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Global oil prices, macroeconomic fundamentals and China's commodity sector comovements

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HIGHLIGHTS

- We examine the comovements of commodity prices at the industry level in China.
- The common factor accounts for a significant portion of commodity sector fluctuations.
- We investigate the joint impacts of global oil price shocks and domestic macro fluctuations on the comovements.
- The global oil price shocks have persistent and strong effects on the comovements.
- The impacts of domestic macro fluctuations on the comovements differ at short and long horizons.

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ABSTRACT

This paper investigates the common movements of commodity sectors in China as well as the economic underpinnings of the comovements. We employ a Bayesian dynamic latent factor model to disentangle the common and idiosyncratic sector-specific factors of the prices of a group of China's commodity sectors: petrochemicals, grains, energy, non-ferrous metals, oils & fats, and softs. The results indicate that the common factor accounts for a significant portion of the fluctuations of China's commodity sectors, providing evidence of the strong commodity sector comovements in China. We further use a VAR model to link the common movements across China's commodity sectors to the underlying determinants, including global oil price shocks and domestic macroeconomic fluctuations. We find that the global oil price shocks have strong effects on the common movements across commodity sectors in China in addition to its domestic macroeconomic fluctuations at long horizons. However, at short horizons, the common movements across commodity sectors in China respond more strongly to the global oil shocks than to its domestic macroeconomic fluctuations.

1. Introduction

In recent decades, with an increase in the global demands for commodities due to economic growth in the world, the fluctuations in commodity prices have attracted increased attentions for academic researchers as well as policymakers. A wide variety of theoretical and empirical studies focuses on different properties of the dynamics of commodity prices. A significant feature of commodities is that their prices exhibit a strong tendency to move together (Pindyck and Rotemberg, 1990). In particular, the common movements of commodity prices are strongly associated with the robust growth of commodity demands across emerging economies in recent years. For example, as the world's most populous country accompanied by a fast-growing economy, China has already become the world's largest consumer of several primary commodity sectors, such as more than 54% of world's cement and iron ore, more than 50% of world's pork and more than 40% of world's copper in 2010. What is really staggering is not only the sheer quantity of commodity consumption, but the growth rate of such commodity consumption. For example, China's energy consumption growth accounted for one-third of the world's energy consumption growth in 2013.

Moreover, due to rapid economic growth and high energy consumption over the past years, China surpassed Japan as the world's second-largest crude oil consumer behind the United States in 2003 and became the global largest net importer of crude oil in 2013. At the same time China's dependence on imported oil has increased to more than 50% in 2013. In addition, the global crude oil prices have been volatile over the recent decades. For

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example, the prices reached the record level of $147 per barrel in July 2008 and followed a precipitous crash which stopped only at $30 per barrel in 2008 to rebound once again to $106 per barrel in January 2011. In the middle of 2014, the prices started declining once again and by December 2014 reached their lowest prices since 2009. Because of China's fast-growing oil consumption and its increasing dependence on imported oil from the global market, the volatility of crude oil prices will inevitably affect energy market as well as economic development in China. In addition, this volatility could be transferred to different bulk commodity markets and then simultaneously affect the fluctuations across different commodity sectors in China. Therefore, it is urgent to investigate the effects of oil price volatility on the common movements of China's commodity prices at the industry level and thus help identify the best policy responses to commodity market and economic development.

Furthermore, the integration of a country's economy can also fundamentally affect the nature of economic uncertainty faced by that country, and, as a result, the fluctuations of its domestic commodity market. For example, in a closed economy, individual country's domestic macroeconomic fluctuations are perhaps the most important driving force of the movements in commodity prices in that country. In an integrated global economy, every single country's commodity market is no longer immune to economic activity in the world, such as the shocks of global oil market. As an emerging economy of rapidly growing commodity consumption as well as one of the world's largest importers of crude oil, China is being increasingly integrated into the global economy. China's commodity market therefore will probably respond strongly to the global oil price shocks as well as to its domestic macroeconomic fluctuations.

In the context of China's increasing integration into the global economy as well as its rapid growth of commodity consumption, the prices of different commodity sectors in China have become more interconnected and may also have spillover and feedback effects on each other. This spurs our interest in the question of how the ongoing phenomenon has affected the transmission of price fluctuations across commodity sectors in China. An important question in this context is whether a substantial fraction of commodity sector price fluctuations are sector-specific or whether there exist a common factor which might be driving the fluctuations that are common across commodity sectors in China. Recently, factor models have been widely applied to investigate the comovements of commodity prices (Byrne et al., 2013; West and Wong, 2014). Therefore, the factor extracted from a panel of commodity prices can be used to characterize the comovements of commodity prices.

In this paper, we aim to investigate the comovements of China's commodity prices at the industry level as well as the joint impacts of global oil price shocks and its domestic macroeconomic fluctuations. First, we employ a Bayesian dynamic latent factor model to investigate the degree of the comovements across a group of commodity sectors in China, including petrochemicals, grains, energy, non-ferrous metals, oils & fats, and softs. Specifically, using the dynamic factor model estimated on monthly data of these six commodity sectors from July 2004 to June 2014 via Bayesian MCMC methods, we examine the extent to which the common factor captures the comovements of commodity sector prices. We find that the common factor accounts for a significant portion of the fluctuations of commodity sectors, providing evidence of a high degree of the commodity sector comovements in China.

We next investigate the relationship between commodity sector comovements and their underlying determinants, including global oil price shocks and its domestic macroeconomic fluctuations. We employ a vector autoregression (VAR, henceforth) model to link the common factor in China's commodity sectors to their determinants. We find that the global oil price shocks have strong effects on the common movements across China's commodity sectors in addition to its domestic macroeconomic fluctuations at long horizons. However, at short horizons, the common movements across commodity sectors in China respond more strongly to the global oil shocks than to its domestic macroeconomic fluctuations.

1.1. Literature review

Our paper is related to two strands of literatures. The first strand is the empirical literature on commodity price comovements. One of the earliest prominent analyses of the comovements of commodity prices can be dated to Pindyck and Rotemberg (1990), and their result demonstrates that the prices of a group of largely unrelated raw commodities tend to move together. Since then, there are a wide variety of empirical studies of the properties of the comovements in commodity prices in the literature (Cuddington, 1992; Malliaris and Urrutia, 1996; Deaton, 1999; Cashin et al., 2002; Ai et al., 2006; Lescaroux, 2009; Natanelov et al., 2011; Byrne et al., 2013; Matesanz et al., 2014; West and Wong, 2014). For example, when examining the cycles in the real prices of 36 individual commodities, Cashin et al. (2002) find the evidence of synchronization in the prices of these commodities. Lescaroux (2009) confirms that prices of unrelated raw resources tend to move together at high frequencies for a large set of 51 commodities, and also provides evidence that the high level of correlation between cycles of oil and metal prices can be largely explained by the common shock to inventory levels. Natanelov et al. (2011) investigate the price movements between crude oil futures and a series of agricultural commodities and gold futures and find that the comovement is a dynamic concept. Their result also indicates that some economic and policy development may affect the relationship between crude oil and agricultural commodities.

In order to investigate the nature of commodity price comovements, the existing studies employ a wide range of econometric models and statistical procedures to revisit the phenomena. Factor models are one of the most widely used approaches to investigate the comovements of commodity prices in the literature (Jerrett and Cuddington, 2008; Chen et al., 2012; Byrne et al., 2013; West and Wong, 2014). For example, using a static factor model which is constructed as a weighted average of commodity prices, West and Wong (2014) find that commodity prices tend to revert towards the factor. Byrne et al. (2013) employ correlation methodology and panel factor model to examine the price comovements among primary commodities. The result indicates a sizeable degree of correlation in the commodity prices and also detects the existence of common factors. To search for the presence of super-cycles in a set of metal goods prices, Jerrett and Cuddington (2008) use correlation analysis and principal component analysis to investigate their degree of concordance.

Moreover, a range of other sophisticated econometric models are employed to investigate the features of commodity price comovements. For example, cointegration techniques have been widely used to examine the linkages of the prices of different commodities in the empirical literature (Malliaris and Urrutia, 1996; Natanelov et al., 2011). Nonetheless, Deb et al. (1996) find weak evidence of excess comovements within the framework of univariate and multivariate GARCH models. Ai et al. (2006) fit a partial equilibrium model to investigate the comovement for the prices of five agricultural commodities and find that the model explains the majority of the comovements among the commodities with high price correlation. Tonn et al. (2010) apply wavelet analysis to study the correlation between the future prices of natural gas and crude oil.

Our paper is also related to another strand of the empirical