# Global Commodity Market Outlook

Following more than two years of strong growth, commodity prices peaked in early 2011 and then declined on concerns about the global macroeconomic and financial outlook and slowing demand in emerging markets, notably China (figure Comm.1). The biggest decreases were for metals but some of the largest individual declines were among agriculture raw materials (cotton and rubber), edible oils (coconut and palmkernel oil), and cocoa. Most indices ended the year much lower compared to their early-2011 peaks—agriculture down 19 percent, energy down 10 percent, and metals down 25 percent.

The recovery in prices in 2009-10 was due to strong economic growth, re-stocking in China, and a number of supply constraints. In early 2011, several disruptions, including drought and heavy rains that affected most agriculture markets as well as coal and mineral output in various locales, pushed prices to annual highs. Political unrest in North Africa and the Middle East resulted in a loss of significant oil supplies, most importantly in Libya. As markets absorbed these disruptions and supply conditions improved, prices began to come under additional downward pressure from slowing demand and uncertainty about the near-term economic and financial outlook.

Figure Comm.1 Commodity price indices

$US nominal, 2005=100
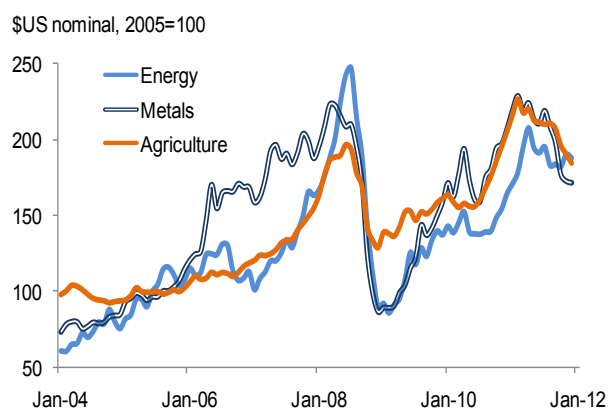
Source: World Bank.

Commodity prices are generally expected to decline from their high levels in 2012 due to a slowdown in demand and improved supply prospects—in part because high prices have led to greater investment. Crude oil prices are expected to average $98/bbl in 2012, assuming the political unrest in the Middle East is contained and Libyan crude exports return to the market. Metals prices are expected to decline by 6 percent in 2012 on moderating demand and commissioning of new supply projects—partly the result of a lengthy period of high prices. Food prices in 2012 are expected to average 11 percent lower than 2011, assuming a normal crop year and a moderation in energy prices (see table Comm.1).

There are both upside and downside risks to the forecast. Continuation of political unrest in the Middle East and North Africa could lead to further disruption of supplies and higher oil prices in the shorter term—especially given low stocks and a market short of light/sweet crude. Strong demand by China, including for re-stocking, could keep metal prices higher than projected, and a continuation of supply constraints that has plagued the industry the past decade could further aggravate markets.

Given low stock levels in some agricultural markets (especially grains), prices are still sensitive to adverse weather conditions, energy prices, and policy reactions. Moreover, the diversion of food commodities to production of biofuels (it reached almost 2 million barrels per day crude oil equivalent in 2011), makes markets tighter and more sensitive to weather and policy responses.

Downside risks entail mostly slower demand growth due to the deterioration of the debt crisis, especially if it expands to emerging countries where most of the growth in commodity demand is occurring. The downside risks apply directly to metals and energy, which are most sensitive to

Table Comm.1 Key nominal annual price indices—actual and forecasts (2005=100)

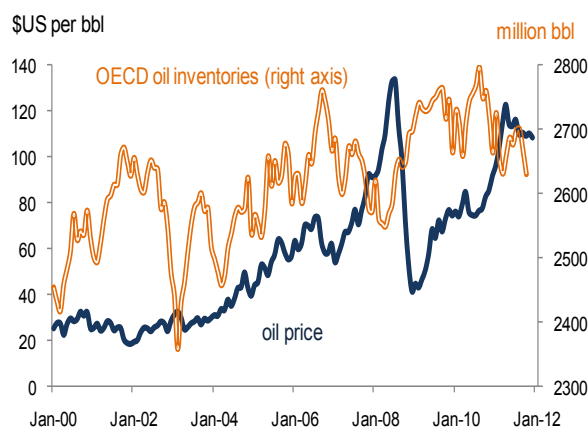|	ACTUAL						FORECAST	
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Energy	118	130	183	115	145	188	179	177
Non-Energy	125	151	182	142	174	210	190	184
Agriculture	112	135	171	149	170	209	185	175
Food	111	139	186	156	170	210	188	177
Beverages	107	124	152	157	182	208	183	165
Raw Materials	118	129	143	129	166	207	183	177
Metals & Minerals	154	186	180	120	180	205	193	196
Fertilizers	104	149	399	204	187	267	252	234
MUV	102	109	117	109	113	123	117	118

Source: World Bank

changes in industrial production, and indirectly to agriculture.

Crude Oil

Crude oil prices (World Bank average) peaked near $120/bbl in April following the loss of 1.4 mb/d of Libyan oil exports. This significantly tightened light/sweet crude markets, particularly in Europe where much of Libya's crude was sold. Disruptions of light crude production elsewhere—including other MENA countries, West Africa and the North Sea—led to a draw on inventories of both crude and products outside of North America (figure Comm.2). At OPEC's June meeting, oil ministers were reluctant to adjust production levels or even discuss how to make up for the shortfall in Libya's output.

Subsequently, IEA member governments released 60 million barrels of emergency stocks over the summer, half of which were from the U.S. Strategic Petroleum Reserve. During the fourth quarter, the World Bank average oil price averaged a little over $100/bbl due to weakening oil demand, recovery in Libyan oil production, and surplus conditions in the U.S. mid-continent that saw WTI prices diverge substantially from internationally traded crudes (box Comm.1). However, heightened geopolitical concerns surrounding Iran's nuclear program, help lift prices toward year-end—it averaged $104/bbl in December.

High oil prices and weakening economic growth impacted oil demand in 2011, with world consumption growth of just 0.7 mb/d or 0.8

Figure Comm.2 Oil prices and OECD oil stocks

Source: World Bank.

Figure Comm.3 World oil demand growth (y-y)
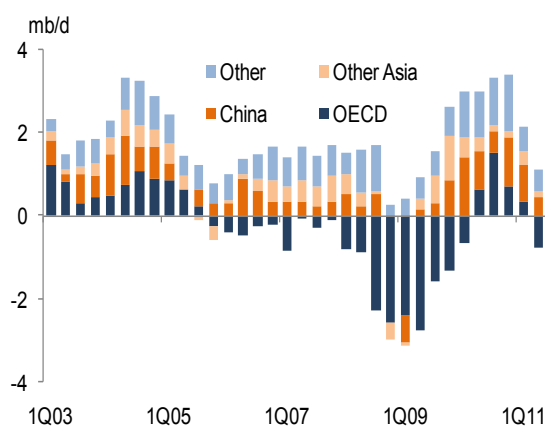
Source: World Bank.

percent—a little more than one-quarter of the large jump in 2010 (figure Comm.3). OECD oil demand declined for the fifth time in the past six years, and is on track to fall again in 2012. Non-OECD oil demand growth, of 1.2 mb/d or 3 percent, was down from a 2.2 mb/d climb in 2010. For 2012, world oil demand is projected to

rise by 1.3 mb/d or 3.6 percent, with all of the growth in emerging markets.

In the near term, light/sweet crude markets could ease with recovery of oil production in Libya. Following the fall of Tripoli in early September, Libya's national oil company and joint venture

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Box Comm.1 WTI-Brent price dislocation

In early 2011 the price of WTI (which historically traded at a small premium to Brent for quality and location reasons) fell by more than $25/bbl below Brent due to a large build-up of crude in the U.S. mid-continent near Cushing Oklahoma—the delivery point for the NYMEX WTI futures contract (box figures Comm.1.1 and Comm.1.2). Crude flows into the region have increased from the new Keystone Pipeline which brings greater volumes from Canada and from rapidly growing production of liquids-rich shale projects in North Dakota. The mid-continent also sources crude from elsewhere in the U.S. as well imports through the Gulf of Mexico. While there are plenty of options to bring crude into the region, there are few to move it out, especially to Gulf coast refineries.

Stocks at Cushing rose in 1Q2011 but then declined, in part due to higher refining runs prodded by large margins from low crude input prices. Maintenance at local refineries was also deferred to take advantage of the high margins. Producers began moving crude to the Gulf coast by rail, barge and truck, as the large WTI-Brent price spread rendered such move profitable. Other pipeline flows into Cushing also eased substantially, as producers sought higher value alternatives for their crude.

In November, the price spread narrowed significantly, following announcement of a planned reversal of the Seaway pipeline that currently ships crude from the Gulf coast to Cushing. The pipeline's prospective new owners said that they will ship 0.15 mb/d to the Gulf in 2Q2012, and raise capacity to 0.4 mb/d by early 2013. Meanwhile the U.S. government deferred a decision until 2013 on the proposed 0.6 mb/d Keystone Pipeline extension, that would transport Canadian crude to the U.S. Gulf, so owners could re-route the pipeline away from environmentally sensitive areas in Nebraska.

Therefore, WTI is expected to be trading at a sizeable discount to Brent until adequate pipeline capacity is constructed to the Gulf of Mexico, or from Alberta to the Pacific coast (expected to be operational in 2017). In addition, more storage capacity is coming online, and lower net volumes flowing into the region are likely to reduce the spread.

Meanwhile Brent crude prices have remained firm due to the tightness in light/sweet markets in the eastern hemisphere, strong demand in Asia, and low stocks. Brent became the main international marker crude in 2011, and prices averaged $111/bbl in the second half of the year. WTI, largely dislocated from international markets, averaged just $92/bbl.

Box figure Comm 1.1 Crude oil prices
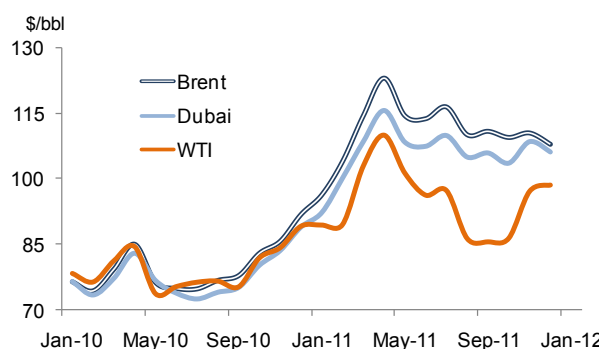
Source: World Bank.

Box figure Comm 1.2 WTI-Brent price differential
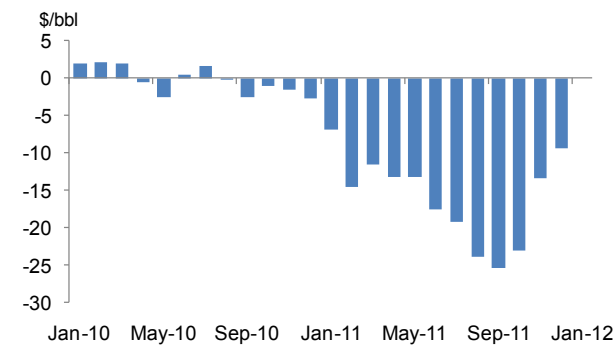
Source: World Bank.

partners moved quickly to restore output in fields that were unaffected by the fighting. Production is reported to have reached 0.9 mb/d in December – more than half of pre-crisis levels of 1.6 mb/d. The IEA expects that production will fully recover by 2014.

Non-OPEC supply developments (figure Comm.4) continue to perform above expectations due to double digit investment growth and less-tight conditions for rigs, equipment and services. These are bearing results, not only with new project developments but also by slowing the decline rates in mature OECD areas, such as the U.S. and North Sea. Last year saw a number of unplanned outages and heavier-than-expected maintenance in the North Sea that kept non-OPEC production growth fairly modest. However non-OPEC output (which accounts for 60 percent total world oil supplies) is expected to increase by 1 mb/d in 2012, according to the IEA, and satisfy much of the growth in global oil demand. The return of Libya's oil production may necessitate accommodation by other OPEC members to keep prices from falling significantly. This would in turn raise OPEC's spare capacity, at a time when most OPEC countries are also investing in new capacity. Iraq's production has risen above 2.7 mb/d, due to increased output from new joint venture projects, and oil exports have also reached new highs. Iraq's oil output is expected to reach nearly 3.2 mb/d in 2012.

In the medium term, world oil demand is expected to grow only moderately, about 1.5 percent p.a., owing to slower global GDP growth coupled with efficiency improvements in transport and ongoing efforts by governments and industry to reduce carbon emissions, particularly in high-income countries. As in the past, all of the consumption growth is expected to be in emerging markets (figure Comm.5), with modest declines in OECD countries—largely due to expected efficiency improvements.

On the supply side, non-OPEC countries are expected to continue to rise moderately their oil supply, in part due to high prices, but also continued technological advances that have brought forth new supplies from shale deposits and deepwater offshore. Production increases are expected from a number of areas, such as Brazil, Canada, the Caspian and West Africa. These will be offset by declines in from older fields, especially in the North Sea and Mexico. Globally there are no resource constraints into the distant future. Impediments are mainly policy issues, such as access to resources and suitable fiscal terms and conditions for investment.
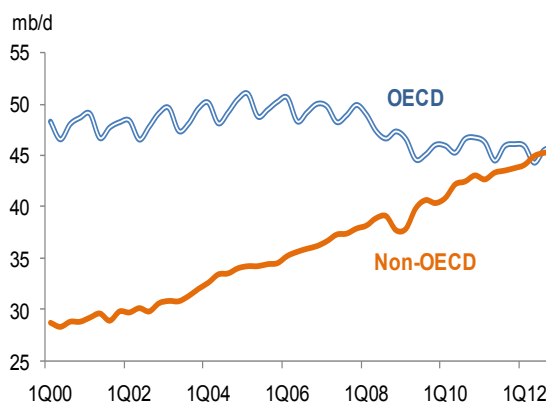
Oil prices (World Bank average) are expected to decline from $104/bbl in 2011 to an estimated $98/bbl in 2012 and fall over the forecast period due to slowing global demand, growing supply, efficiency improvements, and substitution away

Figure Comm.4 World oil production
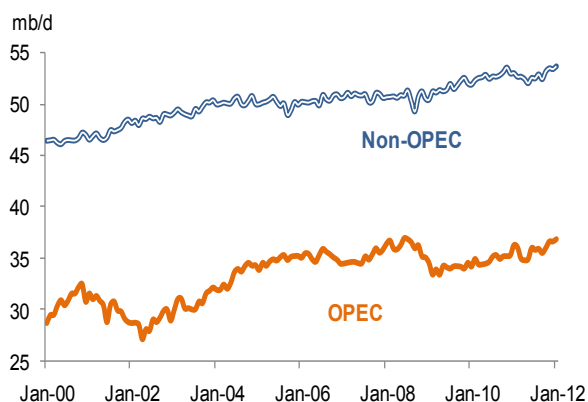
Source: IEA

Figure Comm.5 World oil consumption

Source: IEA

from oil. The long-term oil prices that underpin these projections are based on the upper end cost of developing additional oil capacity, notably from oil sands in Canada, assessed at $80/bbl in constant 2011 dollars. It is expected that OPEC will endeavor to limit production to keep prices relatively high, given the large expenditure needs in most countries. However, the organization will also be wary of letting prices rise too high, having witnessed the impact this has had on demand in recent years, especially in OECD countries.

Metals

Metals prices fell from their highs in early 2011 due to concerns about global growth emanating from the debt crises and policy slowing in China. Prices were strengthening up to the first quarter of 2011 on strong demand in China (including earlier re-stocking), lower stocks, production cutbacks and various supply disruptions. However, China moved into de-stocking mode and stocks outside China began to rise. China's metal imports in the first half of 2011 fell sharply, but started to pick up in the second half, especially for copper. World metals consumption, which grew at 11 percent in 2010, slowed to 4 percent in the first 10 months of 2011, with growth slowing sharply in all main regions (world metals consumption grew 3.8 percent during 2000-10.) For China, however, the data only show apparent demand and do not include stock changes, indicating that underlying consumption may have been higher. Prices were also supported by numerous supply constraints, notably for copper. The aluminum market, which is in surplus, had a substantial portion of stocks tied up in warehouse financing deals and unavailable to the market.

All metals prices are well off their highs in early 2011 (figure Comm.6). Nickel prices have declined more than one-third because of slowing demand by the stainless steel sector and expectations of large new nickel production capacity additions in 2012 and beyond. Copper prices dropped one-quarter third, but still remain above the costs of production due to supply tightness at the mine level. Aluminum prices

have declined less than one-quarter and have fallen into the upper end of the cost curve. Metals prices are expected to rebound from their lows in the near term on re-stocking in China, but are not expected to reach earlier highs because of moderating demand growth and expected supply increases for all metals (see box Comm.2 for the role of China in metal demand).

Prices are projected to decline into the medium term for all metals with the exception of aluminum, which is expected to rise, supported by higher costs for power and other inputs. Although there are no resource constraints into the distant future for any of the metals, over the longer term a number of factors could result in upward pressure on prices such as declining ore grades, environmental and land rehabilitation, as well as rising water, energy and labor costs.

Copper prices fell from over $10,000/ton in February to $7,500/ton during 4Q2011 on high stocks and slowing demand. Copper consumption growth in the first ten months of 2011 fell slightly from an 11 percent gain in 2010. China's apparent demand (excluding stock changes) slowed sharply from 2010, but given likely de-stocking, actual consumption was probably higher (China's copper imports picked up in the second half of the year suggesting an end to inventory withdrawal). In the OECD, strong demand growth at the start of the year turned sharply negative, and growth elsewhere also turned slightly negative. High prices in

Figure Comm.6 Refined metal prices ($/ton)
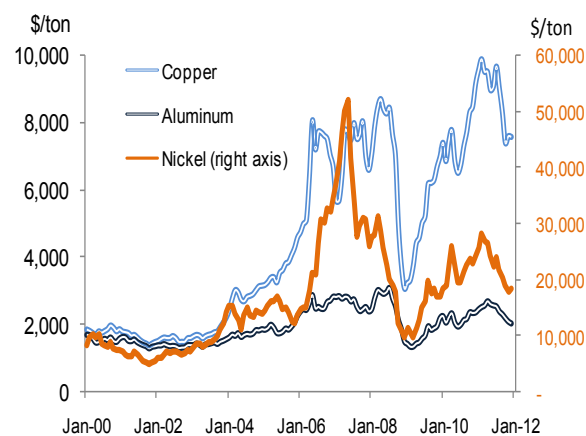
Source: World Bank.

recent years have taken their toll on consumption, as users substituted copper with other materials, such as aluminum and plastics, and lowered the copper content in applications. Copper prices have remained well above the costs of production because of continued problems at the mine supply level, including

slower than expected ramp-up at new mines, technical problems at existing operations, declining ore grades, strikes, accidents and adverse weather. Many of these incidents have occurred in Chile, which supplies 35 percent of the world's mined copper. However, growth in new capacity globally is underway with


Box Comm.2 Metals consumption in China and India

India, with its large population, is often cited as the "next China" in terms of consumption of commodities. Since 1990, China's refined metal consumption (aluminum, copper, lead, nickel, tin and zinc) jumped 17-fold, and its share of world refined metal consumption grew from 5 percent to 41 percent (box figure Comm.2.1). Its average rate of growth since 2000 was 15 percent p.a., while demand in the rest of the world was essentially unchanged. Unquestionably, China has been the major driver of metals demand and higher prices, as the country consumed large quantities of metals (and other primary resources) for construction, infrastructure, and manufacturing to significantly raise its level of income. Consider, for example, that China's metal intensity (metal use per $1,000 of real GDP) was almost three times higher than the rest of the world back in 1990 and it reached almost 9 times in 2008 (box figure Comm 2.2).

It is expected that metals demand will slow over the next decade as economic growth slows and the country transitions from an export-led and investment-driven economy to a domestic consumption and services economy, and seeks to improve the environment and air quality. Still metals demand will remain robust due to urbanization (more high-rise construction), infrastructure needs, and moving up the value chain in manufacturing—all are resource intensive.

India's share of world metals consumption has risen from 2 percent in 1990 to only 3 percent currently due to the very different structure of the economy, levels and direction of investment, sector growth trends, trade and policies. Moreover, its pace of metal demand growth has been only half that of China, and much closer to the pace of economic growth. Should India's refined metal consumption grow at 15 percent p.a., it would take nearly two decades to overtake China's current level consumption. Should that occur, it would present substantial challenges to the metals industry to supply these resources, similar or greater to the challenges the industry has faced the past decade. One possible impact is for even higher prices and pressures on the downstream sectors to innovate and substitute away from high-priced materials. India has ambitious plans for growth and has unveiled a significant power generation program. Thus, a key question is what other policy and structural changes would need to take place to have India's metal consumption growth double for the next twenty years.

Box figure Comm 2.1 Refined metal consumption
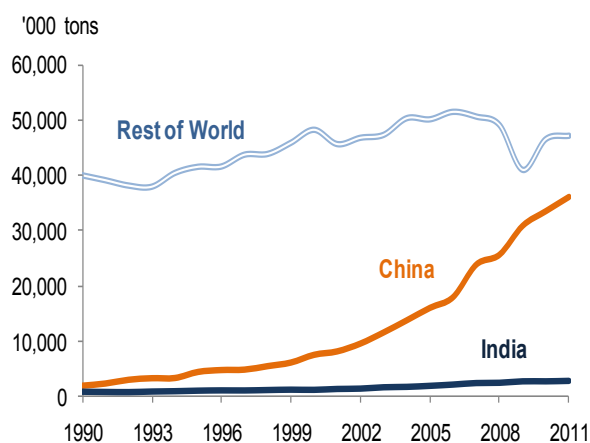
Box figure Comm 2.2 Metal consumption intensity
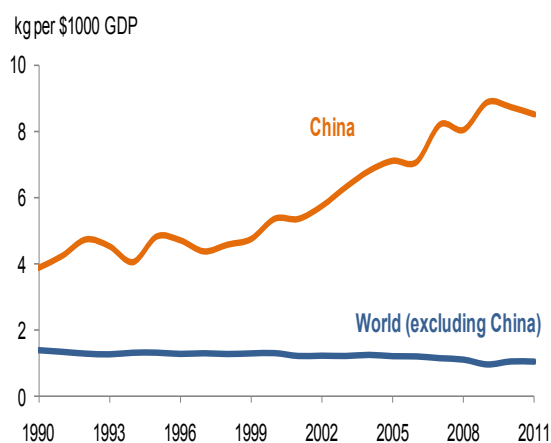
Source: World Bank.

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numerous medium-sized projects expected online beginning in 2012, as well as the massive Oyu Tolgoi project in Mongolia which will add significant growth in 2013-14. Copper prices are expected to rebound from the recent drop as economic growth recovers and China re-stocks. Over the medium term, however, copper prices are expected to decline as demand moderates and new capacity pushes the market into modest surplus.

Aluminum prices, which traded close to copper back in 2000, languished the past decade despite demand growth twice as high copper. The main reason was China which expanded production capacity substantially and exported surplus aluminum to the global market—unlike for copper and other resources in which it is a significant importer. Robust aluminum demand is expected to continue, in part because of its lower relative price which helps it penetrate other markets such as copper, but mainly because of its light-weight, durable characteristics and multiple uses (in transport, construction, packaging and electrical). There are no resource constraints given the abundance of bauxite ore in the earth's crust. However, the recent price decline has fallen into the smelting industry's cost curve, where around 30 percent of the world's producers lose money on a cash-cost basis, much of it China at plants that use outdated technologies. A strengthening renminbi will accelerate closure of this capacity which will be replaced with lower-cost and more efficient facilities. The construction of new capacity will generally be directed to locations with lower power cost advantages, such as the Middle East (power accounts for about 40 percent of aluminum's production cost). Most of the world's new state of the art capacity will be added in China, but large plants are also planned in India and Russia. Aluminum prices are expected to increase over the forecast period driven by higher production costs for power, carbon, and alumina.

Nickel prices are down substantially from their 2007 highs, but remain volatile due to large stainless steel production cycles and stocking/destocking in China. Nickel prices recovered

from their 2009 lows due to large growth in world stainless steel production in 2010 of nearly 25 percent, driven by China but there was also strong growth in Europe and Japan. Growth slowed to around 5 percent in 2011 on slowing output in China and in industrial countries. (About 70 percent of global nickel supply is used in the production of stainless steel.) Nickel prices came under pressure in 2011, despite falling inventories and positive demand gains, because of the expected surge in new nickel projects—the largest being in Brazil, Madagascar, New Caledonia, Papua New Guinea, but increases also expected in Australia, Canada and elsewhere. The new capacity from these and other projects will include traditional nickel sulphides, ferro-nickel and laterite high pressure acid leach (HPAL) projects, and Chinese nickel pig iron (NPI) producers. HPAL projects have had considerable technical problems and delays in recent years but are now scheduled to begin operation. The Chinese NPI industry developed as a result of the nickel price boom in the mid-2000s, with the import of nickel laterite ores from Indonesia and the Philippines. However, Indonesia has proposed developing its own NPI industry and is considering banning nickel ore exports from 2014, which could reduce China's output. NPI production is relatively expensive and may serve a longer-term cost-floor to prices. Nickel prices are expected to decline over the forecast period due to the substantial supply additions in the coming years, and are likely to reflect production costs in the medium term.
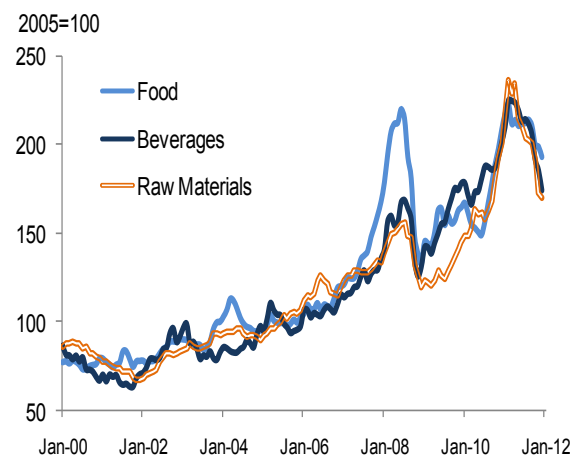
Agriculture

After reaching a peak in early 2011, prices for most agricultural commodities moderated with the index ending the year 19 percent below its February high (figure Comm.7); food prices declined 14 percent. Yet, average agricultural prices (including food) were up 23 percent in 2011, and in real terms averaged the highest level since the aftermath of the 1970s oil crisis (figure Comm.8). Most of the drivers of the post-2005 price increases are still in place (table Comm.2). Energy and fertilizer prices (key inputs to agricultural commodities) are still high,

production of biofuels (currently accounting for the equivalent of 2.2 percent of global crude oil demand) is still growing, the US$ remains weak by historical standards, while most grain markets are experiencing low level of stocks. On the other hand, investment fund activity is set to reach another record level—an estimated US$ 450 billion as of Q4:2011 have been invested in commodities (figure Comm.9). Though not expected to affect long term trends, such activity may induce higher price variability.

Following a brief period of relative stability during 2009, **grain prices** (especially maize and wheat), began rising in the summer of 2010 following weather-induced production shortfalls in Eastern Europe and Central Asia (figure Comm.10). From June to December 2010, wheat prices increased by almost 120 percent, exceeding $300/ton and having since remained above that mark. Maize prices followed a similar pattern, increasing from $152/ton in June 2010 to $320/ton in April 2011, fluctuating around $300/ton since then.
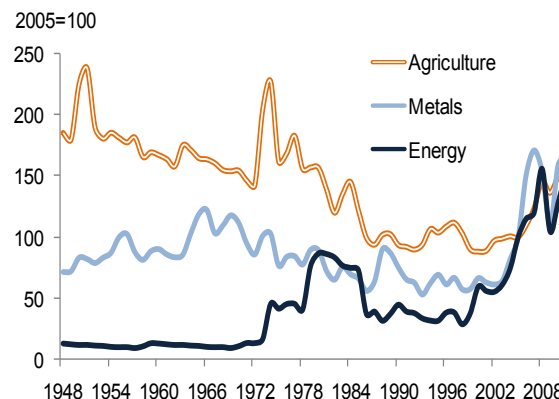
While maize and wheat markets are tight by historical standards, the **rice** market appears to be well-supplied. For most of 2010, rice prices fluctuated within a narrow band of $450 to $500 per ton, far below the early-2008 peak of $900 per ton, but twice as much as its historical average. However, they gained momentum and
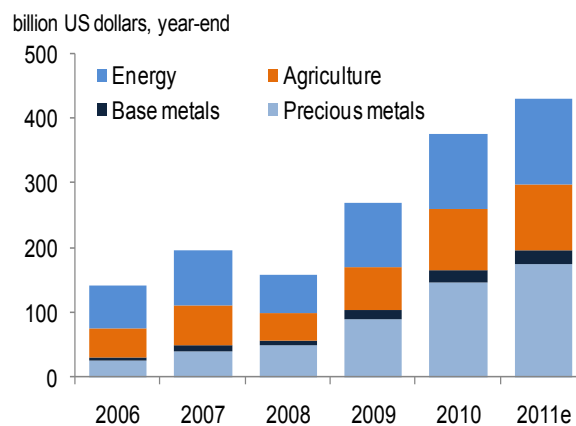
Figure Comm.8 Real price indices (MUV-deflated)

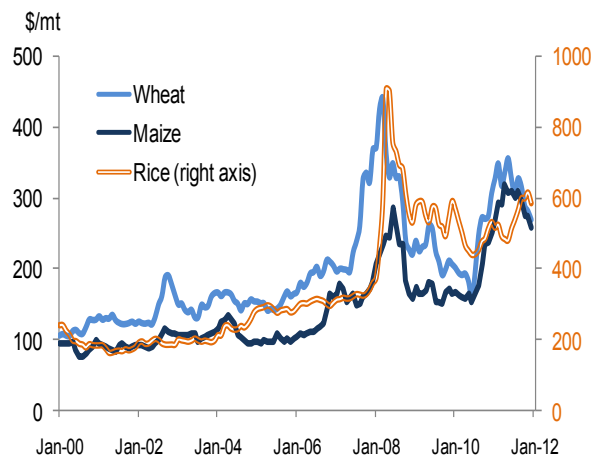

Source: World Bank.

Figure Comm.9 Funds invested in commodities

Source: Bloomberg, Barclays Capital.

Figure Comm.7 Nominal agriculture price indices

Source: World Bank.

Figure Comm.10 Grains prices

Source: World Bank.

Table Comm.2 Most of the price-boom conditions are still in place

	2001-05	2006-10	Change
Agricultural prices (nominal index, 2005 = 100)	**89**	**147**	**+66%**
Grain/oilseed price volatility (stdev of log differences, monthly)	**2.3**	**3.5**	**+52%**
Crude oil price (US$/barrel, nominal)	34	75	+120%
Fertilizer prices (nominal index 2005 = 100)	72	208	+172%
Exchange rates (US$ against a broad index of currencies)	119	104	-13%
Interest rates (10-year US Treasury bill)	4.7	4.1	-14%
Funds invested in commodities ($ billions)	30	230	+667%
GDP growth (low and middle income countries, % p.a.)	5.0	5.8	+16%
Industrial production (low and middle income countries, % p.a.)	6.3	7.1	+13%
Stocks (total of maize, wheat, and rice, months of consumption)	3.2	2.5	-21%
Biofuel production (millions of barrels per day equivalent)	0.4	1.3	+203%
Yields (average of wheat, maize, and rice, tons/hectare)	3.8	4.0	+7%
Growth in yields (% change per annum, average)	1.4	1.0	-32%
Natural disasters (droughts, floods, and extreme temperatures)	374	441	+18%

Source: World Bank.

increased almost 30 percent between May and November 2011, mainly in response to two problems. First, the decision by the Thai government to sharply increase the intervention price to 15,000 baht/ton under the Paddy Rice Program. At the time of the announcement, this new intervention price was 65% higher than market price. Under the program, growers and millers become eligible for a government loan (based on the intervention price) if they place their rice as collateral, stored at a government–certified facility. If, after the expiration of the loan, the market price is higher than the intervention price, the millers sell the rice and repay the loan. Otherwise, the millers can chose to default and the rice becomes property of the government. After the higher intervention price was announced, growers and millers began holding supplies of current off-season-crop paddy in order to participate in the program. Yet, the program is expected to have only limited long term impact as the stored rice will eventually find its way into the market. Second, on the weather front, some flooding in South East Asia appears to have damaged part of Thailand's rice crop. Because Thailand accounts for 25 to 30 percent of word rice exports, the policy and weather developments may affect the world market. On the positive side, India's decision to allow the export of non-Basmati rice

along with good crop prospects elsewhere in the region, are likely to keep rice prices in check. Indeed, rice prices declined 5 percent in December 2011.

Edible oil prices were relatively stable and slightly declining during 2011; the World Bank edible oils index averaged 246 (2005 = 100) in January 2011 and ended the year below 200. A weather-induced shortfall of soybean oil earlier in the year was balanced by better palm oil production—these two oils account for almost two thirds of global edible oil production. The diversion of oils for biodiesel production in Europe appears to be the largest demand-driven factor and is likely to support high prices in the near and medium term. Unlike grains, where demand tends to be relatively stable above a certain income threshold, per capita demand for edible oils continues to rise even in high income countries, as a rising share of food consumed is prepared in professional establishments and in packaged form, both oil consuming processes (the income elasticity of edible oils is twice as high as that of grains).

Beverage prices averaged the year 14 percent higher than 2010, supported primarily by *coffee (arabica)* prices. During 2011 arabica prices averaged close to $6.00/kg, their highest nominal

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level. The rally reflected tight supply conditions, especially from Brazil, the world's dominant arabica supplier. *Cocoa* price increases earlier in the year reflected political instability in Côte d'Ivoire but supplies have recovered more recently, which combined with weak demand in Europe due to the crisis induced price declines towards year's end—Côte d'Ivoire accounts for almost 40 percent of global supplies. The strength in *tea* prices reflects mainly East Africa supply shortages and strong demand, especially of high quality teas by Middle Eastern oil exporting countries.

The *cotton market* experienced tight supplies earlier in the year as well, further exacerbated by an export ban imposed by India to protect its domestic textile industry. The shortfall, coupled with strong demand and low stocks, boosted prices above $5.00/kg in March 2011, effectively doubling within six months. That price level, however, turned out to be unsustainable and by August 2011 cotton prices were down to $2.50/kg on strong supplies and weakening demand. *Natural rubber* prices reached historic highs earlier due to weather-related supply disruptions in South-East Asia rubber producing countries (accounting for 90 percent of global production). However, following weakness in crude oil prices (a key input to competing synthetic rubber) and weaker tire demand due to the economic downturn, rubber prices moderated and ended the year 46 percent below their February 2011 peak. *Timber* prices surged, especially Malaysian logs and to a lesser degree Cameroonian logs and Malaysian sawnwood. Strong demand following the Tohoku disaster in March 2011 contributed to the strength of timber prices.

Fertilizer prices averaged 43 percent higher in 2011 than 2010 on strong demand for agricultural (especially grain and oilseed) production. Fertilizers are a key input to most agricultural commodities (especially grains) in value terms and, due to their tight relationship to natural gas prices, they tend to co-move with energy prices very closely—energy prices gained 25 percent in 2011.

Outlook

As supply conditions improve, agricultural prices are expected to decline 11 percent in 2012. Specifically, for 2012, wheat and maize prices are expected to average 9 and 12 percent lower than their 2011 levels while rice prices are anticipated to decline 6 percent. Soybean and palm oil prices are expected to be 16 and 20 percent lower, respectively. Beverage prices will experience declines as well (cocoa, coffee, and tea 11, 17, and 4 percent down, respectively). Cotton and rubber prices are expected to decline 30 percent, each.

A number of assumptions underpin the outlook. First, is that energy and fertilizer prices are projected to experience moderate declines. Second, it is assumed that the supply outlook during the 2011/12 crop year will improve. Third, no policy responses similar to the ones during 2008 will take place; if they do, they could always upset markets—the changes in rice policy in Thailand introduced in September 2012 is a case in point. On the other hand, the diversion of food commodities to the production of biofuels continues reached the equivalent of almost 2 million barrels per day of crude oil in 2011 (figure Comm.11). Nevertheless, there are signs of a slowdown in global biofuel production: preliminary estimates for 2011 indicate that it grew only marginally compared to the double digit growth rates during the past 10 years. The policy environment for biofuels begins to change as well. The US government let

Figure Comm.11 Biofuels production


mb/d equivalent
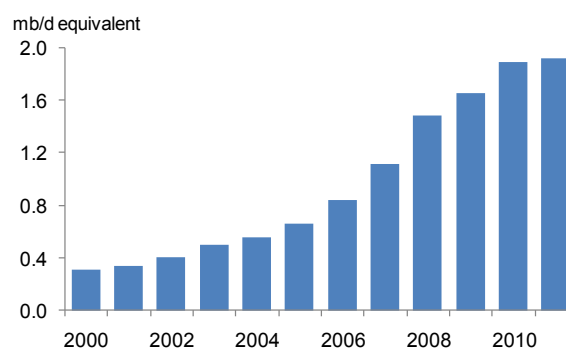
Source: BP Statistical Review

its ethanol tax credit expire as of January 1st 2012 and eliminated ethanol tariffs. Yet, these policy changes are expected to have only a minimal impact on ethanol production in the US (and biofuel related corn production), since mandates requiring minimum amounts of gasoline to be supplied through biofuels are still in place. Moreover, with crude oil prices over $100 per barrel most biofuel production is likely to be profitable without any government intervention. Thus, the role of energy prices in determining agricultural prices (both as a cost component and diversion to biofuels) is expected to remain important.

The USDA during its first assessment for the 2011/12 crop year (published in early May) projected that global food supply conditions will improve with production of maize expected to rise 6.4 percent over the previous crop year, wheat output higher by 3.3 percent, and rice by 1.4 percent. Maize stocks were expected to increase by 13 percent, while stocks for wheat were set to decline by 3 percent (no change was expected in rice stocks). During USDA's subsequent monthly assessments from June 2011 to January 2012, the outlook has been improving gradually, except for the large downward revision of maize stocks in June (figure Comm.12).

While low stocks and poor crops have been the key factors underpinning the early 2011 price hikes, most of the post-2005 increase in agricultural prices can be explained by energy price increases. Energy is a particularly important determinant of agricultural prices and hence an important risk to agricultural prices. Energy feeds into food prices through three main channels. First, as a cost of production (mainly fuel to run agricultural machinery and transporting commodities to markets), second, indirectly through fertilizer and other chemical costs (e.g., nitrogen-based fertilizers are made directly from natural gas), and third, via competition from land to produce biofuels. Indeed, econometric evidence (presented below) ranks energy as the most important driver affecting prices of food commodities, followed

Figure Comm.12 Monthly updates on global pro- duction and stock estimates for 2011/12

Maize

million tons

Wheat

million tons

Rice

million tons
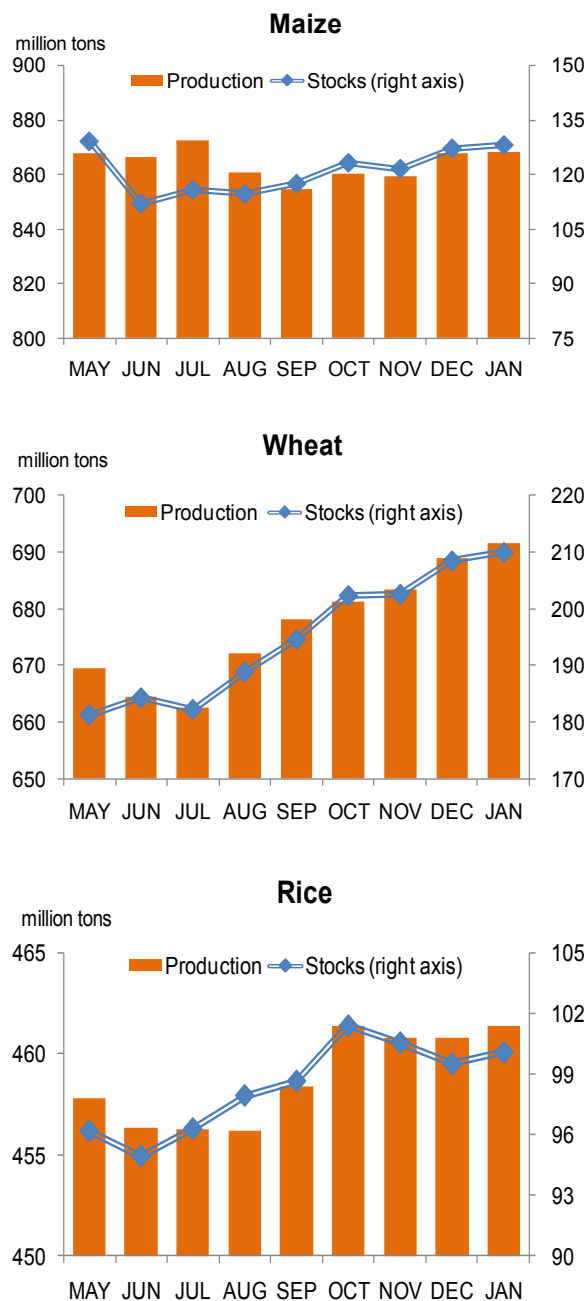
Source: USDA

by stocks and exchange rate movements. Other drivers matter much less.

Fundamentals and long term food price movements

To examine the role of fundamentals in determining food prices, a reduced-form econometric model was utilized and concluded that oil prices contributed about two third to the price increase of key food commodities between 2000-05 and 2006-10. Exchange rate movements accounted for 23 percent while stocks were responsible for 8 percent.

Specifically, the following price determination model was utilized:

$$log(P_t^i) = \mu + \beta_1 log(S/U_{t-1}) + \beta_2 log(P_t^{OIL}) + \beta_3 log(XR_t) + \beta_4 log(R_t) + \beta_5 log(GDP_t) + \beta_6 log(MUV_t) + \beta_7 t + \varepsilon_t.$$

P_t^i denotes the annual average nominal price of commodity i (i = maize, wheat, rice, soybeans, and palm oil). S/U_{t-1} denotes the lagged stock-to-use ratio, P_t^{OIL} is the price of oil, XR_t is the exchange rate, R_t denotes the interest rate, MUV_t is a measure of inflation, GDP_t denotes global GDP, and t is time trend. The β_is are parameters to be estimated while ε_t is the error term.

The interpretation and signs of most parameters are straightforward. The stock-to-use ratio is expected to be negative, since a low S/U ratio (associated with scarcity) leads to high prices while a high S/U ratio (associated with surpluses) leads to low prices (Wright 2011). To circumvent endogeneity, the S/U ratio entered the regression in lagged form. The price of crude oil will have a positive impact on the prices of food commodities, since it is a key factor of production (Baffes 2007). The depreciation of the US dollar—the currency of choice for most international commodity transactions—strengthens demand (limits supply) from non-US$ commodity consumers (producers) thus increasing prices (Radetzki 1985). An increase of the interest rate reduces commodity prices by (i) increasing the required rate of return on storage, (ii) changing expectations about aggregate economic activity, and (iii) stimulating demand; but, it can raise prices by reducing capital investment thereby reducing supplies (Pindyck and Rotemberg 1990). Thus, the effect of interest rate changes on commodity price is ambiguous. Because of the long time period under consideration, the Manufacture Unit Value (MUV) is used as an inflation proxy.

Table Comm.3 Parameter estimates: 1960-2010

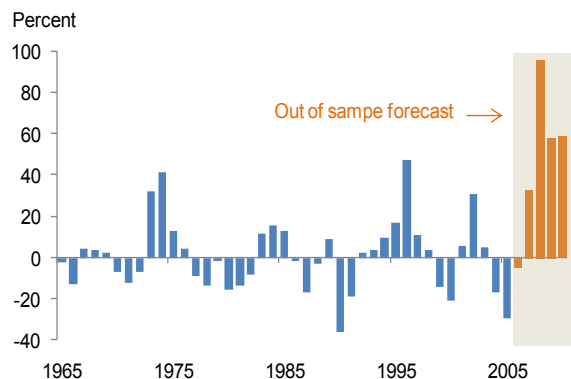|	Maize	Wheat	Rice	Soybeans	Palm oil
Constant (μ)	1.29 (1.57)	3.17*** (5.13)	6.41*** (3.33)	4.46*** (7.91)	4.25*** (3.01)
Stock-to-Use ratio (S/U_{t-1})	-0.45*** (4.67)	-0.53*** (3.78)	-0.08 (0.38)	-0.17** (2.31)	-0.38** (2.04)
Oil price (P_t^{OIL})	0.19*** (4.05)	0.24*** (5.18)	0.25** (2.55)	0.31*** (6.41)	0.45*** (5.26)
Exchange rate (XR_t)	0.02 (0.04)	-0.81** (2.21)	-2.83*** (4.50)	-1.31*** (3.65)	-1.09* (1.74)
Interest rate (R_t)	-0.05 (0.60)	0.05 (0.63)	0.34*** (2.75)	-0.06 (0.64)	-0.04 (0.27)
Global GDP (GDP_t)	-0.01 (0.32)	-0.01 (0.28)	-0.05** (2.56)	0.01 (0.66)	0.01 (0.31)
Inflation (MUV_t)	0.64*** (2.70)	0.08 (0.42)	-0.62 (1.32)	-0.01 (0.05)	0.04 (0.10)
Trend x 100 (t)	-1.76*** (3.07)	-0.65 (1.31)	-0.76 (0.99)	-1.14* (1.78)	-2.17** (2.02)
Adjusted-R^2	0.87	0.91	0.76	0.84	0.62
DW	1.03	1.10	1.03	1.27	1.24
ADF	-3.90***	-5.52***	-3.96***	-4.68***	-4.43***

Note: The numbers in parentheses denote absolute t-ratios. DW is the Durbin-Watson statistic of serial correlation and ADF denotes the Augmented Dickey-Fuller statistic for unit roots (Dickey and Fuller 1979). Asterisks indicate parameter estimates different from zero at the 1% (***), 5% (**) and 10% (*) levels of significance, respectively.

Source: Baffes (2011).

Furthermore, instead of deflating each price series, we used the deflator as an explanatory variable in order to relax the homogeneity restriction and obtain a direct estimate the effect of inflation (Houthakker 1975). Lastly, the time trend is expected to capture the effects of technological change, which for most agricultural commodity prices is expected to be negative.

Table Comm.3 reports parameter estimates for the 1960-2010 period for five food commodities. More than half of the parameter estimates are significantly different from zero, with an average adjusted-R^2 of 0.80 and a stationary error term (implying cointegration), confirming that the model performed well. A number of interesting results emerge from the analysis. First, the S/U ratio estimates are negative and all but one case significantly different from zero. Second, the parameter estimate of the oil price confirms that energy plays a key role in food price movements. In fact, the parameter estimate of the oil price is highly significant in all five cases. Third, with the exception of maize, exchange rate has a strong impact on food prices with the respective elasticity exceeding unity in three cases—the estimate of the exchange for maize (effectively zero) and rice (the highest among the 5 prices) most likely reflects that fact that the US is a dominant player in the global maize market but not a player in the rice market. Interest rate movements do not matter, except for rice. Income has no impact in all prices but rice

(albeit negative). This result indicates that, despite what has been reported in the literature, increases of global GDP are not associated with food prices increases (similar results have been reported elsewhere, e.g. Ai, Chatrath and Song 2006). Indeed, per capita grain consumption in India and China has declined or flattened (these two countries are often mentioned as having contributed to food price increases because of their changing diets and high incomes). Price of manufactures (proxy for inflation) turned out not to be significant (with the exception in maize). Lastly, the parameter estimate of the time trend is negative as expected, but significantly different from zero in maize, wheat, and palm oil (not rice and soybeans). Estimates place the effect of technical change on prices to about 1 percent per annum, very close to the average 1.3 percent estimated here.

What portion of the post-2005 food price movements is explained by the fundamentals? The model was re-estimated by excluding the boom period (i.e., reduced the sample to 1960-2005). Then, based on these estimates, price levels of all five commodities were simulated for the post-2005 period. During the boom years of 2008-10, in all 5 commodities actual prices were much higher than the forecast prices—ranging from 35 percent (wheat in 2009) and 130 percent (rice in 2009). During 2008-10, prices were 70 percent higher than what the model forecasts. It is worth noting that since 1965, the highest model-generated gaps were in 1974 (+37

Figure Comm.13 Gap between actual and model-generated prices: wheat, 1965-2005

Figure Comm.14 Gap between actual and model-generated prices: wheat, 1965-2010
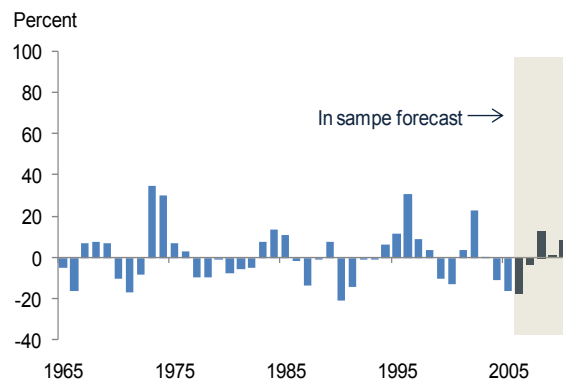
Source: Baffes (2011).

Source: Baffes (2011).

Table Comm.4 Decomposing the contribution of each variable to food price changes from 2000-20 to 2006-10 (percent)

	Maize	Wheat	Rice	Soybeans	Palm oil
Stock-to-Use ratio (S/U_{t-1})	12.0	14.4	0.9	-2.4	1.3
Oil price (P_t^{OIL})	32.6	41.4	27.2	57.0	58.2
Exchange rate (XR_t)	-0.1	11.5	25.4	19.9	11.9
Interest rate (R_t)	0.5	-0.5	-2.0	0.6	0.3
Global GDP (GDP_t)	0.4	0.4	1.2	-0.4	-0.3
Inflation (MUV_t)	13.6	1.7	-8.4	-0.2	0.7
Time trend	-0.3	-0.1	-0.1	-0.2	-0.3
SUM	58.7	68.8	44.2	74.3	71.8
Residual	41.3	31.2	55.8	25.7	28.2
All	100.0	100.0	100.0	100.0	100.0

Note: The contribution was based on the 1960-2010 model parameter estimates
Source: Baffes (2011).

percent) and 1990 (-20 percent). Figure Comm.13 depicts the out-of-sample forecast for the price of wheat. Based on the parameter estimates of the full sample model, fitted prices were calculated. The gap during 2008-10 was eliminated, implying that the addition of just 5 observations (the boom years) eliminates the model-generated error (figure Comm.14).

Finally, using the parameter estimates of the model, the relative contribution of each explanatory variable to price changes for the 2000-05 to 2006-10 was calculated (table Comm.4). The unexplained portion of the price changes during this period was 36 percent. Of the remaining 64 percent, oil's contribution was more than two thirds, followed by exchange rate movements (23 percent) and stocks (8 percent). The contribution of the remaining variables was negligible. Two key conclusions are reached. First, econometric evidence confirms that fundamentals explain most of the food price variation, including the 2005-10 boom years. Second, oil prices matter the most while from the macro perspective exchange rates movements matter as well; interest rates and income growth do not seem to have a long term impact on food prices.

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