CESifo Working Papers
www.cesifo.org/wp

The Relative Volatility of Commodity Prices: A Reappraisal

Rabah Arezki
Daniel Lederman
Hongyan Zhao

CESIFO WORKING PAPER NO. 3694
CATEGORY 9: RESOURCE AND ENVIRONMENT ECONOMICS
DECEMBER 2011

CESifo *Working Paper No. 3694*

The Relative Volatility of Commodity Prices: A Reappraisal

Abstract

This paper studies the volatility of commodity prices on the basis of a large dataset of monthly prices observed in international trade data from the United States over the period 2002 to 2011. The conventional wisdom in academia and policy circles is that primary commodity prices are more volatile than those of manufactured products, although most of the existing evidence does not actually attempt to measure the volatility of prices of individual goods or commodities. The literature tends to focus on trends in the evolution and volatility of ratios of price indexes composed of multiple commodities and products. This approach can be misleading. Indeed, the evidence presented in this paper suggests that on average prices of individual primary commodities are less volatile than those of individual manufactured goods. However, the challenges of managing terms of trade volatility in developing countries with concentrated export baskets remain.

JEL-Code: F140, E320, C430.

Keywords: international commodity prices, volatility, manufactured product prices.

Rabah Arezki
International Monetary Fund
rarezki@imf.org

Daniel Lederman
World Bank
Dlederman@worldbank.org

Hongyan Zhao
University of California, Berkeley
hyzhao@econ.berkeley.edu

Sector Board: EPOL

This version: December 1, 2011
We thank Olivier Cadot, Kaddour Hadri, Jeffrey Frankel, Caroline Freund, Gaston Gelos, Antoine Heuty, Bernard Hoekman, Mico Loretan, Mustapha Nabli, Chris Papageorgiou, Jim Rowe, and Liugang Sheng for useful comments and discussions. All remaining errors are ours. The views expressed in this paper are those of the authors and do not necessarily reflect those of the International Monetary Fund or of the World Bank , its Board of Directors or the countries they represent.

I. INTRODUCTION

Are the international prices of primary commodities more volatile than those of manufactured goods? This question has important implications for macroeconomic and development policies, and the conventional wisdom expressed in academic and policy circles is that they are. The policy literature is replete with prescriptions for economies to cope with the volatility of commodity prices, ranging from prescribed investments in financial hedging instruments such as commodity futures to fiscal stabilization rules to help reduce the pass through of commodity price volatility into domestic economies. A recent example is the World Bank's 4 billion dollar contribution to a joint fund launched in June 21, 2011 with J.P. Morgan to help developing countries invest in commodity-price hedging instruments.[1] In fact, the concern over the impact of commodity price volatility on developing countries has also led the World Bank to argue that economic diversification away from commodities should be a priority for these countries even if this requires industrial policies. These policy prescriptions and concerns are valid, regardless of the relative volatility of commodity prices. Such policies are justified even if the prices of commodities are less volatile than those of manufactured goods, for example, because many developing countries tend to have highly concentrated export baskets that are associated with volatile terms of trade and thus macroeconomic uncertainty, which itself can lead to social unrest (Bruckner and Ciccone 2010). In addition, the volatility of some commodities linked to food staples can result even in social unrest (see Arezki and Bruckner 2011).

[1] World Bank, Press Release No:2011/559/EXT, Washington, DC.

Indeed, there are good reasons to expect that commodity prices are relatively volatile. One is that commodities, by definition, are goods that retain their qualities over time, which allows economic agents to use them as financial assets. This might be the case, for example, of gold and other commodities whose prices tend to rise amidst global financial uncertainty. Caballero et al. (2008), for example, argued that the volatility of commodity prices could be due to the lack of a global safe asset (besides the U.S. Treasury bills). An earlier literature argued that commodity price volatility was fueled by stockpiling policies to secure access to food or fuel during times of relative scarcity (Deaton and Laroque 1992). These mechanisms add price volatility because of unavoidable asymmetric stockpiling rules; that is, the stockpile of commodities cannot be negative. Yet another potential explanation is the lumpiness of exploration investments in mining, which results in inelastic supply in the short run (Deaton and Laroque 2003). Finally, more traditional economic analysis of the effects of random demand shocks on homogeneous (i.e., commodities) and differentiated goods (i.e., manufactured products) also suggests that the resulting price volatility of the latter would tend to be lower as producers of differentiated products could maximize profits by reducing supply in response to negative demand shocks.

However, there are also good reasons to expect a higher volatility of differentiated manufactured goods. Product innovation and differentiation itself might contribute to price volatility by producing frequent shifts in residual demand for existing varieties. Indeed, the trade literature has acknowledged the wide dispersion in unit values of within narrowly defined product categories in the United States import data at the 10-digit level of the Harmonized System (HS) (Schott 2004). Also, the demand for differentiated products might be more unstable with respect to household and aggregate income shocks than that for basic

commodities. For instance, the demand for fuel and food might decline proportionately less than the demand for automobiles or electronics when incomes fall.

In spite of these contradictory predictions, there are very few analyses that systematically compare the volatility of commodity and manufactured goods prices. An important exception is the historical study by Jacks, O'Rourke and Williamson (2011), who examined the volatility of domestic prices since 1700 in several countries; however, it covered only few commodities due to data constraints. In contrast, analyses of the evolution and volatility of the average price of baskets of commodities relative to the average price of a basket of manufactured goods – usually the manufacturing unit value index (MUV) constructed by the International Monetary Fund – are omnipresent in the literature and policy documents (e.g. Cashin and McDermott 2002 ; Calvo-Gonzalez et al. 2010).

Figures 1 and 2 display time series of aggregate price indices for various definitions of primary commodities. These series seem to corroborate the conventional view that commodity prices are more volatile than non commodity prices. The present paper challenges this conventional wisdom by providing a new stylized fact on the relative volatility of primary commodity prices using the 10-digit HS data from U.S. imports data.

This paper contributes to several strands of the literature. First, it contributes more directly to the literature studying the behavior of commodity prices. This literature does not necessarily compare commodity prices to non commodity prices but focuses on the former. For instance, Deaton and Laroque (1992) used coefficients of variation of aggregated price indexes as a measure of volatility to analyze the volatility of 13 commodities. They argue that "commodity prices are extremely volatile" but do not provide an explicit comparison with

non-commodity price volatility.[2] As far as we know, this paper is the first to compare the volatility of individual primary commodity prices not with aggregate indexes but rather with disaggregated monthly data.

Second, our paper contributes to the literature on trends in commodity prices relative to manufactured products (e.g., Harvey et al. 2010). Our paper instead focuses on the differences in the second moments of commodity prices compared to those of non-commodity prices.

Third, this paper also contributes to the literature on the so-called "resource curse" that has focused on the adverse effect of resource endowments on economic growth (e.g., Lederman and Maloney 2007; Van der Ploeg 2011; Frankel 2012). If commodity prices are intrinsically more volatile than the prices of manufactured goods, a higher natural resource endowments could result in higher macroeconomic volatility.

The rest of this paper is organized as follows. Section II discusses the monthly data from the United States international trade records over the period from 2002 to 2011 covering more than 18 thousand goods. Section III presents the main results. Section IV provides an array of robustness tests. Section V concludes.

[2] More recently, Deaton and Laroque (2003) have focused on the longer-run determinants of commodity prices. They developed a Lewis model where commodity supply is infinitely elastic in the long run and the rate of growth of supply responds to the excess of the current price over the long-run supply price. They find that commodity prices are stationary around its supply price and are driven in the short run by fluctuations in world income.

II. DATA

Our data come from trade records of the United States, classified at the 10-digit level of the Harmonized System (HS) of trade classification. We use monthly frequency import data from January 2002 to April 2011. The data was obtained from the Foreign Trade Division of the U.S. Census Bureau. From these data, prices were computed as the ratio of import values to quantities. These unit values are used as our proxy for goods prices.

In total, the dataset covers 26,459 product categories. However, not all categories have price information; 7,976 products do not. Also, the analysis of volatility requires data for extended periods of time, and we dropped products that do not have price data for at least 36 consecutive months. The final data set thus covers 12,955 products.[3] Our benchmark analysis focuses on U.S. imports data rather than on exports data for two reasons. First, the reporting of imports data is generally less subject to measurement errors than exports data, as imports are more subject to tariffs and inspections than exports. Second, U.S. imported products are more numerous and diverse than exports. In fact, the U.S. reports twice as many imported as exported goods. Also, 17 percent of imports are commodities compared to only 4 percent for exports. While studying the pattern of US exports may be relevant for a U.S. specific analysis, it is essential for our general analysis to use imports data. [4]

It is noteworthy that this sample period covers years of historically high volatility of real commodity prices, perhaps only surpassed by the early 1970s (see, e.g., Calvo-Gonzalez et

[3] The results reported below are unaffected by alternative choices of datasets such as keeping products with price data available throughout the whole sample period.

[4] Nevertheless, the main result presented in this paper holds when using US exports data rather than imports.

al. 2010). Consequently, if there is a period selection bias in the data, it would probably bias commodity price volatility upwards. But, again, such historical analyses focus on commodity prices relative to an aggregate price index of non-commodity goods, which might be misleading.

As a starting point, the analysis focuses on aggregate price indexes – see Figures 1 and 2. A relevant issue in this type of analysis concerns the definition of commodities. The International Monetary Fund has one such classification, which includes non-fuel, energy and all primary commodities. The United Nations Conference on Trade and Development (UNCTAD) also has a definition, which includes some commodities that are not in the IMF's, such as cottonseed oil and manganese ore. Appendix 1 lists the commodities included under both definitions. In addition, it is easy to tell which goods are manufactured in the North American Industry Classification System (NAICS). At the two digit level, chapters 31-39 of the NAICS are classified as manufactured goods.

Since the data on import prices from the U.S. are classified according to the Harmonized System, we used concordance tables between the HS and the NAICS. [5] To match the HS data classification to the IMF and UNCTAD commodity classifications, we used the names of the commodities as keywords to find matching product descriptions in the trade data.

To assess the volatility of individual goods prices it is important to de-trend the price series. We report results based on the Hodrick-Prescott filtered series, but all results reported herein

[5] Robert Feenstra's web site provides the concordance for data from 1989-2006: http://cid.econ.ucdavis.edu/. The U.S. Census Bureau provides concordance tables for 2010 and 2011: http://www.cnesus.gov/foreign-trade/reference/codes/index.html.

hold with alternative filters, including the Baxter-King band-pass filter and first differences.[6] In all three cases, we measure volatility with the standard deviation of de-trended price series. After calculating the standard deviations for each 10-digit product, we compare the distribution of volatilities across groups of goods, namely commodities versus manufactured goods.

III. MAIN RESULTS

As mentioned, we are interested in comparing the distribution of price volatilities across broad categories of goods.

III.A. Product "Re-Classification"

For starters, in the HS classification, the goods classified as machinery and electrical equipment have the highest average volatility – see Table 1. Table 2 provides summary statistics for the goods classified as primary commodities and manufactured goods, based on the NAICS-IMF classification, after finding the best concordance between the two classifications. It is noteworthy that over 92 percent of products are classified as manufactured goods and have, on average, higher volatilities than the primary commodities. Furthermore, the cumulative distribution functions (CDFs) in Figure 3 show that the price volatility of manufactured goods dominates both that of primary commodities and that of other (unmatched) goods.

[6] There is thus no concern that the main result presented in this paper is driven by the choice of filtering method.

For the sake of completeness, Figure 4 plots the volatility CDF of primary commodities based on the IMF commodity price table data, the previously defined group of manufactured products and primary commodities (based on the NAICS-IMF overlap sets) and a more narrow set of manufactured goods classified as "computers". The latter appear to have the highest volatility distribution, followed by the large group of all manufactured goods.

Thus, the data on price volatility at the level of individual products suggests that manufactured goods prices are more volatile than that of commodities. This result is at odds with Figure 1. We argue that the use of aggregate indices in comparing prices across classes of goods is subject to an aggregation bias. That is, some price swings in one direction cancel out swings in the other direction, which makes for an overall index that looks more stable than its components. Of course that same effect is also at play in commodity price indices, but there are far fewer commodities than manufactures, so fewer prices cancel each other out. According to NAICS, manufactures account for more than 90 percent of the goods in our data set. [7]

Nonetheless, since the analysis compares the whole distribution of volatilities within categories of goods, we next need to establish that the observed differences in the CDFs are statistically different.

[7] More formally, it can easily be shown that using a variance operator to compute measures of volatility for two different price indices will bias the measure of volatility upward for the index which comprises more sub-components compared to the one with less.

III.B. Formal Tests of CDF Stochastic Dominance

Delgado et al. (2002) provide a non-parametric test for assessing the difference between cumulative distribution functions; it is a two-step test for first order stochastic dominance. The first step is a one-sided test of the null hypothesis that the difference between the two cumulative distribution functions is equal to or less than zero. The second step is a two-sided test of the null hypothesis that the two CDFs are equal. If the one-sided test is not rejected, then this is interpreted as evidence of weakly stochastic dominance. A rejection of the equality of the two CDFs in the two-sided test indicates strict stochastic dominance.

More formally, the test statistic, the Kolmogorov-Smirnov test statistic, for the null hypotheses of the one-sided first-step test can be written as follows:

We now discuss the results of the stochastic dominance tests performed on the CDF of the volatility of manufactured and commodity import prices shown in Figure 3. For the one-sided test, the statistic is 0.034. It is smaller than the 1.073 critical value for the 10% level of significance.[8] Thus we cannot reject the null hypothesis that the CDF of manufactured goods is smaller or equal than that of commodities. The CDF of manufactured goods weakly dominates that of commodities. For the two-sided test, the corrected combined p-value is 0, so we can reject the null hypothesis that the two distributions are equal at 1% significance level. Overall, the results of the stochastic dominance test suggest that the CDF of the standard deviations of prices of manufactured goods strictly stochastically dominates that of commodity prices.

IV. ROBUSTNESS

This section tests the robustness of our surprising finding that prices of commodities are less volatile than those of manufactured goods. This finding could be misleading for at least four reasons. First, some products tend to disappear from the sample. If most product exits are observed within the group of manufactured goods, then it is possible that the observed volatility of manufactures might be biased upward, driven by product destruction rather than by within-product price fluctuations. Second, the trade data on unit values comes from ratios of reported values over reported quantities. Hence it is worth examining the volatility of quantities. Third, the key distinguishing feature of commodities is their relative lack of product differentiation over time, and this characteristic might not be neatly identified in the

[8] Critical values of the one-sided test are 1.073, 1.2239, and 1.5174 for the 10%, 5%, and 1% levels of significance respectively (Barrett and Donald 2003, page 78).

ad hoc categorizations used by the IMF, UNCTAD or in the NAICS. Fourth, measurement errors in unit values may be an important explanation for our main results. We address these concerns below. [9]

IV.A. Product Destruction

An easy way to examine the influence of product destruction on the previous results is to limit the analysis to a constant sample of products. For this constant sample, we chose goods that have price information for the whole time period from January 2002 to April 2011. Thus, our sample is reduced to 7,842 goods, which is about 60% of the total number of goods (12,955) in the benchmark sample. Indeed, Table 3 shows that there is quite a bit of product exit in manufactured products. It is also noteworthy that there is a notable increase in the number of entering and exiting products in 2007, which is very likely due to changes in the trade classification and reporting systems. However, Figure 5 shows that even when considering a constant sample of products, our main result remains intact: commodities appear to be less volatile than manufactured goods.

IV.B. Volatility of Quantities

So far, we have used unit values to compute measures of price volatility. It is important to bear in mind that quantities may adjust to prices so it is worth exploring whether the difference in relative volatility between primary commodity and non primary commodity

[9] The results from stochastic dominance tests indicate that we failed to reject the null hypothesis in the first step but reject the null hypothesis in the second steps for all the robustness cases presented hereafter. For the sake of conciseness, the test statistics and associated critical values are not reported but are available from the authors upon request.

also applies to quantities. We thus re-computed the volatility for quantities both for individual commodities and manufactures. Figures 6 shows that our main result i.e. that individual commodity prices are less volatile than those of manufactures, holds for import quantities as well.

IV.C. Homogeneous versus Differentiated Products

Rauch (1999) provided an intuitive classification of homogeneous and differentiated goods which goes to the heart of the economic distinction. Homogeneous goods are those which are traded globally in organized exchanges, whereas differentiated goods are those that are not. An intermediate category in Rauch (1999) is composed of goods for which no formal exchanges (organized markets) exist, but for which there are "reference prices." Rauch provided a concordance between the Standard International Trade Classification (SITC) and his three categories. We used the SITC-HS concordance table in order to then classify our sample of products into Rauch's three groups. In our sample, 95 percent of manufactured goods appear in the bin of differentiated goods, whereas only 35 percent of commodities were classified as differentiated products. Thus there was a notable overlap, albeit not enough to overturn the main findings: Figure 7 indicates that the most volatile products are differentiated manufactured goods.

IV.D Measurement Errors

One potential caveat to our results is that measurement errors in the unit values may be an important driver of the difference in the observed – as opposed to the true-- price volatility

between commodity and manufactured goods.[10] One potential source of measurement error is that goods which have smaller import values may be disproportionately more subject to measurement error. Following Hummels and Klenow (2005) and Feenstra, Romalis and Schott (2002), we re-computed the price volatility CDFs for various groups of products by dropping goods whose monthly import value was less than a given cut-off from our sample. Specifically, we dropped goods below US$50,000 import value, which resulted in a drop of 6 percent (805 goods) of the total number of products. Interestingly, the dropped goods were evenly distributed across commodity and manufactured goods. Our main results regarding the higher volatility of manufactured goods unit values were confirmed after dropping goods with low import values.

Another potential source of concern is that using the standard deviation as a measure of dispersion may give disproportionate importance to outliers, which in turn may lead to over or underestimation of the relative volatility of commodity prices. Indeed, a standard deviation, being a sum of square distances to the trend, implicitly gives more weight to outliers. To address that issue we used alternative measures of dispersion, namely the inter-deciles range: the difference between the first and the ninth deciles, or the interquartile range, the difference between the upper and lower quartiles. Once again, when re-computing the price volatility CDFs, our main results regarding the higher volatility of manufactured goods unit values were confirmed using these alternative measures of dispersion. While it is impossible to argue with absolute certainty that measurement error is not driving our main results, this evidence suggests that measurement errors that disproportionately affect unit

[10]The results discussed in this sub-section are not reported but available from the authors upon request.

values of manufactured goods are unlikely to be the main source of the difference in volatilities with respect to commodities.

V. CONCLUSIONS

Conventional wisdom holds that commodity prices are much more volatile than prices of differentiated manufactured products are. However, there are economic arguments that both support and counter this perception. Our empirical results also challenge this conventional wisdom. In fact, the evidence presented in this paper suggests that on average the prices of individual primary commodities might be less volatile than those of individual manufactured goods. The literature has thus far focused on trends in the evolution and volatility of ratios of price indexes composed of multiple commodities and products. This approach can be misleading as the use of aggregate indices in comparing prices across classes of goods is subject to aggregation bias. More research is needed to explore the theoretical explanations behind these new findings. As mentioned in the introduction, one likely candidate to explain why differentiated manufactured good prices would be more volatile that commodities is that product differentiation itself might contribute to price volatility by producing frequent shifts in residual demand for existing varieties. The wide dispersion in unit values of within narrowly defined product categories in the United States import data at the 10-digit level of the Harmonized System (HS) (Schott 2004) certainly supports that view.

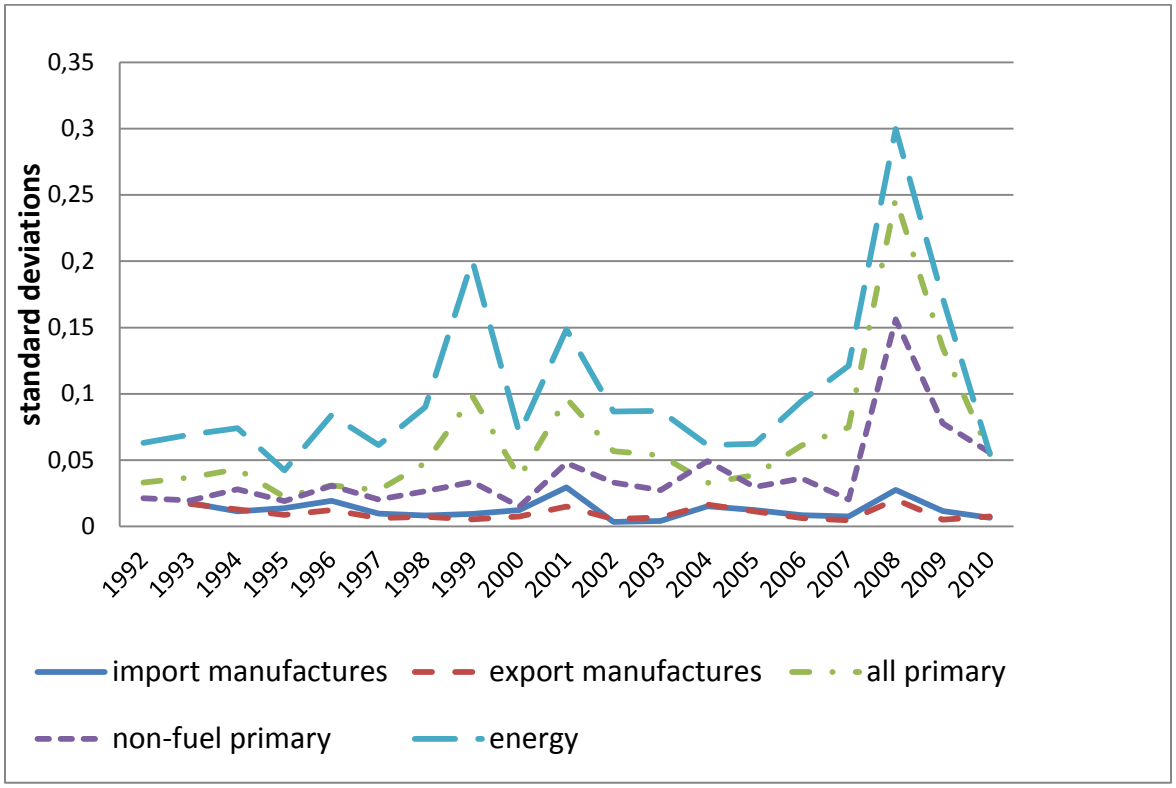
Our empirical results also have potentially important implications for the macroeconomics literature and perhaps for development policy. For instance, our evidence suggests that specialization in the manufacturing sector does not necessarily yield less volatility. On the contrary, specializing in manufacturing activity could increase exposure to volatility.

Moreover, manufacturing may prove more challenging than commodity specialization, perhaps because it requires constant upgrading of the production process to meet international competition through product upgrading and quality differentiation. Thus, while specializing in manufactures should still be considered as an important option, authorities must bear in mind that manufacturing requires a strong capacity to innovate and adapt to withstand international competition.

That said, developing countries tend to be smaller, poorer and more dependent on primary commodity exports than high-income economies, all of which result in higher export concentration dominated by basic commodities. This concentration of their export baskets is, in turn, associated with volatile terms of trade. Hence managing external volatility and economic diversification in the long run remain important policy challenges for developing countries, but this is not because commodity prices per se are more volatile. Similarly, developing financial hedging instruments to help countries to dampen the consequences of commodity-price volatility are also worth pursuing, but this is so because it is plausible to develop such instruments for goods that are homogeneous over time rather than because the prices of commodities are (supposedly) relatively more volatile than those of differentiated manufactured goods.

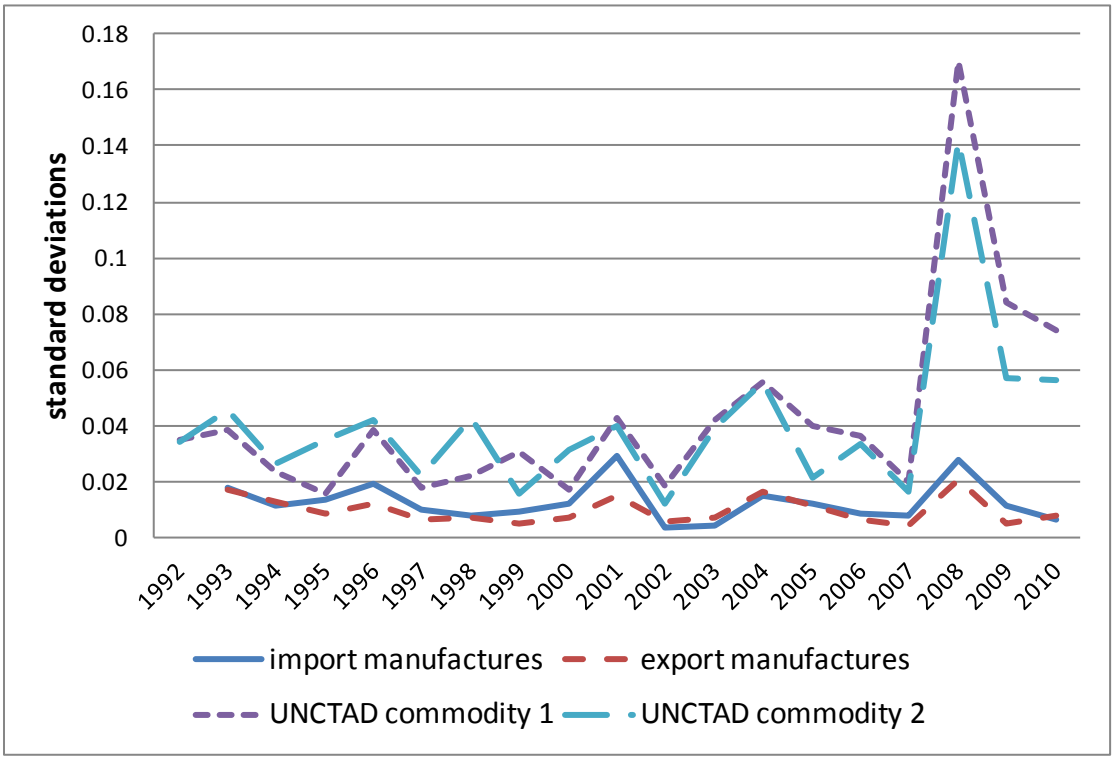
Figures and Tables

Figure 1. Volatility of Aggregate Price Indices using IMF Commodity Indices



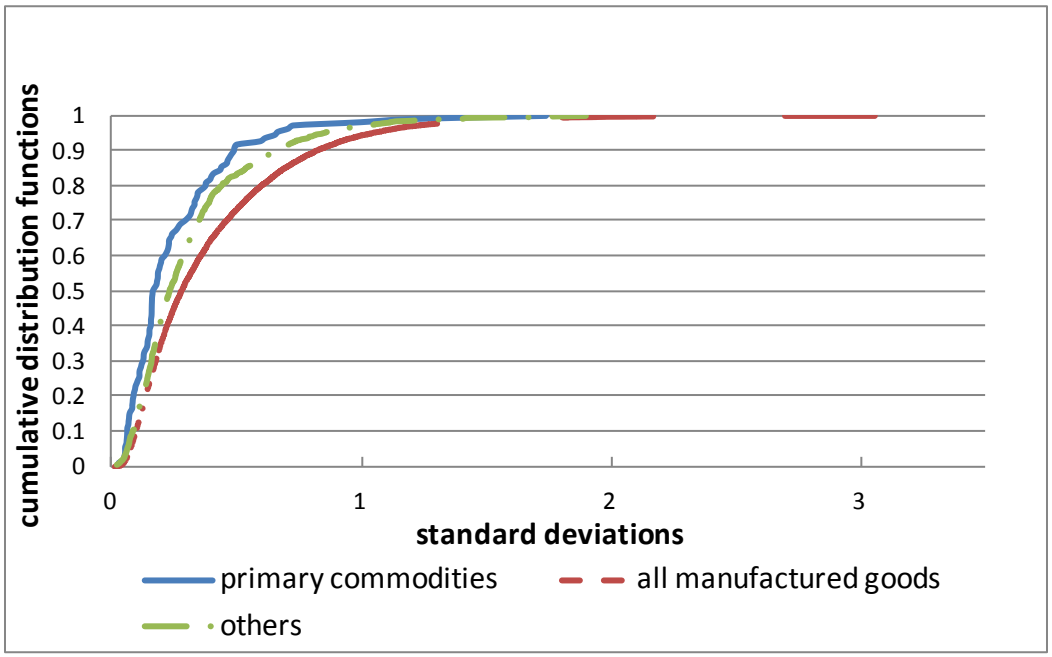
Note: The figure shows the evolution of the annualized standard deviations of Hodrick-Prescott filtered price series. The aggregate price indices for all primary, non-fuel primary and energy goods are from IMF Primary Commodity Price Tables (2005=100). The aggregate price indices for import and export manufactured goods are from the Bureau of Labor Statistics (2000=100). The latter data is available using the Standard International Trade Classification from 1993 to 2005 and available using North American Industry Classification System from 2005 to 2010. We constructed an extended series throughout the period 1993 to 2010 by setting the same index value for December 2005 in those two available series.

Figure 2. Volatility of Aggregate Price Indices using UNCTAD Commodity Indices



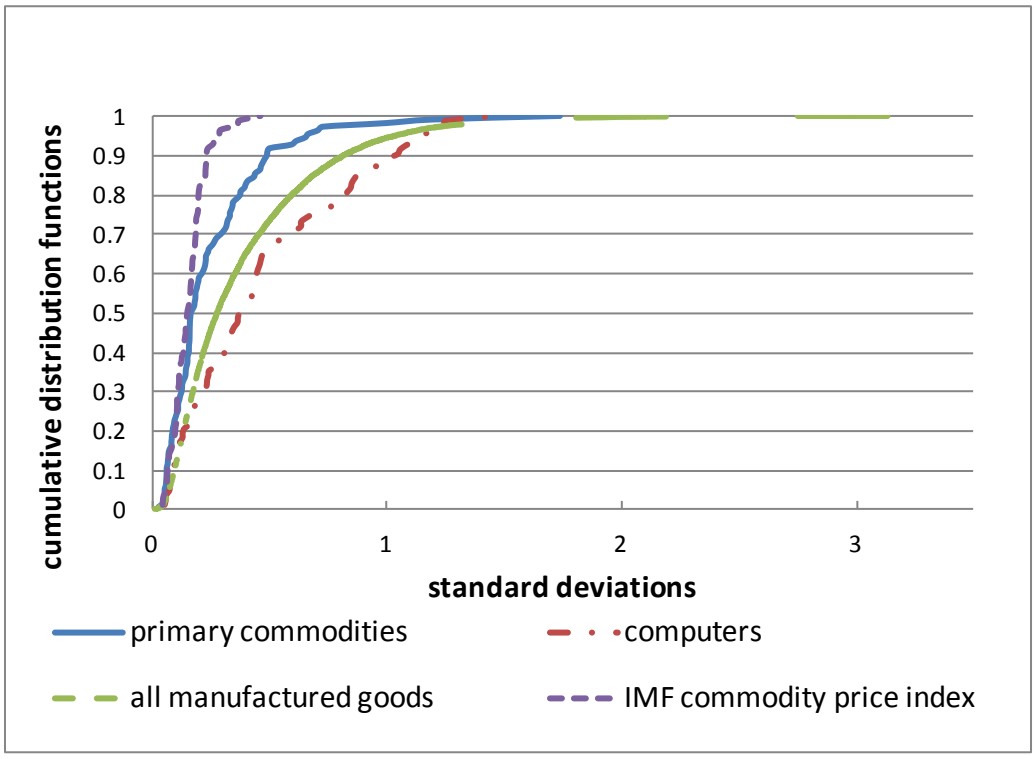
Note: The figure shows the evolution of the annualized standard deviations of Hodrick-Prescott filtered price series. Commodity price indices are from UNCTAD Stat (2000=100). The UNCTAD commodity 1 price index is originally in current dollars while UNCTAD Commodity 2 is in Special Drawing Rights. The aggregate price indices for import and export manufactured goods are from the Bureau of Labor Statistics (2000=100). The latter data is available using the Standard International Trade Classification from 1993 to 2005 and available using North American Industry Classification System from 2005 to 2010. We constructed an extended series throughout the period 1993 to 2010 by setting the same index value for December 2005 in those two available series.

Figure 3. Cumulative Distribution Functions of Price Volatility for Goods with Uninterrupted Price Series



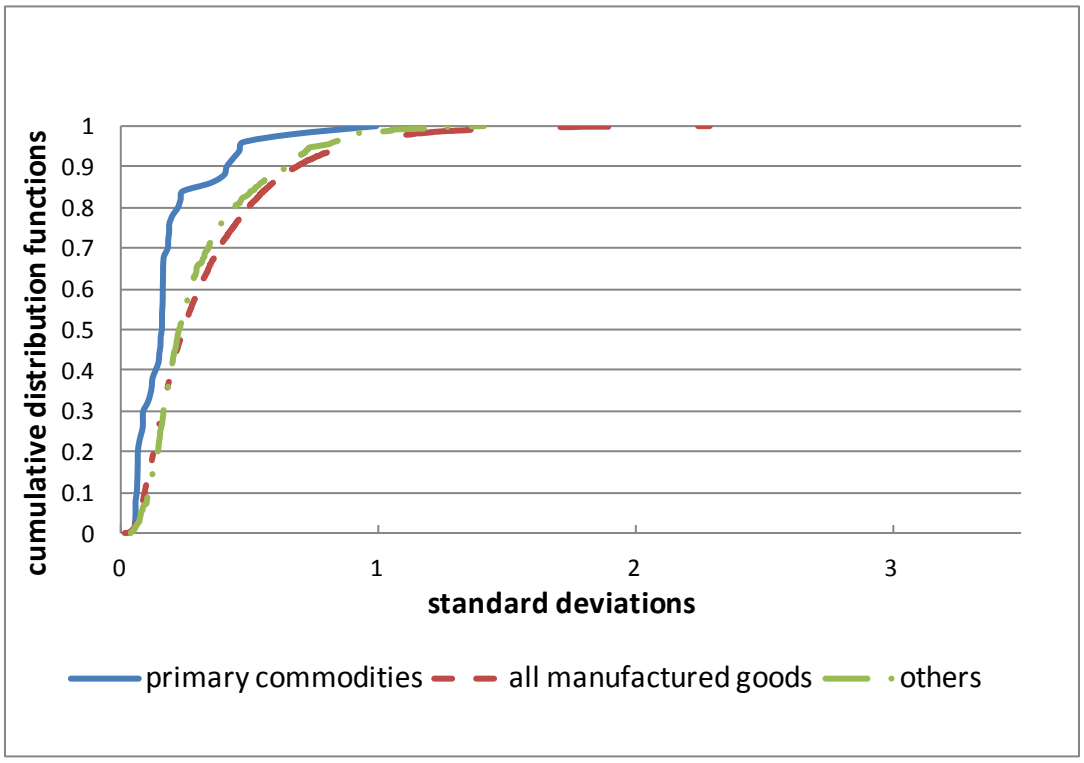
Note: The figure shows the cumulative distribution functions of the standard deviations of Hodrick-Prescott filtered series of individual goods prices. The goods represented are those which prices are available for at least 36 consecutive months. Data are from the Foreign Trade Division of the U.S. Census Bureau.

Figure 4. Cumulative Distribution Functions of Price Volatility for Selected Manufactured Products



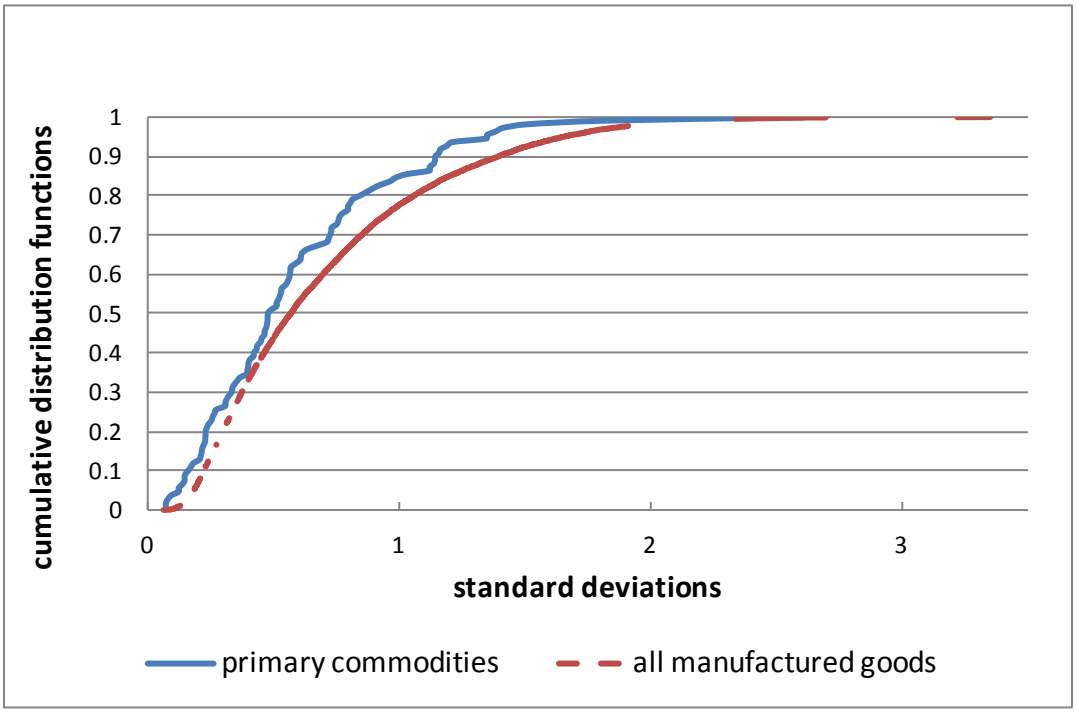
Note: The figure shows the cumulative distribution functions of the standard deviations of Hodrick-Prescott filtered series of individual goods prices. Data are from the Foreign Trade Division of the U.S. Census Bureau.

Figure 5**.** Cumulative Distribution Function of Price Volatility for Goods Available for the Whole Period



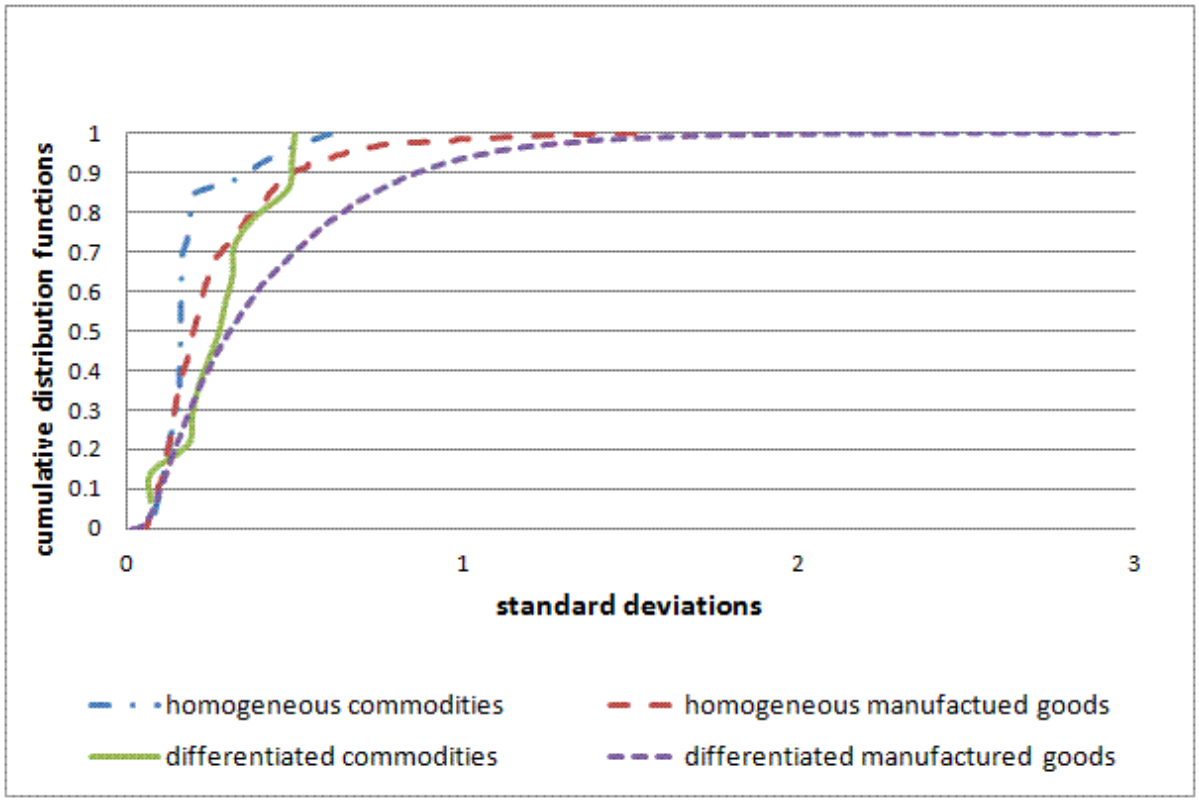
Note: The figure shows the cumulative distribution functions of the standard deviations of Hodrick-Prescott filtered series of individual goods prices. The goods represented are those which prices are available for the whole sample period. Data are from the Foreign Trade Division of the U.S. Census Bureau.

Figure 6. Cumulative Distribution Function of Volatility of Import Quantities



Note: The figure shows the cumulative distribution functions of the standard deviations of Hodrick-Prescott filtered series of individual goods quantities. Data are from the Foreign Trade Division of the U.S. Census Bureau.

Figure 7. Cumulative Distribution Function of Price Volatility for Differentiated and Homogenous Goods



Note: The figure shows the cumulative distribution functions of the standard deviations of Hodrick-Prescott filtered series of individual goods prices. Data are from the Foreign Trade Division of the U.S. Census Bureau.

Table 1. Price Volatility by Harmonized System Groups

HS	Description	Number of goods	Mean (standard deviation)	Minimum (standard deviation)	Maximum (standard deviation)
01-05	Animal & Animal Products	505	0.223	0.023	1.499
06-15	Vegetable Products	592	0.271	0.027	1.736
16-24	Foodstuffs	662	0.219	0.013	1.131
25-27	Mineral Products	201	0.376	0.033	1.435
28-38	Chemicals & Allied Industries	1564	0.425	0.038	2.543
39-40	Plastics / Rubbers	420	0.280	0.026	1.551
41-43	Raw Hides, Skins, Leather, & Furs	220	0.444	0.071	1.528
44-49	Wood & Wood Products	808	0.293	0.028	2.206
50-63	Textiles	2630	0.410	0.028	1.583
64-67	Footwear / Headgear	341	0.301	0.016	1.163
68-71	Stone / Glass	385	0.415	0.019	2.750
72-83	Metals	1448	0.271	0.044	1.678
84-85	Machinery / Electrical	2021	0.526	0.034	3.310
86-89	Transportation	384	0.382	0.028	2.370
90-97	Miscellaneous	773	0.502	0.033	2.326
98-99	Service	1	0.406	0.406	0.406
	Total	12955	0.382	0.013	3.310

Note: Data are from the Foreign Trade Division of the U.S. Census Bureau.

Table 2. Price Volatility using Alternate Goods Classification

Description	Number of goods	Mean (standard deviation)	Minimum (standard deviation)	Maximum (standard deviation)
Primary commodities	110	0.257	0.031	1.736
Manufactured goods	12006	0.387	0.013	3.310
Others	839	0.316	0.023	1.897
Total	12955	0.382	0.013	3.310

Note: Data are from the Foreign Trade Division of the U.S. Census Bureau.

Table 3. Goods Entry and Exit

	Number of exiting goods				Number of new goods			
year	commodities	manufactured goods	others	total	commodities	manufactured goods	others	total
2003	1	90	8	99	0	115	10	125
2004	1	81	5	87	0	97	0	97
2005	3	70	9	82	0	94	7	101
2006	0	57	6	63	0	113	2	115
2007	19	1510	225	1754	20	1320	216	1556
2008	0	37	5	42	1	73	6	80
2009	1	40	11	52	2	63	12	77
2010	3	55	5	63	3	33	2	38
2011	3	307	67	377	10	108	16	134

Note: Data are from the Foreign Trade Division of the U.S. Census Bureau.

References

Arezki, Rabah, and Markus Bruckner. 2011. "Food Prices and Political Instability." International Monetary Fund Working Paper No. 1162, Washington, DC.

Barrett, G. F. and Donald, S. G. 2003. "Consistent Tests for Stochastic Dominance." *Econometrica*, 71: 71–104.

Bruckner, Markus, and Antonio Ciccone. 2010. "International Commodity Price Shocks, Growth, and the Outbreak of Civil War in Sub-Saharan Africa." *Economic Journal* 120: 519-534.

Calvo-Gonzalez, Oscar, Rashmi Shankar, and Riccardo Trezzi. 2010. "Are Commodity Prices More Volatile Now? A Long-Run Perspective." World Bank Policy Research Working Paper No.5460, Washington, DC.

Deaton, Angus, and Guy Laroque. 1992. "On the Behaviour of Commodity Prices." *Review of Economic Studies* 59 (1): 1-23.

Deaton, Angus, and Guy Laroque. 2003. "A model of commodity prices after Sir Arthur Lewis." *Journal of Development Economics* 71: 289– 310.

Delgado, Miguel A., Jose C. Farinas, and Sonia. Ruano. "Firm productivity and export markets: a non-parametric approach". *Journal of international Economics*, 57(2):397–422, 2002.

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. “Financial Crash, Commodity Prices, and Global Imbalances. *Brookings Papers on Economic Activity*, Fall: 1–55.

Cashin, Paul, and John McDermott. 2002. “The Long-Run Behavior of Commodity Prices: Small Trends and Big Variability.” *IMF Staff Papers* 49(2):175–99.

Feenstra, Robert C., John Romalis, and Peter K. Schott, 2002. "U.S. Imports, Exports, and Tariff Data, 1989-2001," NBER Working Papers 9387, National Bureau of Economic Research, Inc.

Frankel, J. "Natural Resource Curse: A Survey of the Literature," forthcoming in Commodity Prices and Inclusive Growth in Low-Income Countries, *eds, Arezki, Pattillo and Quintyn, International Monetary Fund.*

Harvey, David I., Neil M. Kellard, Jakob B. Madsen, and Mark E. Wohar. 2010. "The Prebisch-Singer Hypothesis: Four Centuries of Evidence." *The Review of Economics and Statistics* 92(2): 367-377.

Hummels, David and Peter J. Klenow. 2005. "The Variety and Quality of a Nation's Exports," *American Economic Review*, American Economic Association, vol. 95(3), pages 704-723, June.

IMF Primary Commodity Price Tables. http://www.imf.org/external/np/res/commod/index.aspx

Jacks, David S., Kevin H. O’Rourke, and Jeffrey G. Williamson. 2011. “Commodity price volatility and world market integration since 1700”. *Review of Economics and Statistics* 2011 93:3, 800-813.

Lederman, Daniel and William F. Maloney. 2007. *Natural Resources, neither Curse nor Destiny.* Stanford University Press and World Bank: Washington, DC.

Rauch, James E. "Networks versus markets in international trade". *Journal of International Economics*, 48(1):7–35, 1999.

Schott, Peter K. "Across-Product Versus Within-Product Specialization in International Trade". *Quarterly Journal of Economics*. 119(2):647-678, 2004.

Van der Ploeg, Frederick. "Natural resources: curse or blessing?" *Journal of Economic Literature*, 49(2): 366-420. 2011

Appendix 1. Lists of Commodities under the IMF Primary Commodity Price Tables **and UNCTAD Classifications**

IMF Primary Commodity Price Tables: Aluminum, bananas, barley, beef, butter, coal, cocoa beans, coconut oil, coffee, copper, copra, cotton, DAP, fish, fish meal, gasoline, gold, groundnuts, groundnut oil, hides, iron ore, jute, lamb, lead, linseed oil, maize, natural gas, newsprint, nickel, olive oil, oranges, palm kernel oil, palm oil, pepper, petroleum, phosphate rock, potash, poultry, plywood, pulp, rice, rubber, shrimp, silver, sisal, sorghum, soybeans, soybean meal, soybean oil, sugar, sunflower oil, superphosphate, swine meat, tea, timber, hardwood logs, hardwood sawnwood, softwood logs, softwood sawnwood, tin, tobacco, uranium, urea, wheat, wool, zinc.

UNCTAD: Aluminum, bananas, beef, cattle hides, coarse wool, cocoa beans, coconut oil, coffee, copper, copra, cotton, cottonseed oil, crude petroleum, fine wool, fish meal, gold, groundnut oil, iron ore, jute, lead, linseed oil, maize, manganese ore, nickel, non-coniferous woods, palm kernel oil, palm oil, pepper, phosphate rock, plywood, rice, rubber, silver, sisal, soybean oil, soybeans, soybean meal, sugar, sunflower oil, tea, tin, tobacco, tropical logs, tropical sawnwood, tungsten ore, wheat, zinc.