The impact of index funds on grain futures markets revisited

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Abstract

We analyse the impact of index investment on four grain futures markets by applying several vector auto-regression models, generalised impulse response functions (GIRF), and a structural break analysis. We also test for effects of long-short index funds, an aspect widely ignored so far. Index funds have some price-disturbing effects. These are, however, short-term and variable. In all markets, significant effects vanish after 2010 and we conclude that markets learned and adjusted to rising index investment. GIRF of different trader types imply that index investment serves actual hedging needs and does not generally contribute to the financialisation of futures markets.

Keywords: **grain futures, commodity index funds, long-short index funds, impulse response analysis**

1 Introduction

The world faced some severe peaks in food commodity prices in recent decades having especially devastating consequences for many developing and transition countries (Irwin and Sanders 2010a). Nonetheless, the exact factors responsible for these rapid price movements are still subject to a vivid debate. In particular, one question divides researchers: the impact of so-called commodity index investment on futures markets. Commodity index investment has become increasingly popular, especially after the profitability of traditional asset classes decreased due to market collapses, leading to a money inflow of about 100 billion US dollars between 2004 and 2007 (Irwin and Sanders 2010a). Nevertheless, theoretical and empirical studies show that the causality is by no means clear-cut and other fundamental factors have to be considered to explain peaks in commodity prices as well (e.g., Gilbert 2010a).

It is particularly important to conduct a thorough evaluation of all arguments because of the political implications of the opposing positions. The United States already enabled the Commodity Futures Trading Commission (CFTC) to monitor and regulate swap dealers with the Dodd-Frank Wall Street Reform and Consumer Protection Act in 2010 (Irwin and Sanders 2010a). The European Union developed the Markets in Financial Instruments Directive II (MiFID II), which came into force in January 2017, to control commodity traders' positions (Desai 2015). If forces other than index investment drive commodity prices, these measures are likely to be ineffective and perhaps even harmful as they can draw liquidity from futures markets (Pirrong 2010).

In this paper, we analyse the effect of commodity index investment in the four grain futures markets of Chicago Board of Trade (CBOT) corn, CBOT wheat, Kansas City Board of Trade (KBOT) wheat, and CBOT soybeans from 2006 to 2014. We find significant but short-term effects of index fund investment on fund returns. However, by considering a recent and comparably long data set, we can identify changes in the dynamics of price effects of index investment not detected in older empirical studies (e.g., Sanders and Irwin 2011, Gilbert 2010a). All four markets show signs of adjustment to index investment. Furthermore, our results imply that index funds serve actual hedging needs rather than leading to a financialisation of grain futures markets. We do not find any price-disturbing effect of long-short index funds.

The paper is structured as follows. A literature review provides an overview of theoretical and empirical findings. Our data and methodology is introduced in the data and methods section, and our empirical evidence is presented in the results and discussion section. Finally, our conclusions section summarizes all findings.

2 Literature review

Looking at the two opposing fronts in the debate on index funds[1] in commodity markets, both sides provide sensible theoretical justification for their claims. Irwin and Sanders (2012a) divide the two lines of argumentation into "rational" and "irrational market impacts" (p. 372). Thereby, they already show that the critical point for the whole debate is the functioning of the markets where index investment is taking place. Consequently, the next logical step has to be an empirical analysis of commodity markets to find out more about their efficiency. In the following we present the theoretical arguments and empirical evidence of rational and irrational market impacts of index funds.

Assuming an efficient market, Prehn et al. (2014) set up a detailed model explaining the mechanisms of index funds in agricultural markets highlighting two particular effects: (i) price-stabilizing effect and (ii) "fixed asset effect" (Prehn et al. 2014:4). The price-stabilizing effect is seen as a direct consequence of the investment strategy pursued by index funds. Mimicking an index, an index fund is based on a relative and mean-reverting concept (Qian 2012). Even though index funds generally follow a long-only strategy, they must sell positions in commodities that gained in value and buy positions in commodities that lost in value (Prehn et al. 2013). In a market in backwardation index funds support the convergence of the futures price toward the expected spot price, leading to a decreasing risk premium, (Irwin and Sanders 2012a, Main et al. 2013). Even if index fund push the futures price beyond the expected spot price (fixed asset effect) losses will eventually force some index funds out of the market and the disequilibrium will be corrected (Prehn et al. 2014). The bottom line of the rational impact arguments is that the effects of index investment for hedgers but also consumers are mainly positive because of reduced risk premiums and more stable prices due to an increased liquidity in the futures markets (Irwin and Sanders 2012a, Prehn et al. 2014).

Index fund critics doubt the capacity of commodity markets to deal efficiently with the new popularity of long-only index investment. In his testimony in front of the Committee on Homeland Security and Governmental Affairs of the Unites States in 2008, portfolio manager M. W. Masters described index fund investment as "excessive speculation" (Masters 2008:13). This term is based on the following key ideas: First, the long-only strategy of index funds creates a bias in the demand and supply equilibrium and therefore must drive up prices; second, traditional speculators such as hedge funds will follow this upward price performance by also taking long positions, which will further intensify price development (Master and White 2008). Assuming no competition between index and hedge fund positions, Masters and White (2008) see normal supply faced with a double demand. An additional criticism states that index fund decisions are not necessarily based on fundamentals because index investment always involves a relative basket of commodities and can no longer contain information on one particular commodity contributing to an individual price discovery (Masters 2008). Summing up these arguments, convergence problems between prices and fundamental values, or increasing price volatility, are possible consequences for the concerned futures markets (Masters 2008).

In the following we will give a brief overview about recent empirical work on the effect of index funds to find out which line of argumentation receives more support.[2]

From 2004 to 2011 the share of open interest held by index traders in the important grain markets nearly tripled to 15% in corn and soybean, and even to 25% in wheat markets (Irwin and Sanders 2012a). These numbers seem to support the theory that demand has increased substantially. However, in a correlation analysis, Domanski and Heath (2007) find that the increase in non-commercial long positions coincides with higher hedging needs. Hedgers build the classical

[1] When not specified differently, the term "index fund" always refers to a long-only investment strategy.

[2] For a more detailed literature review see for example, Irwin and Sanders (2010a).

counterpart and justification for financial investors by holding short positions (supply) to pass on their price risk (Prehn et al. 2014). Comparable to Domanski and Heath (2007), Prehn et al. (2014) conclude there is an increasing hedging need from increasing risk premiums. These authors even argue that the markets not only bear index traders' long positions, but actually need them. Domanski and Heath (2007), on the other hand, found that from 2002 to 2007 the sign of the correlation coefficient between long and short positions held by non-commercials (financial investors) changed from negative to positive. Based on this finding, they compare commodity markets with traditional financial markets (financialisation) and warn of concentrated trading activity. This then can lead to higher price volatility (Bessembinder and Seguin 1993).

Thus, index funds became a major participant in commodity futures markets. Nevertheless, a parallel increase in short futures positions contradicts the static argument by Master (2008); in some markets the increase of long positions might even be needed.

Applying Granger Causality tests, Gilbert (2010b) does not find that index funds influence price levels in agricultural markets. Hamilton and Wu (2015) find comparable results. They do not find a significant impact of index funds on the price level in any of the twelve tested agricultural futures markets. Working on price volatility, Sanders and Irwin (2011) investigate aggregated and systematic impacts of index funds across twelve agricultural markets and the crude oil and natural gas market. Even though they find a significant impact in several markets, they are not able to identify an aggregated or systematic direct effect.

Gilbert (2010a) argues that large price movement across different markets should not be analysed market-by-market, but rather aggregated. With a theoretical model, he concludes that common demand shocks (i.e., macroeconomic shocks) are best for explaining large price moves. Defining several macroeconomic shock variables (including index investment behaviour) and testing their impact on the overall level of agricultural prices, Gilbert (2010a) finds economic growth in China and changes in exchange rates to be the most influential factors. Nonetheless, according to his tests, index investment might be the channel for these fundamentals to affect futures prices, for example when index funds are used as a dollar hedge.

In summary, there is only little evidence for a direct impact of index funds on agricultural futures markets. Therefore, one can assume that these markets are liquid and efficient enough to absorb the additional money inflow and also that traders behave rationally. Even though statistical methods of individual studies are criticized for their particular set-up or a lack of statistical power (see, e.g., Irwin and Sanders 2010a), the overall amount of empirical research that does not find direct price impacts of commodity index funds is striking. There are some indications that there might be an indirect effect of index investment but for a clear picture more analysis is necessary.

3 Data and methods

The four data sets for the different grain markets were all constructed in the same manner. Each set contains weekly data on futures prices, returns, and long and short positions of index and hedge funds from 2006 to 2014. We used data from the Stevens Continuous Futures database (via www.quandl.com) and the CFTC. Constructing the dataset we assumed that the majority of index and hedge fund traders close out their contracts before the 8th day of the month before the expiration month of the respective contract (i.e. between this day and the actual expiration date of the contract, traders will base their investment decision on the prices of the second-nearby contract). Prices are replaced accordingly. Log returns are defined as $retrun_t = \ln\frac{p_t}{p_{t-1}} \cdot 100$ with p_t and p_{t-1} being two subsequent futures prices in the data set (Sanders and Irwin 2011).

For the position data, we used the weekly data on long and short hedge and index fund positions which is available from 2006 onwards in the Commodity Index Trader Supplement (CIT) by the CFTC. The category of Index Traders was interpreted as index fund positions and the category of

Non-Commercials as hedge fund positions. Following a correlation study by Irwin and Sanders (2012b), the CIT is the most suitable approximation of (index) fund positions when a high frequency of observations is required.

For all four grain markets, VAR models (1) with y_t = (return$_t$, index long$_t$, hedge long$_t$, hedge short$_t$) are estimated[3]. The names of the position variables are derived from the kind of fund and the type of position.

$$y_t = \alpha + \sum_{i=1}^{k} \beta_i \, y_{t-i} + e_t \,, \qquad (1)$$

Augmented-Dicky-Fuller (ADF) tests prior to the estimation indicate non-stationarity in the times series of index and hedge fund positions. Since Johansen trace tests do not indicate any cointegration relationships, we continued our estimation with a VAR model using first differences of the position variables. Returns are stationary in all models and markets. The appropriate lag order is determined by applying the Akaike Information criterion (AIC).

By construction, VAR models are generally over-parameterized so that the interpretation of the coefficients can be problematic (Kirchgässner and Wolters 2007). For a meaningful interpretation of the system a structural analysis is necessary. Therefore, we perform a (scaled) general impulse response (GIR) analysis based on the previous estimated VAR models. For the decomposition of the covariance matrix we follow Pesaran and Shin (1998). This method of decomposition has the big advantage that the estimation results are independent from the ordering of variables in y_t. For this study, two relationship patterns are primarily interesting: (i) the influence of the funds positions on the futures returns, and (ii) the influence of the long index and hedge fund positions on the short hedge fund positions.

Using F statistics and the dynamic programing algorithm presented by Bai and Perron (2003), we tested for multiple unknown structural breaks in the time series of short index fund positions (Zeileis et al. 2003). Three structural breaks were found in the corn and wheat time series of short index fund positions, whereas there are four for the soybean time series. Disregarding the third breakpoint of the soybean time series, it seems that the remaining break dates more or less coincide. The second breakpoint (mid 2010) is particularly interesting for the present analysis. The data sets were split up and the VAR estimation and GIR analysis repeated for the subsets. Assuming that index funds are originally a long-only investment strategy, the development of short index fund positions must be an indicator for the development of long-short index funds. In that way, the estimation of the two subsets might give some initial information about the influence of the new investment tool of long-short index funds on grain futures markets. Furthermore, this break also coincides with a time when it became obvious that long-only index investment was by far not as rewarding as anticipated in the beginning. Despite generally rising commodity prices, the overall return of index funds were in many cases even negative (Main et al. 2013). That means long-short index investment might not simply be a new investment tool but the sign that fund managers are looking for new strategies to adjust to disappointing returns from long-only index investment. Therefore, the comparison of the subset estimation might also give insights into overall market dynamics.

4 Results and discussion

In this section we focus on two particular effects: (i) the effect of funds on returns (Figures 1-2 and Table 1), and (ii) interaction of long and short fund positions (Table 1 and Figures 3-6).

[3] Where possible, we restrict the models sequentially eliminating repressors with absolute t-ratios smaller than 2. During the course of the analysis we also estimated the VAR model with an aggregated variable of net hedge fund positions. However, likelihood ratio tests (Verbeek 2004) show that the disaggregated consideration of long and short hedge fund positions is the better choice.

4.1 Effect of funds on returns

Table 1 summarizes significant responses of returns after impulses of fund positions estimated in the GIR analysis for all four markets.[4] The GIRF of the complete data set yields positive significant effects for index fund positions in all four markets except the CBOT wheat market. The results of the subset estimation show a uniform change in the significance pattern of index funds in all four markets from the first to the second subset. Index funds have a positive significant impact on returns in the first subset but not in the second one. Hedge funds show a consistent significance pattern in all four markets and subsets. Effects of long hedge funds positions are positive, and negative for short hedge fund positions.

The GIR analysis also shows that changes of hedge fund positions cause more extreme responses of returns than shocks in changes of long index fund positions (Figures 1 and 2)[5]. Shocks in changes of long and short hedge fund positions have a clearly significant influence on returns. This holds for the magnitude as well as for the precision of the estimate. The effects of hedge funds on returns are about double as high as for index fund positions and the confidence intervals of the GIRF of hedge fund positions are much smaller. Additionally, effects of hedge funds last longer, sometimes up to three weeks until original price levels are regained. Shocks in changes of long positions temporarily increase returns, whereas shocks in changes of short positions decrease them. In absolute terms, influences of short and long hedge fund position changes are more or less equal by means of magnitude and timing in the respective markets (Figures 1 and 2). Observing identical timing and absolute magnitude of responses of returns toward shocks in long and short positions of hedge funds shows that these funds are equally able to influence the markets in opposite directions, establishing equilibrium. This is in accordance with the theory of an efficient futures market presented in section 2 and it is not surprising that significant return responses to shocks in long index fund positions are economically negligible regarding their length and magnitude. Consequently,—if there is a type of fund that has a significant impact on returns—hedge funds seem to play a more relevant role than index funds.

Nevertheless, there is also a significant effect of index funds on returns. These results seems to somewhat contradict the findings of the literature review, which hardly gives any support for a direct effect of index funds on returns. However, even though returns respond significantly to shocks from index funds, the effect is limited to one week.

In addition, the original question was about a price-distorting effect of index funds; positive and negative returns also have different implications in an upward or downward price trend. In an upward price development, increasing returns will reinforce the trend. If prices trend downward, increasing returns work against this trend, slow it down, and eventually re-verse it. In contrast, decreasing returns will reinforce downward and slow down upward price trends. Analysing the price effect of index and hedge funds, the critical question is therefore how dynamics of funds coincide with upward or downward price trends.

All four grain markets show comparable behaviour of prices and positions, so that the CBOT corn market is shown here representatively in Figure 7[6]. Generally the number of long index fund positions and the price move parallel (i.e. an upward price trend goes along with increasing positions and a downward price trend with decrease positions). Consequently, long index funds seem to reinforce current price trends, both up- and downward, however only for a maximum of one week. Because the positions of long hedge funds show a comparable path to that of the index funds

[4] If we talk about effects in the discussion section, we are always referring to the relationship of an impulse and a response variable in the GIR analysis, i.e. the effect of a unit shock in the impulse variable on the response variable.

[5] We present the GIRF of the CBOT corn market. The graphs of the other markets look very similar and are available on request.

[6] Other graphs available on request.

and they also yield positive coefficients, the interpretation of their impact on prices should be the same. Positions of short hedge funds move anti-cyclical to the other positions. However, due to the negative coefficients, the short hedge funds also seem to reinforce current price trends.

The two data subsets were first of all established to gain information on the impact of long-short index funds. The positions of these particular funds are not distinguishable in the dataset; therefore, only holdings in short index fund positions can hint at the activity of long-short index funds in the grain markets. The number of short index fund positions is negligible in the first data subset compared to the general open interest in these grain markets (Irwin and Sanders 2012a). Consequently, only the estimation for the second data subset can include influence from a long-short index investment strategy. In all four markets, long index fund positions have no significant influence on returns from 2010 to 2014. In comparison, there is a significant positive impact in all of these markets in the first data subset (Table 1). Therefore, if there is any effect, the introduction of the long-short index funds rather reduced the impact of index funds on returns. However, any observed dynamic in the estimation results could also be attributed to the investment behaviour of long-only index funds as discussed in the section above. Further empirical evidence and disaggregated data are certainly necessary.

Assuming that observed effects of index positions are generated primarily by long-only index funds, the subset estimation still yields an important finding. It seems as if dynamics of impacts of index funds change significantly between the two subsets. All markets show significant impacts of index funds until 2010 but no significance afterward (Table 1). Because the number of index fund positions held in the second data subset (Figures 7 and 8) is more or less the same as in the first one, the decreasing impact cannot result from a decreasing importance of index funds as an investment tool. It rather seems that the markets needed some time to learn how to deal with the new popularity of index funds. This means that it is very likely that index funds had a limited price-disturbing effect in the beginning but that markets, i.e. their participants, adjusted for it.

It is unfortunately difficult to specify how trading behaviour changed exactly based on our data set. Main et al. (2013) show that the total return of index funds falls far below expectations—if they are not negative. Therefore, it should be very likely that managers of index funds came up with new investment tools and strategies such as long-short indices. In this sense the structural break analysis does not only hint at effects of a new investment tool but also at the need for changes in the market in general. It is also likely that hedge fund managers learned to use index funds to their advantage. Index funds follow a passive investment strategy and adjust their held positions in certain intervals. Hedge fund managers might use this information to anticipate price movements (i.e. possibility to front-run). This might also reduce effects of index funds in the markets. These are possible scenarios but this matter definitely needs more empirical investigation.

Nevertheless, even if we cannot narrow down the exact changes in trading behaviour, the basic result that dynamics in the markets changed is worth noting. It also shows that older empirical analyses might lack information about some new tendencies in grain futures markets. Actually, the majority of the literature investigating price effects in grain futures markets only work with time series until around 2010 (e.g., Sanders and Irwin 2011, Irwin and Sanders 2010b, Gilbert 2010a).

4.2 Interaction of long and short fund positions

Figures 3-6 and Table 1 illustrate how shocks in long index and hedge fund positions affect short hedge fund positions. The GIRF for the different grain markets show quite heterogeneous patterns. In the CBOT wheat market, a unit shock in changes of index fund positions has a significant positive influence on hedge fund short positions of 1.5 units (1,500 positions; Figure 6). Responses to shocks of changes in index fund positions are insignificant in all the other markets. Responses to changes in long hedge fund positions are even more diverse. Even though the corn and soybean markets both show a significant negative effect of changes in short hedge fund positions lasting for

one to two weeks, the magnitude of the effect is more than double in the corn market. On the other hand, the two wheat markets do not show any significant response of short hedge fund positions to long hedge fund positions.

Even though there are noticeable differences in timing and magnitude, three out of four futures markets show a similar significance pattern in the impulse response analysis of long and short positions (Table 1). With the exception of the CBOT wheat market (Figure 4 and Table 1), shocks in long index fund positions do not affect short hedge fund positions, whereas long hedge fund positions do in the CBOT corn and CBOT soybean markets (Figures 3 and 6). The interaction of the two types of hedge fund positions is most likely explained by the price and the liquidity of the respective market. The timing of the response of short positions implies the ability of the particular futures market to react to a change in its term structure (contango or backwardation) (i.e., how fast hedge funds can change their positions from short to long if the price trend changes) (for the theory see Prehn et al. 2014). The high magnitude of response in the CBOT corn market therefore signals high market liquidity, whereas the marginal response in the KBOT wheat market (Figure 5) rather points towards comparably low market liquidity. Considering the KBOT wheat market (Figure 8) in comparison with the other markets (e.g. Figure 7), it is evident that the open interest of hedge funds in the KBOT wheat market is noticeable smaller. A lower liquidity level is therefore comprehensible. The impulse response pattern in the CBOT wheat market is completely different. Long positions of hedge funds do not affect short hedge funds positions at all, but long index fund positions have a clear positive, significant effect. The finding might be explained with a look at the ratio of long hedge and index positions. The number of long hedge and index funds positions is more or less equal in all markets except the CBOT wheat market; in the CBOT wheat market the share of long index fund positions is at least 100,000 positions higher throughout the whole sample period. This also fits the result of Irwin and Sanders (2012a), who find a 10% higher open interest rate held by index traders in wheat markets than in the other grain markets. This should explain why a stronger effect of long index fund positions in the CBOT wheat market is possible. This pattern also persists in the results of the subset estimation (Table 1).

The next question is how to interpret this stronger effect. A possibility would be that the long index fund positions in the CBOT wheat market exceed the hedging need. The excess is then met by short hedge fund positions (Prehn et al. 2014). Following the argumentation of Domanski and Heath (2007), index funds in the CBOT wheat market would contribute to the financialisation of the market.

Therefore,—except for the CBOT wheat market— it seems that index funds primarily address hedging needs. This does not mean that the other three markets do not face financialisation. The results of this study only indicate that index funds in these markets do not contribute to it.

5 Conclusion

The overall findings of this study can be summarized as follows:

i. There is only limited empirical evidence for a significant impact of index funds in the four grain markets tested here. This result also holds for the impact of long-short index funds. However, found implications for the latter are still superficial and require further analysis and more comprehensive data acquisition.

ii. If there are types of funds that have a significant influence on returns, then these are hedge funds. The estimation results of all data sets and in all markets show significant interaction between hedge fund positions (long and short) and returns.

iii. It appears that throughout the sample period the impact of index investment on returns changes. It seems that markets have to learn how to deal with the popularity of the new investment tool.

However, the learning process seems quite fast as adjustment (i.e., no significant impact of index funds on returns) is already effective in 2010 in all four markets.

iv. With the exception of the CBOT wheat market, long index fund investment does not drive up the number of short hedge fund positions. This implies that index fund investment in grain markets rather meets hedging demands and does not generally contribute to the financialisation of these markets.

These findings suggest liquid and efficient grain futures markets that were able to absorb and even require the large money inflow from index funds to meet hedging needs. Because the price-distorting effects by index investment are limited, fundamental factors and availability (inventories) should be seen as the major drivers of the commodity price peaks during recent decades.

As far as political implications are concerned, the results of this study do not indicate any justification for restrictions in index trading in grain futures markets; rather, they indicate that the additional demand in long positions is needed to satisfy an increasing hedging demand.

Finally, some remarks for future research. Structural change analyses and tests for the stability of coefficients should be considered in longer data sets for finding changes in the dynamics of fund-return interactions. In order to better understand market dynamics an analysis of changes in investment strategies of index and hedge funds would be interesting. We assume that fundamental factors play a major role in explaining commodity price peaks; therefore, we suggest including variables representing fundamentals in future studies.

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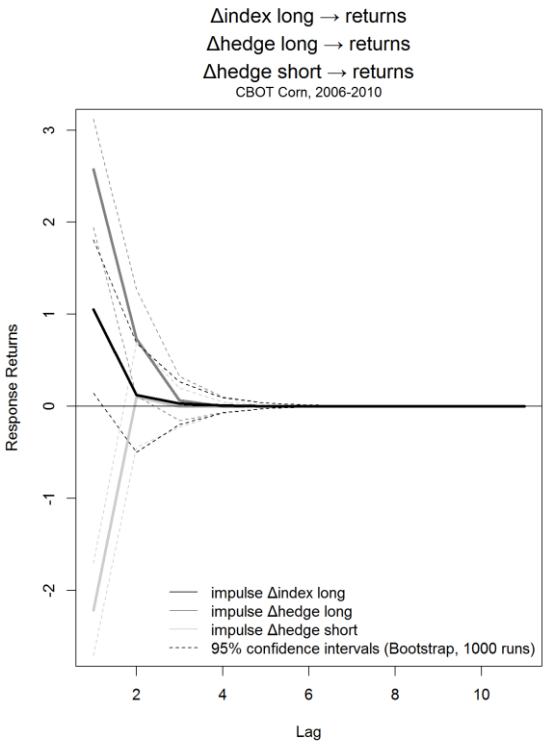

Figure 1. Impulse responses, first difference positions on returns, CBOT corn market, 2006-2010

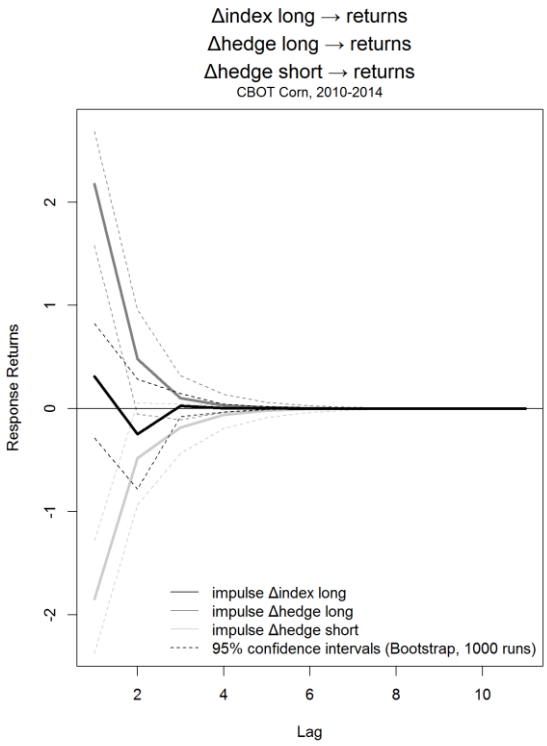

Figure 2. Impulse responses, first difference positions on returns, CBOT corn market, 2010-2014

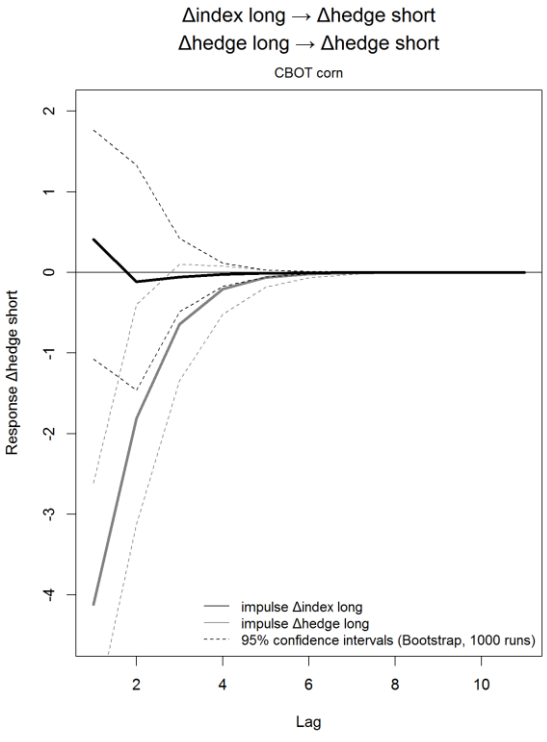

Figure 3. Impulse responses, first difference long positions on first difference short hedge fund positions, CBOT corn market

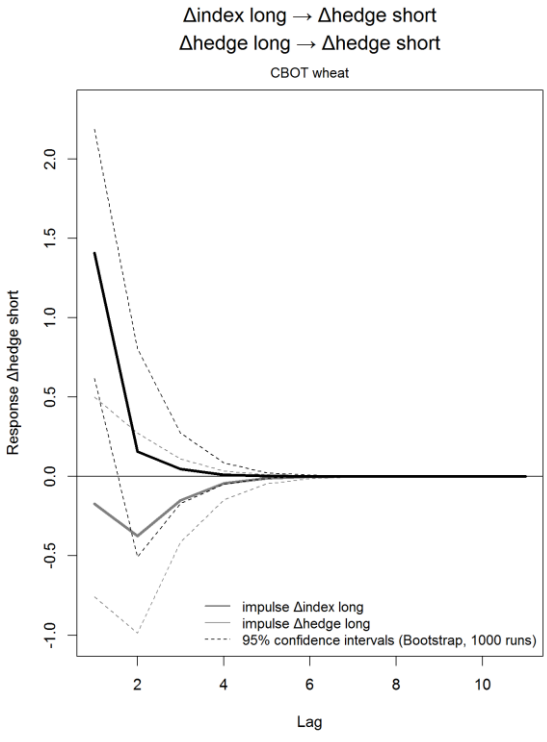

Figure 4. Impulse responses, first difference long positions on first difference short hedge fund positions, CBOT wheat market

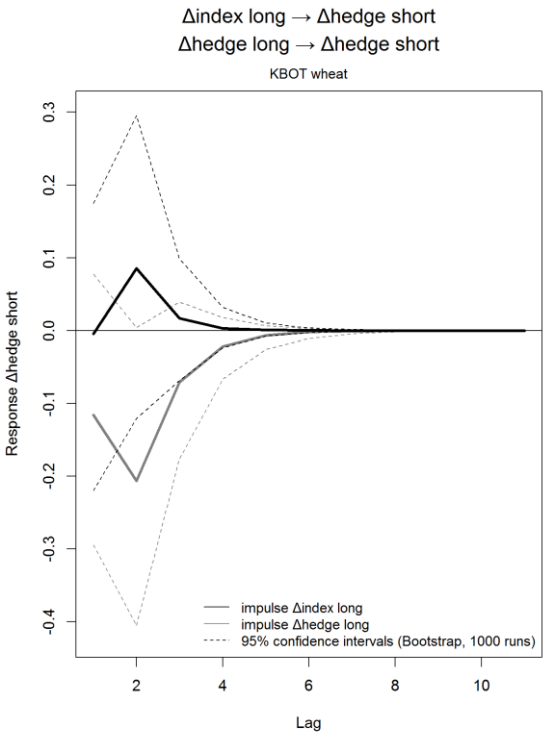

Figure 5. Impulse responses, first difference long positions on first difference short hedge fund positions, KBOT wheat market

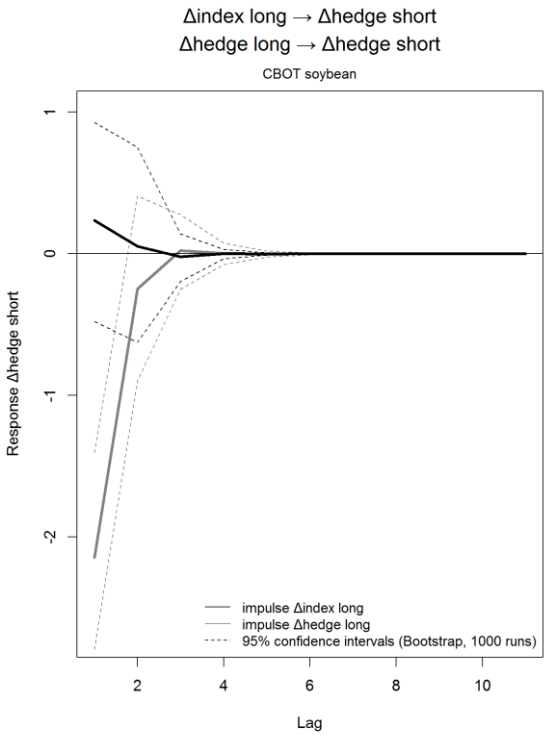

Figure 6. Impulse responses, first difference long positions on first difference short hedge fund positions, CBOT soybean market

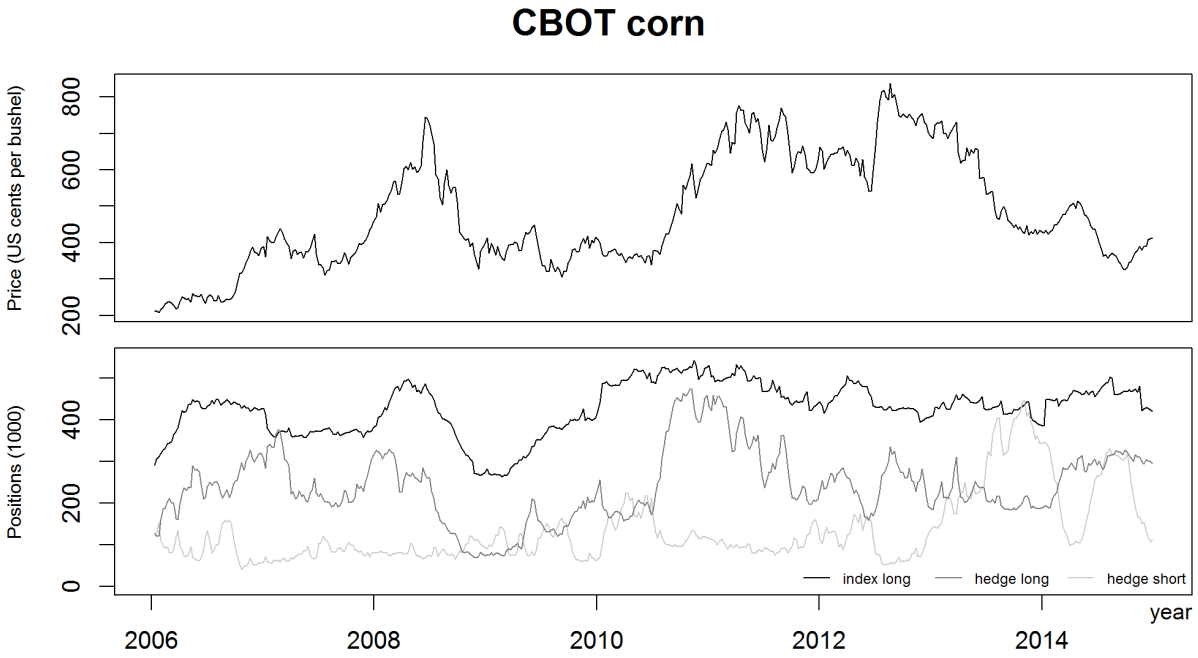

Figure 7. Futures prices and fund positions in the CBOT corn futures market from 2006 to 2014

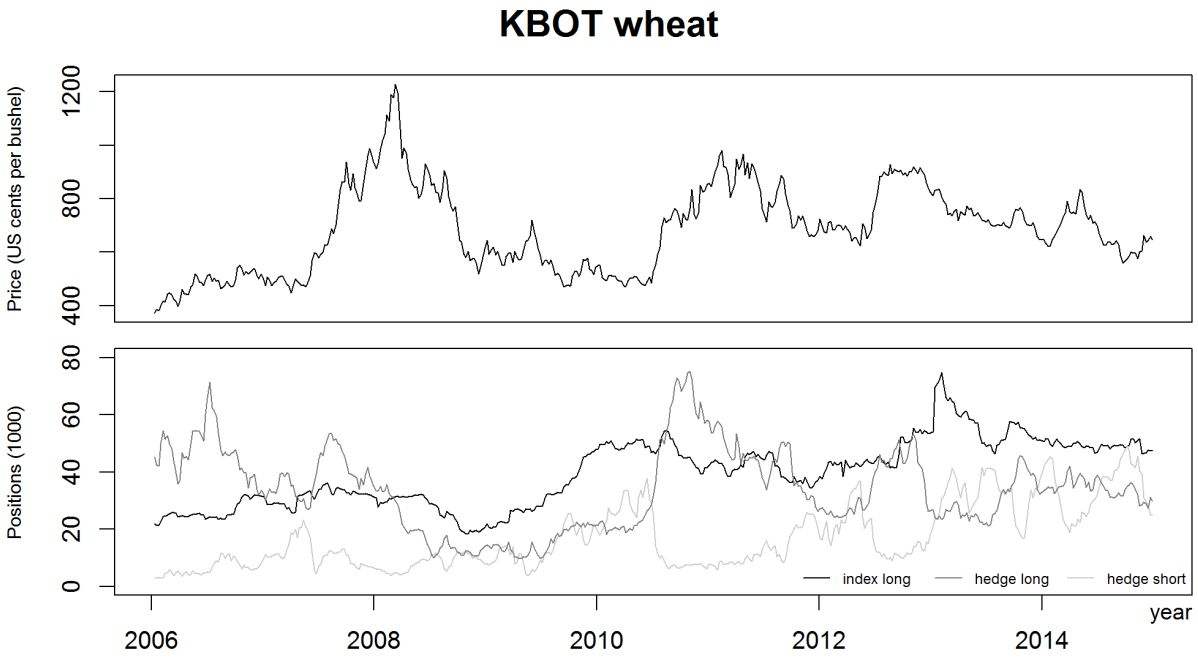

Figure 8. Futures prices and fund positions in the KBOT wheat futures market from 2006 to 2014

Table 1
Pattern of significant impulse response relationships, all data sets

			Δ index long	Δ hedge long	Δ hedge short
Impulse: Δ positions **Response:** returns	**Complete data set**	CBOT corn	+[1)]	+	-
		CBOT wheat		+	-
		KBOT wheat	+	+	-
		CBOT soybean	+	+	-
	Subset I (2006-2010)	CBOT corn	+	+	-
		CBOT wheat	+	+	-
		KBOT wheat	+	+	-
		CBOT soybean	+	+	-
	Subset II (2010-2014)	CBOT corn		+	-
		CBOT wheat		+	-
		KBOT wheat		+	-
		CBOT soybean		+	-
Impulse: Δ long positions **Response:** Δ hedge short positions	**Complete data set**	CBOT corn		-	
		CBOT wheat	+		
		KBOT wheat			
		CBOT soybean		-	
	Subset I (2006-2010)	CBOT corn			
		CBOT wheat	+		
		KBOT wheat		-	
		CBOT soybean		-	
	Subset II (2010-2014)	CBOT corn		-	
		CBOT wheat	+		
		KBOT wheat			
		CBOT soybean		-	

[1)] Significant effects and their direction are indicated with a + or -; i.e. if there is no sign, we did not detect a significant response in the GIR analysis.