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Speculative bubbles in agricultural prices☆

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ABSTRACT

We use the momentum threshold autoregressive (MTAR) approach to test for speculative bubbles in US corn, soybean and wheat prices. To approximate fundamental values of these agricultural commodities, we use real crude oil prices and real exchange rates. Our empirical results support the hypothesis that speculative bubbles are present in wheat prices between 2003 and 2013. For corn and soybeans, however, our empirical results are inconclusive.

1. Introduction

In nominal terms, agricultural commodity prices reached unprecedented heights in mid-2008, then collapsed during the global financial crisis, and skyrocketed again in 2011. High agricultural and food prices may destabilize countries due to their impact on inflation, income distribution and poverty (Agricultural Economics, 2008; FAO, 2008; USDA, 2008; von Braun, 2008). While countries with strong competitive advantages can benefit from soaring commodity prices, poor households might suffer from the increase in food prices, and exporting sectors may lose competitiveness due to the appreciating currency (Estrades & Terra, 2012).

There is an ongoing debate among academics, the media and politicians about the causes that led to the recent price spikes and crashes in agricultural markets. On the one hand, several fundamentals such as growth in emerging markets, weather shocks, declining inventory or consumption growth are put forward as price increase factors. However, it is not proven that these factors are responsible for the price spikes and crashes. In addition, it is difficult to quantify their impact due to the lack of valid data availability.[1]

On the other hand, politicians, regulators and part of the media claim that low interest rates and the attractiveness of raw materials with respect to portfolio diversification fostered the increasing financialization of commodity markets, which finally led to speculative bubbles in agricultural prices. The claim that commodity index traders (CIT) caused the recent price spikes became known as the Masters hypothesis, coined by Irwin and Sanders (2012b).[2] Empirical results about the impact of CITs on price levels and volatility are mixed. While the majority of studies rejects the hypothesis that index funds caused commodity prices to spike (e.g. Irwin & Sanders, 2010, 2011, 2012b; Sanders & Irwin, 2011a, 2011b;

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[1] An overview and discussion about those factors are given by Headey and Fan (2008) and Headey, Mailayandi, and Fan (2010).

[2] On May 2008, the founder and manager of Masters Capital Management, Michael Masters (2008), stated before the US Senate Committee on Homeland Security and Governmental Affairs that index funds are primarily to blame for the energy and food commodity price spikes.

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Stoll & Whaley, 2011), some studies find support for the reproach (e.g. Gilbert, 2010b; Gilbert & Pfuderer, 2012).

We investigate whether agricultural prices were exposed to speculative bubbles by using two factors, which are widely considered as long-run impact factors on agricultural prices, namely the crude oil price and the exchange rate.

We apply the momentum threshold autoregressive (MTAR) approach to detect speculative bubbles. It is an improvement over the TAR model proposed by Tong (1978), and was adapted to the cointegration context by Enders and Granger (1998) and Enders and Siklos (2001). The test consists of two steps. First, it analyzes whether the fundamentals and observed prices are threshold cointegrated. Second, if threshold cointegration is found to exist, the parameter signs indicate whether a speculative bubble is present. So far, the MTAR model was applied to data on US stock prices (Behr, 2007; Bohl, 2003; Bohl & Siklos, 2004; Boucher, 2007; Self & Mathur, 2006) and on real estate investment trusts (Payne & Waters, 2005, 2007; Waters & Payne, 2007) to detect speculative bubbles. The application to (agricultural) commodity prices is novel.

While previous studies have extensively drawn on the present value model, convenience yields and the sup-ADF test to detect speculative bubbles in commodity markets, we contribute to the current literature by applying the MTAR test which accounts for asymmetric adjustment between real grain prices, real crude oil prices and real exchange rates. We build on the study by Liu and Tang (2010) who use approximated convenience yields as fundamentals to detect speculative bubbles but within a symmetric cointegration framework.

Our empirical evidence is favorable for the existence of speculative bubbles in wheat prices over the last decade while for corn and soybeans, we are unable to confirm the bubble hypothesis. However, since we do not find a threshold cointegration relation for corn and soybeans, we can neither deny the existence of speculative bubbles in those prices nor confirm it.

The paper proceeds as follows: In Section 2, we review the literature dealing with the impact of oil prices and exchange rates on agricultural commodity prices as well as the literature dealing with speculative bubbles in agricultural commodity markets. Section 3 describes the data. Section 4 explains the MTAR model. Section 5 discusses the empirical results, and Section 6 finally concludes.

2. Literature review

In the following, we first summarize studies about the influence of oil prices and exchange rates on agricultural prices. In the second part, we outline the literature dealing with speculative bubbles in agricultural prices.

2.1. The relation between oil prices, the exchange rate and agricultural prices

Following Reboredo (2012), the argument that oil prices influence agricultural prices is twofold. First, agricultural production consumes large amounts of energy. This consumption either occurs directly through combustion of fossil fuels or indirectly through the use of energy-intensive inputs such as fertilizers (see also USDA, 2011). The second mechanism is based on the fact that energy and agricultural markets have become closely linked since 2006, due to the increase of demand for corn- and soybean-based biofuels (Reboredo, 2012).

Empirical evidence on the impact of oil prices and its long-run relation with agricultural commodities is inconclusive. Campiche, Bryant, Richardson, and Outlaw (2007) conduct Johansen (1988, 1991) cointegration tests between crude oil prices and corn, sorghum, sugar, soybeans, soybean oil and palm oil prices during 2003 and 2007. They split their sample into two subperiods, namely 2003 to 2005 and 2006 to 2007. While the authors find no cointegration relation for the first subsample, corn prices and soybean prices are cointegrated with crude oil prices from 2006 to 2007. Saghaian (2010) conducts Johansen cointegration tests for corn, soybean, wheat, crude oil and ethanol prices. His results show that albeit there is a strong correlation among oil and commodity prices, the evidence for a causal link from oil to commodity prices is mixed. Reboredo (2012) applies different copula model specifications with both time-invariant and time-varying dependence structures to determine whether key agricultural commodities (corn, soybean and wheat) are immune to the effects of oil price changes. His results show no causal impact of oil price spikes on agricultural prices. Chen, Kou, and Chen (2010) investigate the relation between the crude oil price and the same agricultural goods as Reboredo (2012). The authors find a strong influence of oil prices on grain prices between 2005 and 2008. They argue that grain commodities compete with the demand for biofuels, especially during periods of high crude oil prices in recent years. In addition, Nazlioglu (2011) conducts nonlinear causality regressions between oil and agricultural commodities and confirms nonlinear information transmissions between oil and agricultural prices, as well as persistent nonlinear causality from oil to corn and from oil to soybean prices.

However, the aforementioned studies might suffer from an omitted variable bias, since oil and agricultural commodities are predominantly traded in US-Dollars. The exchange rate should thus be taken into account as well (Nazlioglu & Soytas, 2012). The first study considering the exchange rate as a driving factor of commodity prices was conducted by Schuh (1974). He argues that the undervaluation of agricultural prices after World War II was due to the overvaluation of the US-Dollar. More recently, Chen, Rogoff, and Rossi (2010) find that exchange rates are useful in forecasting commodity prices.

Further studies which consider the exchange rate and the oil price as fundamental factors have been conducted. Harri, Nalley, and Hudson (2009) conduct a Johansen cointegration analysis between the exchange rate, and futures prices for crude oil, corn, soybeans, soybean oil, cotton and wheat for the period 2000 to 2008. With the exception of wheat, they find a cointegration relation between the agricultural prices and the oil prices as well as the exchange rates. Nazlioglu and Soytas (2012) conduct a panel cointegration and causality analysis between 24 world agricultural commodity prices, world oil prices and exchange rates. The authors find strong support for the hypothesis of information transmission from oil to agricultural prices. In addition, they find an impact of the exchange rate on agricultural prices.

Apparently, the sample length and the data frequency have an influence on empirical results. Especially with regard to corn and soybeans, a cointegration relation with crude oil was predominantly found more recently due to, so the argument goes, the increase of biofuel production.

2.2. Speculative bubbles in agricultural prices

Although testing for speculative bubbles originated in stock markets, a variety of other asset classes has been investigated recently. Concerning agricultural commodities, the literature is growing, but empirical results are ambiguous. For instance, Gilbert (2010a) focuses on the agricultural price spike from 2006 to 2008. He finds speculative bubbles in the soybean, but not in the corn and wheat market. His study is based on the supremum Augmented