



The End of the Commodity Super-Cycle? Implications for USAID Presence Countries

Abstract: The prices of the world’s most important commodities tripled between 1999 and 2008, with the price of oil increasing by a factor of 8. Since 2008, however, commodity prices have fallen by over 50 percent. Large commodity-price movements affect economic growth prospects and have important implications for government revenues and macroeconomic management in commodity-exporting countries. Most forecasters do not expect a strong revival of prices in the next few years. We review recent trends and explore the implications for USAID presence countries of a potentially extended period of low commodity prices.

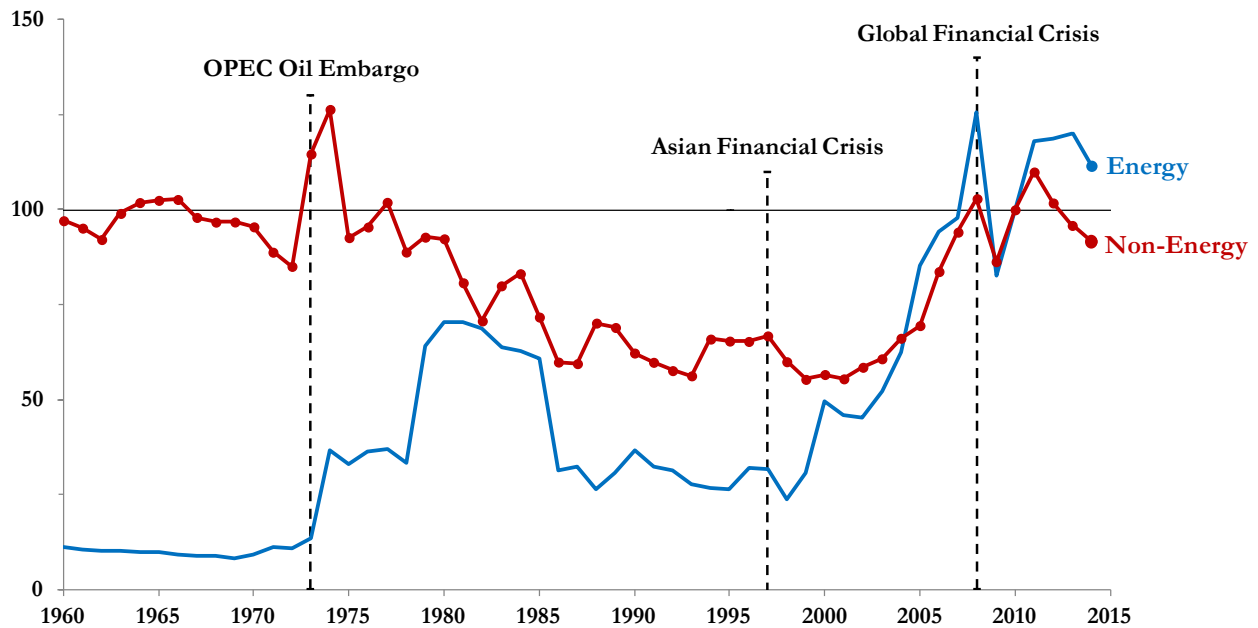
The commodity super-cycle

A commodity super-cycle occurs when the prices of many significant primary commodities rise and then fall in concert over an extended period, around some slow-moving underlying trend. Fluctuations in global economic activity typically play a key role in generating these correlated price movements, by exerting demand pressures – first boom, then bust – across an array of commodity prices. Supply-side shocks are less associated with super-cycles because

they are so often commodity-specific. An important exception on the supply side is energy, which is a key input into the production of goods and services and can have systemic impacts on other commodity prices via both production costs and consumer purchasing power. For this reason, energy and non-energy prices are often analyzed separately, as we will do at various points in this brief.

The turning points in a super-cycle are a matter of judgment and are only apparent *ex post*. Erten and

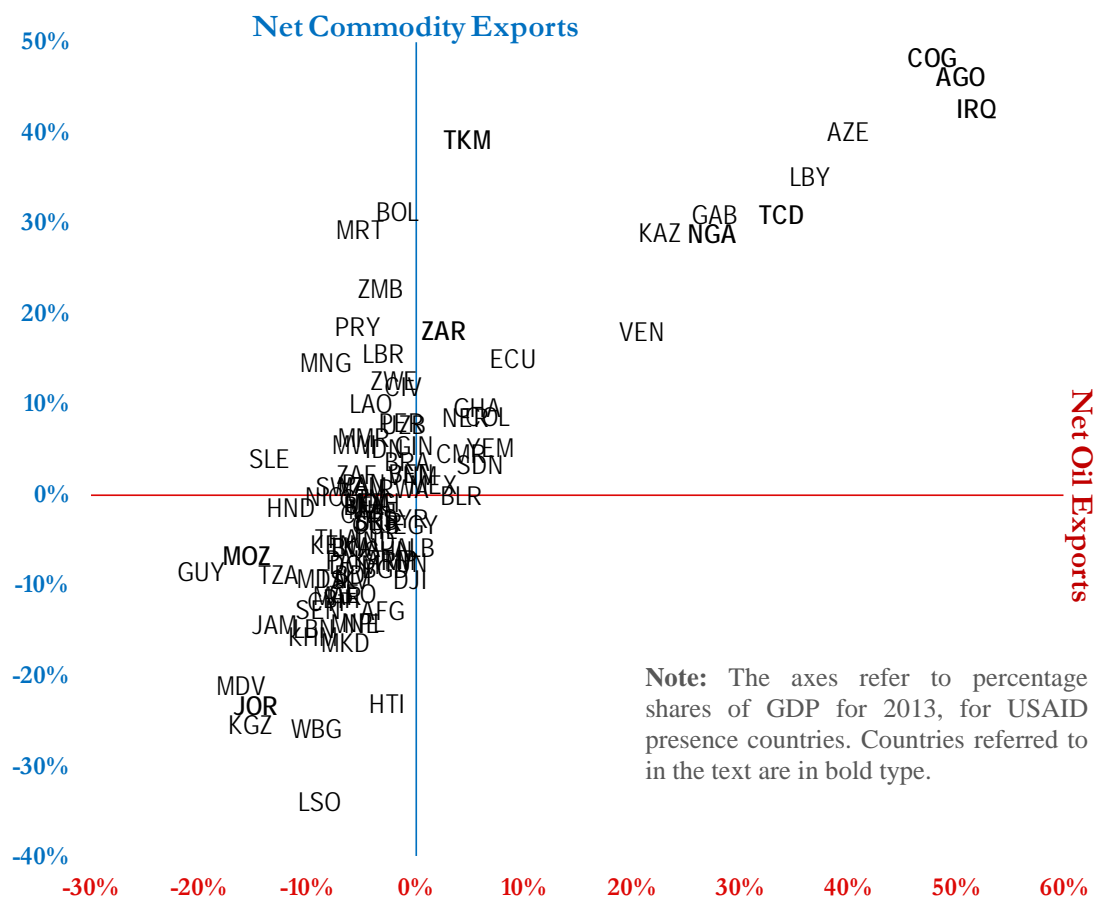
Figure 1. World Bank Indices of Real Commodity Prices



Source: World Bank Global Economic Monitor (GEM), 2010 = 100. See Data Appendix for details.

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Figure 2. Exposure to Oil and Non-Oil Commodity Prices Varies Widely Across Countries



Source: UNCTAD. See Data Appendix for details.

Ocampo (2012) detect four super-cycles in non-fuel commodities over the last century, the first three of which peaked in 1917, 1951, and 1973. Their analysis places us in the fourth super-cycle, which began around the year 2000 and appears to have peaked between 2008 and 2011 (see Figure 1).

Where are prices going? The statistical best guess in the case of storable commodities is often that prices will remain close to current levels, because any anticipated increase or reduction feeds into current prices by altering the value of inventories. This effect is apparent for non-energy prices in Figure 3, which shows the most recent projections by the International Monetary Fund (IMF) and World Bank. Both agencies, by contrast, anticipate a gradual revival in energy prices following their sharp reduction this year.

But any impression of stability in these forecasts is misleading. Commodity prices have been highly volatile in recent years, and none of the major

historical movements in Figure 1 were predicted at the time, so forecast errors are likely to be large.¹ However, it is already clear that the recent weakness of commodity prices has dampened growth forecasts for commodity-exporting countries, with the sharpest impact among energy exporters.

Exposure of presence countries

The macroeconomic impact of commodity price movements varies sharply across countries, largely because some countries are major net exporters of particular commodities and others are major net

¹ Erten and Ocampo (2012) note that average real non-oil commodity prices have trended downward since 1865, consistent with the prediction by Prebisch (1950) and Singer (1950) that primary commodity prices would fall in the long run relative to the prices of manufactured goods. Oil prices are an important exception, having trended upward in real terms since 1875.

importers. A simple measure of the first-round macroeconomic impact of commodity price movements is the *income effect of the terms of trade* – the amount of purchasing power in international markets that is gained or lost by a country, holding its trade volumes fixed, due to changes in the global prices of its exports or imports.² By this measure, Nigeria – where oil constitutes over 90 percent of exports – gained the equivalent of 17 percent of gross domestic product (GDP) in real purchasing power from the increases in global oil prices that occurred between 2003 and 2008. Kenya – which imports all of its oil – lost the equivalent of 10 percent of GDP from the same source.³

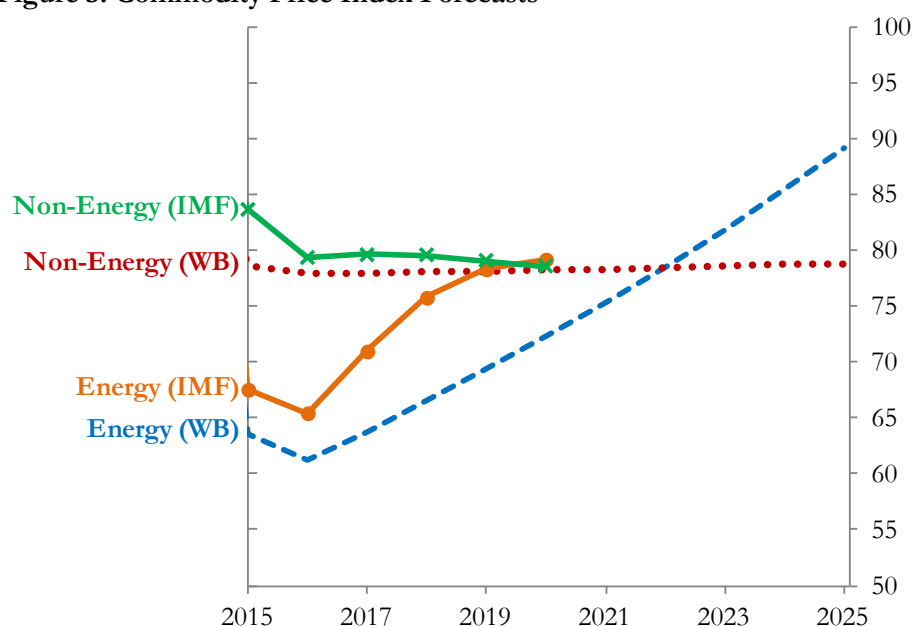
Among USAID presence countries, three groups stand out in terms of their exposure to large commodity price fluctuations (see Figure 2):

- Major primary commodity exporters like Chad, the Democratic Republic of Congo, and Turkmenistan have felt large macroeconomic gains and then losses over the super-cycle.
- Major oil exporters have experienced the sharpest boom-bust cycle: countries like Angola, Iraq, and Nigeria are now struggling with severe fiscal and balance of payments pressures.
- Major oil importers were hurt by the oil price boom and have benefited substantially from recent declines. This includes countries that are net exporters of non-oil primary commodities but that rely heavily on oil imports, like Mongolia and Mozambique.

² The *terms of trade* are defined here as the ratio of a country's export prices to its import prices.

³ See Data Appendix for details.

Figure 3. Commodity Price Index Forecasts



IMF forecasts of nominal prices, 2010 = 100

World Bank forecasts of real prices, 2010 = 100

These categories evolve over time as high commodity prices motivate investments in exploration and development. The latest super-cycle has been associated with large inward foreign investments to explore and develop mineral and energy resources, particularly in Sub-Saharan Africa.

Medium-term forecasts

After a boom period of roughly 10 years, most analysts now anticipate a period of continued difficulties for commodity exporters, with commodity prices unlikely to return to the lofty heights of 2008 and 2011 within the next 5 years. The concept of a super-cycle, in fact, suggests that further broad declines may be possible.

The World Bank's Otaviano Canuto (2014) argues that we are still experiencing the super-cycle that began around the year 2000. Canuto points to the fact that 2014 commodity prices were similar to 2008 levels. Furthermore, the correlation between the prices of different commodities has increased over the last 30 years, a key characteristic of a super-cycle. This increased correlation has resulted from two factors: a massive increase in demand for commodities from China as it seeks to industrialize and urbanize a country of over 1.3 billion people, and an increase in the use of natural resources as

inputs for other commodities, such as the use of sugarcane ethanol for gasoline.

Canuto (2014) also traces the unusually high volatility of prices during the current super-cycle to a set of short-term and long-term forces. In the short term, the increased ease with which traders in New York and London can shake commodity markets, the increased frequency of natural catastrophes, and specific instances of sociopolitical conflict have all made commodity markets more of a rollercoaster. Long-term structural factors include the increased amount of technical and political risk associated with extracting newfound reserves of oil, gas, and precious metals; and market imperfections that prevent arable land from being brought rapidly into use when agricultural prices rise. These factors compound the historical volatility of commodity prices by further reducing the already-slow and limited responsiveness of commodity demand and supply to market prices.

Forecasts of long-run trends in prices differ within specific categories of commodities. In global oil markets, observers expect oil prices to remain stable at current levels or rise slightly next year. Oil futures markets appear to be weighted slightly towards the upside, but with substantial uncertainty: according to the U.S. Energy Information Administration (EIA 2015a), next year's oil prices could leap to 90 dollars per barrel or sink to 20 from their 2015 average of roughly 50 dollars per barrel. This uncertainty springs partly from the surprising decision by OPEC to raise and maintain high production levels even as non-OPEC producers (e.g. the United States) have increased production from investments begun when oil prices were high. U.S. oil production has risen by nearly 4 million barrels a day since 2008, increasing the U.S. share of global output from roughly 7 percent to nearly 13 percent (EIA 2015b). Demand from China and other emerging markets (among other factors) was strong enough to lift oil prices from their 2008 nadir to levels near their pre-financial crisis peak by the summer of 2014, but it was not enough to counteract the more recent supply glut and a continued decline in demand from the Organization for Economic Cooperation and Development (OECD), ongoing since 2005, leading to a price collapse in late 2014 that persists today. Many observers expect oil prices to rise significantly by 2020.

Among non-oil commodities, the IMF predicts falling demand for some base metals (including iron ore, copper, aluminum and nickel) but rising demand for the materials associated with consumption as incomes rise. This prediction is tied to the consumption patterns of China (see below). In the long run, growth in developing countries may offset slowing demand for base metals. The OECD and Food and Agricultural Organization/United Nations (FAO) expect that, over the next decade, real prices of agricultural commodities will decline from their 2014 levels but remain above the levels witnessed in 2007, before the most dramatic price spikes of the last fifteen years occurred. Higher demand for calories in developing countries and constraints on the expansion of agricultural production (in the form of land use and environmental limits) drive this expectation.⁴ The IMF supports the forecast of a mild near-term price decline, due partly to record harvests since 2011.⁵

The China effect

China's commodity-intensive growth process has had an extraordinary impact on global commodity markets in recent years. For example, China alone consumed nearly half of the world's base metals in 2014.⁶ A number of observers have therefore stressed the impact of ongoing changes in China's growth process on commodity prices.

Growth in Chinese demand for basic food staples, base metals, and oil and coal has slowed since 2013 due to rising incomes and efforts by the government to reduce pollution by transitioning the economy away from a growth pattern that is intensive in oil and coal. Government efforts have included limits on coal consumption, higher fuel efficiency standards for cars, improvements in rail infrastructure to displace diesel truck transportation, and tighter credit requirements for commodity-intensive industries. Along with slower economic growth rates, these factors constitute China's "new normal" development path.⁷

When combined with medium-term increases in the global supply – *The Economist* (2014) reports a three-

⁴ OECD-FAO (2015).

⁵ IMF (2015a).

⁶ These are key inputs into finished goods destined for both domestic and foreign markets.

⁷ Meidan, Sen, and Campbell (2015).

fold increase in iron ore production since 2000, for example – the recent reductions in Chinese demand have created sharp declines in the prices of low-grade commodities tied to construction and infrastructure (including copper, steel, and iron ore). Meanwhile, China’s “nascent demand rebalancing” – as characterized by the IMF (2014) – has increased the global demand for higher-grade commodities (e.g. beef, zinc, and aluminum). The IMF anticipates that this pattern is likely to persist, implying continued weakness in the prices of low-grade commodities and more favorable prospects for high-grade commodities tied to growth in private consumption.

Results

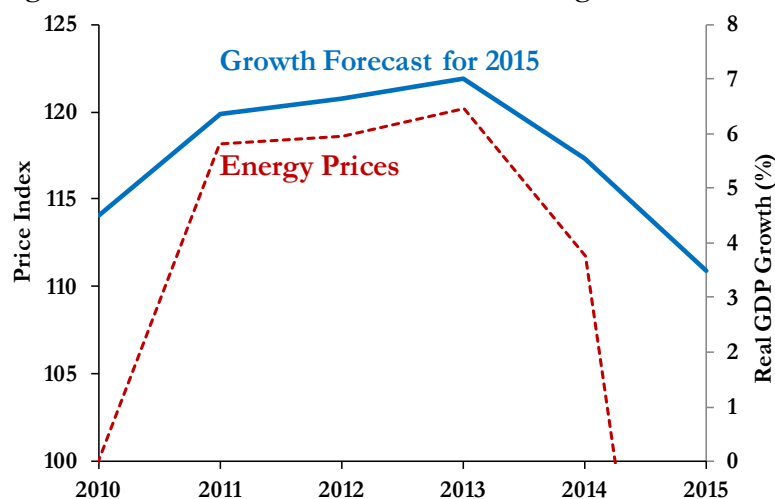
Real commodity prices have fallen sharply since 2011, but remain well above their trend-adjusted levels at the outset of the latest long commodity boom. While previous super-cycles suggest that further declines may be forthcoming, the concept of a super-cycle is largely an *ex post* construct and most expert forecasts do not anticipate major further declines. But neither do they anticipate a return to the heights of 2008 or even 2011.

The China effect, along with ongoing urbanization and growth in other developing countries, suggests that there may be more differentiation across commodity groups than in the recent past. Basic commodities, in particular, may be in for more extended weakness than commodities associated with rising consumer incomes. Oil prices have long confounded the Prebisch-Singer hypothesis that primary-commodity prices fall in the long run relative to the prices of manufactured goods (see Footnote 1), and could rebound sooner. There is substantial uncertainty around all of these predictions, and commodity prices are expected to continue to display greater volatility than in previous super-cycles.

Impacts of weak commodity prices

Commodity price changes are largely out of the control of the affected countries. USAID countries with significant commodity exports or imports are

Figure 4. Forecasts of Real GDP Growth in Angola for 2015



Growth Forecasts: IMF World Economic Outlook (WEO)
Prices: World Bank, real prices, 2010 = 100; forecast for 2015 = 63.5

“price-takers,” unable to influence global commodity prices because of their relatively small share of the global market.⁸ Commodity prices can nonetheless exert major macroeconomic influence, particularly in commodity-exporting countries. We focus here on the implications of a potentially extended period of price weakness for growth, government revenues, competitiveness, and exchange rates in USAID presence countries.

Economic growth

For net commodity importers, falling commodity prices are good news for growth. Cheaper raw materials act like a boost in the productivity of capital and labor, driving up real GDP from the supply side. This favorable impact is reinforced from the demand side as the income effect of lower commodity prices expands the demand for domestic goods and services.

Falling prices are more challenging for net commodity exporters. The favorable impact of falling raw material costs is overwhelmed by a direct hit on profitability that affects both output and investment in the commodity-producing sectors,

⁸ Oil is a partial exception; Angola, Ecuador, Iraq, Libya, Nigeria, and Venezuela enjoy some collective influence over global oil markets through their membership in OPEC. But this influence is limited; oil prices remain well below 2008 levels despite the adverse impacts of this development on USAID presence countries in OPEC.

Table 1. Estimated Impact of Primary Commodity Prices on Real GDP

Variable	Dependent variable log y	
	PPP-adjusted, per capita (PWT)	Constant LCU
<i>ietot</i> (PWT)	0.490*** (0.0569)	
<i>ietot</i> (World Bank)		0.497*** (0.0815)
Constant	8.189*** (0.00417)	26.69*** (0.00679)
Observations	3,108	2,115
R-squared	0.024	0.018
Number of countries	150	110

Standard errors in parentheses; *** $p < 0.01$. Regressions include country-level fixed effects. See Data Appendix for sources.

while the demand-side impact of a large and negative income effect drives down spending and GDP in the non-commodity sectors of the economy.

Table 1 provides cross-country evidence on the influence of primary commodity prices on real GDP. For a sample of developing countries over the period 1990 to 2013, the table estimates the bivariate regression model

$$\log y(it) = \alpha_i + \beta \cdot ietot(it) + \varepsilon(it),$$

where $y(it)$ is real GDP in country i and year t , α_i is a country-specific intercept term, and $\varepsilon(it)$ is the residual (see Appendix for details). The parameter β can be interpreted as an elasticity – it shows the impact on real GDP, in percentage points, of an exogenous shock to commodity prices that increases the economy's real purchasing power in international markets by one percentage point of GDP. The variable *ietot* is the income effect of the terms of trade, introduced earlier – it measures the size of the shock, in percentage points of real GDP.

The effects are large and statistically significant: each PPP-adjusted dollar of real income generated by commodity price movements raises domestic real GDP by roughly 0.5 (half) of an international dollar.⁹ These results are consistent with a broader literature; Izquierdo *et al.* (2008) and Osterholm *et al.*

⁹ Robustness checks reduce the size of this impact, but it remains statistically significant. See Appendix.

(2008), for example, document the substantial impact of commodity prices on economic growth in Latin America.

For countries with significant commodity exports or imports, growth forecasts are linked to commodity prices. Worsening commodity prices reduce growth projections along with actual growth. Figure 4 shows this effect for Angola, where growth forecasts for 2015 rose from 2010 to 2013 when energy prices rose and remained high, but then deteriorated in 2014 as energy prices declined. The 2010 and 2015 IMF forecasts for growth in 2015 are similar, suggesting that the doubts about commodity markets immediately following the global financial crisis have returned.

The trends in Angola have held for other lower-income commodity exporters as well. Since 2010, the IMF's forecast for global real GDP growth in 2015 has fallen from 4.5 percent to 3.1 percent. Discussing its downward revisions, the IMF (2015b) identified lower-than-expected commodity prices as a major factor for emerging markets and lower income developing countries.

Fiscal impacts and private financial flows

In countries with significant commodity exports, governments often depend heavily on royalties and resource-related taxes for revenue. Falling commodity prices can sharply worsen the fiscal position of governments in such countries, depriving the Treasury of revenues to invest in healthcare, infrastructure, and education. Figure 5 shows the extent of this impact in the Republic of the Congo, where oil exports constitute roughly half of GDP and are the main source of government revenue.

The prudent government response to revenue volatility is to save during times of high commodity prices and to use these savings to maintain stable levels of government spending during times of low commodity prices. Without savings to buffer the effects of volatile commodity prices, governments can be drawn into *procyclical* spending – when public expenditure rises during periods of economic growth and falls during periods of economic weakness. Commodity booms can stimulate pro-

cyclical spending by enhancing the creditworthiness of commodity exporters, resulting in lower interest rate spreads and increasing the access of both governments and private sector actors to international capital markets.

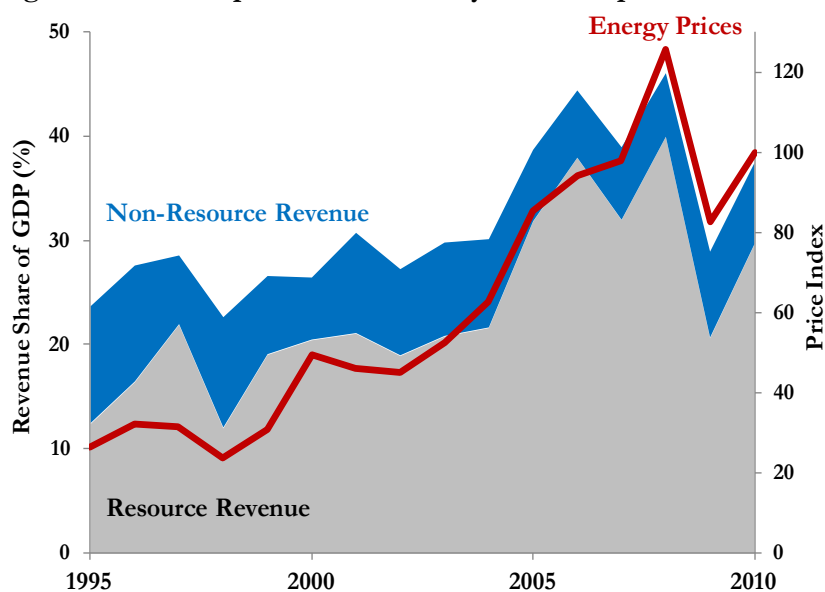
There is evidence that developing countries have managed the present super-cycle better than in the past. Frankel *et al.* (2013) document a sizeable reduction in the procyclicality of government deficits during the 2000s, implying more conservative fiscal management by commodity exporters and higher levels of macro-economic stability.¹⁰ For example, public spending patterns in Côte d'Ivoire flipped dramatically from procyclical to countercyclical during the decade beginning in 2000. This reduction in procyclicality has been driven by improvements in the quality of domestic institutions and the incentives to increase savings levels during commodity booms. An indicator of this trend is the rise in sovereign wealth funds linked to commodities since the year 2000, including oil-fueled funds in Kazakhstan and Timor-Leste.¹¹

Beyond commodity exporters, falling commodity prices can deliver a fiscal boon to any government that regulates domestic prices on political or other grounds. Many governments subsidize domestic fuel consumption, for example. Regardless of their fuel-exporter status, a period of declining global prices provides these governments with a window of opportunity for cutting subsidy rates on a

¹⁰ Adler and Magud (2015), however, find that Latin American countries saved less of the income effect of the boom than in past booms. This suggests that in aggregate, a more procyclical private sector spending response outweighed the increase in fiscal prudence.

¹¹ Among developed countries, oil-rich Norway created its sovereign wealth fund in 1990 to manage oil revenue and has used the fund as a critical source of investment in the country's long-term economic growth since then.

Figure 5. Fiscal Impacts of Commodity Prices: Republic of the Congo



Price index: World Bank, 2010 = 100

Revenue data: International Centre for Tax and Development

permanent basis – a policy that is often justifiable on sustainability, efficiency, and equity grounds (Clements *et al.* 2013). Some governments in developing countries have recently taken advantage of this opportunity; Indonesia, for example, slashed fossil fuel subsidies last year. Reduced subsidy expenditure can open fiscal space for increased national saving.

Competitiveness and export diversification

The market value of energy and mineral exports typically exceeds the cost of extraction by a large margin. These activities therefore generate large *economic rents* – payments in excess of what is required to draw the observed supply into the market. In contrast to most agricultural, manufacturing, and service activities, primary commodity rents can be highly persistent, because the investment required to develop new sources of supply is subject to sharply increasing costs.

Primary commodity rents translate into large foreign exchange inflows, easily obtained government revenues, and increased demand for goods and services produced in the local economy. One of the central puzzles of cross-country development experience is that despite these advantages, many primary commodity exporters failed to achieve rapid growth and transformation during the second half of the 20th century.

Sachs and Warner (2003) and many others have explained this phenomenon by arguing that the presence of commodity rents diverts the economy's resources into activities characterized by low productivity growth. The leading example is *Dutch disease*, which refers to the tendency for any non-primary commodity activity that faces global competition, such as tradable services and much of manufacturing, to become unprofitable in the presence of a primary commodity boom. In a country with primary commodity wealth, a commodity-price boom can therefore produce deindustrialization.¹² The sectors that produce non-traded goods and services – transport, construction, retail, government – expand in response to higher demand and siphon off the economy's labor. Non-primary-commodity exports cannot compete because their prices are kept down by a strong exchange rate as commodity export revenues flow in. Manufacturing firms do not want to invest (except behind import quota barriers), because labor costs are uncompetitive when measured in dollar terms. This syndrome constitutes a disease – even as the economy booms in the short run – because the sectors that are viewed as crucial to high quality jobs and long-run productivity gains are shrinking.

A second and very different type of diversion may occur in the absence of transparent and legitimate rules for allocating commodity rents. In this situation, private and public actors may be prepared to devote otherwise productive resources to gaining a share of available rents – even though such activities reduce the economy's productive capacity compared with an allocation achieved through stable and broadly accepted rules. These negative-sum rent-seeking contests may be worse than wasteful if they create an environment of corruption, violence, and institutional deterioration.¹³ The Extractive Industries Transparency Initiative is one important response to these concerns.

¹² The argument applies to tradable activities, whether as exports or import substitutes. Williamson (2011) argues that the decreases in trade barriers and transport costs and increases in commodity trade from the early 19th century until World War I contributed to deindustrialization among developing countries as they shifted their attention and investment to commodity exports at the expense of previously developed industries.

¹³ Collier (2010).

When combined with the more favorable macroeconomic management of the boom phase in the current super-cycle – which reduced the damage to economic diversification – these arguments suggest that despite the short-run difficulties the end of the super-cycle poses for primary commodity exporters, the weakening of commodity prices creates a window of opportunity for export diversification to reduce primary commodity dependence and improve long-run growth.

Exchange rates and the balance of payments

Exchange rate movements play a key role in the macroeconomic response to large changes in the terms of trade. A commodity export boom spurs spending, which raises domestic prices relative to foreign prices (when measured in the same currency) so that spending shifts towards imports and the demand-driven increase in domestic output and employment is partially softened. Likewise, falling commodity prices tend to bring real depreciation, making domestic goods look relatively cheaper and shifting demand away from imports – thereby dampening the contraction of domestic output and employment. The IMF (2003) refers to the currencies of a number of major commodity exporters as *commodity currencies*. In a country with a commodity currency, the real exchange rate is highly procyclical with the terms of trade.

While these exchange rate adjustments help stabilize the economy in the face of commodity price fluctuations, the exchange rate linkage can become a source of acute instability in a period of falling commodity prices, as the commodity-currency effect is exacerbated by the procyclical movements in private capital flows mentioned earlier. Governments are often strongly averse to large exchange rate depreciations, which can destabilize domestic inflation, increase the burden of foreign debt, and stimulate renewed capital outflows. When the underlying balance of payments pressures are transitory, depreciation can be held in check through foreign exchange intervention (selling foreign exchange reserves) without requiring the tougher approach of raising interest rates to discourage capital outflows. But the duration of exchange rate pressures is hard to predict, and this line of defense is limited. Reserves can run out, and as long as traders expect exchange rate pressures to continue, they can create those pressures through currency speculation. Once a central bank is unable to defend

its domestic currency, dramatic swings in exchange rates and inflation rates can occur while the economy adjusts.

For commodity exporters, successful macro-economic adjustment to a potentially lengthy period of terms-of-trade weakness is likely to require modest short-run depreciation in the nominal and real exchange rate, coupled with a tightening of monetary and fiscal policies so as to avoid excessive reserve losses or debt accumulation. Capital controls may be part of an overall package designed to reduce exposure to excessive capital account volatility, but economists widely consider the renewal of controls on the current account (export surrender requirements, foreign exchange rationing for imports) a sign of poor management and an invitation to corruption and illegal activity.

Medium-term responses

For commodity exporters, the end of a super-cycle underscores the ongoing value of prudent fiscal management and the urgency of economic diversification in the medium term. On the latter, low commodity prices create an opportunity to reverse Dutch disease, as a weaker exchange rate favors the emergence of alternative export activities. And for all countries, excessive energy subsidies can be cut while international prices remain low, delivering permanent benefits in terms of both efficiency and equity.

Exploiting these opportunities may be challenging in an environment of acute revenue pressures and potentially heightened rent seeking. In the medium term, therefore, resource-rich governments should focus on domestic resource mobilization, with the goal of diversifying their sources of domestic revenue beyond royalties and resource-related taxes.

Good governance can improve a country's preparedness for and responsiveness to commodity price shocks. The Natural Resource Governance Institute (NRGI) argues that some countries are better prepared to weather commodity price super-cycles than others. In the context of price declines, Bauer and Mihalyi (2015) argue that well-prepared governments satisfy two criteria: "(1) the government is in a sustainable fiscal position in absolute terms, meaning that it has low public debt levels and/or relatively large holdings of foreign assets to withstand a prolonged commodity price slump, and (2) the government acted in a fiscally

responsible manner relative to its degree of capital scarcity in the decade(s) prior to the commodity crash, meaning that, if it was capital-rich a significant portion of resource revenues were saved, whereas if it was capital-scarce it was investing well in human and physical infrastructure." Among developing countries, they point to Bolivia, Peru, and Timor-Leste as examples of well-prepared governments while naming the Republic of the Congo, Mexico, Mongolia, South Sudan, Venezuela, and Zambia as ill-prepared countries.¹⁴ Regarding responsiveness, Arezki and Gylfason (2011) have found that democracies respond to commodity price volatility more effectively than autocracies, by increasing non-commodity growth through an increase in net national savings levels.

Conclusions

The prices of the world's most important commodities tripled from 1999 to 2008. Since 2008, commodity prices have fallen by over 50 percent, with major impacts on the economies of commodity-exporting countries. The World Bank and IMF anticipate a period of continued weakness over the next 5 years, with non-energy prices stagnating in real terms and energy prices failing to recover to their 2010 levels. Economists also expect greater volatility in commodity prices than during previous super-cycles. These trends will affect USAID countries differently depending on their resource endowments. Net commodity exporters are likely to suffer lower levels of economic growth, fiscal deterioration, and a falling trade balance, while net commodity importers enjoy higher levels of economic growth, fiscal improvement, and a rising trade balance. Resource-rich countries can respond to declines in commodity prices through a mix of policy reform, prudent macroeconomic management, and economic diversification.

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¹⁴ Bauer and Mihalyi (2015).

Appendix: methods and data

Figure 1. World Bank Indices of Real Commodity Prices

World Bank Global Economic Monitor (historical commodity prices): <http://data.worldbank.org/data-catalog/global-economic-monitor>

Figure 2. Commodity Exposure of USAID Presence Countries as a Percentage of GDP (2013)

Commodity dependency is calculated as the ratio of nominal net exports to nominal GDP in current U.S. dollars. Trade and GDP data were sourced from UNCTAD, with the exception of Cuba, Sudan, and Venezuela; nominal GDP data for those countries was derived from the World Bank.

UNCTAD (GDP and trade statistics): <http://unctad.org/en/Pages/Statistics.aspx>

World Bank World Development Indicators (GDP): <http://data.worldbank.org>

Figure 3. Commodity Price Index Forecasts

IMF (nominal price forecasts): <http://www.imf.org/external/np/res/commod/index.aspx>

World Bank (real price forecasts, October

2015): <http://pubdocs.worldbank.org/pubdocs/publicdoc/2015/10/966751445286237369/CMO-Oct-2015-Historical-Forecasts.pdf>

Figure 4. Forecasts of Real GDP Growth in Angola for 2015

Growth forecasts for Angola are derived from averaging the point estimates of real GDP growth for 2015 from the April and October releases of the World Economic Outlook from 2010 to 2014.

IMF World Economic Outlook (GDP growth): <http://www.imf.org/external/ns/cs.aspx?id=28>

World Bank (real energy prices, forecast for

2015): <http://www.worldbank.org/en/research/commodity-markets>

Table 1. Estimated Impact of Primary Commodity Prices on Real GDP

Data for column 1 are from the Penn World Tables 7.1 (1990-2010). IETOT is calculated by subtracting real GDP from real GDP adjusted for terms of trade changes, both in constant 2005 international dollars per capita, and expressing this as a percentage of real GDP per capita. In column 2, real GDP and the terms of trade adjustment to real GDP (in constant LCU, 1990-2013) are from the World Development Indicators. Both models incorporate country-level fixed effects and only include countries for which there were observations for each regression variable for a majority of the years during the regression period.

Penn World Tables (GDP and terms of trade): <http://www.rug.nl/research/ggdc/data/pwt/pwt-7.1>

World Bank World Development Indicators (GDP and terms of trade): <http://data.worldbank.org>

As a robustness check, we eliminated all observations where the deviation of either variable from its country mean was greater than 3 standard deviations. This reduced the estimated coefficients in columns 1 and 2 to 0.422*** (0.069) and 0.365*** (0.115), both significant at the 1% level. Including a full set of time dummies (in the full sample) reduced the coefficients to 0.125*** (0.047) and 0.158*** (0.051) respectively, but there is a sharp tradeoff here: the time dummies protect against unobserved time effects that may generate a misleading correlation between the variables, but in the presence of measurement error, including the time dummies biases the estimated coefficients sharply towards zero (Griliches and Hausman 1986).

Figure 5. Fiscal Impacts of Commodity Prices: Republic of the Congo

World Bank Global Economic Monitor (historical commodity prices): <http://data.worldbank.org/data-catalog/global-economic-monitor>

International Centre for Tax and Development (revenue statistics): <http://www.ictd.ac/dataset>

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