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Study on spillover effect between international soybean market and China's domestic soybean market

Kun Ma [a,b], Gang Diao [a,*]

[a] Business College, Hebei Agricultural University, No. 2596 Lekai South Street, Baoding, Hebei 071000, China
[b] Economic and Business College, Hebei University of Science and Technology, No. 26 Yuxiang Street, Shijiazhuang, Hebei 050018, China

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ABSTRACT

Due to high import dependency, China's domestic soybean market became unstable and soybean production was lingering and declining. It would be better to know the correlation between international and China's domestic soybean market for policy-making and production decision. This study used data of CBOT soybean futures price, imported soybean distribution price at Qingdao port and soybean spot price in China from September 10, 2011 to November 19, 2016 and chose multivariate GARCH model to check the spillover effect and correlation between them. The results showed that price volatilities of three markets had significant clustering effect while GARCH effect was stronger than ARCH effect. The spillover effect and correlations between markets were remarkable. It demonstrated the imported soybean market was significantly affected by the international soybean future market volatility, and such instability then resulted in violent fluctuations of China's domestic soybean spot market. Policies should be made to keep China's soybean industry safe and developed.

Estudio sobre el efecto derrame entre el mercado internacional de soja y el mercado nacional de soja de China

RESUMEN

Como consecuencia de la gran dependencia de las importaciones, el mercado nacional de soja de China se ha vuelto inestable y la producción de soja se ha mantenido constante para después disminuir. Sería mejor conocer la correlación entre el mercado internacional de soja y el mercado nacional de soja de China para la adopción de decisiones de política y de producción. Este estudio ha utilizado datos del precio de los futuros de soja CBOT, el precio de distribución de la soja importada en el puerto de Qingdao y el precio al contado de la soja en China entre el 10 de septiembre de 2011 y el 19 de noviembre de 2016, y eligió el modelo GARCH multivariado para comprobar el efecto derrame y la correlación entre ellos. Los resultados mostraron que la volatilidad de los precios de los 3 mercados tenía un efecto de agrupamiento importante, mientras que el efecto GARCH era más fuerte que el efecto ARCH. El efecto derrame y las correlaciones entre los mercados fueron notables. Se demostró que el mercado de importación de soja tuvo grandes repercusiones por la volatilidad del mercado internacional de futuros de la soja y que dicha inestabilidad provocó bruscas fluctuaciones del mercado nacional de soja de China. Deben establecerse políticas para que la industria de la soja de China se mantenga segura y desarrollada.

* Corresponding author.
 E-mail address: mkbisheng@163.com (G. Diao).

1. Introduction

Food price fluctuations have been under great interest for a long time. Earlier kinds of equilibrium models demonstrated that food price was influenced by multiple factors such as supply and demand, economic situation, trade policy, prices of related products, etc. These models focused on predicting long-term food price trend, and despised the frequent and drastic change of price (Labys, 2006). Food price crisis in 2007–2008 and 2009–2010 attracted more attention to short-term food price volatility and more efforts to modeling it.

Soybean is one of the most important food products in the world, especially in China. The consumption of edible oil and soybean meal in China increased sharply since 1990s. To close the gap between China's soybean demand and supply and ease the agricultural production pressure on resources and environment (Ni, Yu, Xu, Song, Wang and Qian, 2014), China began to import soybeans increasingly (Li, Li, Liu, Hu, Luo and Zhang, 2015) (see Fig. 1). The import quantity of soybean in 2015 increased to 81.74 million tons, accounting for 87.3% of total domestic soybean consumption. The consequent soybean price volatility (SPV) increased the uncertainty of soybean growing gains, so domestic soybean production was not increasing by the growing domestic demand; instead, it was lingering and declining (see Fig. 2). It is important and valuable for both policy-makers and soybean growers to know the correlation between international market and China's domestic market, so they can know soybean price volatility better and improve food policies and production plans.
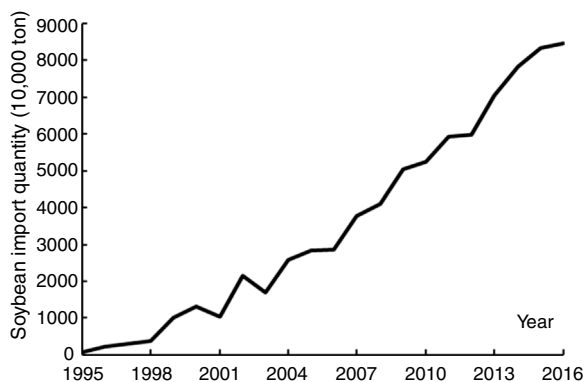

Fig. 1. Soybean import quantity.   *Data source*: Wind database (2016).
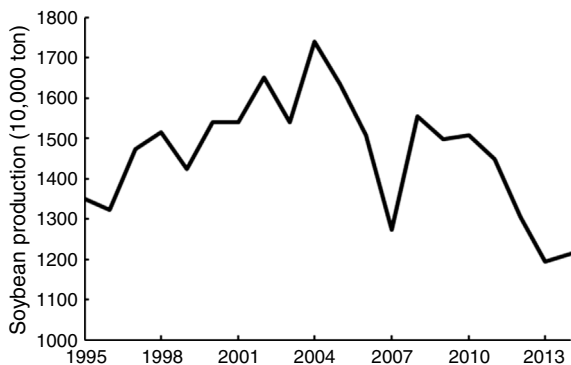

Fig. 2. Soybean production.   *Data source*: Wind database (2016).

The high import dependency and price volatility of soybean caught much interest in studying the relationship of them. Yao and Cao (2015) made cointegration analysis of the relationship between the soybean import volume, international price and domestic price and attested the long-term equilibrium relationship between them; they also did Granger causality test on them, and the results demonstrated that international price and import quantity affected domestic soybean price in one-way direction. Chen (2013) continued to establish VAR models and applied variance decomposition to analyze different contributions of GDP, agriculture production means price and imported soybean price to soybean price changing. The results showed that imported soybean price shock was the leading factor of China's domestic SPV. Chen and Zhou (2016) followed the same way to learn the integration relationship between international and domestic soybean market at different periods, and concluded that in spite of several changes in the trading environment, the price volatility transmission capacity of international soybean market to domestic soybean market was much stronger than reaction of the latter. Besides the studies on soybean spot (SP) markets, soybean futures (SF) markets were also under extensive discussion. Zhou and Zou (2007) used VECM model to analyze short-term correlation between Chinese and international SF market. The evidence proved that US SF market played a leading role in the global SF pricing system and affected the China SF price trend. Xia and Cheng (2006) applied the same model to discuss the relationship of DEC and CBOT SF price and China's domestic SP price and got different results. They found that DEC SF market played a leading role in the changing of international SF price and China's domestic SP price also had some weak influence on soybean futures price. This difference may come from the data quality and processing.

Cointegration, Granger causality tests testified the long-term relationships between different soybean markets. VAR models moved forward to analyze influence of the international soybean price mean and lagged value on domestic soybean price changing which was called spillover effect (SE) of mean. VEC models were typically constrained VAR models and can show the adjustment speed of China's domestic market to international market shocks. The following variance decomposition can further analyze the degree of international soybean market impact on domestic SPV. But VAR or VEC models paid little attention on heteroscedasticity and time-varying covariance. GARCH models took them into account so as to optimize the estimations and explain the price volatility better. Song, Li, and Xu (2013) took use of VECH-TARCH model to study the volatility of US SP market and China's SP market, and found that both markets had obvious dependence on its past volatility and external shock which was called clustering effect (CE) of market volatility, but US SPV mainly relied on transmission of its previous volatility while Chinese SPV was more vulnerable to external shocks; the volatility SE between two markets were not significant. Gu, Guo, and Tian (2013) applied GARCH-BEKK model to investigate price volatility SE between foreign and China's domestic SP market using different price data. The result proved that international SPV had a one-way SE on domestic soybean price. Liu, Han, and Bao (2016) chose DCC-GARCH model to analyze the dynamic correlations of three markets, the results demonstrated that the relation between imported SP market and DEC SF market became closer, but the correlations between China's domestic SP market and imported SP market or SF market were weak due to domestic policies. Previous studies mainly used bivariate-GARCH models to examine the correlations between two markets, such as international and China's domestic markets or imported soybean market and China's domestic markets, and the conclusions of existing studies were inconsistent due to different methods and data. Dynamic relationship between international SF