Discussion

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This paper focuses on China´s demand for commodities. While this is a broad topic, the paper sets out to perform three well-defined tasks. First, it gives a comprehensive view of the market specificities for several commodities that China demands, including various classes in the broader categories of metals, energy and food. Second, it builds a rich panel dataset where various countries' demand for different commodities is estimated as a function of each country's economic development, essentially per capita GDP. Third, with the insight of the descriptive section and the quantitative methodology of the empirical exercise, the authors run a scenario to project Australia–China bilateral trade.

My discussion focuses on three main points. First, I will make some general comments on the descriptive part of the paper. Second, I will provide some suggestions for improvement on the empirical section. Finally, I will suggest applying their methodology to forecast the consequences of the surge of India in the demand for world commodities as a possible extension.

As a descriptive section within an empirical paper, the second section seems too long at first glance, taking more than 50 per cent of the paper's main text. However, a closer look at the material validates the size of this section. Indeed, for a reader who is somewhat familiar with some commodities, but not an expert – as was my case – this section is invaluable in terms of summarising the key aspects of various commodity classes. The main takeaway from this section is that the details matter in understanding and forecasting the demand for a particular commodity. Let me give a few examples, starting with an easy one given my background – the case of copper. This metal is mostly used for electricity consumption. How would you try to assess the demand for this particular commodity? It seems natural to use the projected growth of a country's power grid as the relevant metric, in favour of a broader index, such as GDP or population growth.

A less obvious metal to deal with is steel, intensively used by China for construction as well as in manufactured goods for exporting. Steel can be produced from iron ore and coal in blast furnace-basic oxygen convertors, the main technology used in Chinese steel production, but can also be recycled from scrap steel in different types of furnaces. As the paper notes, while there are many upsides to the outlook for steel production and therefore demand for iron ore and coal from other countries, including Australia, there is also the downside risk that the use of scrap becomes more prevalent in China than currently forecast. Indeed, the authors document that other countries rely more on scrap than China. The paper also paints a relatively dark future for coal demand. While around 80 per cent of China´s electricity generation requirements are currently met by burning coal, environmental issues have grown more severe in the past decade and there are credible signs that Chinese authorities might start prioritising the development of alternative energy sources.

Overall, I believe this section makes for an insightful and entertaining read, and I suggest that the authors keep it this way, perhaps adding a table summarising the main drivers of demand for each commodity and the features of each market.

My second line of comments relates to the empirical exercise. The authors build an impressive panel to estimate the drivers of different commodity consumption levels. For each commodity, the panel has a minimum of 41 economies and 43 years (for nickel), but up to 115 economies and 53 years in the case of food consumption (measured in calories). The estimation method is non-linear ordinary least squares (OLS), where a measure of commodity consumption is on the left-hand side (production in the case of steel), and as explanatory variables they include GDP per capita, with a quadratic specification as well as a time trend. An alternative specification, which allows a more flexible relationship between GDP and demand, uses a smooth transition function instead of the quadratic term and, in a third specification used for food, the inverse of GDP is used.

The authors then highlight a number of results. First and foremost: non-linearity matters. Indeed, demand is hump-shaped in GDP (whether the quadratic or the smooth transition specifications are used). Based on these regressions, the authors conclude that while some commodities have already reached their peak – steel, and aluminium in some specifications – others will continue to increase in the medium term – copper and nickel – and even further in the case of energy demand.

While I believe the exercise performed seems appropriate, in particular the use of non-linear OLS, I do see a potential drawback for the exercise, so a word of caution is in order when interpreting these results. The main limitation of the exercise in my view is that the technologies today are radically different from those available in the 1970s or 1980s. This is important because, with alternative technologies available today, the relationship between development in China and its demand for energy products can be quite different from that of, say, an advanced economy in the 1970s when it reached a comparable GDP per capita level to China today. I do not believe there is much the authors can do about this, besides perhaps estimating the regression for different sub-periods, but it does raise a concern. This should perhaps be mentioned explicitly and the results taken with a grain of salt.

Another suggestion concerns the variables included in the right-hand side of the regression. After all the valuable details discussed in Section 2, one would expect some of the market specificities to show up in the regression. For instance, electric power grid, and not just GDP, could be used to estimate copper demand. I believe the authors chose parsimony over detail in this section, but it strikes me as at odds with the important messages in the descriptive section. Here I would suggest providing alternative regressions with a few extra explanatory variables, chosen specifically for each commodity in line with the previous discussion.

My final set of remarks outlines a potential extension. Looking at the growth numbers in China, one cannot help but wonder if India could provide the next wave of global commodity demand. Indeed, India has the second largest population in the world (1.25 billion) – not far from China's 1.35 billion – but India's current GDP per capita is less than half of China's. Several growth projections (take the Consensus Economics forecasts, for instance) see India's growth outpacing China over the medium run, closing this gap. This will obviously have deep implications for commodity demand worldwide. Indeed, as development catches on, one would expect other gaps to close as well, like the 750 kWh per person energy consumption in India vis-à-vis the 3 500 kWh per person

consumption in China, or steel production per capita, which today in India is about a tenth of the figure in China. While it is perhaps out of the scope of the conference, I can see the estimation of the effect of India´s growth on commodity demand worldwide as an extension to this paper or as the basis of another paper.

Overall, I thought this was a well-thought-out paper, with important qualitative insights backed with a very serious empirical exercise that can perhaps be improved and extended by taking these suggestions along with others offered during the general discussion.

2. General Discussion

Much of the discussion centred on the projections of Chinese commodity demand and the econometrics used in the paper. Some participants noted that the econometric framework does not take into account the structure of China's industrial sector. These participants suggested that the authors could include additional explanatory variables in their models to account for differences in the composition of industry across countries. One participant argued that these adjustments would likely result in a stronger projection of Chinese crude steel production, with China's steel intensity likely to be closer to the high levels observed in Japan and South Korea. Similarly, another participant suggested basing the projections on the World Steel Association's estimates of true steel consumption, which adjusts domestic steel consumption for trade in steel-containing goods.

Ivan Roberts noted that the authors could include additional explanatory variables on the composition of industry and that this would be similar to the approach used in various other papers. However, he also suggested that this would complicate the paper's approach to projecting commodity demand, as it is not clear how the authors would construct projections for these additional explanatory variables. He further suggested that a key advantage of the approach used in the paper is that it allows scenario analysis to be conducted in a simple and transparent way.

One participant noted that over the medium to long term, the intensity of commodity use in an economy is largely driven by changes in consumer preferences and technological advancement. The participant suggested that while the paper focuses on changes in preferences, it does not address the issue of technological change. In response, Dr Roberts pointed out that the models include a time trend, which is partly intended to capture the effect of technological change.

Participants also suggested that the paper would benefit from more discussion on the outlook for supply of different commodities, both from China and other global producers. One participant made the point that a large share of state-owned iron ore producers in China have continued to operate despite being loss making. Another participant questioned whether environmental concerns could lead to reduced domestic output of coal, iron ore and steel production. Dr Roberts agreed that these were interesting areas of research, but suggested that addressing these issues was outside the scope of the paper.

There was also discussion on the projections of Australian commodity exports to China. One participant suggested extending the projections to include demand from other economies, such as India and south-east Asian economies. Other participants focused on estimates of demand

for specific energy commodities and how they were derived from the projections of aggregate energy demand. One participant suggested using the historical relationship between GDP per capita and the composition of energy demand to improve the projections for each of the types of primary energy products. Another participant suggested that environmental concerns may reduce China's demand for coal in the future. This participant also suggested the relative prices of energy commodities would be an important factor in determining China's energy mix.

Another participant thought there were large downside risks to the outlook for Australian coal exports. They noted that the cost of transporting coal in China has declined in recent years, due to large investment in rail infrastructure. The participant also suggested that this increase in the competitiveness of Chinese coal producers largely explains the decline in coal imports in recent years. Dr Roberts agreed that there is considerable downside risk to the outlook for China's coal imports, noting that investment in rail and ultra-high voltage electricity transmission will increase the competitiveness of Chinese coal producers. However, another participant suggested that, while China could be self-sufficient in coal, it is unlikely. This participant suggested that China will continue to import low-cost coal, which will maintain competitive pressure on domestic producers.

One participant suggested the paper would benefit from a distinction between metallurgical coal and thermal coal. Demand for these two types of coal is driven by different factors, with metallurgical coal being used in steel production and thermal coal being used predominately for electricity generation. Dr Roberts pointed out that the authors have only modelled aggregate energy demand and that the projections for coal are then estimated based on Chinese government targets. However, he also noted that the paper could provide a more detailed analysis of the drivers of demand for different types of coal.

One participant also suggested that there was significant upside risk to the liquefied natural gas (LNG) export projections, given the large investments in Australia's LNG export capacity in recent years. However, Dr Roberts suggested that the projections were consistent with previous work published by the RBA that used a bottom-up approach to project Australian LNG exports.