher commodity price volatility. It remains to be seen whether anything can be done to mitigate this volatility in a coordinated fashion either through market or policy mechanisms, but this volatility will certainly continue to affect the growth prospects of nations, particularly those which are commodity exporters and which have relatively low levels of financial development.

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**Appendix I**

This appendix details the sources of the real commodity prices used throughout this paper. As such, there are a few key sources of data: the annual Sauerbeck/*Statist* (SS) series dating from 1850 to 1950; the annual Grilli and Yang (GY) series dating from 1900 to 1986; the annual unit values of mineral production provided by the United States Geographical Survey (USGS) dating from 1900 to 2012; the annual Pfaffenzeller, Newbold, and Rayner (PNR) update to Grilli and Yang's series dating from 1987 to 2010; and the monthly International Monetary Fund (IMF), United Nations Conference on Trade and Development (UNCTAD), and World Bank (WB) series dating variously from 1960 and 1980 to 2012. The relevant references are:

Grilli, E.R. and M.C. Yang (1988), "Primary Commodity Prices, Manufactured Goods Prices, and the Terms of Trade of Developing Countries: What the Long Run Shows." *World Bank Economic Review* 2(1): 1-47.

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"Wholesale Prices in 1950." *Journal of the Royal Statistical Society* 114(3): 408-422.

A more detailed enumeration of the sources for each individual series is as follows.

*Aluminum*: 1900-2010, GY and PNR; 2011-2012, UNCTAD.
*Bauxite*: 1900-2012, USGS.
*Beef*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.
*Chromium*: 1900-2012, USGS.
*Cocoa*: 1850-1899, Global Financial Data; 1900-1959, GY; 1960-2012, WB.
*Coffee*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.
*Copper (wire bars)*: 1850-1899, SS; 1900-2010, GY and PNR; 2011-2012, UNCTAD.
*Corn*: 1850-1851, Cole, A.H. (1938), *Wholesale Commodity Prices in the United States, 1700-1861: Statistical Supplement*. Cambridge: Harvard University Press; 1852-1859; Bezanson, A. (1954), *Wholesale Prices in Philadelphia 1852-1896*. Philadelphia: University of Pennsylvania Press; 1860-1999, Global Financial Data; 2000-2012, United States Department of Agriculture National Agricultural Statistics Service.
*Cotton*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.
*Gold*: 1850-1999, Global Financial Data; 2000-2012, Kitco.
*Hides*: 1850-1899, SS; 1900-1959, GY; 1960-2012, UNCTAD.
*Iron ore*: 1900-2012, USGS.

*Lead*: 1850-1899, SS; 1900-2010, GY and PNR; 2011-2012, UNCTAD.

*Manganese*: 1900-2012, USGS.

*Natural gas (wellhead)*: 1900-1921, Carter, S. *et al*. (2006), *Historical Statistics of the United States, Millennial Edition*. Cambridge: Cambridge University Press; 1922-2012, United States Energy Information Administration.

*Nickel*: 1850-1899, Carter, S. *et al*. (2006), *Historical Statistics of the United States, Millennial Edition*. Cambridge: Cambridge University Press; 1900-2012, USGS.

*Palm oil*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.

*Petroleum (WTI)*: 1860-2000, Global Financial Data; 2001-2012, IMF.

*Potash*: 1900-2012, USGS.

*Rice*: 1850-1899, SS; 1900-1956, GY; 1957-1979, Global Financial Data; 1980-2012, IMF.

*Rubber*: 1890-1899, Global Financial Data; 1900-1959, GY; 1960-2012, WB.

*Silver*: 1850-2012, Kitco.

*Steel (hot-rolled bar)*: 1897-1998, Carter, S. *et al*. (2006), *Historical Statistics of the United States, Millennial Edition*. Cambridge: Cambridge University Press; 1999-2012, WB.

*Sugar*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.

*Tea*: 1850-1899, SS; 1900-1959, GY; 1960-2012, WB.

*Tin*: 1850-1899, SS; 1900-2010, GY and PNR; 2011-2012, UNCTAD.

*Tobacco*: 1850-1865, Clark, G. (2005), "The Condition of the Working Class in England, 1209-2004." *Journal of Political Economy* 113(6): 1307-1340; 1866-1899, Carter, S. *et al*. (2006), *Historical Statistics of the United States, Millennial Edition*. Cambridge: Cambridge University Press; 1900-1959, GY; 1960-2012, WB.

*Wheat*: 1850-1999, Global Financial Data; 2000-2012, United States Department of Agriculture National Agricultural Statistics Service.

*Wool*: 1850-1899, SS; 1900-1979, GY; 1980-2012, IMF.

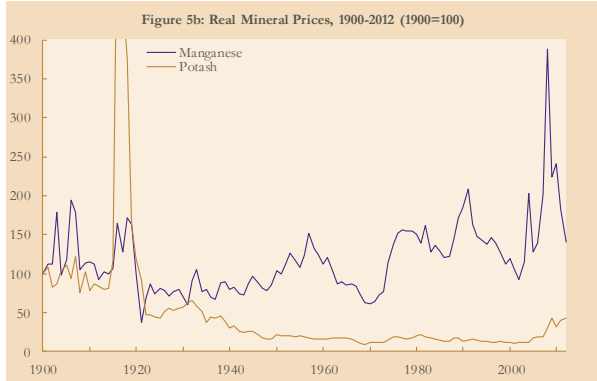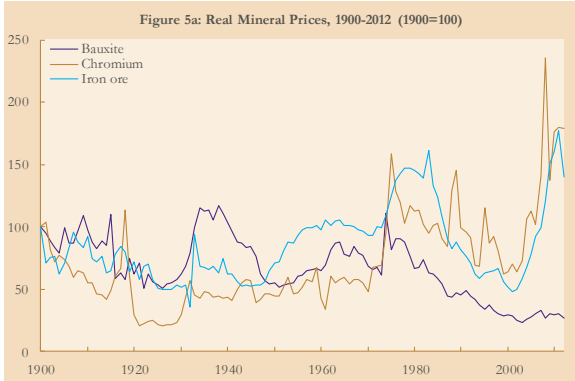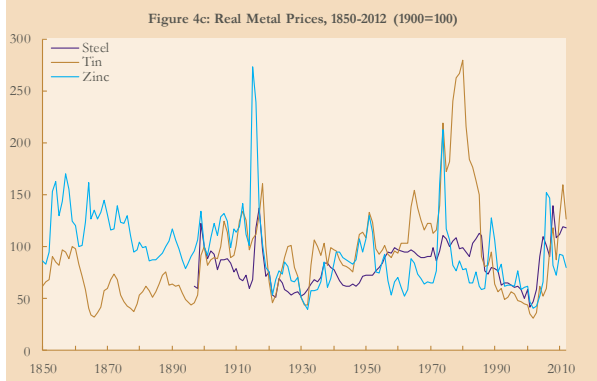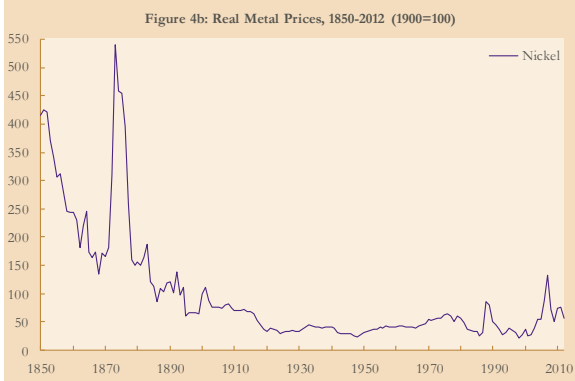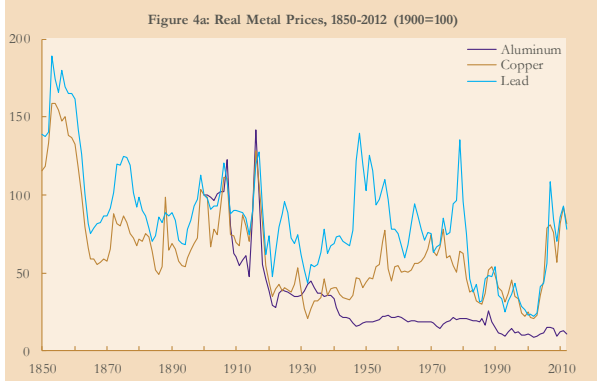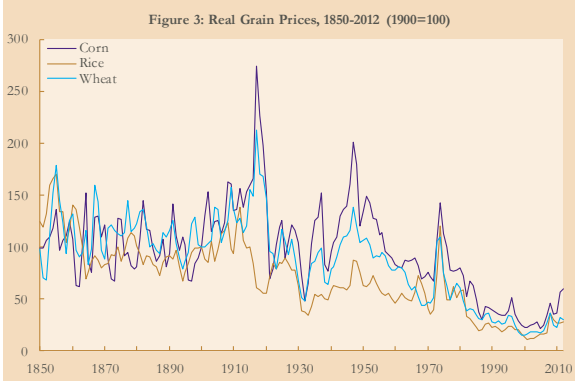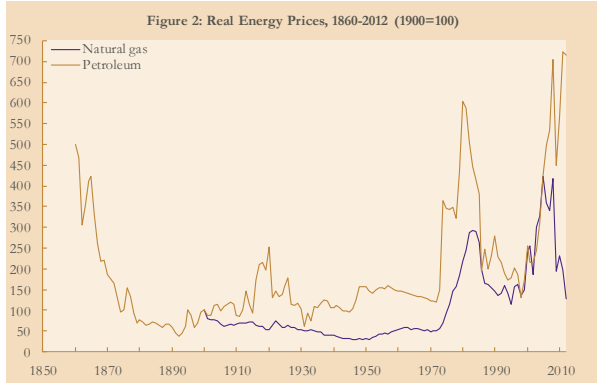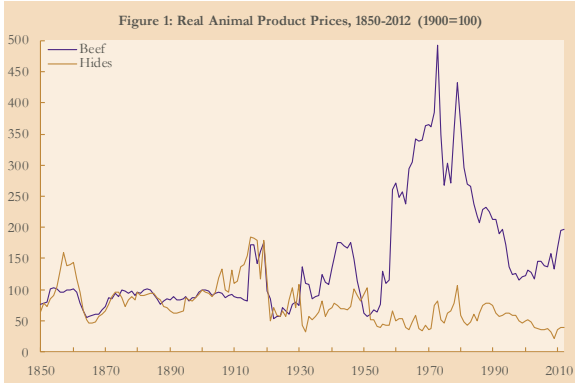*Zinc*: 1850-2000, Global Financial Data; 2001-2012, IMF.

## Appendix II

Table A1 below replicates the exercise first reported in Table 2. Instead of comparing observed price levels in 1850, 1900, 1950, and 1975 versus 2012, it compares the estimated value of the long-run trend in the same years as described in the text. The results remain broadly unaffected.

| Table A1: Cumulative Changes in Prices Relative to Long-Run Trend | | | | |
|---|---|---|---|---|
| Commodity | Cumulative change in in price from 1850 (%) | Cumulative change in price from 1900 (%) | Cumulative change in price from 1950 (%) | Cumulative change in price from 1975 (%) |
| **Animal products** | | | | |
| Beef | 116.41 | 66.22 | 11.89 | -32.65 |
| Hides | -41.18 | -57.18 | -26.87 | -20.90 |
| | | | | |
| **Energy products** | | | | |
| Natural gas | N/A | 88.64 | 394.02 | 89.52 |
| Petroleum | N/A | 434.01 | 267.67 | 195.57 |
| | | | | |
| **Grains** | | | | |
| Corn | -57.42 | -58.58 | -65.18 | -36.45 |
| Rice | -81.12 | -78.32 | -65.54 | -46.29 |
| Wheat | -75.64 | -75.28 | -73.09 | -50.76 |
| | | | | |
| **Metals** | | | | |
| Aluminum | N/A | -89.05 | -50.23 | -37.44 |
| Copper | -51.01 | -43.26 | 24.04 | 22.58 |
| Lead | -60.20 | -44.80 | -36.12 | -8.64 |
| Nickel | -87.78 | -49.13 | 39.00 | 17.18 |
| Steel | N/A | -5.65 | 20.36 | 9.02 |
| Tin | 44.00 | -11.08 | -19.13 | -20.83 |
| Zinc | -12.72 | -24.69 | -3.55 | -2.68 |
| | | | | |
| **Minerals** | | | | |
| Bauxite | N/A | -72.60 | -64.27 | -58.69 |
| Chromium | N/A | 37.26 | 206.01 | 73.74 |
| Iron ore | N/A | 3.96 | 34.80 | 4.16 |
| Manganese | N/A | 52.17 | 77.11 | 29.76 |
| Potash | N/A | -71.41 | 26.72 | 137.23 |
| | | | | |
| **Precious metals** | | | | |
| Gold | 92.36 | 127.19 | 206.05 | 143.91 |
| Silver | -49.21 | 4.89 | 123.68 | 63.80 |
| | | | | |
| **Soft commodities** | | | | |
| Cocoa | -71.86 | -78.81 | -44.51 | -57.24 |
| Coffee | -60.04 | -55.87 | -65.11 | -67.29 |
| Cotton | -75.39 | -67.72 | -68.70 | -55.84 |
| Palm oil | -73.38 | -69.25 | -61.26 | -39.44 |
| Rubber | N/A | -93.33 | -49.87 | -16.37 |
| Sugar | -88.88 | -78.12 | -43.85 | -32.03 |
| Tea | -84.63 | -72.65 | -63.70 | -50.43 |
| Tobacco | -56.29 | -28.70 | -66.75 | -45.42 |
| Wool | -82.24 | -77.50 | -74.58 | -36.92 |

## Table 1: Value of Production across Commodities

| Commodity | Production in 2011 | Units of measurement | Value of production (b 2011 USD) |
|---|---|---|---|
| **Animal products** | | | **257.81** |
| Beef | 62.54 | Million tonnes | 252.79 |
| Hides | 6.12 | Million tonnes | 5.02 |
| | | | |
| **Energy products** | | | **3641.60** |
| Natural gas | 3.39 | Trillion cubic m. | 472.63 |
| Petroleum | 4.01 | Billion tonnes | 3168.98 |
| | | | |
| **Grains** | | | **768.85** |
| Corn | 883.46 | Million tonnes | 206.59 |
| Rice | 722.76 | Million tonnes | 398.75 |
| Wheat | 704.08 | Million tonnes | 163.50 |
| | | | |
| **Metals** | | | **2104.15** |
| Aluminum | 43.99 | Million tonnes | 109.88 |
| Copper | 16.10 | Million tonnes | 146.51 |
| Lead | 10.59 | Million tonnes | 25.27 |
| Nickel | 1.59 | Million tonnes | 36.41 |
| Steel | 1.49 | Billion tonnes | 1746.65 |
| Tin | 383.50 | Thousand tonnes | 10.53 |
| Zinc | 13.12 | Million tonnes | 28.90 |
| | | | |
| **Minerals** | | | **457.26** |
| Bauxite | 259.00 | Million tonnes | 8.00 |
| Chromium | 23.30 | Million tonnes | 64.80 |
| Iron ore | 2.94 | Billion tonnes | 339.25 |
| Manganese | 16.00 | Million tonnes | 18.76 |
| Potash | 36.40 | Million tonnes | 26.45 |
| | | | |
| **Precious metals** | | | **277.88** |
| Gold | 4.52 | Thousand tonnes | 251.14 |
| Silver | 21.59 | Thousand tonnes | 26.75 |
| | | | |
| **Soft commodities** | | | **386.52** |
| Cocoa | 4.05 | Million tonnes | 12.08 |
| Coffee | 8.28 | Million tonnes | 19.94 |
| Cotton | 26.57 | Million tonnes | 88.42 |
| Palm oil | 48.98 | Million tonnes | 55.12 |
| Rubber | 10.98 | Million tonnes | 52.98 |
| Sugar | 172.15 | Million tonnes | 98.68 |
| Tea | 4.27 | Million tonnes | 12.48 |
| Tobacco | 7.57 | Million tonnes | 33.94 |
| Wool | 1.07 | Million tonnes | 12.88 |

Figure 1: Real Animal Product Prices, 1850-2012 (1900=100)



Figure 2: Real Energy Prices, 1860-2012 (1900=100)



Figure 3: Real Grain Prices, 1850-2012 (1900=100)



Figure 4a: Real Metal Prices, 1850-2012 (1900=100)



Figure 4b: Real Metal Prices, 1850-2012 (1900=100)



Figure 4c: Real Metal Prices, 1850-2012 (1900=100)



Figure 5a: Real Mineral Prices, 1900-2012 (1900=100)



Figure 5b: Real Mineral Prices, 1900-2012 (1900=100)

**Figure 6: Real Precious Metals Prices, 1850-2012 (1900=100)**

**Figure 7a: Real Soft Commodity Prices, 1850-2012 (1900=100)**

**Figure 7b: Real Soft Commodity Prices, 1850-2012 (1900=100)**

**Figure 7c: Real Soft Commodity Prices, 1850-2012 (1900=100)**

## Table 2: Cumulative Changes in Prices over the Long-Run

| Commodity | Cumulative change in in price from 1850 (%) | Cumulative change in price from 1900 (%) | Cumulative change in price from 1950 (%) | Cumulative change in price from 1975 (%) |
|---|---|---|---|---|
| **Animal products** | | | | |
| Beef | 155.75 | 96.44 | 214.71 | -26.82 |
| Hides | -40.21 | -61.42 | -58.47 | -16.23 |
| | | | | |
| **Energy products** | | | | |
| Natural gas | N/A | 28.82 | 292.52 | 39.62 |
| Petroleum | N/A | 614.05 | 355.65 | 106.60 |
| | | | | |
| **Grains** | | | | |
| Corn | -39.93 | -40.65 | -55.90 | -47.34 |
| Rice | -77.77 | -72.21 | -55.68 | -62.54 |
| Wheat | -69.33 | -69.93 | -71.74 | -59.80 |
| | | | | |
| **Metals** | | | | |
| Aluminum | N/A | -89.56 | -42.97 | -43.28 |
| Copper | -29.51 | -18.37 | 84.07 | 37.57 |
| Lead | -43.51 | -21.67 | -23.86 | 5.16 |
| Nickel | -86.42 | -43.50 | 85.32 | -9.84 |
| Steel | N/A | 18.30 | 62.37 | 10.23 |
| Tin | 104.46 | 26.25 | 16.88 | -26.53 |
| Zinc | -7.87 | -20.50 | -26.09 | -32.19 |
| | | | | |
| **Minerals** | | | | |
| Bauxite | N/A | -73.60 | -52.38 | -67.74 |
| Chromium | N/A | 79.15 | 301.05 | 13.04 |
| Iron ore | N/A | 40.00 | 97.83 | 12.17 |
| Manganese | N/A | 40.12 | 36.00 | 1.63 |
| Potash | N/A | -57.75 | 96.90 | 135.01 |
| | | | | |
| **Precious Metals** | | | | |
| Gold | 166.18 | 186.23 | 325.06 | 198.66 |
| Silver | -20.52 | 70.40 | 308.32 | 78.79 |
| | | | | |
| **Soft commodities** | | | | |
| Cocoa | -69.55 | -75.67 | -62.32 | -54.99 |
| Coffee | -58.70 | -46.70 | -71.99 | -60.51 |
| Cotton | -75.06 | -66.38 | -75.03 | -62.29 |
| Palm oil | -66.48 | -60.67 | -54.58 | -46.03 |
| Rubber | N/A | -89.89 | -57.87 | 41.17 |
| Sugar | -86.62 | -71.79 | -52.57 | -75.32 |
| Tea | -83.17 | -67.84 | -53.34 | -40.51 |
| Tobacco | -58.00 | -23.87 | -63.27 | -45.34 |
| Wool | -73.29 | -67.64 | -73.09 | -20.19 |

Figure 8a: Real Beef Price Components, 1850-2012



Figure 9a: Real Hide Price Components, 1850-2012



Figure 8b: Real Beef Price Components, 1850-2012



Figure 9b: Real Hide Price Components, 1850-2012



Figure 10a: Real Natural Gas Price Components, 1900-2012



Figure 11a: Real Petroleum Price Components, 1860-2012



Figure 10b: Real Natural Gas Price Components, 1900-2012



Figure 11b: Real Petroleum Price Components, 1860-2012

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**Figure 12a: Real Corn Price Components, 1850-2012**

**Figure 13a: Real Rice Price Components, 1850-2012**

**Figure 12b: Real Corn Price Components, 1850-2012**

**Figure 13b: Real Rice Price Components, 1850-2012**

**Figure 14a: Real Wheat Price Components, 1850-2012**

**Figure 15a: Real Aluminum Price Components, 1900-2012**

**Figure 14b: Real Wheat Price Components, 1850-2012**

**Figure 15b: Real Aluminum Price Components, 1900-2012**

**Figure 16a: Real Copper Price Components, 1850-2012**



**Figure 17a: Real Lead Price Components, 1850-2012**



**Figure 16b: Real Copper Price Components, 1850-2012**



**Figure 17b: Real Lead Price Components, 1850-2012**



**Figure 18a: Real Nickel Price Components, 1850-2012**



**Figure 19a: Real Steel Price Components, 1900-2012**



**Figure 18b: Real Nickel Price Components, 1850-2012**



**Figure 19b: Real Steel Price Components, 1900-2012**



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**Figure 20a: Real Tin Price Components, 1850-2012**

**Figure 21a: Real Zinc Price Components, 1850-2012**

**Figure 20b: Real Tin Price Components, 1850-2012**

**Figure 21b: Real Zinc Price Components, 1850-2012**

**Figure 22a: Real Bauxite Price Components, 1900-2012**

**Figure 23a: Real Chromium Price Components, 1900-2012**

**Figure 22b: Real Bauxite Price Components, 1900-2012**

**Figure 23b: Real Chromium Price Components, 1900-2012**

**Figure 24a: Real Iron Ore Price Components, 1900-2012**

**Figure 25a: Real Manganese Price Components, 1900-2012**

**Figure 24b: Real Iron Ore Price Components, 1900-2012**

**Figure 25b: Real Manganese Price Components, 1900-2012**

**Figure 26a: Real Potash Price Components, 1900-2012**

**Figure 27a: Real Gold Price Components, 1850-2012**

**Figure 26b: Real Potash Price Components, 1900-2012**

**Figure 27b: Real Gold Price Components, 1850-2012**

**Figure 28a: Real Silver Price Components, 1850-2012**

**Figure 29a: Real Cocoa Price Components, 1850-2012**

**Figure 28b: Real Silver Price Components, 1850-2012**

**Figure 29b: Real Cocoa Price Components, 1850-2012**

**Figure 30a: Real Coffee Price Components, 1850-2012**

**Figure 31a: Real Cotton Price Components, 1850-2012**

**Figure 30b: Real Coffee Price Components, 1850-2012**

**Figure 31b: Real Cotton Price Components, 1850-2012**

**Figure 32a: Real Palm Oil Price Components, 1850-2012**

Real price (logged)
Long-run trend

**Figure 33a: Real Rubber Price Components, 1890-2012**

Real price (logged)
Long-run trend

**Figure 32b: Real Palm Oil Price Components, 1850-2012**

Detrended price series
Super-cycle component

**Figure 33b: Real Rubber Price Components, 1890-2012**

Detrended price series
Super-cycle component

**Figure 34a: Real Sugar Price Components, 1850-2012**

Real price (logged)
Long-run trend

**Figure 35a: Real Tea Price Components, 1850-2012**

Real price (logged)
Long-run trend

**Figure 34b: Real Sugar Price Components, 1850-2012**

Detrended price series
Super-cycle component

**Figure 35b: Real Tea Price Components, 1850-2012**

Detrended price series
Super-cycle component

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**Figure 36a: Real Tobacco Price Components, 1850-2012**

**Figure 37a: Real Wool Price Components, 1850-2012**

**Figure 36b: Real Tobacco Price Components, 1850-2012**

**Figure 37b: Real Wool Price Components, 1850-2012**

### Table 3: Dates of Commodity Price Supercycles for Animal Products

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|---|---|---|---|---|---|---|
| Beef | 1850? | 1854 | 1867 | 4? | 17? | 27.49 |
| Hides | 1850? | 1856 | 1869 | 6? | 19? | 50.77 |
| Beef | 1890 | 1916 | 1929 | 26 | 39 | 35.30 |
| Hides | 1893 | 1914 | 1931 | 21 | 39 | 41.56 |
| Beef | 1929 | 1940 | 1953 | 11 | 24 | 43.21 |
| Hides | 1931 | 1946 | 1963 | 15 | 32 | 30.87 |
| Beef | 1953 | 1968 | 1999 | 15 | 46 | 70.34 |
| Hides | 1963 | 1991 | 2009 | 28 | 46 | 22.11 |

### Table 4: Dates of Commodity Price Supercycles for Energy Products

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|---|---|---|---|---|---|---|
| Petroleum | 1860? | 1860 | 1886 | 0? | 26? | 62.65 |
| Petroleum | 1886 | 1918 | 1936 | 32 | 50 | 53.14 |
| Natural gas | 1907 | 1934 | 1948 | 27 | 41 | 25.70 |
| Petroleum | 1966 | 1981 | 1996 | 15 | 30 | 116.04 |
| Natural gas | 1969 | 1982 | 1994 | 13 | 25 | 78.47 |
| Natural gas | 1994 | 2006 | - | 12 | - | 51.84 |
| Petroleum | 1996 | - | - | - | - | 29.10 |

### Table 5: Dates of Commodity Price Supercycles for Grains

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|---|---|---|---|---|---|---|
| Rice | 1850? | 1853 | 1869 | 3? | 19? | 24.85 |
| Rice | 1891 | 1907 | 1936 | 16 | 45 | 34.67 |
| Wheat | 1893 | 1915 | 1934 | 22 | 41 | 36.89 |
| Corn | 1897 | 1913 | 1933 | 16 | 36 | 46.93 |
| Corn | 1933 | 1949 | 1962 | 16 | 29 | 27.16 |
| Wheat | 1933 | 1950 | 1963 | 17 | 30 | 24.68 |
| Rice | 1960 | 1974 | 1999 | 14 | 39 | 49.29 |
| Corn | 1962 | 1976 | 2002 | 14 | 40 | 40.31 |
| Wheat | 1963 | 1978 | 2000 | 15 | 37 | 23.59 |
| Rice | 1999 | - | - | - | - | 21.49 |

## Table 6: Dates of Commodity Price Supercycles for Metals

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|-----------|-------|------|--------|---------------|--------------|----------------|
| Copper | 1850? | 1854 | 1869 | 4? | 19? | 47.56 |
| Lead | 1850? | 1854 | 1868 | 4? | 18? | 29.93 |
| Nickel | 1850? | 1850 | 1862 | 0? | 12? | 27.92 |
| Tin | 1850? | 1856 | 1872 | 6? | 22? | 42.30 |
| Zinc | 1850? | 1861 | 1886 | 11? | 36? | 20.19 |
| Nickel | 1862 | 1876 | 1891 | 14 | 29 | 34.94 |
| Zinc | 1886 | 1912 | 1931 | 26 | 45 | 43.63 |
| Copper | 1889 | 1909 | 1933 | 20 | 44 | 51.86 |
| Lead | 1889 | 1904 | 1935 | 15 | 46 | 34.36 |
| Nickel | 1891 | 1910 | 1924 | 19 | 33 | 30.41 |
| Tin | 1893 | 1911 | 1928 | 18 | 35 | 56.18 |
| Steel | 1897? | 1908 | 1920 | 11? | 23? | 21.05 |
| Aluminum | 1923 | 1936 | 1949 | 13 | 26 | 25.00 |
| Zinc | 1931 | 1947 | 1961 | 16 | 30 | 33.20 |
| Copper | 1933 | 1969 | 1998 | 36 | 65 | 35.85 |
| Lead | 1935 | 1951 | 1963 | 16 | 28 | 27.76 |
| Nickel | 1948 | 1977 | 1995 | 29 | 47 | 22.52 |
| Tin | 1961 | 1979 | 1997 | 18 | 36 | 97.34 |
| Zinc | 1961 | 1975 | 2000 | 14 | 39 | 21.02 |
| Lead | 1963 | 1976 | 1997 | 13 | 34 | 33.43 |
| Aluminum | 1971 | 1983 | 1997 | 12 | 26 | 32.65 |
| Steel | 1972 | 1982 | 1997 | 10 | 25 | 25.23 |
| Nickel | 1995 | - | - | - | - | 32.78 |
| Lead | 1997 | - | - | - | - | 50.70 |
| Steel | 1997 | - | - | - | - | 28.90 |
| Tin | 1997 | - | - | - | - | 35.65 |
| Copper | 1998 | - | - | - | - | 44.88 |

**Table 7: Dates of Commodity Price Supercycles for Minerals**

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|---|---|---|---|---|---|---|
| Manganese | 1900? | 1910 | 1926 | 10? | 26? | 26.34 |
| Potash | 1902 | 1916 | 1929 | 14 | 27 | 58.21 |
| Bauxite | 1924 | 1938 | 1952 | 14 | 28 | 53.90 |
| Chromium | 1925 | 1940 | 1966 | 15 | 41 | 32.19 |
| Manganese | 1926 | 1955 | 1970 | 29 | 44 | 37.02 |
| Bauxite | 1952 | 1980 | 1998 | 28 | 46 | 23.25 |
| Chromium | 1966 | 1981 | 1998 | 15 | 32 | 36.74 |
| Iron ore | 1969 | 1981 | 1997 | 12 | 28 | 47.25 |
| Manganese | 1970 | 1983 | 1996 | 13 | 26 | 26.20 |
| Potash | 1970 | 1982 | 1999 | 12 | 29 | 49.02 |
| Iron ore | 1997 | - | - | - | - | 36.40 |
| Chromium | 1998 | - | - | - | - | 27.25 |
| Potash | 1999 | - | - | - | - | 29.87 |

**Table 8: Dates of Commodity Price Supercycles for Precious Metals**

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|---|---|---|---|---|---|---|
| Gold | 1875 | 1908 | 1923 | 33 | 48 | 22.65 |
| Silver | 1900 | 1915 | 1931 | 15 | 31 | 35.74 |
| Gold | 1923 | 1939 | 1964 | 16 | 41 | 56.88 |
| Silver | 1961 | 1979 | 1997 | 18 | 36 | 108.21 |
| Gold | 1964 | 1982 | 2000 | 18 | 36 | 101.80 |
| Silver | 1997 | - | - | - | - | 42.51 |
| Gold | 2000 | - | - | - | - | 27.22 |

**Table 9: Dates of Commodity Price Supercycles for Soft Commodities**

| Commodity | Start | Peak | Trough | Years to peak | Cycle length | Peak value (%) |
|-----------|-------|------|--------|---------------|--------------|----------------|
| Coffee | 1850? | 1850 | 1865 | 0? | 15? | 22.73 |
| Cotton | 1850? | 1864 | 1894 | 14? | 44? | 43.80 |
| Palm oil | 1850? | 1855 | 1868 | 5? | 18? | 33.57 |
| Sugar | 1850? | 1853 | 1867 | 3? | 17? | 23.76 |
| Wool | 1850? | 1855 | 1868 | 5? | 18? | 21.75 |
| Coffee | 1865 | 1890 | 1903 | 25 | 38 | 23.57 |
| Wool | 1890 | 1918 | 1933 | 28 | 43 | 24.53 |
| Palm oil | 1891 | 1914 | 1931 | 23 | 40 | 49.59 |
| Cocoa | 1892 | 1908 | 1937 | 16 | 45 | 61.66 |
| Rubber | 1893 | 1911 | 1929 | 18 | 36 | 74.38 |
| Cotton | 1894 | 1914 | 1936 | 20 | 42 | 44.41 |
| Sugar | 1901 | 1917 | 1933 | 16 | 32 | 61.84 |
| Coffee | 1903 | 1918 | 1940 | 15 | 37 | 24.45 |
| Tea | 1928 | 1958 | 1971 | 30 | 43 | 22.38 |
| Rubber | 1929 | 1953 | 1971 | 24 | 42 | 42.20 |
| Sugar | 1933 | 1949 | 1962 | 16 | 29 | 44.06 |
| Cotton | 1936 | 1950 | 1962 | 14 | 26 | 33.11 |
| Cocoa | 1937 | 1952 | 1966 | 15 | 29 | 79.55 |
| Coffee | 1940 | 1954 | 1966 | 14 | 26 | 57.36 |
| Wool | 1961 | 1978 | 1998 | 17 | 37 | 22.45 |
| Cotton | 1962 | 1976 | 2001 | 14 | 39 | 31.19 |
| Palm oil | 1962 | 1977 | 1994 | 15 | 32 | 43.01 |
| Sugar | 1962 | 1976 | 2002 | 14 | 40 | 66.85 |
| Cocoa | 1966 | 1979 | 1995 | 13 | 29 | 69.66 |
| Coffee | 1966 | 1979 | 2000 | 13 | 34 | 75.67 |
| Rubber | 1998 | - | - | - | - | 50.61 |
| Tea | 1998 | - | - | - | - | 26.50 |

**Figure 38: Frequency of Commodity Price Supercycle Start Dates**

**Figure 39: Frequency of Commodity Price Supercycle Peak Dates**

**Figure 40: Frequency of Commodity Price Supercycle End Dates**

**Figure 41: Frequency of Commodity Price Supercycle Years to Peak**

**Figure 42: Frequency of Commodity Price Supercycle Length in Years**

**Figure 43: Frequency of Commodity Price Supercycle Peak Values (%)**

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Figure 44: Real Beef Price Booms & Busts, 1850-2012



Figure 45: Real Hide Price Booms & Busts, 1850-2012



Figure 46: Real Natural Gas Price Booms & Busts, 1900-2012



Figure 47: Real Petroleum Price Booms & Busts, 1860-2012



Figure 48: Real Corn Price Booms & Busts, 1850-2012



Figure 49: Real Rice Price Booms & Busts, 1850-2012



Figure 50: Real Wheat Price Booms & Busts, 1850-2012



Figure 51: Real Aluminum Price Booms & Busts, 1900-2012

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**Figure 52: Real Copper Price Booms & Busts, 1850-2012**

**Figure 53: Real Lead Price Booms & Busts, 1850-2012**

**Figure 54: Real Nickel Price Booms & Busts, 1850-2012**

**Figure 55: Real Steel Price Booms & Busts, 1900-2012**

**Figure 56: Real Tin Price Booms & Busts, 1850-2012**

**Figure 57: Real Zinc Price Booms & Busts, 1850-2012**

**Figure 58: Real Bauxite Price Booms & Busts, 1900-2012**

**Figure 59: Real Chromium Price Booms & Busts, 1900-2012**

Figure 60: Real Iron Ore Price Booms & Busts, 1900-2012


Figure 61: Real Manganese Price Booms & Busts, 1900-2012


Figure 62: Real Potash Price Booms & Busts, 1900-2012


Figure 63: Real Gold Price Booms & Busts, 1850-2012


Figure 64: Real Silver Price Booms & Busts, 1850-2012


Figure 65: Real Cocoa Price Booms & Busts, 1850-2012


Figure 66: Real Coffee Price Booms & Busts, 1850-2012


Figure 67: Real Cotton Price Booms & Busts, 1850-2012

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**Figure 68: Real Palm Oil Price Booms & Busts, 1850-2012**

**Figure 69: Real Rubber Price Booms & Busts, 1890-2012**

**Figure 70: Real Sugar Price Booms & Busts, 1850-2012**

**Figure 71: Real Tea Price Booms & Busts, 1850-2012**

**Figure 72: Real Tobacco Price Booms & Busts, 1850-2012**

**Figure 73: Real Wool Price Booms & Busts, 1850-2012**

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## Table 10: Dates of Commodity Price Booms & Busts for Animal Products

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Hides | 1855 | 1857 | 1861 | 2 | 6 | 116.54 |
| Hides | 1912 | 1916 | 1919 | 4 | 7 | 92.19 |
| Beef | 1915 | 1919 | 1919 | 4 | 4 | 106.59 |
| Beef | 1942 | 1942 | 1944 | 0 | 2 | 49.43 |
| Hides | 1947 | 1951 | 1951 | 4 | 4 | 76.48 |
| Beef | 1966 | 1973 | 1974 | 7 | 8 | 101.62 |
| Hides | 1972 | 1973 | 1973 | 1 | 1 | 52.03 |
| Beef | 1978 | 1979 | 1980 | 1 | 2 | 75.05 |
| Hides | 1978 | 1979 | 1979 | 1 | 1 | 98.08 |

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Hides | 1864 | 1866 | 1868 | 2 | 4 | -40.16 |
| Hides | 1890 | 1892 | 1894 | 2 | 4 | -33.12 |
| Hides | 1921 | 1921 | 1926 | 0 | 5 | -44.94 |
| Beef | 1922 | 1922 | 1924 | 0 | 2 | -37.24 |
| Hides | 1931 | 1932 | 1934 | 1 | 3 | -57.86 |
| Beef | 1949 | 1951 | 1958 | 2 | 9 | -62.35 |
| Hides | 1963 | 1964 | 1964 | 1 | 1 | -34.63 |
| Hides | 1967 | 1968 | 1971 | 1 | 4 | -36.25 |
| Beef | 1995 | 1998 | 2003 | 3 | 8 | -41.48 |
| Hides | 2008 | 2009 | 2009 | 1 | 1 | -49.86 |

## Table 11: Dates of Commodity Price Booms & Busts for Energy Products

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Petroleum | 1860? | 1865 | 1866 | 5? | 6? | 82.30 |
| Petroleum | 1916 | 1920 | 1920 | 4 | 4 | 131.54 |
| Petroleum | 1974 | 1980 | 1985 | 6 | 11 | 195.39 |
| Natural gas | 1978 | 1982 | 1985 | 4 | 7 | 110.85 |
| Natural gas | 2003 | 2008 | 2008 | 5 | 5 | 109.21 |

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Petroleum | 1891 | 1892 | 1893 | 1 | 2 | -53.31 |
| Petroleum | 1931 | 1931 | 1933 | 0 | 2 | -54.21 |
| Natural gas | 1968 | 1972 | 1974 | 4 | 6 | -40.42 |
| Natural gas | 1994 | 1995 | 1999 | 1 | 5 | -42.08 |
| Petroleum | 1994 | 1998 | 2003 | 4 | 9 | -63.45 |
| Natural gas | 2012 | - | - | - | - | -39.06 |

## Table 12: Dates of Commodity Price Booms & Busts for Grains

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Rice | 1853 | 1855 | 1855 | 2 | 2 | 52.81 |
| Wheat | 1854 | 1855 | 1856 | 1 | 2 | 71.09 |
| Corn | 1864 | 1864 | 1864 | 0 | 0 | 52.02 |
| Wheat | 1867 | 1867 | 1867 | 0 | 0 | 42.30 |
| Rice | 1906 | 1908 | 1908 | 2 | 2 | 52.62 |
| Corn | 1908 | 1908 | 1909 | 0 | 1 | 45.26 |
| Wheat | 1909 | 1909 | 1909 | 0 | 0 | 45.09 |
| Rice | 1911 | 1912 | 1913 | 1 | 2 | 77.85 |
| Corn | 1914 | 1917 | 1919 | 3 | 5 | 133.62 |
| Wheat | 1915 | 1917 | 1920 | 2 | 5 | 101.35 |
| Corn | 1947 | 1947 | 1948 | 0 | 1 | 63.86 |
| Wheat | 1947 | 1947 | 1948 | 0 | 1 | 45.79 |
| Rice | 1967 | 1967 | 1968 | 0 | 1 | 48.93 |
| Corn | 1973 | 1974 | 1976 | 1 | 3 | 112.02 |
| Rice | 1973 | 1974 | 1975 | 1 | 2 | 191.48 |
| Wheat | 1973 | 1974 | 1976 | 1 | 3 | 111.21 |
| Rice | 1978 | 1981 | 1981 | 3 | 3 | 69.35 |
| Wheat | 1979 | 1979 | 1980 | 0 | 1 | 46.20 |
| Rice | 2008 | 2008 | 2009 | 0 | 1 | 64.88 |
| Wheat | 2008 | 2008 | 2008 | 0 | 0 | 46.86 |
| Corn | 2012 | - | - | - | - | 43.77 |

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Wheat | 1851 | 1852 | 1852 | 1 | 1 | -33.15 |
| Corn | 1861 | 1862 | 1862 | 1 | 1 | -37.57 |
| Rice | 1864 | 1864 | 1865 | 0 | 1 | -35.18 |
| Corn | 1872 | 1873 | 1873 | 1 | 1 | -34.47 |
| Wheat | 1894 | 1894 | 1895 | 0 | 1 | -32.05 |
| Corn | 1896 | 1897 | 1897 | 1 | 1 | -37.61 |
| Corn | 1921 | 1921 | 1922 | 0 | 1 | -42.25 |
| Wheat | 1930 | 1932 | 1933 | 2 | 3 | -53.62 |
| Corn | 1931 | 1932 | 1933 | 1 | 2 | -62.58 |
| Rice | 1931 | 1933 | 1934 | 2 | 3 | -50.92 |
| Corn | 1938 | 1939 | 1939 | 1 | 1 | -40.18 |
| Wheat | 1938 | 1939 | 1939 | 1 | 1 | -36.23 |
| Wheat | 1968 | 1968 | 1969 | 0 | 1 | -29.06 |
| Rice | 1985 | 1986 | 1987 | 1 | 2 | -35.21 |
| Corn | 1987 | 1987 | 1987 | 0 | 0 | -35.88 |
| Corn | 1998 | 2005 | 2006 | 7 | 8 | -45.29 |
| Wheat | 1998 | 2000 | 2005 | 2 | 7 | -44.78 |
| Rice | 1999 | 2001 | 2005 | 2 | 6 | -52.88 |

## Table 13a: Dates of Commodity Price Booms & Busts for Metals

*Panel A: Booms*

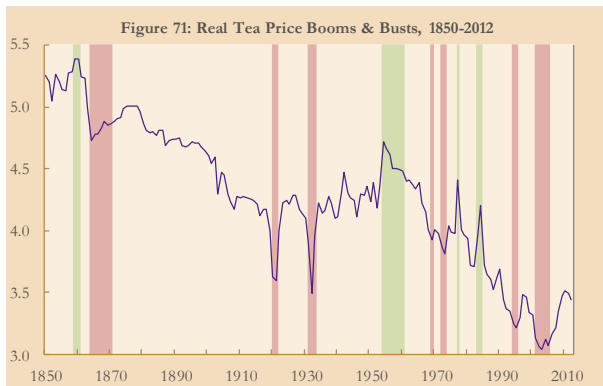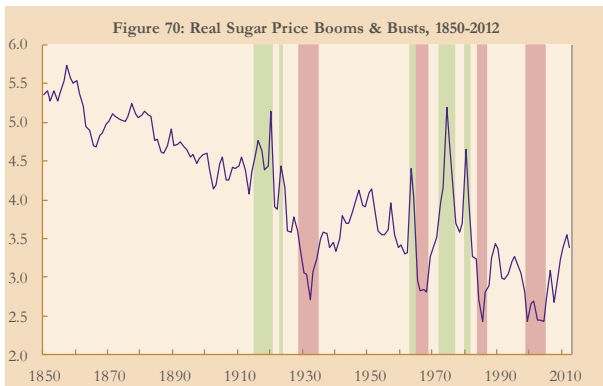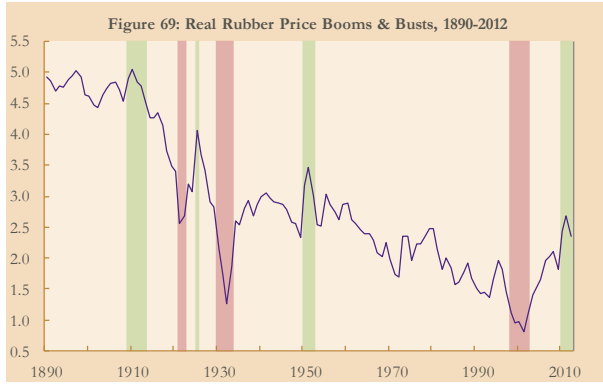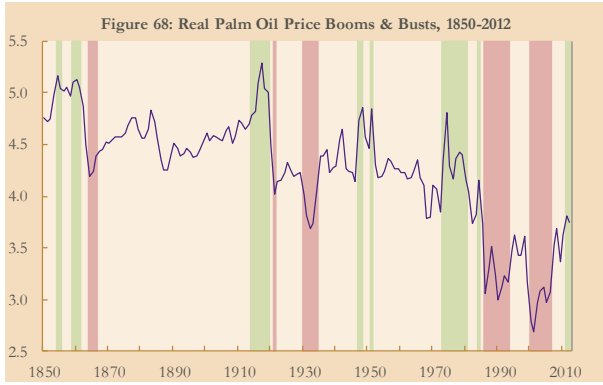| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Copper | 1853 | 1854 | 1860 | 1 | 7 | 58.97 |
| Zinc | 1853 | 1854 | 1854 | 1 | 1 | 54.29 |
| Tin | 1856 | 1859 | 1860 | 3 | 4 | 70.89 |
| Zinc | 1857 | 1857 | 1858 | 0 | 1 | 56.82 |
| Nickel | 1872 | 1873 | 1877 | 1 | 5 | 157.97 |
| Copper | 1899 | 1899 | 1901 | 0 | 2 | 53.62 |
| Steel | 1899 | 1899 | 1903 | 0 | 4 | 72.70 |
| Copper | 1905 | 1907 | 1907 | 2 | 2 | 80.96 |
| Aluminum | 1906 | 1907 | 1907 | 1 | 1 | 57.14 |
| Lead | 1906 | 1907 | 1907 | 1 | 1 | 57.34 |
| Tin | 1906 | 1907 | 1907 | 1 | 1 | 66.94 |
| Tin | 1911 | 1912 | 1913 | 1 | 2 | 72.90 |
| Copper | 1912 | 1916 | 1918 | 4 | 6 | 135.91 |
| Zinc | 1912 | 1912 | 1912 | 0 | 0 | 52.03 |
| Aluminum | 1915 | 1916 | 1917 | 1 | 2 | 140.40 |
| Zinc | 1915 | 1915 | 1917 | 0 | 2 | 202.56 |
| Lead | 1916 | 1917 | 1917 | 1 | 1 | 68.23 |
| Steel | 1916 | 1917 | 1918 | 1 | 2 | 99.04 |
| Tin | 1917 | 1918 | 1918 | 1 | 1 | 99.78 |
| Aluminum | 1932 | 1933 | 1934 | 1 | 2 | 36.25 |
| Lead | 1947 | 1948 | 1949 | 1 | 2 | 60.39 |
| Zinc | 1950 | 1951 | 1952 | 1 | 2 | 65.60 |
| Copper | 1955 | 1956 | 1956 | 1 | 1 | 67.97 |
| Copper | 1969 | 1970 | 1970 | 1 | 1 | 60.92 |
| Copper | 1973 | 1974 | 1974 | 1 | 1 | 68.66 |
| Zinc | 1973 | 1974 | 1976 | 1 | 3 | 174.04 |
| Tin | 1974 | 1980 | 1985 | 6 | 11 | 161.21 |
| Nickel | 1975 | 1976 | 1977 | 1 | 2 | 47.68 |
| Lead | 1977 | 1979 | 1981 | 2 | 4 | 140.83 |
| Aluminum | 1986 | 1988 | 1988 | 2 | 2 | 67.51 |
| Nickel | 1988 | 1988 | 1989 | 0 | 1 | 87.64 |
| Zinc | 1989 | 1989 | 1990 | 0 | 1 | 68.60 |
| Copper | 2006 | - | - | - | - | - |
| Nickel | 2006 | 2007 | 2011 | 1 | 5 | 167.85 |
| Zinc | 2006 | 2006 | 2007 | 0 | 1 | 102.71 |
| Lead | 2007 | - | - | - | - | - |
| Steel | 2008 | 2008 | 2008 | 0 | 0 | 52.54 |
| Tin | 2010 | 2011 | 2011 | 1 | 1 | 80.41 |

## Table 13b: Dates of Commodity Price Booms & Busts for Metals

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|---|---|---|---|---|---|---|
| Nickel | 1862 | 1862 | 1862 | 0 | 0 | -34.91 |
| Tin | 1863 | 1864 | 1865 | 1 | 2 | -45.38 |
| Lead | 1864 | 1865 | 1868 | 1 | 4 | -37.13 |
| Copper | 1865 | 1867 | 1870 | 2 | 5 | -37.50 |
| Nickel | 1865 | 1868 | 1870 | 3 | 5 | -43.84 |
| Copper | 1885 | 1886 | 1887 | 1 | 2 | -35.86 |
| Nickel | 1886 | 1886 | 1886 | 0 | 0 | -37.33 |
| Nickel | 1895 | 1895 | 1897 | 0 | 2 | -39.03 |
| Aluminum | 1920 | 1922 | 1922 | 2 | 2 | -41.96 |
| Lead | 1921 | 1921 | 1921 | 0 | 0 | -38.69 |
| Steel | 1921 | 1922 | 1922 | 1 | 1 | -25.71 |
| Tin | 1921 | 1921 | 1922 | 0 | 1 | -44.56 |
| Zinc | 1921 | 1921 | 1921 | 0 | 0 | -37.58 |
| Tin | 1930 | 1932 | 1932 | 2 | 2 | -51.56 |
| Zinc | 1930 | 1932 | 1935 | 2 | 5 | -51.03 |
| Copper | 1931 | 1932 | 1935 | 1 | 4 | -56.61 |
| Lead | 1931 | 1932 | 1935 | 1 | 4 | -47.51 |
| Aluminum | 1946 | 1947 | 1949 | 1 | 3 | -32.57 |
| Nickel | 1947 | 1948 | 1948 | 1 | 1 | -32.67 |
| Zinc | 1958 | 1958 | 1958 | 0 | 0 | -31.95 |
| Zinc | 1962 | 1962 | 1963 | 0 | 1 | -33.24 |
| Lead | 1985 | 1985 | 1986 | 0 | 1 | -39.50 |
| Nickel | 1986 | 1986 | 1987 | 0 | 1 | -42.62 |
| Tin | 1990 | 2002 | 2006 | 12 | 16 | -64.49 |
| Aluminum | 1991 | 1993 | 1993 | 2 | 2 | -34.46 |
| Lead | 1992 | 1993 | 1994 | 1 | 2 | -48.55 |
| Steel | 1992 | 2001 | 2003 | 9 | 11 | -52.69 |
| Nickel | 1993 | 1993 | 1994 | 0 | 1 | -42.15 |
| Copper | 1997 | 2002 | 2004 | 5 | 7 | -59.05 |
| Lead | 1997 | 2002 | 2003 | 5 | 6 | -54.77 |
| Nickel | 1997 | 1998 | 2002 | 1 | 5 | -55.92 |
| Aluminum | 1998 | 2002 | 2003 | 4 | 5 | -28.73 |
| Zinc | 2001 | 2002 | 2004 | 1 | 3 | -45.77 |

## Table 14: Dates of Commodity Price Booms & Busts for Minerals

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|-----------|-------|------|-----|---------------|-------------|--------------------------|
| Manganese | 1903 | 1903 | 1903 | 0 | 0 | 66.18 |
| Manganese | 1906 | 1906 | 1907 | 0 | 1 | 82.46 |
| Bauxite | 1915 | 1915 | 1915 | 0 | 0 | 41.32 |
| Manganese | 1916 | 1919 | 1919 | 3 | 3 | 68.09 |
| Potash | 1916 | 1916 | 1919 | 0 | 3 | 530.32 |
| Chromium | 1917 | 1918 | 1919 | 1 | 2 | 153.96 |
| Chromium | 1932 | 1932 | 1932 | 0 | 0 | 51.90 |
| Bauxite | 1933 | 1938 | 1941 | 5 | 8 | 61.39 |
| Iron ore | 1933 | 1933 | 1933 | 0 | 0 | 53.03 |
| Manganese | 1956 | 1957 | 1958 | 1 | 2 | 66.63 |
| Bauxite | 1974 | 1974 | 1979 | 0 | 5 | 63.55 |
| Chromium | 1975 | 1975 | 1977 | 0 | 2 | 100.61 |
| Iron ore | 1976 | 1983 | 1984 | 7 | 8 | 62.41 |
| Potash | 1980 | 1981 | 1982 | 1 | 2 | 70.58 |
| Chromium | 2008 | 2008 | 2008 | 0 | 0 | 81.90 |
| Manganese | 2008 | 2008 | 2010 | 0 | 2 | 153.56 |
| Iron ore | 2009 | - | - | - | - | - |

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|-----------|-------|--------|-----|-----------------|-------------|--------------------------|
| Chromium | 1920 | 1921 | 1929 | 1 | 9 | -51.73 |
| Manganese | 1921 | 1921 | 1922 | 0 | 1 | -61.95 |
| Bauxite | 1922 | 1922 | 1928 | 0 | 6 | -31.15 |
| Potash | 1922 | 1924 | 1925 | 2 | 3 | -40.40 |
| Manganese | 1931 | 1931 | 1931 | 0 | 0 | -31.64 |
| Iron ore | 1932 | 1932 | 1932 | 0 | 0 | -41.49 |
| Bauxite | 1948 | 1951 | 1956 | 3 | 8 | -32.57 |
| Chromium | 1961 | 1961 | 1961 | 0 | 0 | -41.19 |
| Manganese | 1968 | 1970 | 1973 | 2 | 5 | -43.64 |
| Iron ore | 1992 | 2001 | 2004 | 9 | 12 | -50.48 |
| Chromium | 1993 | 1993 | 1994 | 0 | 1 | -36.24 |
| Chromium | 1998 | 2002 | 2003 | 4 | 5 | -46.35 |
| Potash | 1999 | 2003 | 2004 | 4 | 5 | -48.40 |
| Manganese | 2001 | 2002 | 2003 | 1 | 2 | -39.75 |
| Bauxite | 2002 | 2003 | 2003 | 1 | 1 | -29.44 |

## Table 15: Dates of Commodity Price Booms & Busts for Precious Metals

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|-----------|-------|------|-----|---------------|-------------|--------------------------|
| Silver | 1916 | 1919 | 1919 | 3 | 3 | 87.91 |
| Gold | 1933 | 1934 | 1942 | 1 | 9 | 58.41 |
| Gold | 1973 | 1974 | 1974 | 1 | 1 | 76.19 |
| Silver | 1973 | 1979 | 1983 | 6 | 10 | 502.23 |
| Gold | 1977 | 1979 | 1983 | 2 | 6 | 245.34 |
| Gold | 1986 | 1987 | 1987 | 1 | 1 | 58.12 |
| Gold | 2011 | - | - | - | - | 50.15 |
| Silver | 2011 | - | - | - | - | 102.83 |

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|-----------|-------|--------|-----|-----------------|-------------|--------------------------|
| Gold | 1919 | 1920 | 1928 | 1 | 9 | -43.78 |
| Silver | 1930 | 1932 | 1932 | 2 | 2 | -43.64 |
| Gold | 1962 | 1966 | 1971 | 4 | 9 | -37.63 |
| Silver | 1990 | 2001 | 2005 | 11 | 15 | -61.01 |
| Gold | 1997 | 2001 | 2005 | 4 | 8 | -57.66 |

## Table 16a: Dates of Commodity Price Booms & Busts for Soft Commodities

*Panel A: Booms*

| Commodity | Start | Peak | End | Years to peak | Boom length | Deviation from trend (%) |
|-----------|-------|------|-----|---------------|-------------|--------------------------|
| Tobacco | 1851 | 1851 | 1851 | 0 | 0 | 25.58 |
| Palm oil | 1854 | 1854 | 1855 | 0 | 1 | 52.76 |
| Palm oil | 1859 | 1860 | 1861 | 1 | 2 | 50.50 |
| Tea | 1859 | 1860 | 1860 | 1 | 1 | 27.85 |
| Wool | 1859 | 1860 | 1860 | 1 | 1 | 42.64 |
| Cotton | 1862 | 1863 | 1865 | 1 | 3 | 158.89 |
| Tobacco | 1874 | 1874 | 1874 | 0 | 0 | 38.13 |
| Tobacco | 1887 | 1887 | 1887 | 0 | 0 | 45.78 |
| Coffee | 1889 | 1890 | 1891 | 1 | 2 | 59.42 |
| Tobacco | 1891 | 1892 | 1892 | 1 | 1 | 30.21 |
| Cocoa | 1904 | 1907 | 1907 | 3 | 3 | 86.24 |
| Cotton | 1909 | 1910 | 1911 | 1 | 2 | 57.43 |
| Rubber | 1909 | 1910 | 1913 | 1 | 4 | 147.00 |
| Coffee | 1911 | 1912 | 1913 | 1 | 2 | 83.55 |
| Palm oil | 1914 | 1917 | 1919 | 3 | 5 | 138.65 |
| Cocoa | 1915 | 1916 | 1916 | 1 | 1 | 93.61 |
| Sugar | 1915 | 1920 | 1920 | 5 | 5 | 224.49 |
| Cotton | 1916 | 1918 | 1919 | 2 | 3 | 94.35 |
| Wool | 1917 | 1917 | 1919 | 0 | 2 | 84.81 |
| Tobacco | 1918 | 1920 | 1922 | 2 | 4 | 67.48 |
| Coffee | 1919 | 1919 | 1919 | 0 | 0 | 65.09 |
| Cotton | 1923 | 1923 | 1924 | 0 | 1 | 54.82 |
| Sugar | 1923 | 1923 | 1923 | 0 | 0 | 70.84 |
| Coffee | 1924 | 1925 | 1926 | 1 | 2 | 63.30 |
| Rubber | 1925 | 1925 | 1925 | 0 | 0 | 94.16 |
| Tobacco | 1944 | 1944 | 1946 | 0 | 2 | 28.55 |
| Cocoa | 1947 | 1954 | 1955 | 7 | 8 | 150.19 |
| Palm oil | 1947 | 1948 | 1948 | 1 | 1 | 60.53 |
| Coffee | 1950 | 1954 | 1957 | 4 | 7 | 92.08 |
| Rubber | 1950 | 1951 | 1952 | 1 | 2 | 145.59 |
| Wool | 1950 | 1951 | 1951 | 1 | 1 | 75.07 |
| Palm oil | 1951 | 1951 | 1951 | 0 | 0 | 61.36 |
| Tea | 1954 | 1954 | 1960 | 0 | 6 | 47.69 |
| Tobacco | 1957 | 1960 | 1960 | 3 | 3 | 26.62 |
| Cocoa | 1958 | 1958 | 1958 | 0 | 0 | 64.51 |
| Sugar | 1963 | 1963 | 1964 | 0 | 1 | 122.00 |
| Sugar | 1972 | 1974 | 1976 | 2 | 4 | 454.53 |
| Cotton | 1973 | 1976 | 1980 | 3 | 7 | 68.75 |
| Palm oil | 1973 | 1974 | 1980 | 1 | 7 | 135.51 |
| Wool | 1973 | 1974 | 1974 | 1 | 1 | 111.33 |
| Cocoa | 1976 | 1977 | 1980 | 1 | 4 | 201.85 |
| Coffee | 1976 | 1977 | 1979 | 1 | 3 | 241.33 |
| Wool | 1976 | 1979 | 1980 | 3 | 4 | 42.68 |
| Tea | 1977 | 1977 | 1977 | 0 | 0 | 57.19 |
| Sugar | 1980 | 1980 | 1981 | 0 | 1 | 250.78 |
| Tea | 1983 | 1984 | 1984 | 1 | 1 | 56.74 |
| Palm oil | 1984 | 1984 | 1984 | 0 | 0 | 55.48 |
| Coffee | 1986 | 1986 | 1986 | 0 | 0 | 65.02 |
| Rubber | 2010 | - | - | - | - | - |
| Cotton | 2011 | 2011 | 2011 | 0 | 0 | 78.06 |
| Palm oil | 2011 | - | - | - | - | - |
| Wool | 2011 | - | - | - | - | - |

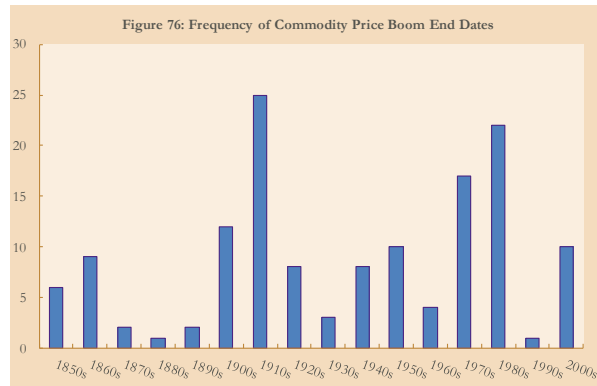## Table 16b: Dates of Commodity Price Booms & Busts for Soft Commodities

*Panel B: Busts*

| Commodity | Start | Trough | End | Years to trough | Bust length | Deviation from trend (%) |
|-----------|-------|--------|-----|-----------------|-------------|--------------------------|
| Cotton | 1854 | 1854 | 1855 | 0 | 1 | -32.21 |
| Palm oil | 1864 | 1864 | 1866 | 0 | 2 | -40.34 |
| Tea | 1864 | 1864 | 1870 | 0 | 6 | -32.19 |
| Tobacco | 1864 | 1865 | 1867 | 1 | 3 | -28.79 |
| Coffee | 1865 | 1868 | 1870 | 3 | 5 | -50.53 |
| Wool | 1867 | 1869 | 1870 | 2 | 3 | -31.18 |
| Tobacco | 1875 | 1877 | 1879 | 2 | 4 | -38.09 |
| Cotton | 1892 | 1894 | 1895 | 2 | 3 | -34.81 |
| Cotton | 1898 | 1898 | 1899 | 0 | 1 | -34.67 |
| Tea | 1920 | 1921 | 1921 | 1 | 1 | -41.80 |
| Cocoa | 1921 | 1921 | 1921 | 0 | 0 | -41.25 |
| Palm oil | 1921 | 1921 | 1921 | 0 | 0 | -32.83 |
| Rubber | 1921 | 1921 | 1922 | 0 | 1 | -64.52 |
| Wool | 1921 | 1921 | 1921 | 0 | 0 | -30.23 |
| Tobacco | 1928 | 1932 | 1933 | 4 | 5 | -39.54 |
| Sugar | 1929 | 1932 | 1934 | 3 | 5 | -65.34 |
| Cotton | 1930 | 1932 | 1933 | 2 | 3 | -56.62 |
| Palm oil | 1930 | 1932 | 1934 | 2 | 4 | -52.34 |
| Rubber | 1930 | 1932 | 1933 | 2 | 3 | -84.17 |
| Wool | 1930 | 1932 | 1933 | 2 | 3 | -52.30 |
| Cocoa | 1931 | 1932 | 1935 | 1 | 4 | -49.05 |
| Tea | 1931 | 1932 | 1933 | 1 | 2 | -49.38 |
| Cotton | 1937 | 1938 | 1940 | 1 | 3 | -45.53 |
| Cocoa | 1938 | 1939 | 1940 | 1 | 2 | -46.89 |
| Coffee | 1938 | 1940 | 1940 | 2 | 2 | -51.18 |
| Wool | 1938 | 1938 | 1938 | 0 | 0 | -30.70 |
| Tobacco | 1939 | 1940 | 1942 | 1 | 3 | -35.87 |
| Cocoa | 1965 | 1965 | 1965 | 0 | 0 | -45.69 |
| Sugar | 1965 | 1966 | 1968 | 1 | 3 | -53.34 |
| Tea | 1969 | 1969 | 1969 | 0 | 0 | -20.74 |
| Tobacco | 1969 | 1971 | 1973 | 2 | 4 | -28.01 |
| Cocoa | 1971 | 1971 | 1971 | 0 | 0 | -38.93 |
| Wool | 1971 | 1971 | 1971 | 0 | 0 | -43.29 |
| Tea | 1972 | 1973 | 1973 | 1 | 1 | -22.18 |
| Sugar | 1984 | 1985 | 1986 | 1 | 2 | -58.73 |
| Palm oil | 1986 | 1986 | 1993 | 0 | 7 | -45.63 |
| Cocoa | 1989 | 1992 | 1993 | 3 | 4 | -45.86 |
| Coffee | 1990 | 1992 | 1993 | 2 | 3 | -53.17 |
| Wool | 1991 | 1993 | 1993 | 2 | 2 | -36.22 |
| Tea | 1994 | 1995 | 1995 | 1 | 1 | -23.37 |
| Rubber | 1998 | 2001 | 2002 | 3 | 4 | -62.40 |
| Wool | 1998 | 2000 | 2001 | 2 | 3 | -50.62 |
| Cocoa | 1999 | 2000 | 2001 | 1 | 2 | -54.17 |
| Sugar | 1999 | 1999 | 2004 | 0 | 5 | -50.19 |
| Coffee | 2000 | 2001 | 2005 | 1 | 5 | -67.11 |
| Palm oil | 2000 | 2001 | 2006 | 1 | 6 | -53.00 |
| Cotton | 2001 | 2002 | 2002 | 1 | 1 | -40.55 |
| Tea | 2001 | 2003 | 2005 | 2 | 4 | -26.59 |
| Tobacco | 2002 | 2003 | 2006 | 1 | 3 | -21.32 |

**Figure 74: Frequency of Commodity Price Boom Start Dates**

**Figure 75: Frequency of Commodity Price Boom Peaks**

**Figure 76: Frequency of Commodity Price Boom End Dates**

**Figure 77: Frequency of Commodity Price Boom Years to Peak**

**Figure 78: Frequency of Commodity Price Boom Lengths in Years**

**Figure 79: Frequency of Commodity Price Boom Increases (%)**

Figure 80: Frequency of Commodity Price Bust Start Dates



Figure 81: Frequency of Commodity Price Bust Troughs



Figure 82: Frequency of Commodity Price Bust End Dates



Figure 83: Frequency of Commodity Price Bust Years to Trough



Figure 84: Frequency of Commodity Price Bust Lengths in Years



Figure 85: Frequency of Commodity Price Bust Declines (%)

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## Table 17: Contribution of Booms & Busts to Volatility of Deviations from Long-run Trends
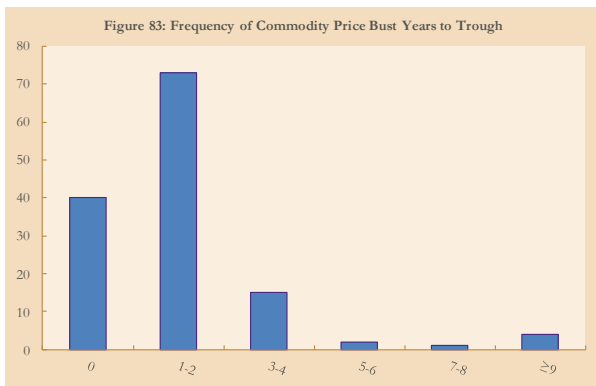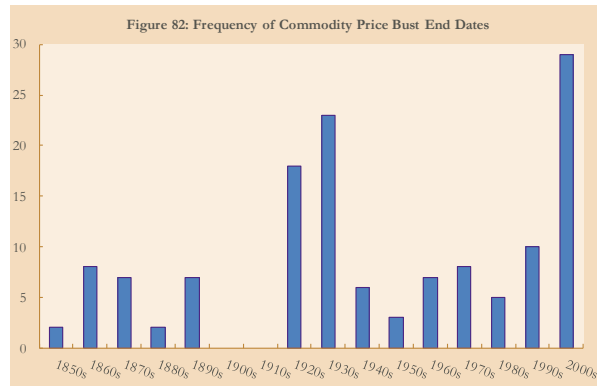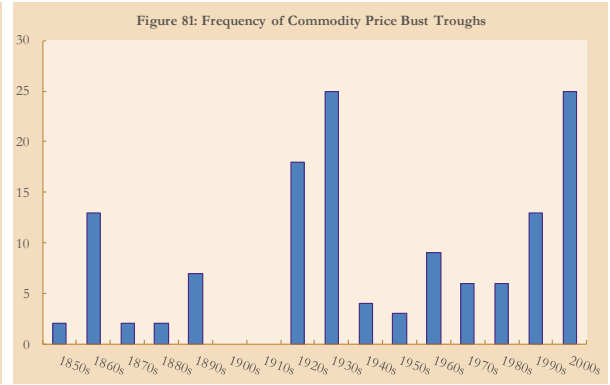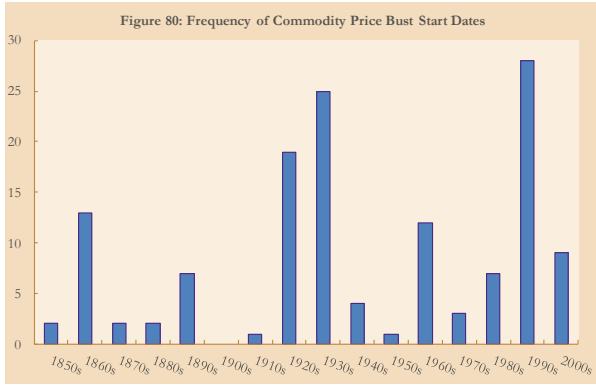
| Commodity | SD of deviation from long-run trend (A) | SD of deviation without booms/busts (B) | Proportion of two SDs (B)/(A) |
|---|---|---|---|
| **Animal products** | | | |
| Beef | 0.3214 | 0.1711 | 0.53 |
| Hides | 0.3060 | 0.1658 | 0.54 |
| | | | |
| **Energy products** | | | |
| Natural gas | 0.2882 | 0.1618 | 0.56 |
| Petroleum | 0.3921 | 0.2301 | 0.59 |
| | | | |
| **Grains** | | | |
| Corn | 0.2902 | 0.1712 | 0.59 |
| Rice | 0.2774 | 0.1621 | 0.58 |
| Wheat | 0.2531 | 0.1370 | 0.54 |
| | | | |
| **Metals** | | | |
| Aluminum | 0.2253 | 0.1450 | 0.64 |
| Copper | 0.3361 | 0.1955 | 0.58 |
| Lead | 0.3041 | 0.1876 | 0.62 |
| Nickel | 0.3017 | 0.1774 | 0.59 |
| Steel | 0.2328 | 0.1466 | 0.63 |
| Tin | 0.3821 | 0.2201 | 0.58 |
| Zinc | 0.2887 | 0.1655 | 0.57 |
| | | | |
| **Minerals** | | | |
| Bauxite | 0.2197 | 0.1306 | 0.59 |
| Chromium | 0.3116 | 0.1708 | 0.55 |
| Iron ore | 0.2601 | 0.1517 | 0.58 |
| Manganese | 0.2810 | 0.1624 | 0.58 |
| Potash | 0.3898 | 0.2214 | 0.57 |
| | | | |
| **Precious Metals** | | | |
| Gold | 0.3371 | 0.2440 | 0.72 |
| Silver | 0.3593 | 0.1429 | 0.40 |
| | | | |
| **Soft commodities** | | | |
| Cocoa | 0.3637 | 0.2322 | 0.64 |
| Coffee | 0.3759 | 0.2351 | 0.63 |
| Cotton | 0.2953 | 0.1750 | 0.59 |
| Palm oil | 0.2986 | 0.1587 | 0.53 |
| Rubber | 0.4586 | 0.2647 | 0.58 |
| Sugar | 0.4031 | 0.2183 | 0.54 |
| Tea | 0.1717 | 0.1192 | 0.69 |
| Tobacco | 0.1788 | 0.1030 | 0.58 |
| Wool | 0.2417 | 0.1317 | 0.54 |

## Table 18: Contribution of Booms & Busts to Volatility of Deviations from Long-run Trends

| Commodity | SD of price changes (A) | SD of price changes without booms/busts (B) | Proportion of two SDs (B)/(A) |
|---|---|---|---|
| **Animal products** | | | |
| Beef | 0.1677 | 0.1501 | 0.90 |
| Hides | 0.2243 | 0.1915 | 0.85 |
| | | | |
| **Energy products** | | | |
| Natural gas | 0.1560 | 0.1461 | 0.94 |
| Petroleum | 0.2166 | 0.1925 | 0.89 |
| | | | |
| **Grains** | | | |
| Corn | 0.2242 | 0.2013 | 0.90 |
| Rice | 0.1715 | 0.1325 | 0.77 |
| Wheat | 0.1852 | 0.1614 | 0.87 |
| | | | |
| **Metals** | | | |
| Aluminum | 0.1650 | 0.1397 | 0.85 |
| Copper | 0.1790 | 0.1697 | 0.95 |
| Lead | 0.1725 | 0.1487 | 0.86 |
| Nickel | 0.2052 | 0.1395 | 0.68 |
| Steel | 0.1525 | 0.1065 | 0.70 |
| Tin | 0.1838 | 0.1758 | 0.96 |
| Zinc | 0.2161 | 0.1609 | 0.74 |
| | | | |
| **Minerals** | | | |
| Bauxite | 0.1349 | 0.1216 | 0.90 |
| Chromium | 0.2210 | 0.1929 | 0.87 |
| Iron ore | 0.1489 | 0.1122 | 0.75 |
| Manganese | 0.2384 | 0.1888 | 0.79 |
| Potash | 0.2473 | 0.1752 | 0.71 |
| | | | |
| **Precious Metals** | | | |
| Gold | 0.1249 | 0.0965 | 0.77 |
| Silver | 0.2051 | 0.1638 | 0.80 |
| | | | |
| **Soft commodities** | | | |
| Cocoa | 0.2250 | 0.1866 | 0.83 |
| Coffee | 0.2269 | 0.2109 | 0.93 |
| Cotton | 0.1800 | 0.1625 | 0.90 |
| Palm oil | 0.1996 | 0.1645 | 0.82 |
| Rubber | 0.2885 | 0.2260 | 0.78 |
| Sugar | 0.2957 | 0.2211 | 0.75 |
| Tea | 0.1368 | 0.1187 | 0.87 |
| Tobacco | 0.1370 | 0.1182 | 0.86 |
| Wool | 0.1831 | 0.1557 | 0.85 |

## Figure 86: Australian Booms and Busts, 1900-2012
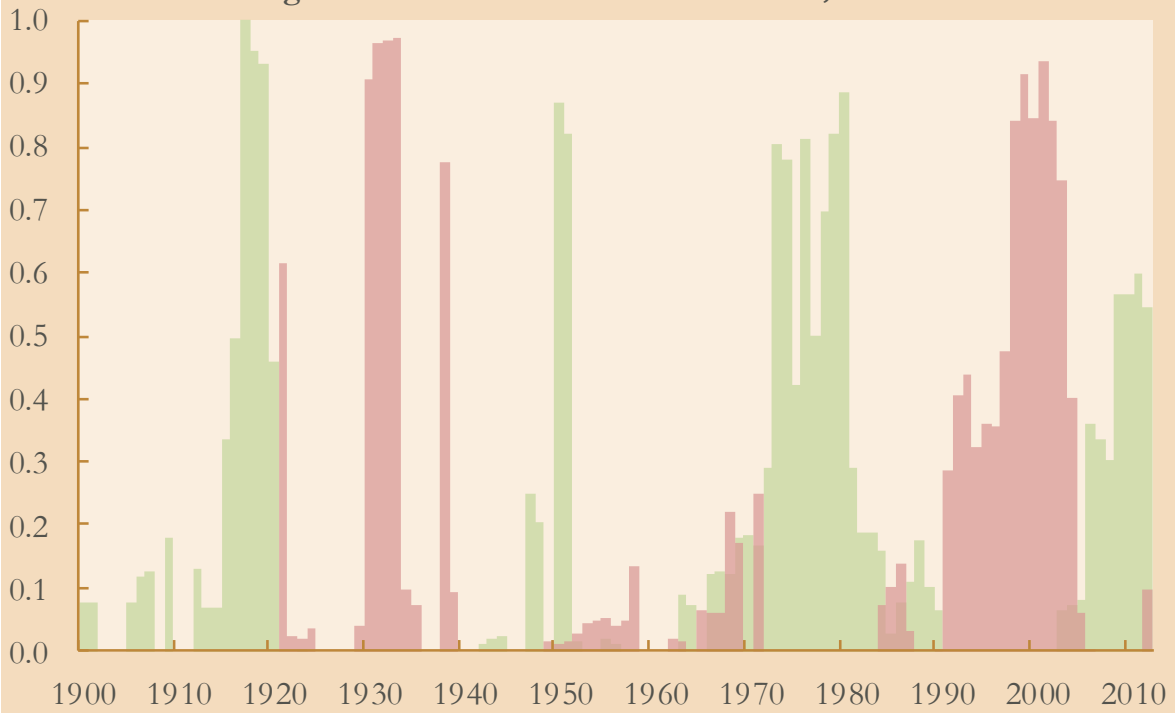


## Figure 87: Deviations in GDP from Long-Run Trend, 1900-2012