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Primary commodity prices: Co-movements, common factors and fundamentals ☆

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ABSTRACT

The behavior of commodities is critical for developing and developed countries alike. This paper contributes to the empirical evidence on the co-movement and determinants of commodity prices. Using nonstationary panel methods, we document a statistically significant degree of co-movement due to a common factor. Within a Factor Augmented VAR approach, real interest rate and uncertainty, as postulated by a simple asset pricing model, are both found to be negatively related to this common factor. This evidence is robust to the inclusion of demand and supply shocks, which both positively impact on the co-movement of commodity prices.

1. Introduction

Movements in commodity prices matter for countries' external and internal balances as well as their respective fiscal and monetary policies. It is therefore not surprising that the nature of such movements, and their determinants, have attracted so much attention in both academic and policy circles. Earlier research has focused on the historical trends of primary commodity prices relative to the price of manufactured goods within the context of the Prebisch (1950) and Singer (1950) hypothesis, as recently revisited by Harvey et al. (2010). Attention has also focused on commodity prices' time series properties (for example, Cashin et al., 2000; Cuddington, 1992a; Deaton, 1999). Both aspects carry important welfare implications: while a sustained decline in commodity prices supports the hypothesis of the so-called 'resource curse' for commodity-abundant developing countries, the degree of volatility and persistence of commodity prices affects the design and effectiveness of stabilization policies.

Another relevant feature of commodity prices is their tendency to co-move. Understanding such co-movement is however just as important, as it carries important welfare implications for both commodity importers and exporters. Indeed, a synchronized increase in commodity prices is likely to place commodity import dependent countries under considerable inflation pressure (see Borensztein and Reinhart, 1994). Moreover, if co-movements are due to substitution effects, they further foster export concentration in commodity producing countries. In both cases, the ability to diversify shocks to the current account, to manage domestic imbalances and to resist inflation pressures will be constrained.

The contemporaneous and dramatic upsurge in commodity prices in the 2000s has prompted a new search for the fundamentals, which make commodity prices co-move. Among the alternatives, Frankel (2008) and Calvo (2008) have discussed the role of the real interest rate; Wolf (2008) and Svensson (2008) have mentioned the importance of shifts in global supply and demand. Further, Krugman (2008) has argued that the increase in oil prices, providing an incentive to produce biofuels, is responsible for the increase in food prices. Little effort, however, has so far been devoted to disentangling these different hypotheses from an empirical standpoint.

In this paper, we attempt to progress the empirical evidence on primary commodity prices along different directions. First, we examine the extent and nature of price co-movements between primary commodities.[1] To do so, we exploit the information embedded in annual historical prices. Specifically, we analyze 24 commodity price series observed for over one hundred years of data from 1900 to 2008. Such low frequency should reduce the noise to signal ratio, allowing us to concentrate on the "fundamental" price co-movements. We first diagnose the overall

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[1] This mirrors a much recent empirical work on the co-movement of economic variables, for example Kose et al. (2003), Monacelli and Luca (2009) and Ciccarelli and Mojon (2010).

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co-movement in the panel, using the test statistic suggested by Ng (2006). We then apply the Bai and Ng (2004) Panel Analysis of Nonstationary and Idiosyncratic Components (PANIC) to identify potential common factors in commodity prices. These methods are attractive since they include statistical tests of co-movement, taking account of the time series properties of the data. Our findings highlight a sizeable degree of correlation in the data and detect the existence of a common factor.

We next investigate the relationship between commodity prices and macroeconomic determinants. Using a Factor Augmented Vector Auto Regression (FAVAR) approach,[2] we relate the identified common factor in commodity prices to their macroeconomic fundamentals. Here, we draw on a stylized theoretical model that postulates the role of the real interest rate, as suggested by Frankel (2008) and Calvo (2008), and uncertainty, as indicated by Beck (1993, 2001). Furthermore, we assess whether our results are robust to alternative measures of risk or other factors, such as demand and supply shocks, as suggested by Svensson (2008), Wolf (2008) and Krugman (2008).

The rest of the paper proceeds as follows. Section 2 reviews the relevant empirical literature on commodity prices. Section 3 posits a stylized model of the fundamental determinants of commonalities in commodity prices. Section 4 presents the data and the empirical evidence on the co-movements in commodity prices. Section 5 relates the common factor in commodity prices to its determinants. Section 6 concludes.

2. Related empirical literature on commodity prices

Movements in commodity prices are important for the welfare of both developing and developed countries (see, among the others, Daude et al., 2010; Frankel, 2008; Neftci and Lu, 2008).[3] This importance has spawned a considerable academic literature with a primary focus on their time series properties. Seminal empirical work in this area can probably be dated back to Prebisch (1950) and Singer (1950) and their controversial thesis (PST) of a declining long-term trend in the terms of trade of commodity exporters. The PST provided justification for import substitution policies as an appropriate tool for development. An extensive literature ensued that focused on the historical relationship between the price indices of primary commodities and manufactured goods.[4]

Furthermore, Deaton (1999) has stressed the importance of assessing the time series properties of individual commodities and their co-movement, rather than price indices, in order to assess the different impact of commodity prices on developing and industrial countries, and assess the need for stabilization policies.[5] A strand of literature has subsequently investigated these properties. With respect to their degree of persistence, Cashin et al. (2000), for example, calculate median unbiased half lives of 60 commodity prices observed monthly between 1957 and 1998. They find that shocks are typically long lasting, and conclude that stabilization schemes may be more costly than beneficial. Cashin et al. (2000) report "typical" commodity prices half lives in the range of 5 years.[6] Regarding the issue of co-movement, Cashin et al. (2002) find evidence of synchronization in the prices of related commodities.[7]

As mentioned above, the surge in commodity prices in the 2000s has renewed the interest for the co-movement of commodity prices and their determinants. Mollick et al. (2008), for example, investigate the impact of globalization on the terms of trade of relative prices and test whether US relative prices are affected by international prices. While they establish a decreasing trend in relative prices, they argue that this trend is not related to globalization or international integration. On this evidence, they conclude that policies aimed at increasing or decreasing the degree of integration with the world economy would thus not be effective at modifying this long term trend. Cuddington and Jerrett (2008) and Jerrett and Cuddington (2008) search for the presence of super-cycles (20–70 year cycles) in a set of metal goods prices and use correlation and principal component analysis to investigate their degree of concordance.

A parallel and lively debate, also spurred by the recent price boom, has revolved around the determinants of commodity prices. In this respect, Frankel (2008) purports the role played by the real interest rate on bonds as follows: a rise in the real interest rate provides an incentive to intensify mining in an effort to invest the proceeds. As the supply of natural resources is increased in consequence, their price should come down. At the same time, higher rates of return on bonds will reduce speculative demand for commodities and, hence, further cut their price. Moreover, higher interest rates reduce inventory demand and commodity prices. Similarly, Calvo (2008) argues that the increase in commodity prices mostly stems from the combination of low central bank interest rates, the growth of sovereign wealth funds and the consequent lower demand for liquid assets. However, he argues that this relationship is only temporary as prices will adjust in the long-run. Empirically, a number of studies have tended to include a commodity price index in the context of monetary VARs. Overall, these papers tend to find evidence of a negative impact of interest rates on commodity prices (see Bernanke and Mihov, 1998; Bernanke et al., 2005; Christiano et al., 1999; Sims, 1992).[8]

While presenting the case for interest rates, Frankel (2008) and Svensson (2008) also underline the role of risk in explaining primary commodity movements. Without considering the role of interest rates, the relevance of risk was previously considered also by Beck (1993, 2001), who discussed ARCH effects and possibly GARCH in mean effects in commodity prices, finding mixed evidence. The importance of uncertainty for economic outcomes, and particularly for investment, has also been suggested by Dixit and Pindyck (1994).

The recent interest in commodity price movements has led to additional explanations with respect to their determinants. Svensson (2008) argues that global demand and supply shocks may be important for commodity prices. The importance of global demand as a determinant of commodity prices has also been highlighted by Wolf (2008). He emphasizes the increasing demand from emerging market economies such as China and India, as they become more prominent in the world trade of commodities. Finally, according to Krugman (2008), as inventory holdings have not surged in recent years, speculation is a less convincing rationale for common or idiosyncratic movements in commodity prices. Instead, Krugman believes that a resource shortage is the main determinant of increases in the prices of primary commodities. Consistent with this view, the increase in oil prices may explain the contemporaneous increase in the price of other commodities, such as foodstuff, via both cost effects on the energy intensive agriculture sector and substitution effects due to increasing biofuel production.

[2] Such an approach has been applied by Bernanke et al. (2005) in the examination of US monetary policy.

[3] On the different impact of commodity prices for developing and developed countries, Frankel (2008) notes how, on the one hand, the low levels of commodity prices in the late 1980s and in the 1990s may have played a role in some of the financial crises in commodity exporters emerging markets, deteriorating their current accounts. On the other hand, he also notes, they have acted like a positive supply shock for industrial countries, such as the US, lowering input prices and inflation and allowing high growth and employment.

[4] See, among others, Grilli and Yang (1988), Cuddington (1992a), Leon and Soto (1997), Kellard and Wohar (2005), Bunzel and Vogelsang (2005), Zanias (2005), Balagtas and Holt (2009) and Harvey et al. (2010).

[5] In particular, Deaton (1999) underlines how industrial countries, who on average are net importers of a large range of commodities, perform very differently from less developed countries, who often export only a limited range of primary goods. Further, he argues that while world demand (imports) may determine common shocks to a wide range of prices, the impact of shocks to the world supply may differ from good to good, causing relative prices to differ.

[6] For other studies of commodity prices see, inter alia, Bleaney and Greenaway (2001), MacDonald and Ricci (2004), Chen and Rogoff (2003) and Chen et al. (2010).

[7] Prominent work on the co-movement of commodity prices from Pindyck and Rotemberg (1990) suggests substantial price co-movement beyond macroeconomic fundamentals and argues, looking at monthly data, that this is due to commodity speculation. In this paper, we look at long spans with a lower frequency in the attempt to limit the extent of noise or speculation in the data.

[8] We would like to thank an anonymous referee for bringing this literature to our attention.