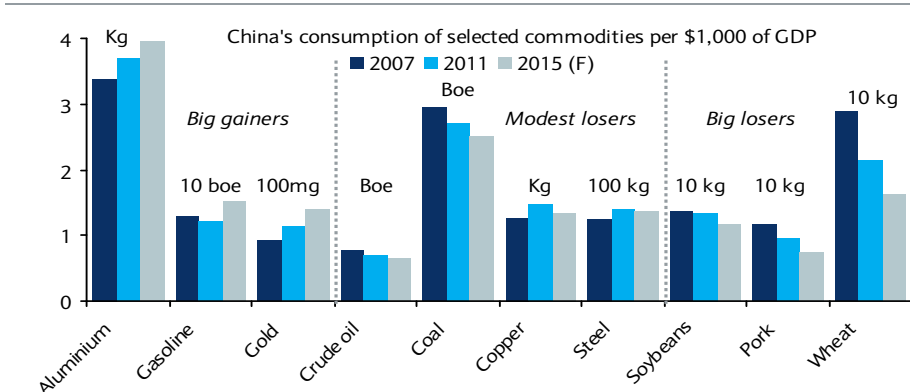


## CHINA'S COMMODITY INTENSITY

### The Dragon's appetite is changing

- China's goal of slower GDP growth, driven less by investment and more by consumption, has major implications for future commodity demand, and big shifts are likely to occur in the economy's intensity of use of different commodities.
- The winners from this transformation will be those commodities with strong linkages to rising living standards and changing tastes, or to the industrial sectors that will outperform such as autos, renewable energy or power investment.
- With their intensity of use rising, growth rates will increase especially fast for gasoline and palladium (used in vehicle autocatalysts). The use of nuclear, wind and solar energy will also accelerate rapidly; gold will benefit strongly from both rising investment and jewellery demand; and in agricultural commodities, coffee will see its growth rate accelerate very fast as urban dwellers drink more.
- In contrast, intensity of use is declining for some industrial metals, with steel, copper and zinc (the metals most leveraged to slower construction and fixed asset investment growth) the worst affected. Demand will continue to expand for these metals, but at much slower rates both in percentage terms and in annual average growth rates expressed in quantities.
- Other industrial metals are set to benefit from rising intensity of use, however, especially aluminium, due to its linkage to autos and power infrastructure, and nickel, which will gain from the increased use of stainless steel.
- Agricultural commodities are amongst the biggest losers, reflecting the fact that China's food consumption is already on a par with more developed Asian nations, both in terms of total calorie intake and consumption of protein and fats.

Figure 1: Winners and losers from China's changing commodity appetite



Note: Different units have been used (as labelled), in order to scale different commodities on the same vertical axis.  
Source: Barclays Research

#### Commodities Research

Kevin Norrish  
+44 (0)20 7773 0369  
kevin.norrish@barcap.com

Roxana Mohammadian Molina  
+44 (0)20 7773 2117  
roxana.mohammadian-molina@barcap.com

#### Emerging Markets Research

Yiping Huang  
+852 2903 3291  
yiping.huang@barcap.com

Lingxiu Yang  
+852 2903 2653  
lingxiu.yang@barcap.com

www.barcap.com

*The evolution of China's economy has big implications for commodities*

## Summary: The Dragon's changing appetite

Commodity investors, producers and consumers are concerned that the phase of most rapid demand growth for commodities in China, which so far this century has been the main driving force for many commodities markets, is nearing an end. For the current five-year plan (2011-15), China's government is targeting both a reduction in average GDP growth and a change in its composition, moving towards a less investment-intensive, more consumption-orientated growth model. In addition, there are targets aimed explicitly at continuing to reduce the usage intensity of many commodities, especially energy, as well as reducing pollution and carbon emissions.

Despite these potential negatives for commodity demand, there are three key offsets that are likely to be very positive for demand over the next five years:

- **Huge improvements are scheduled in China's metals intensive power transmission network**, with spending on the grid planned in the current FYP to be almost double the previous five years and including the construction of an ultra-high-voltage AC transmission system and a smart grid.
- **Urbanisation is expected to continue to rise at an average rate of about 22mn people per year, and per capita income is expected to rise almost 50% on a PPP basis to about \$12,000 by 2015.** As a result, there should continue to be massive construction requirements, as well as big increases in demand for consumer durables and electronics as living standards rise.
- **Growth in car production and ownership will be one of the key drivers of commodity demand over the next five years** as the average rate of car sales leaps to 17m p.a., compared with 10m p.a. over the past five years. This will support rapid growth in demand for transport fuels and the materials used in auto manufacture.

**Figure 2: The outlook for commodity intensity of use by market**

### Commodities sorted according to their 5-year intensity of use and demand growth outlook in China

*Rapid gainers (intensity of use rising and annual average growth rates in quantities expanding rapidly)*

Nuclear	Natural Gas	Hydro
Coffee	Gold	Aluminium
Renewables	Nickel	Diesel
Gasoline		

*Steady gainers (intensity of use falling modestly but quantity growth rates still increasing)*

Silver	Coal	Cotton
Crude oil	Lead	
Palladium	Beef	

*Losers (intensity of use falling and quantity growth rates declining)*

Steel	Petchem	Soybeans
Jet fuel	Zinc	Soybean oil
Copper	Platinum	Corn

*Big losers (intensity of use and quantity growth rates both falling fast)*

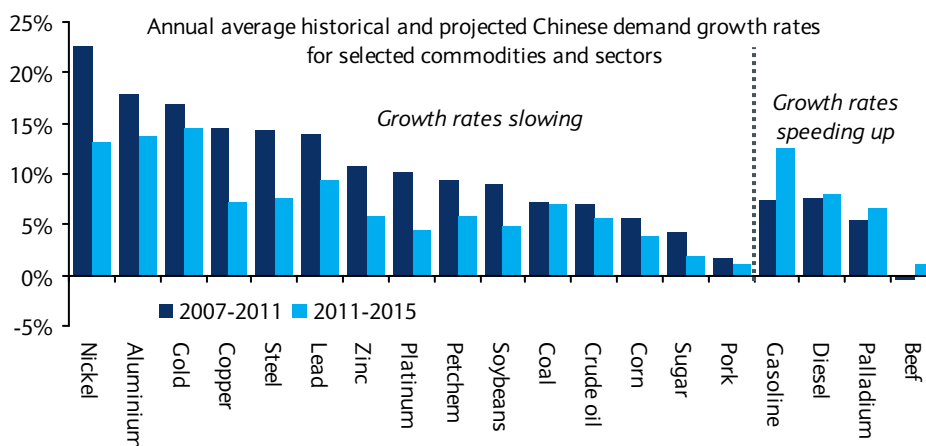
Soybean meal	Cotton	Rice
Sugar	Pork	Residual fuel oil
Poultry	Wheat	

Note: Intensity of use is defined in this report as quantity used per unit of Chinese GDP measured in constant terms. Quantities refer to the five-year average growth rate measured in quantity terms (not percentage growth rates). Please see Figure 28 for a more detailed version of this table. Source: Barclays Research

We examine the consequences of these changes for the intensity of use per unit of GDP for all the major commodity sectors over the next five years. Our key findings are as follows:

- **Average annual percentage demand growth rates for almost all commodities will slow over the next five years** compared with recent history as incremental GDP growth becomes less commodity intensive, but also simply because base levels of commodity demand are now much higher than just a short while ago. It is important to bear in mind that despite percentage growth rates slowing, growth in quantity terms for many commodities will stay very high and even increase for some.
- **Percentage growth rates are slowing most quickly for industrial metals**, with steel, copper and zinc (the metals most leveraged to slower construction and fixed asset investment growth) the worst affected. Demand will continue to grow for these commodities but at slower rates in both percentage terms and in annual average growth rates expressed in quantities.
- **The commodities that will see their percentage growth rates increase most rapidly over the next five years have a strong linkage to the auto sector, to renewable energy, or to rising living standards and changing tastes.** Demand growth rates for diesel and especially gasoline are projected to increase and palladium, used in vehicle autocatalysts, will also benefit; in power generation nuclear and renewables (especially wind) will see a big move up in intensity; gold will benefit from rising investment and jewellery demand and in agricultural commodities coffee will see its growth rate accelerate very fast (though from an extremely low base).
- **There are several metals and energy commodities where growth measured in quantity terms will still be higher over the next five years even though percentage growth rates are slowing.** These include gold and nickel (both benefitting from more consumer-led growth), aluminium, lead and crude oil (due to their linkage to autos) and coal (which will continue to be by far the most important power generating fuel).
- **For many agricultural commodities, intensity of use is falling so fast that it will reduce future demand growth rates measured in quantities as well as percentage terms.** This group comprises the meats especially pork and poultry (reflecting the fact that average per capita protein consumption in China is already relatively high) and staples such as wheat and rice. Fuel oil is the only commodity that is likely to see a negative growth rate over the next five years as refineries that use it as a feedstock are to be shut down.

Figure 3: China's demand growth rates set to decline most rapidly for industrial metals



Source: Barclays Research

## Transition of the Chinese economy

- The Chinese economy is currently shifting towards slower gear, led by a slowdown in infrastructure and property investment.
- Structurally, it is also a transition towards a new growth model, which points to slower GDP growth and lower commodity intensity of GDP.
- These imply that Chinese commodity demand – both in terms of quantity and composition – should change over time.
- However, China may remain as an important driver in the global commodity market due to its resilient growth, accelerating urbanisation and rising consumption.

## The need to change the growth model

For more than 30 years the Chinese economy has maintained average GDP growth of 10% and average CPI of 3-4%. Over time, however, the economy became increasingly reliant on exports and investment, contributing to the imbalance problems. Recently, the government has been trying to change the growth model while accepting somewhat slower growth. If these expected changes materialise, they should mean not only slower GDP growth but also a lower commodity intensity of the economy.

*China's product markets are liberalised but factor markets are distorted*

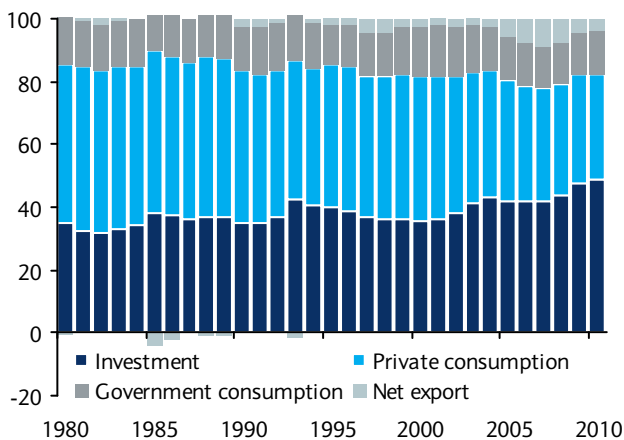
A key feature of Chinese economic reform is asymmetric market liberalisation: almost complete liberalisation of the product market but heavy distortions of the factor markets. This approach is responsible for the successful growth performance and serious structural risks. It provides implicit subsidies to the corporate sector and extra incentives for producers, investors and exporters by depressing factor costs, while at the same time taxing the households.

*Consumption has been weak*

These explain why consumption has been relatively weak – the consumption share of GDP declined from 62% in 2000 to 47% in 2010 according to the official statistics. Meanwhile, the investment share of GDP rose to almost 50% in recent years (Figure 3). Therefore, although China is still a middle-income economy and its share in the world economy remains modest, it is already dominant in global commodity markets, especially for iron ore, copper, and aluminium (Figure 4).

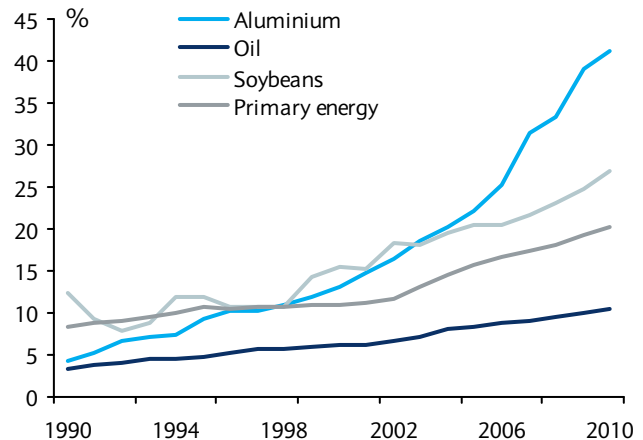
But the authorities recognise that this pattern of economic development is not sustainable. High investment share is a typical characteristic of the East Asian growth model, but if the

Figure 4: An unsustainable investment-led growth



Source: CEIC, Barclays Research

Figure 5: China's rising share of global commodity demand



Source: CEIC, Barclays Research

share is too high, it could also bring about risks of inefficiency, overcapacity and overheating. In the meantime, since China is already a large economy, its massive consumption also imposes significant constraints on the global commodity market. As some government officials have pointed out, if China continues its rapid growth under the same economic model, the world would not have enough resources to accommodate it.

### Changes needed to facilitate the next transition

*New premier wants to expand domestic demand and stabilize investment*

In mid-February, Li Keqiang, who is widely expected to take over as the next premier in March 2013, published an article outlining his key economic policy thoughts. His main policy objective would be to expand domestic demand by increasing consumption and stabilizing investment. Specifically, he emphasised likely policy actions in three areas: urbanisation; the service sector; and balanced regional development.

Li's vision summarises key changes necessary to make Chinese growth sustainable. However, Li did not detail how these are to be implemented. Some skeptical observers might point out that previous other senior leaders, such as Premier Wen Jiabao, have expressed similar views. So what could convince us that this time is different?

We can offer at least two reasons for our conviction on this matter. One is that there is an increasing sense of urgency among the (new) leaders. Many of the structural problems have been continuing for a long time, and the risks of them derailing the growth trajectory are real and rising. Despite the upcoming leadership transition, the government is currently implementing a large number of policy initiatives to change the growth model, including:

- Reform of the household registration system in cities at the prefecture level or below: Farmers can now actually obtain urban household registration relatively easily, which should have a significant effect on urbanisation and consumption and service development.
- The government has been continuously adjusting prices for energy, water and other resources to better reflect market demand and supply condition. The authorities also introduced various policies, including the new financial experiment in Wenzhou, to facilitate changes of the growth model.
- The government also undertook some measures to rebalance the economy. RMB has appreciated more than 30% in real effective terms since 2005. The Shanghai municipal government started experimentation with service VAT to promote the service sector. The authorities have also made efforts to improve the social welfare system in order to boost consumption.

*Labour is in increasingly short supply*

The second reason is that some important changes are already taking place in the economy and market. For instance, wages have been growing faster than GDP for several years as the country transitioned from labour surplus to labour shortage. This has significant implications for household income, production costs and income distribution – both between corporate and households and among households – in addition to the inflation problem. This is likely to be a long-term trend, in our opinion.

Even in financial markets, we observed *de facto* interest rate liberalisation during the past few years. The PBoC has not eased its regulation on bank deposit and lending rates, but it is preparing for interest rate liberalisation by developing the bond markets, strengthening the interbank market and improving financial institutions. However, the past couple of years saw a surge in shadow banking activities, which increased significantly the importance of market-based interest rates in total financial intermediation (or total social financing) and raised investment returns to households.

*Rebalancing is already underway*

In any case, rebalancing is already underway in China. On the external sector, the current account surplus reduced from 10.8% of GDP in 2007 to 2.8% in 2010 (Figure 3), while the trade surplus decreased from 7.5% to 2.1% during the same period. Even domestically, we think the consumption share of GDP also started to rise after 2008, although the official statistics point to a continued decline. Such improvement can be attributed mainly to the recent policy actions, especially adjustments in factor costs and incentive structure.

However, it is too early to conclude success. Rebalancing has barely started; in fact, many analysts are skeptical about whether it has even started. The bottom line is that more needs to be done. The core changes, in our view, are the liberalisation of interest rates and exchange rates and the reform of energy and other resource prices.

**Likely changes in the economy**

If the transition continues as expected, the Chinese economy will likely transition from economic miracle to normal development (Figure 4) and exhibit a number of new characteristics, including:

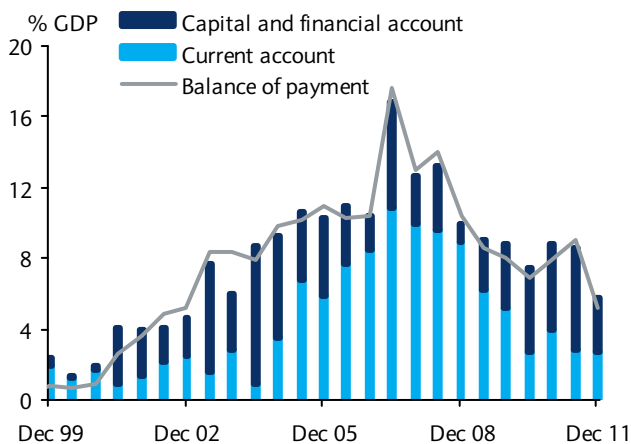
- Somewhat lower growth potential;
- Slightly higher inflation pressure;
- More balanced economic structure;
- More equal income distribution;
- Faster industrial upgrading; and
- More dramatic economic cycles.

*Commodity demand growth may weaken*

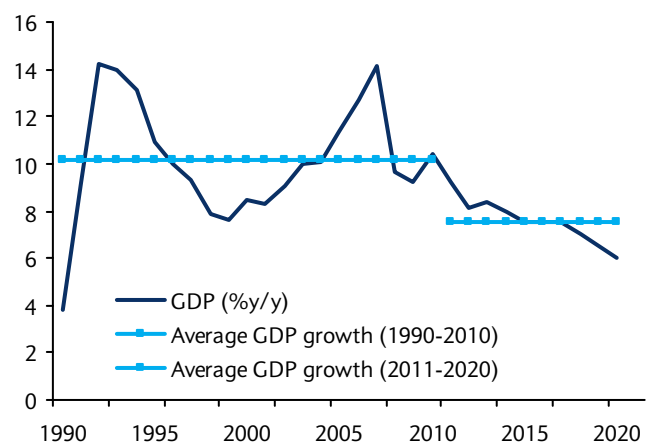
All these should have significant implications for China's commodity demand and the global commodity markets. For instance, if rebalancing between domestic/external demand and between consumption/investment really take place, then China's demand for commodities may weaken. The government already reduced energy intensity of GDP by 20% during the 11<sup>th</sup> FYP and plans to reduce it another 16% during the 12<sup>th</sup> FYP.

*But changes will be relative*

However, these changes are only in relative terms. After all, China will likely remain one of the world's most dynamic economies. Its investment growth may moderate from past peaks but it should stay relatively high in a global context.

**Figure 6: Current account surplus reduced sharply**

Source: CEIC, Barclays Research

**Figure 7: Transition from economic miracle to normal**

Source: CEIC, Barclays Research

There are some specific factors supporting Chinese commodity demand. Urbanisation should actually pick up pace (Figure 5). The government expects a further 45 million farmers to migrate to cities during the current FYP. There are already a total of 250 million migrant workers, a majority of which already live in the cities but do not have urban household registration. Therefore, they do not lead a normal urban lifestyle. The recently announced household registration system reform should enable many of them to settle in the cities, which could create huge demand for urban infrastructure and housing.

Even rebalancing from investment towards consumption is not entirely commodity-negative. For instance, rising consumption may increase Chinese spending on some soft commodities, including food and energy. Increasing demand for electronics and automobiles also imply significant consumption of certain commodities (Figure 6).

*Growth may slow but China will remain the main driver in many commodity markets*

Both cyclically and structurally, the Chinese economy is facing some important changes. Growth should moderate to relatively low levels in the coming quarters, led by slowing infrastructure and property investment. The economy is transitioning towards a more balanced growth model, relying less on investment and more on consumption. Therefore, China's commodity demand – in terms of quantity and composition – may change over time, but relatively resilient growth, continued urbanisation and rising consumption mean that China should remain a main driver in the global commodity market.

## China is following a less commodity-intensive development path

The perception that China is following a more commodity-intensive growth path than other developing countries have in the recent past is a common one. However, it is an oversimplification, encouraged we suspect simply by the fact that China's population, land mass and economy are so much larger than any country at this same stage of development than ever before. As a consequence, its consumption of commodities in absolute terms and its effect on global commodity markets are an order of magnitude greater than other countries that have made the same transition in the past 30-40 years. The tendency is often to equate sheer size with a much more resource-hungry type of development than is actually the case.

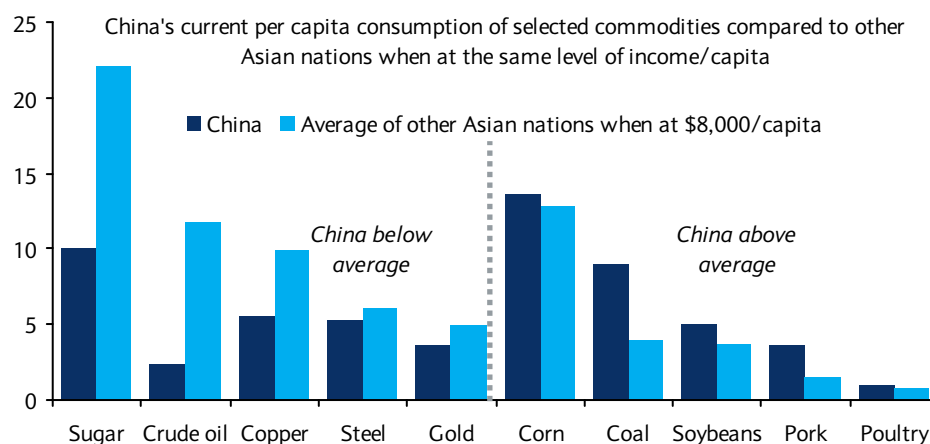
*China uses many commodities less intensively than other Asian countries did*

The true picture is much more nuanced. Relative to its size China is using less energy and smaller amounts of many industrial commodities, such as steel and copper, than other nations did at similar levels of development. However, its consumption of other commodities, especially foodstuffs, is considerably higher. This suggests that its development path is more resource-efficient than that followed by many other Asian countries before it, but that the dietary shifts that have characterised the development of other countries in the region may be happening earlier in China's industrialisation process.

### Less energy and metals, but more food

Comparing China's consumption of a range of energy, industrial metals and food commodities with that of other Asian nations when they were at similar per capita income levels – China is currently about \$8,000 on a purchasing power parity basis (Japan was at this level in 1980, Taiwan in 1988 and South Korea in 1990) – these differences are clear.

**Figure 8: China is following a relatively low commodity-intensive path of development compared with the past experience of other Asian nations**



Note: The group of other Asian nations referred to here comprises Japan, Taiwan and S. Korea. Units of annual commodity consumption per capita are as follows: sugar – kg, crude oil – barrels, copper – kg, steel – 100kg, gold – 100mg, corn – 10kg, coal – boe, soybeans – 10kg, pork – 10kg, poultry – 10kg.

Source: BP, Brook Hunt, WGC, USDA, Barclays Research

China's annual average per capita consumption of oil is just 2.4 barrels, compared with 15.3 barrels in early 1980s Japan and 8.9 in early 1990s Korea. Even though its annual use of coal is more than double, at the equivalent of 9 barrels of oil (boe) per capita, its total energy consumption at roughly 13 boe is much lower than Japan's was at 22.3 boe, and also below that of Taiwan (16.6) and Korea (15.4).



It is a similar picture in industrial metals. Copper demand at 5.5kg is less than half the level its Asian neighbours were at when at similar levels of development, though the difference in steel consumption is much less at 530kg/capita, versus an average of 610kg. Zinc consumption is just 3.6kg/capita, compared with an average of 5.2kg. For industrial metals as a whole, only in aluminium is China ahead at 14kg/capita, compared with an average of 11kg elsewhere.

For the main basic foodstuffs, the picture is very different, however, with China ahead on almost all measures, including corn (136kg of annual consumption per capita, versus average of 129kg in Japan/South Korea), soybeans (50kg versus 37kg), pork (35kg versus 15kg) and poultry (9.2kg versus 8.1kg).

### Price incentives and technical advances explain some of the differences

*China has leapfrogged some technologies*

In part, these differences reflect that since our group of comparator countries industrialised 20-30 years ago, there have been massive changes in patterns of raw materials and energy use. Rising prices for energy and industrial raw materials, especially in the past decade, have provided huge incentives to economise on use. This has encouraged technical innovation aimed at reducing raw materials and energy usage in transport, infrastructure and manufacturing. China has leapfrogged earlier technological stages in autos, for example, so that the average fuel consumption level of its car fleet is far higher than those of its Asian neighbours 20-30 years ago.

Trends like this are likely to continue and are reinforced by much greater government sensitivity to pollution, the quality of the environment and the use of scarce resources, than was the case in other Asian nations in the 1980s and 1990s. China's current fuel efficiency standards, at an average of about 35mpg, are much more onerous than that of the US, currently at less than 30mpg for example, whilst a range of government initiatives have reduced the overall energy intensity of the Chinese economy by 15% from 2005-11.

*It is a leader in economisation of use*

In materials use, in manufacturing and construction, China has also reacted to price incentives. Its cars are lighter and smaller, using far less steel, copper and aluminium. China has also pioneered the light-weighting and downsizing of components such as the thin gauge copper air conditioning tube used in heat exchange equipment. It is also at the forefront of materials substitution. Its wire and cable manufacturers, for example, have developed a range of low voltage power cables that use more aluminium and less copper to take advantage of the big decline in aluminium prices relative to copper over the past decade. Technological change, especially the widespread dissemination of wireless communication and greater use of fibre optic cable to increase capacity, means that very little copper is used in China's telecommunications systems compared with those installed in other parts of Asia 20-30 years ago.

*Lower prices have boosted food consumption*

The consistently higher level of foodstuff consumption compared with other Asian nations when they were at similar income levels per head stands out as an exception to the trends in energy and metals. Since it is evident across all the food categories we examined, it is unlikely to reflect regional or national differences in taste and preference. Instead, the long-run downtrend in the real price of food for most of the past 30 years seems likely to have enabled Chinese consumers to raise their consumption levels of protein and other higher income foodstuffs at lower levels of income than had previously been the case. Consistent with this, it appears that consumption of foodstuffs associated with lower income levels (rice and wheat for example) are falling as fast as, and sometimes faster than, in other Asian countries when they were at similar income levels.

### Scale of export markets is also an important differentiator

Another important factor in explaining why China's consumption intensity of many raw materials, especially industrial metals, is lower than its Asian neighbours at similar levels of development is the relative size of its export sector. China is an important exporter of energy and metals intensive goods, and this adds to its own consumption of primary raw materials. However, because of its economy's sheer size, the share of export-related demand relative to domestic consumption is for many commodities quite small.

This is in stark contrast to the other Asian economies we examine, where exports, especially of metals-intensive items, gave a huge boost to the metals consumption of their economies in the initial stages of industrialisation, and in many cases still do.

*Exports are a less important commodity demand driver per capita than in smaller Asian nations*

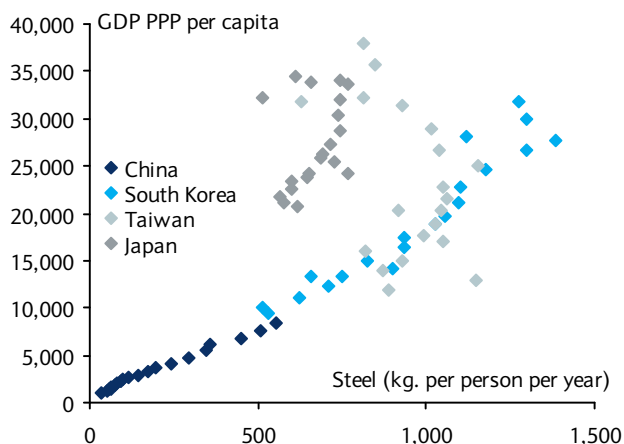
South Korea's steel consumption is a good example of this. During its phase of most rapid industrial growth, it became a major global exporter of many highly steel-intensive products, especially cars and ships. Estimates suggest that almost 50% of Korean domestic steel consumption is currently used in these two sectors, with about 80% of that ultimately getting exported. In contrast, China's production of steel goods that are exported, though high in absolute terms (it is now the world's second largest shipbuilder, for example), is much smaller in relation to its domestically driven demand, with less than 20% of its total steel consumption being exported.

Adjusting Korean steel demand for the amount exported in manufactured goods cuts its current level of domestically generated steel demand when it was at China's current level of development to 273kg per capita compared with China's current level of 550kg.

Whilst this adjustment suggests the steel intensity of China's domestic economy is higher than that of its Asian neighbours when they were at similar development levels (after adjusting for net trade), it also highlights another important point: China's level of steel demand relative to its population or the size of its economy will never reach that of other Asian economies in which exports, though smaller in gross terms, are much more important relative to the size of their economies and populations.

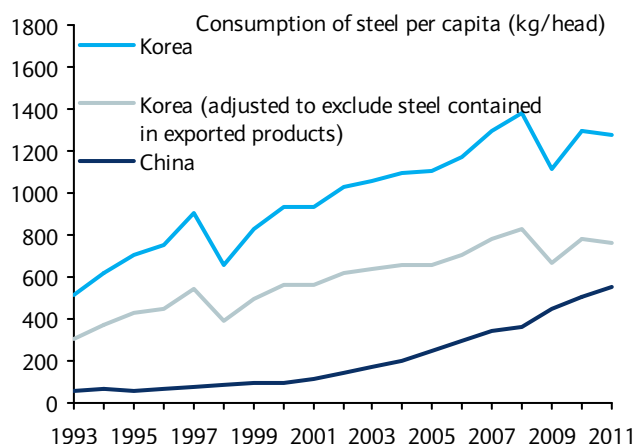
Adjusting Korea's current level of steel consumption 1.3t/capita lower to account for net trade puts domestically driven demand at about 750kg per capita, much closer to China's current consumption level of 550kg per capita.

**Figure 9: Relative to Asian neighbours, China's per capita steel demand appears to have plenty of room for growth...**



Source: CRU, Barclays Research

**Figure 10: ... but potential growth looks much lower after trade in steel products is taken into account**



Source: CRU, Barclays Research

The message is clear: China will simply never reach the elevated levels of per capita steel or base metals consumption of its Asian neighbours, so the common practice of overlaying charts of China's steel consumption per capita with those of its Asian neighbours and concluding that growth has a long way to go are extremely misleading. China may actually be much closer to a peak in its usage intensity curve for steel and some base metals demand than is commonly recognised.

## For many commodities, China's intensity of use is already falling

*Just five commodities for which intensity of use is still rising*

Whilst investors have recently become very concerned about the issue of peaking intensity of use, the evidence suggests that for many commodities, declining use relative to economic growth has existed in China for a long time already. So far this century, a wide range of energy and agricultural commodities have had their usage intensity pass their peaks (often quite some time ago), and then decline steadily when measured relative to the growth in China's GDP. Indeed, as our ranking of commodities in Figure 10 illustrates, there are only five commodities and two energy sectors in which China's usage intensity is still rising:

- Aluminium, which is capturing market share from other materials in the packaging, transport and power sectors;
- Nickel, whose use as an alloying element in steel has been boosted by recent technical changes to China's production processes;
- Steel, which benefits from investment-led growth in early stages of development;
- Coffee, in which recent rapid consumption growth reflects changing tastes amongst urban dwellers, but this is also expanding from an extremely low base (China accounts for less than 1% of global consumption);
- Natural gas, which the government has targeted as a priority, but a lack of domestic resources means that growth is from a very low level of existing use in power generation.

Hydro electricity generation and the renewable energy sector are also expanding very fast. The latter includes various sources of alternative energy including wind, geothermal, solar, biomass and waste, but again that growth is from a very low base. Currently renewable energy sources account for less than 1% of China's total primary energy consumption.

*Intensity of use for some industrial metals is still increasing*

In terms of how long ago different commodities reached peak intensity, there are some interesting patterns. By sector, industrial metals are peaking later in their usage intensity than most other commodities. Aluminium, nickel and steel are all yet to peak. Copper and lead intensity appears to have peaked only in the past two years, with zinc peaking earliest in 2005. Even for those base metals in which usage intensity has already peaked, it has only declined marginally in recent years.

*For many energy commodities it is falling*

For most major energy commodities, peak usage relative to economic growth arrived much earlier than for metals, and the subsequent declines have been much larger. Primary energy intensity peaked in the 1990s, as did coal use, whilst oil usage peaked in the 1990s, as did gasoline and diesel. Residual fuel oil (used mainly in power generation and also as input to other refined products) is the refined oil product that has experienced the biggest decline in usage of any commodity we examined.

*Most agricultural commodities passed their peak a long time ago*

With the exception of soy products, which did not peak until early this century, most other agricultural commodities reached their peak levels of usage in the 1990s, including corn, poultry, beef and pork. The intensity of use of wheat and rice has been in decline for even longer, since the late 1980s.

Figure 11: Timing of peaks in China's GDP intensity for different commodities

Annual Consumption/\$1,000 GDP							
Commodity	Unit	2009	2010	2011	Peak usage	When	Change since peak
Aluminium	kg	3.17	3.41	3.68	3.68	2011	0%
Nickel	kg	0.101	0.112	0.124	0.124	2011	0%
Steel	kg	136	140	141	141	2011	0%
Coffee	kg	0.004	0.005	0.008	0.008	2011	0%
Gas	boe	0.14	0.15	0.17	0.17	2011	0%
Hydro	boe	0.24	0.25	0.27	0.27	2011	0%
Renewables	boe	0.012	0.019	0.023	0.023	2011	0%
Zinc	kg	0.94	0.97	0.99	1.00	2005	-1%
Copper	kg	1.45	1.49	1.47	1.49	2010	-1%
Lead	kg	0.84	0.83	0.82	0.84	2009	-2%
Gold	g	0.098	0.105	0.114	0.119	2000	-4%
Silver	g	0.78	0.82	0.86	0.93	2003	-7%
Soymeal	kg	8.6	9.0	8.8	9.8	2005	-10%
Primary energy	boe	4.47	4.52	4.56	5.39	1990s	-15%
Nuclear	boe	0.07	0.07	0.07	0.08	2007	-15%
Coal	boe	2.66	2.66	2.70	3.21	2005	-16%
Soybeans	kg	13.6	13.6	13.4	16.7	2002	-20%
Petrochemical	boe	0.20	0.21	0.21	0.26	1990s	-21%
Diesel	boe	0.24	0.24	0.24	0.30	1990s	-22%
Soyoil	kg	2.38	2.30	2.21	3.08	2003	-28%
Oil	boe	0.70	0.71	0.69	0.97	1990s	-29%
Gasoline	boe	0.13	0.13	0.12	0.18	1990s	-30%
Jet Fuel	boe	0.03	0.03	0.03	0.04	1990s	-31%
Palladium	oz	0.0004	0.0004	0.0004	0.0006	2005	-40%
Corn	kg	37.7	36.4	36.1	67.3	1990s	-46%
Cotton	kg	2.5	2.1	1.7	3.3	2005	-47%
Platinum	oz	0.0005	0.0004	0.0004	0.0008	2002	-48%
Sugar	kg	3.3	2.9	2.7	5.2	2002	-48%
Poultry	kg	2.79	2.57	2.46	5.3	1990s	-53%
Pork	kg	11.14	10.57	9.42	22.2	1990s	-57%
Beef	kg	1.31	1.15	1.05	2.9	1990s	-63%
Wheat	kg	24.4	22.8	21.9	61.7	1980s	-64%
Rice	kg	30.7	27.9	26.2	75.2	1980s	-65%
Resid Fuel Oil	boe	0.05	0.05	0.04	0.13	1990s	-66%

Agriculture

Precious metals

Ind.metals

Energy

Meat

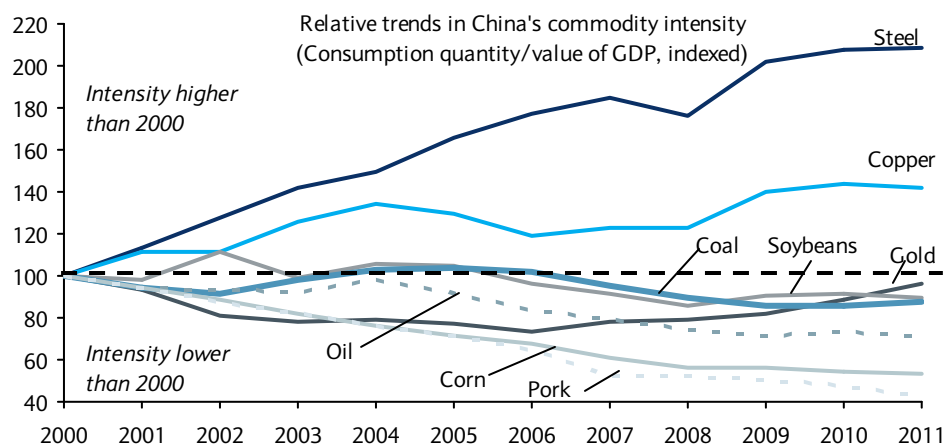
Note: This table ranks commodities in terms of changes in intensity of use relative to their peak year (except for those commodities in which usage peaked before the turn of the century, in which case both peak intensity of use and the change in intensity of use is measured from the year 2000). Source: Barclays Research

*China's economy has recently become much more "gold intensive"*

## China's commodity usage has intensified again since 2008

Although usage intensity for many commodities in China has been declining for some time, 2008 appears to have marked something of a turning point, with intensity of use in industrial metals (especially nickel, steel, aluminium and copper) accelerating and downward trends in usage intensity falling at a much slower rate for many other commodities. Perhaps the most significant change during this period was a big improvement in the consumption of gold relative to China's rate of economic growth, with its intensity of use rising 20% since 2008, returning it close to the levels that prevailed at the start of the decade.

**Figure 12: A turning point in 2008 – intensity of use of most commodities has improved in past three years**



Source: USDA, BP, Brook Hunt, WGC, Barclays Research

This inflection point appears to have been driven by three factors. One is the 2009 stimulus package was highly metals-intensive, focusing on public infrastructure (railway, road, irrigation, and airport construction) and reconstruction in earthquake-damaged areas. This helps explain why the improvement in intensity of use during the period was especially strong for base metals.

*The luxury items threshold has been passed*

A second factor is this period coincided with China passing the threshold level of per capita income associated with rapid increases in demand for consumer durables, autos and luxury items such as jewellery. This level is generally understood by development economists to be \$5,000 per capita, which China exceeded, on a PPP basis, in 2007-08. This factor has been reinforced by government policies such as the provision of large discounts on sales of consumer durables to rural dwellers, plus the ongoing de-regulation of China's precious metals markets, which have contributed strongly to the expansion in gold demand.

The third factor, in our opinion, is that initiatives to raise the living standards of China's rural dwellers, with provisions of social safety nets and better access to free education, shifted some previously very low income groups into higher per capita income levels associated with big improvements in diet, thus helping to slow temporarily some of the rapid declines in foodstuffs consumption relative to average income, evident earlier this century.

## The outlook for China's commodity intensity by sector and market

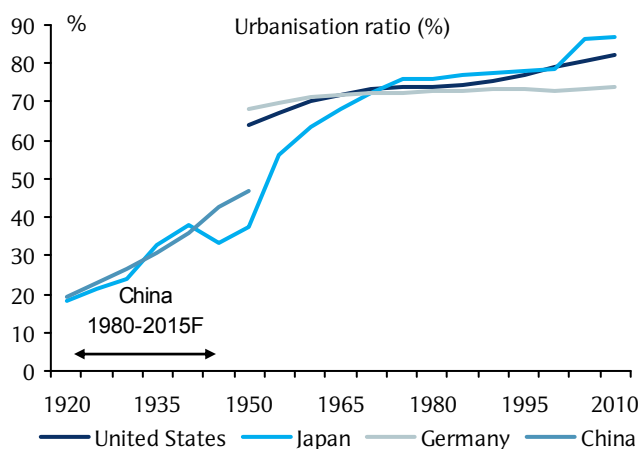
Many of the factors that have supported recent improvements in commodity intensity in China may turn out to be temporary, especially with the influence of the 2009 stimulus fading fast and China now aiming for a less investment-intensive, more consumer-led growth model, as outlined earlier in this report.

The slowdown in GDP growth led by lower growth rates in infrastructure and property investment, the policy goal of further reductions in the energy intensity of the economy and a greater focus on reducing pollution and improving the environment all suggest a lower intensity relative to GDP for some commodities in future. However, other factors such as continued rapid growth in urbanisation, rapidly rising living standards and increased demand for consumer goods are likely to act in the opposite direction.

The key forecasts we have used in this section of the report are as follows:

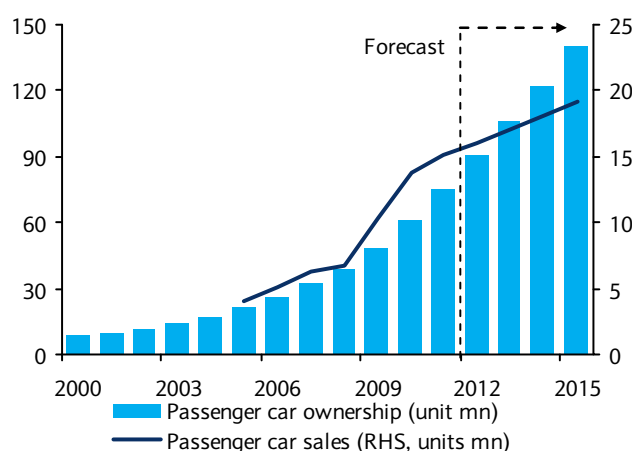
- Average GDP growth to slow from 10.5% p.a. from 2007-11 to 8% p.a. 2011-15.
- Income per capita on a PPP basis to rise from \$8,400 to \$12,000 by 2015.
- FAI to slow from an average annual y/y growth rate of 24.2% in 2010-11 to an average of 17.6% over the forecast period.
- China's power industry investment from 2011 to 2015 to total RMB6.1trn, up 88.3% compared to the past five years, including a power generation investment of RMB3.2trn and a power grid investment of RMB2.9trn.
- Industrial production to slow from an average of 14.1% p.a. in 2007-11 to 12% p.a. in 2011-15.
- Auto sales to increase from an annual average of 11.5m units per year in 2008-11, to an average of 17.6mn units annually in 2011-15.
- The urbanisation rate to remain constant at around 22mn people per year.
- Floor space of new buildings to increase from an annual average of 1.1bn sq m in 2007-11 to 1.6bn sq m in 2011-15.
- Manufacturing export growth to slow from an annual average of 20% recently to average 12% p.a. in 2011-15.

Figure 13: Urbanisation should actually pick up pace



Source: CEIC, UN, Barclays Research

Figure 14: Increasing demand for automobiles



Source: CEIC, Barclays Research

*China's energy consumption  
is still a long way behind its  
Asian neighbours*

## Energy

China's overall per capita energy consumption is less than a quarter of the current average for developed Asian nations. Even in coal, China's present consumption level is 20-25% lower per capita than in South Korea or Taiwan, though it is significantly above that of Japan. Nevertheless, just because China's economy is less energy intensive than its neighbours were in the 1980s and 1990s does not rule out the likelihood of further strong growth in usage intensity for many energy commodities. Note that this section draws heavily on some of our previously published research on China's energy sector (see: [Energy Flash: China: more of everything but...](#), 9 November 2012 and [Energy Flash: China and oil – what lies ahead?](#), 23 November 2012).

### Power-generating fuels

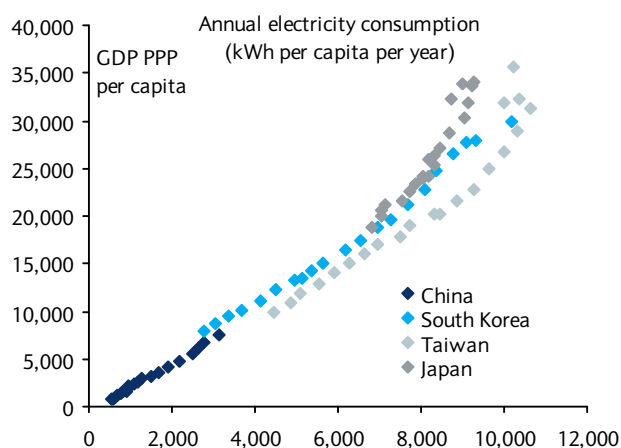
China's 12th 5-year plan envisages further strong growth in energy infrastructure to combat persistent power shortages. We expect that by 2015, total installed electricity generation capacity will reach 1.45-1.5 TW, up from 962 GW in 2010, a pace of growth very similar to that of 2005-10 when about 500 GW was added. By 2015, we forecast that China's total power consumption per capita will have reached 6,100TWh – a 50% increase from 2010. However, on a per capita basis, at 4.4MWh, that will still leave it at less than half the level of its Asian neighbours, where the current weighted average (for Japan, Taiwan and South Korea) is 9.4MWh.

*In the power generation mix  
hydro, wind and solar will  
grow fastest*

Growth in the power generation fuel mix is likely to be most rapid in renewable energy sources like hydro, wind and solar. Hydro generating capacity is expected to grow by a third, reaching 284 GW by 2015, nuclear and renewables capacity by 424 GW to 551 GW, with wind to be the fastest growing renewable, rising four-fold to 123 GW. Growth in gas will be much more modest, doubling to 60 MW, constrained by a lack of affordable natural gas resources. Its main use is expected to be to alleviate pollution problems in tier-one cities, rather than becoming an integral part of the national power mix.

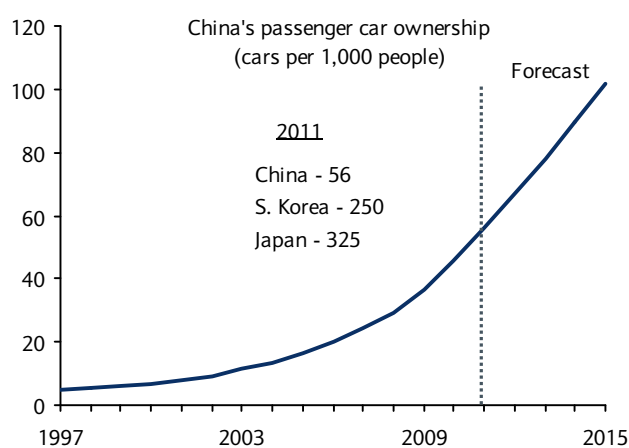
Although growth in coal-fired capacity will slow to 6% per year, on average, out to 2015, it will still be far and away the most important fuel, with its share in generation falling from 80% in 2010 to 73%.

**Figure 15: China is closely following the electricity demand path of other Asian nations**



Source: BP, Barclays Research

**Figure 16: Car ownership is likely to continue rising very rapidly**



Source: Ecwin, NBS, Barclays Research



### *Oil and refined products*

For oil, the key drivers of China's consumption growth over the next five to ten years are likely to be: the speed and level of passenger car and commercial vehicle penetration and the extent to which those vehicles can be made more fuel efficient; the development of alternative fuels and next-generation engines; and the growth in its petrochemicals industry (which now consumes almost twice as much oil as passenger cars).

*The number of cars on China's roads will double in the next five years – good for gasoline*

Historically, vehicle ownership has grown relatively slowly at the lowest levels of per capita income, about twice as fast as income growth at the middle-income levels (from \$3,000 to \$10,000 per capita), and about as fast as income at higher income levels, before reaching saturation (see "Vehicle Ownership and Income growth", by Dargay, Gately and Sommer). With China's income level of about \$8,000 (on a PPP basis), it is still within the range at which car ownership grows most rapidly – we expect the number of passenger cars on China's roads to double to well over 100m by 2015. We estimate the additional volumes of cars to add 1.25 mb/d to gasoline demand by 2015, taking it to almost 3 mb/d, an expansion of about 75%.

For diesel, despite the increasing challenge posed by railway, civil aviation and private cars to road transportation, the rising level of agricultural and railway electrification, as well as new energy vehicles and energy-saving vehicles (including CNG trucks), which will cause diesel demand growth to slow, we still expect it to rise 40% to 4.7 mb/d by 2015, supported by booming freight movements and its continued use as the marginal source of power supply in the country during periods of power rationing.

*Petrochemicals growth will slow because of competition in export markets*

China's petrochemicals industry is the fastest growing petrochemicals industry in the world. China's demand for petrochemical and plastics products is about 100 mt/year (~2 mb/d of crude oil). The long-term construction and manufacturing needs of China are likely to provide ample demand growth for petrochemicals in the medium term, assisted by regulatory changes, with energy-efficiency requirements leading to greater use of PVC in pipes, windows and doors. PVC packaging will also contribute to the sector's growth as it is increasingly used as an alternative material. However, due to increasing international competition in export markets over the next few years (especially from the US, where the petrochemical industry is benefitting from low-cost gas), we expect China's future petrochemical demand to stem primarily from domestic demand. Thus, overall petrochemical demand growth is likely to moderate compared with previous years. We project it to expand 25%, taking total demand to 3.7m bpd.

### **Industrial metals**

*The metals intensity of China's economy has doubled since 2000*

It is in industrial metals markets that China is most dominant on the world stage, accounting for 40-50% of consumption. The growth in metals intensity of the Chinese economy since 2000 has been dramatic: on average, the intensity of use of base metals in the Chinese economy has doubled since 2000. For every \$1,000 of GDP, China now consumes 140kg of steel, compared with just 67kg/\$1000 of GDP in 2000; it consumes 3.7kg of aluminium, compared with 1.9kg in 2000; and 1.5kg of copper, up from 1kg in 2000. A slowdown in fixed asset investment is likely to be a negative factor affecting the intensity of use of industrial metals in the years ahead. However, this is likely to be offset by other factors such as further increases in auto output and plans to massively upgrade China's power transmission system over the next five years.

We have modelled China's metal consumption and used our economists' assumption on the outlook for fixed asset investment, floor space of new buildings started and passenger car sales to derive the trends over the next five years. Our results show that aluminium and nickel are the two base metals with the most positive usage trends. We expect both to



strongly benefit from the wave of consumption upgrading and consumer goods spending over the next five years, supporting consumption growth rates in tonnage terms to accelerate from recent levels, although percentage growth rates will fall.

*Aluminium is used intensively at all stages of development*

Aluminium differs from some other base metals because whilst it is crucial for use in power networks and construction in early urbanisation stages, it is also heavily used in transport and consumer goods, benefiting as economies mature and move towards consumer-led demand growth.

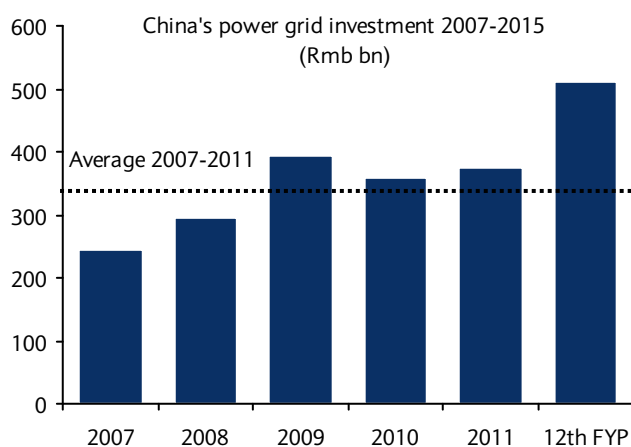
China's economy is already much more aluminium-intensive than other Asian nations were at similar stages of development. This is partly because prices have remained very competitive relative to other materials, so aluminium is benefitting from increased penetration in end-use sectors such as transport (due to light weighting in vehicles), windows and doors (substituting steel and wood), cans and packaging (substituting paper and glass), plus some components in air conditioners and copper-clad aluminium cables for power transmission. In addition, aluminium's high recyclability means it benefits from consumers moving towards "greener goods" and the Chinese government's initiatives encouraging more recycling.

Aluminium is also set to benefit a lot from plans to build a large, ultra-high-voltage alternating current system, as well as a more traditional direct current system to increase connectivity between grids over the next five years. Power-related uses account for almost a fifth of total demand in China, mostly in overhead power cables.

The State Grid Corporation of China is planning seven UHV AC transmission lines which could increase transmission capacity and distance by 2-5x the existing 500kv lines. Aluminium use in UHV lines is typically about 1.7t/km, which is about 70% more than in 500kv lines. To reflect this additional boost to aluminium consumption, we have added approximately 600ktpy to our five-year projected growth rates over and above that generated by the modelling exercise.

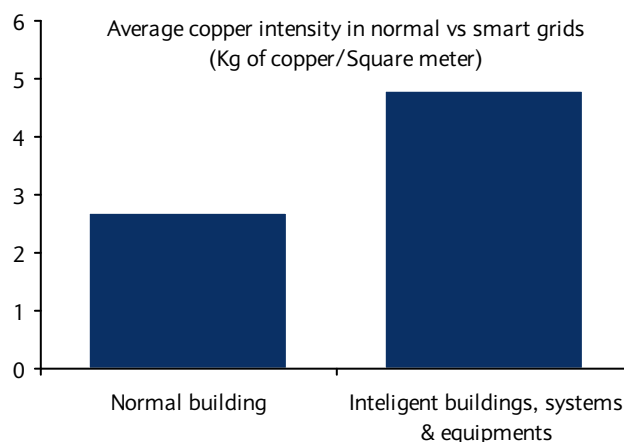
Nickel, too, will benefit from China's consumption upgrading embedded in the current five-year plan. Its use in stainless steel for higher grade consumer goods, cookware, food processing and pharmaceuticals industries, as well as in the construction of chemical and petro-chemical plants, means it benefits from a move towards a more consumer-led demand growth model.

**Figure 17: China's power grid investment is set to soar over the next five years**



Source: CEIC, Barclays Research

**Figure 18: Smart grid technology is much more copper-intensive**



Source: ICSG, Barclays Research

Lead's main use in car and e-bike batteries means its consumption should benefit from the increase in car sales in China over the next five years and from the upgrade in previously low-quality lead batteries. We do acknowledge the role of more scrap coming into the system, and we expect more lead to be recycled as China's car fleet grows. However, the growing requirement of China's increasing car fleet will more than offset the new scrap coming into the system until China's car fleet growth slows significantly.

Copper potentially faces a very large slowdown in demand growth rates over the next five years as it continues to lose share in non-electrical end-uses due to high prices and as construction, one of its most important end uses in building wire, slows.

*Construction of smart grids will help to slow China's declining intensity of copper use*

However, like aluminium, copper is set to benefit from improvements to China's power transmission system since as part of this investment China plans some major expenditure on smart grid technology. Smart grids contain much more copper than in normal building due to the need for things like flow meters, sensors, controls and intelligent energy meters. In steel, the dramatic urbanisation – increasing construction activity to accommodate new urban residents and new infrastructure – over the past few years has created a very high base for demand. As a result, although our economists expect urbanisation and construction activity to continue (but at a slower pace), the steel intensity of GDP growth, as well as the tonnage quantity increase of steel consumption, should decline over the next five years. In particular, we expect the steel intensity of GDP growth to decline 3% over the next five years, and the average annual growth rate of demand to slow from 14% to 8%.

Zinc's intensity of use per unit of GDP peaked earlier than for any other base metal, at 1kg/\$1000 in 2005, and has declined modestly since then. Almost half of zinc's end-uses are in the bulk galvanised steel markets, which we believe is a slower growth sector as construction activity slows in the years ahead. Consequently, we expect its average growth rate over the next five years to be only half the rate of the past five, and for consumption growth in tonnage terms to slow as well.

All in all, the key message is that despite a clear decline in the intensity of use for industrial metals in China over the next five years in percentage terms, in tonnage terms consumption is likely continue to grow quite rapidly and in the case of aluminium, nickel and lead will likely accelerate.

**Figure 19: Model results (with adjustments) for China's demand growth by metal**

Metal	Unit	Annual average change in quantities			Annual average growth rate		
		2007-11	2011-15	Adjusted	2007-11	2011-15	Adjusted
Aluminium	Kt	2,135	2,391	2,950	18%	11.6%	13.7%
Copper	Kt	763	501	600	15%	6.2%	7.3%
Nickel	Kt	80	91	n/a	23%	13.1%	n/a
Lead	Kt	416	452	n/a	14%	9.3%	n/a
Zinc	Kt	418	305	n/a	11%	6.4%	n/a
Steel	Kt	71,858	59,769	n/a	14%	7.6%	n/a

Note: Adjustments have been made to the modelled results for copper and aluminium demand to account for the increased investment in the power grid over the next five years. Source: Barclays Research

## Precious metals

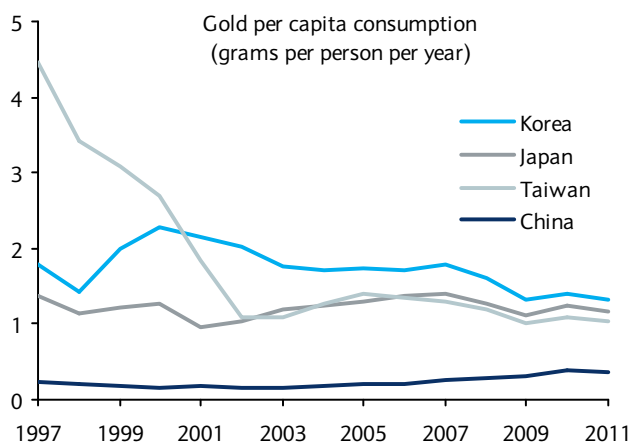
Turning to precious metals, current gold demand per head is some 25% below where other Asian nations were at similar levels of per capita income, and less than a third of the average level for developed Asian nations currently. In the more industrially driven precious metals such as silver, the gap is even wider, with current national per capita usage levels less than one-sixth that of its neighbours.

*China's gold demand has been pent-up for a long time*

The main reason for these big differences is the suppression of China's precious metals demand by heavy regulation for many years. Gold has always had a big role in China's culture, but it was not until 2002 that private ownership of gold bullion was made legal after being banned in 1949. Further freeing the gold trading rules, the 2009 rescindment of a ban on private ownership of gold investment products and the start-up of a large number of gold exchanges in different parts of the country have stimulated very rapid growth in consumption of gold in jewellery and investment forms. China's intensity of use per unit of GDP has risen by a fifth since 2008; it even appears likely to soon overtake India as the world's largest gold consumer.

These trends have been supported by rapid expansion in the ways in which Chinese consumers can access gold investments. There has been a proliferation of banking products, investment products and checking accounts linked to gold, whilst silver and gold bullion bars can now be bought at most major Chinese banks in a range of different sizes.

**Figure 20: China's gold consumption per head is a long way below that of other Asian nations**



Source: CRU, Barclays Research

**Figure 21: China's jewelry demand has expanded rapidly since 2007**



Source: Ecwin, NBS, Barclays Research

The popularity of gold investing in China should not come as too much of surprise: there are very few ways for Chinese investors to diversify away from traditional investment vehicles such as local stocks and property. Gold represents one of the few. Furthermore, Chinese citizens face numerous hurdles and restrictions to investing directly in foreign equity markets, and with inflation rising, many see gold as a good way of protecting the real value of their investments. Finally, the ownership of gold as an investment is receiving official sanction in the government's well-publicised decision to increase its own gold reserves.

Demand for precious metals jewellery is also likely to continue expanding fast. According to NBS data, China's jewellery market grew 42% in 2012, reaching the equivalent of \$2.9bn, and many experts predict that its luxury goods market will overtake that of the US to become the world's largest by about the middle of this decade.

We expect silver to benefit from many of the trends supporting gold demand over the next five years, especially in jewellery and in greater uptake as an investment. Silver's industrial demand in China is dominated by the electronics sector, which has had rapid growth in recent years supported by strong sales growth of consumer electronics. High prices (silver prices have increased more than for any other metal over the past five years) mean it is vulnerable to substitution and thrifting in its use, but overall it should benefit from the growing volume of domestic appliances and robust growth in auto output, which would boost demand for silver contacts.

The main driver of intensity of use for PGMs will be the rate of growth in vehicle output. We think it unlikely that palladium loadings in autocatalysts for China's gasoline-based passenger car fleet will decline over the next five years since China's emissions legislation is getting tougher. The same is true for the use of platinum in commercial vehicles running on diesel. Increased use of scrap from cars that have reached the end of their life cycle is unlikely to have much effect on demand for primary PGMs over the next few years because given the 10+ year average life of a vehicle in China, the reservoir of scrap that can supply this sector is extremely low.

One factor that could add considerable upside risk to our forecasts for intensity of use of precious metals is the establishment of domestic physically-backed exchange-traded products – the key driver of precious metals demand growth in industrial nations in recent years.

*The approval of physically backed ETP's could add even more to already strong precious metals demand growth*

Chinese consumers cannot yet invest in physically-backed exchange-traded products on domestic stock exchanges, though the Shanghai Gold Exchange is reported to be working with regulators to allow this. The appetite for this type of investment is high judging from the success of the \$500mn Lion Fund, the first to be permitted to invest in overseas exchange-traded funds backed by gold, as it was fully subscribed in less than a month.

For now, we assume that part of the increase in demand for gold as investment over the next five years is from physically-backed ETPs but that these products do not penetrate other precious metals sectors to any great extent. If we are wrong, the outlook for demand for these precious metals could be much stronger than we currently expect.

### Agriculture and livestock

In the food sector, however, the picture is very different than that for most other commodities. At an average per capita intake level of about 2970 calories a day, China is already on par with the per capita calorie consumption of other Asian nations despite the wide differential in incomes, suggesting that growth in food demand is already maturing. This is not surprising because the history of most other developing nations shows that periods of rapid growth in calorie consumption tend to occur at income levels a long way below the current \$8,000. From 1990-92 to 2000-02, when its GDP/capita rose from about \$1,000 to \$3,500, China's average daily calorie intake per person climbed 13%; however, since then, it has risen less than 2%.

*China's dietary patterns are already quite mature*

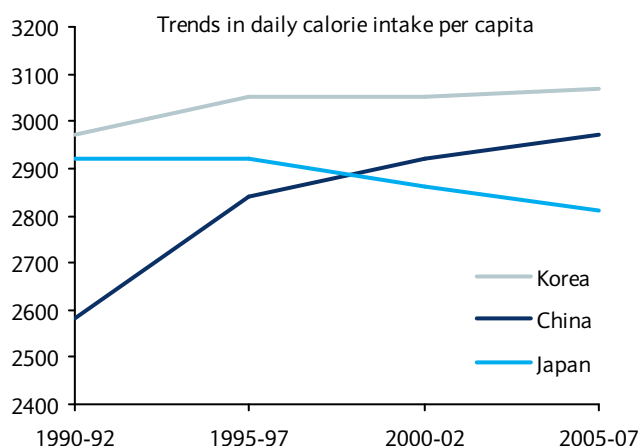
Moreover, the breakdown of the source of China's average calorie intake suggests that dietary patterns may also be maturing. Traditionally, as living standards rise, consumers reduce the share of low-value carbohydrates in their diets and increase the share of higher value fats and proteins. China's average calorie intake levels are still skewed towards carbohydrates at 61%, and are far above the average for the developed world at just 53%. However, this almost certainly reflects local tastes and preferences; current shares for the different food groups may not change significantly as average incomes continue to rise. Indeed, China's average levels for the share of calories from protein and fats is already larger than in many of its higher-income Asian neighbours.

One issue we have not dealt with yet is the huge disparity in income between urban and rural dwellers in China. On a purchasing power parity basis, we estimate that average rural incomes are about \$3,500/capita, which is only a third that of their urban counterparts. Surely, as the living standards of almost 600mn Chinese rural dwellers rise over the next 10-15 years, changes in their dietary patterns will raise average levels of Chinese per capita calorie and protein intake overall?

*China's rural population already has a high quality diet*

Not necessarily so. Analysis of take-off levels for calorie consumption shows that most of the growth occurs as incomes rise from less than \$1,000 per capita to about \$3,000 per capita. Higher incomes for rural dwellers in China are much more likely to be spent on consumer goods, health and education rather than additional calorific intake. As far as dietary patterns are concerned, there is also plenty of evidence to suggest that China's rural population already have a varied and relatively high quality diet, certainly above that of low income city dwellers, since they are able to consume the crops and livestock they raise themselves.

**Figure 22: China's calorie consumption per head has overtaken that of Japan**



Source: FAO, Barclays Research

**Figure 23: Calorie intake from higher income food groups like proteins and fats is already high in China**

Share of calories from different food groups			
	Carbohydrate	Protein	Fat
World	63	11	26
Developed	53	12	34
Developing	67	11	23
Japan	58	13	29
S. Korea	63	11	25
Thailand	71	9	20
Average	64	11	25
China	61	12	27

Source: FAO, Barclays Research

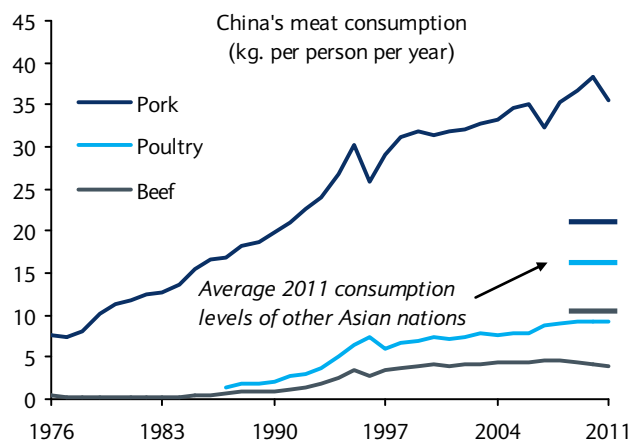
In our view, the only circumstances under which China is likely to experience further strong growth in its per capita calorie consumption levels is if the population adopts a western-type diet similar to that of the US, for example, where average daily calorie intake is 3,770, roughly 26% above China's current level, and protein consumption is about a third higher. If such a change does take place, however, it is likely to do so only gradually. A much more likely scenario is for Chinese diets to remain close to those of their Asian neighbours as income levels converge.

If, as appears to be the case, China is close to saturation levels in terms of its per capita food consumption and its uptake of calories from those food groups associated with higher incomes, then the key drivers of China's agricultural commodity demand over the next 5-10 years will be population growth (likely to be modest), the use of grains in the manufacture of processed food (eg, corn starch and sweeteners), and any growth that occurs in the use of crops for fuel.

*Unless China adopts a western diet demand for food should slow*

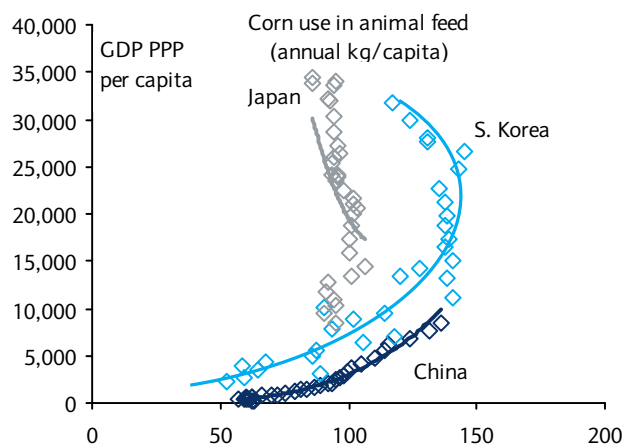
We do not expect any of these factors to result in strong growth in the quantity of grain or meat consumption. More important trends are likely to revolve around growing demand for higher quality, fresher foodstuffs, as well as changing tastes and preferences within different food groups. Whilst the quality of the average Chinese diet is likely to gain significantly over the next five years, quantities are not.

**Figure 24: China's per capita pork consumption is already very high, but poultry and beef demand relatively low**



Source: USDA, Barclays Research

**Figure 25: If China's per capita use of corn in animal feed follows the South Korean path, it may stop growing soon**



Source: USDA, Barclays Research

## Softs

A brief word on the softs, sugar, cocoa and coffee. Consumption of these agricultural commodities has very little correlation across countries or regions with any of the key measures of development such as rising living standards or urbanisation rates. Demand for these commodities tends to be driven much more by local traditions, tastes and preferences.

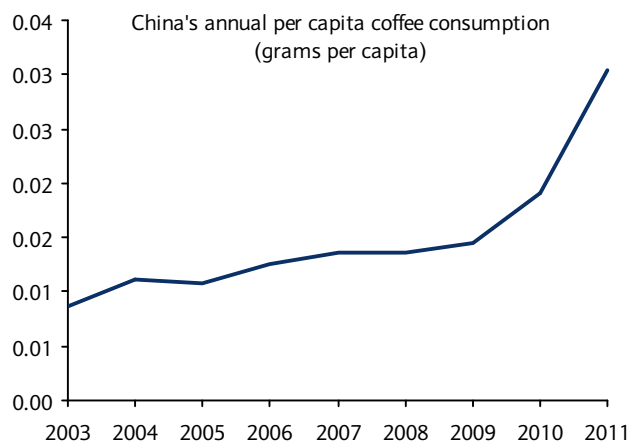
*The “coffee intensity” of China’s economy is growing fast but from a very low base*

The soft commodity in which demand appears to be growing most rapidly is coffee, especially in urban areas. Total demand for coffee has been growing at an annual average rate of more than 30% since 2006, and the “coffee intensity” of China’s economy is increasing fast. However, coffee consumption in China is still exceptionally low. According to SPR coffee, one of Taiwan’s major coffee chains, the average consumption of coffee in China amounts to less than half a cup per person each year; even in urban areas, it is only five cups per person per year. To put things in context, China drank more than 1mn tonnes of tea in 2010 but only 25,000t of coffee.

Whilst the growth potential from such a low base is undeniable, and we expect rapid growth to continue in China’s coffee consumption, base levels are so low that this growth is unlikely to exert much influence in global markets over the next five years, in our opinion.

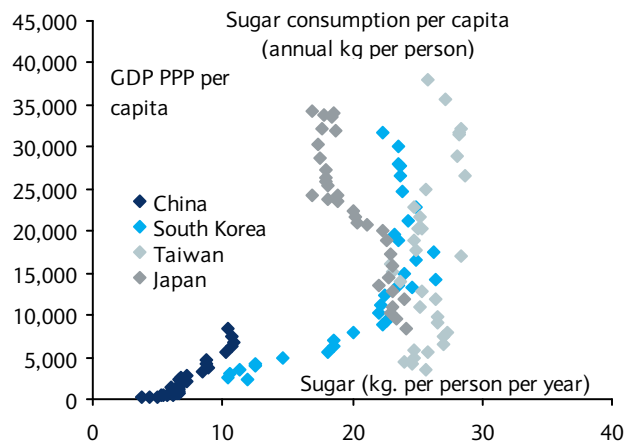
In contrast to coffee, the consumption of sugar is declining in per capita terms and relative to economic growth, and this is occurring at a much lower income level than observed in many other Asian nations. Traditionally, China has consumed relatively low amounts of sugar with wide discrepancies by region. Northern diets tend to favour salt foods, whilst sugar consumption in the south tends to be higher. FAO data suggest that sugar consumption is falling most rapidly in urban areas, yet it is still climbing in rural areas. This suggests that the medium-term outlook for sugar consumption in China is not strong as the country becomes increasingly urbanised.

**Figure 26: China's coffee consumption is taking off, though from extremely low levels**



Source: USDA, Barclays Research

**Figure 27: China's sugar consumption is maturing much earlier than in other Asian nations**



Source: USDA, Barclays Research

## Conclusion: Still hungry, but appetites are changing

To simplify the analysis of this report and organise the data in a way that makes comparisons possible between different commodities and sectors, our forecasts are summarised in Figure 27.

We have categorised each commodity depending on their prospects for intensity of use and growth rates measured in quantities. The quantity measure is chosen because although percentage growth rates are useful short-hand measures for long-term trends, they do not tell the whole story. In the context of a supply side that is struggling to keep up with commodity demand, it is quantities that count. This is especially so in China because base levels of demand have risen so fast in recent years. This means that even with slowing percentage growth rates, quantities will continue to expand fast for many commodities.

Our four categories are as follows:

**Rapid gainers:** These are commodities we expect to increase in usage per unit of GDP over the next five years. As a result, demand growth in quantity terms would accelerate rapidly, though percentage growth rates for some would still fall.

**Steady gainers:** Commodities in this category are set to have their intensity of use decline modestly, but because base levels have risen so fast over the past five years, these commodities should still experience an increase in average growth rates in quantities.

**Losers:** This category covers those commodities in which intensity of use is falling fast enough to result in modest declines in growth rates expressed in quantities.

**Big losers:** We expect commodities in this category to experience such rapid declines in usage intensity over the next five years that growth rates in quantities fall very fast indeed, typically by more than 25%.

Figure 28: Summary outlook for China's intensity of use and demand outlook by commodity

Commodity	Unit	Usage intensity/\$1000 GDP			Change in usage intensity		Annual average change in quantity		Annual average growth rate	
		2007	2011	2015	2007-11	2011-15	2007-11	2011-15	2007-11	2011-15
Rapid gainers (intensity of use rising and annual average growth rates in quantities expanding rapidly)										
Nuclear	boe	0.080	0.068	0.204	-15%	200%	26	221	10%	35%
Renewables	boe	0.004	0.023	0.053	514%	135%	22	59	66%	34%
Coffee	kg	0.005	0.008	0.018	57%	131%	5	21	22%	39%
Gasoline	boe	0.13	0.12	0.15	-7%	26%	106	268	8%	13%
Natural Gas	boe	0.130	0.170	0.210	30%	24%	104	155	20%	17%
Gold	g	0.09	0.11	0.14	23%	22%	65	98	17%	15%
Nickel	kg	0.094	0.124	0.139	32%	12%	80	91	23%	13%
Hydro	boe	0.225	0.271	0.293	20%	8%	139	178	14%	12%
Aluminium	kg	3.37	3.68	3.96	9%	8%	2,135	2,950	18%	14%
Diesel	boe	0.26	0.24	0.24	-8%	1%	207	300	8%	8%
Steady gainers (intensity of use falling modestly but quantity growth rates still increasing)										
Silver	g	0.89	0.86	0.85	-2%	-2%	348	430	10%	9%
Palladium	oz	0.00040	0.00037	0.00035	-7%	-7%	89	139	5%	7%
Coal	boe	2.95	2.70	2.51	-8%	-7%	837	1,038	7%	7%
Crude oil	boe	0.77	0.69	0.64	-10%	-8%	572	611	7%	6%
Lead	kg	0.72	0.82	0.69	14%	-16%	416	452	14%	9%
Cotton	kg	2.86	1.74	1.39	-39%	-20%	-1,100	48	-2%	0%
Beef	kg	1.66	1.05	0.82	-37%	-22%	-32	61	0%	1%
Losers (intensity of use falling and quantity growth rates declining)										
Steel	kg	125	141	136	13%	-3%	71,858	59,769	14%	8%
Jet fuel	boe	0.026	0.027	0.025	2%	-4%	27	26	9%	6%
Copper	kg	1.28	1.47	1.35	15%	-8%	763	600	15%	7%
Petchem	boe	0.20	0.21	0.19	1%	-8%	210	181	9%	6%
Platinum	oz	0.00042	0.00039	0.00035	-7%	-10%	136	99	10%	4%
Zinc	kg	0.96	0.99	0.87	3%	-13%	418	305	11%	6%
Soybeans	kg	13.61	13.35	11.67	-2%	-13%	4,896	3,604	9%	5%
Soybean oil	kg	2.65	2.21	1.92	-17%	-13%	601	544	6%	4%
Corn	kg	41	36	30	-12%	-18%	9,200	7,261	6%	4%
Big losers (intensity of use and quantity growth rates both falling fast)										
Soybean meal	kg	8.4	8.8	7.7	4%	-13%	3,785	2,394	11%	5%
Sugar	kg	3.7	2.6	2.2	-28%	-17%	500	291	4%	2%
Poultry	kg	3.1	2.5	2.0	-21%	-18%	530	405	5%	3%
Pork	kg	11.7	9.4	7.5	-19%	-20%	759	550	2%	1%
Wheat	kg	29	21	16	-26%	-25%	2,300	1,352	2%	1%
Rice	kg	35	26	19	-25%	-27%	2,260	692	2%	1%
Residual fuel oil	boe	0.080	0.044	0.028	-45%	-38%	-46	-16	-6%	-2%

Note: Commodities are sorted by their growth in intensity usage 2011-15. The unit for the annual average growth rates in quantity are as follows: '000' tonnes for base metals, corn, rice, soybeans and products, sugar, coffee, wheat, pork, poultry and beef, tonnes for gold and silver, '000' oz for PGMs, million barrels of oil equivalent for non-oil energy products, '000 bpd for oil and refined products, '000 of 480lb bales for cotton.

Source: Barclays Research



### Analyst Certification(s)

We, Yiping Huang, Roxana Mohammadian Molina, Kevin Norrish and Lingxiu Yang, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

### Important Disclosures

Barclays Research is a part of the Corporate and Investment Banking division of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays"). For current important disclosures regarding companies that are the subject of this research report, please send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 17th Floor, New York, NY 10019 or refer to <http://publicresearch.barcap.com> or call 212-526-1072.

Barclays Capital Inc. and/or one of its affiliates does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays Capital Inc. and/or one of its affiliates regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). Barclays trading desks may have either a long and / or short position in such securities and / or derivative instruments, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, Barclays fixed income research analyst(s) regularly interact with its trading desk personnel to determine current prices of fixed income securities. Barclays fixed income research analyst(s) receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the investment banking department), the profitability and revenues of the Fixed Income, Currencies & Commodities Division ("FICC") and the outstanding principal amount and trading value of, the profitability of, and the potential interest of the firms investing clients in research with respect to, the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. The Corporate and Investment Banking division of Barclays produces a variety of research products including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations contained in one type of research product may differ from recommendations contained in other types of research products, whether as a result of differing time horizons, methodologies, or otherwise. In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to <https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-research-dissemination.html>.

### Disclaimer

This publication has been prepared by the Corporate and Investment Banking division of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays"). It has been issued by one or more Barclays legal entities within its Corporate and Investment Banking division as provided below. It is provided to our clients for information purposes only, and Barclays makes no express or implied warranties, and expressly disclaims all warranties of merchantability or fitness for a particular purpose or use with respect to any data included in this publication. Barclays will not treat unauthorized recipients of this report as its clients. Prices shown are indicative and Barclays is not offering to buy or sell or soliciting offers to buy or sell any financial instrument.

Without limiting any of the foregoing and to the extent permitted by law, in no event shall Barclays, nor any affiliate, nor any of their respective officers, directors, partners, or employees have any liability for (a) any special, punitive, indirect, or consequential damages; or (b) any lost profits, lost revenue, loss of anticipated savings or loss of opportunity or other financial loss, even if notified of the possibility of such damages, arising from any use of this publication or its contents.

Other than disclosures relating to Barclays, the information contained in this publication has been obtained from sources that Barclays Research believes to be reliable, but Barclays does not represent or warrant that it is accurate or complete. Barclays is not responsible for, and makes no warranties whatsoever as to, the content of any third-party web site accessed via a hyperlink in this publication and such information is not incorporated by reference.

The views in this publication are those of the author(s) and are subject to change, and Barclays has no obligation to update its opinions or the information in this publication. The analyst recommendations in this publication reflect solely and exclusively those of the author(s), and such opinions were prepared independently of any other interests, including those of Barclays and/or its affiliates. This publication does not constitute personal investment advice or take into account the individual financial circumstances or objectives of the clients who receive it. The securities discussed herein may not be suitable for all investors. Barclays recommends that investors independently evaluate each issuer, security or instrument discussed herein and consult any independent advisors they believe necessary. The value of and income from any investment may fluctuate from day to day as a result of changes in relevant economic markets (including changes in market liquidity). The information herein is not intended to predict actual results, which may differ substantially from those reflected. Past performance is not necessarily indicative of future results.

This communication is being made available in the UK and Europe primarily to persons who are investment professionals as that term is defined in Article 19 of the Financial Services and Markets Act 2000 (Financial Promotion Order) 2005. It is directed at, and therefore should only be relied upon by, persons who have professional experience in matters relating to investments. The investments to which it relates are available only to such persons and will be entered into only with such persons. Barclays Bank PLC is authorised and regulated by the Financial Services Authority ("FSA") and a member of the London Stock Exchange.

The Corporate and Investment Banking division of Barclays undertakes U.S. securities business in the name of its wholly owned subsidiary Barclays Capital Inc., a FINRA and SIPC member. Barclays Capital Inc., a U.S. registered broker/dealer, is distributing this material in the United States and, in connection therewith accepts responsibility for its contents. Any U.S. person wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of Barclays Capital Inc. in the U.S. at 745 Seventh Avenue, New York, New York 10019.

Non-U.S. persons should contact and execute transactions through a Barclays Bank PLC branch or affiliate in their home jurisdiction unless local regulations permit otherwise.

Barclays Bank PLC, Paris Branch (registered in France under Paris RCS number 381 066 281) is regulated by the Autorité des marchés financiers and the Autorité de contrôle prudentiel. Registered office 34/36 Avenue de Friedland 75008 Paris.

This material is distributed in Canada by Barclays Capital Canada Inc., a registered investment dealer and member of IIROC ([www.iiroc.ca](http://www.iiroc.ca)).

Subject to the conditions of this publication as set out above, Absa Capital, the Investment Banking Division of Absa Bank Limited, an authorised financial services provider (Registration No.: 1986/004794/06), is distributing this material in South Africa. Absa Bank Limited is regulated by the South African Reserve Bank. This publication is not, nor is it intended to be, advice as defined and/or contemplated in the (South African) Financial Advisory and Intermediary Services Act, 37 of 2002, or any other financial, investment, trading, tax, legal, accounting, retirement, actuarial or other professional advice or service whatsoever. Any South African person or entity wishing to effect a transaction in any security discussed herein should do so only by contacting a

representative of Absa Capital in South Africa, 15 Alice Lane, Sandton, Johannesburg, Gauteng 2196. Absa Capital is an affiliate of Barclays.

In Japan, foreign exchange research reports are prepared and distributed by Barclays Bank PLC Tokyo Branch. Other research reports are distributed to institutional investors in Japan by Barclays Capital Japan Limited. Barclays Capital Japan Limited is a joint-stock company incorporated in Japan with registered office of 6-10-1 Roppongi, Minato-ku, Tokyo 106-6131, Japan. It is a subsidiary of Barclays Bank PLC and a registered financial instruments firm regulated by the Financial Services Agency of Japan. Registered Number: Kanto Zaimukyokuchō (kinsho) No. 143.

Barclays Bank PLC, Hong Kong Branch is distributing this material in Hong Kong as an authorised institution regulated by the Hong Kong Monetary Authority. Registered Office: 41/F, Cheung Kong Center, 2 Queen's Road Central, Hong Kong.

This material is issued in Taiwan by Barclays Capital Securities Taiwan Limited. This material on securities not traded in Taiwan is not to be construed as 'recommendation' in Taiwan. Barclays Capital Securities Taiwan Limited does not accept orders from clients to trade in such securities. This material may not be distributed to the public media or used by the public media without prior written consent of Barclays.

This material is distributed in South Korea by Barclays Capital Securities Limited, Seoul Branch.

All equity research material is distributed in India by Barclays Securities (India) Private Limited (SEBI Registration No: INB/INF 231292732 (NSE), INB/INF 011292738 (BSE), Registered Office: 208 | Ceejay House | Dr. Annie Besant Road | Shivsagar Estate | Worli | Mumbai - 400 018 | India, Phone: + 91 22 67196363). Other research reports are distributed in India by Barclays Bank PLC, India Branch.

Barclays Bank PLC Frankfurt Branch distributes this material in Germany under the supervision of Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin).

This material is distributed in Malaysia by Barclays Capital Markets Malaysia Sdn Bhd.

This material is distributed in Brazil by Banco Barclays S.A.

This material is distributed in Mexico by Barclays Bank Mexico, S.A.

Barclays Bank PLC in the Dubai International Financial Centre (Registered No. 0060) is regulated by the Dubai Financial Services Authority (DFSA). Principal place of business in the Dubai International Financial Centre: The Gate Village, Building 4, Level 4, PO Box 506504, Dubai, United Arab Emirates. Barclays Bank PLC-DIFC Branch, may only undertake the financial services activities that fall within the scope of its existing DFSA licence. Related financial products or services are only available to Professional Clients, as defined by the Dubai Financial Services Authority.

Barclays Bank PLC in the UAE is regulated by the Central Bank of the UAE and is licensed to conduct business activities as a branch of a commercial bank incorporated outside the UAE in Dubai (Licence No.: 13/1844/2008, Registered Office: Building No. 6, Burj Dubai Business Hub, Sheikh Zayed Road, Dubai City) and Abu Dhabi (Licence No.: 13/952/2008, Registered Office: Al Jazira Towers, Hamdan Street, PO Box 2734, Abu Dhabi).

Barclays Bank PLC in the Qatar Financial Centre (Registered No. 00018) is authorised by the Qatar Financial Centre Regulatory Authority (QFCRA). Barclays Bank PLC-QFC Branch may only undertake the regulated activities that fall within the scope of its existing QFCRA licence. Principal place of business in Qatar: Qatar Financial Centre, Office 1002, 10th Floor, QFC Tower, Diplomatic Area, West Bay, PO Box 15891, Doha, Qatar. Related financial products or services are only available to Business Customers as defined by the Qatar Financial Centre Regulatory Authority.

This material is distributed in the UAE (including the Dubai International Financial Centre) and Qatar by Barclays Bank PLC.

This material is distributed in Saudi Arabia by Barclays Saudi Arabia ('BSA'). It is not the intention of the publication to be used or deemed as recommendation, option or advice for any action (s) that may take place in future. Barclays Saudi Arabia is a Closed Joint Stock Company, (CMA License No. 09141-37). Registered office Al Faisaliah Tower, Level 18, Riyadh 11311, Kingdom of Saudi Arabia. Authorised and regulated by the Capital Market Authority, Commercial Registration Number: 1010283024.

This material is distributed in Russia by OOO Barclays Capital, affiliated company of Barclays Bank PLC, registered and regulated in Russia by the FSFM. Broker License #177-11850-100000; Dealer License #177-11855-010000. Registered address in Russia: 125047 Moscow, 1st Tverskaya-Yamskaya str. 21.

This material is distributed in Singapore by the Singapore branch of Barclays Bank PLC, a bank licensed in Singapore by the Monetary Authority of Singapore. For matters in connection with this report, recipients in Singapore may contact the Singapore branch of Barclays Bank PLC, whose registered address is One Raffles Quay Level 28, South Tower, Singapore 048583.

Barclays Bank PLC, Australia Branch (ARBN 062 449 585, AFSL 246617) is distributing this material in Australia. It is directed at 'wholesale clients' as defined by Australian Corporations Act 2001.

IRS Circular 230 Prepared Materials Disclaimer: Barclays does not provide tax advice and nothing contained herein should be construed to be tax advice. Please be advised that any discussion of U.S. tax matters contained herein (including any attachments) (i) is not intended or written to be used, and cannot be used, by you for the purpose of avoiding U.S. tax-related penalties; and (ii) was written to support the promotion or marketing of the transactions or other matters addressed herein. Accordingly, you should seek advice based on your particular circumstances from an independent tax advisor.

© Copyright Barclays Bank PLC (2012). All rights reserved. No part of this publication may be reproduced in any manner without the prior written permission of Barclays. Barclays Bank PLC is registered in England No. 1026167. Registered office 1 Churchill Place, London, E14 5HP. Additional information regarding this publication will be furnished upon request.

---

