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HERDING BEHAVIOR OF SPECULATORS AND HEDGERS IN COMMODITIES FUTURE MARKET

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OBJETIVO

Este artigo verifica a presença do comportamento de efeito manada de especuladores e hedgers no mercado future de commodities. Contratos futuros de cinco *commodities* (algodão, café, trigo, soja e açúcar) dos EUA e retornos do mercado à vista do Brasil são considerados.

METODOLOGIA

Este artigo utiliza o *cross sectional absolute deviation* (CSAD) de Chang *et al.* (2000) para a estimação do efeito manada e aplica a regressão quantílica condicional de Koenker (2005).

RESULTADOS E CONCLUSÕES

Como resultado, verifica-se a presença de efeito manada considerando somente estratégias de razão de hedge. Por outro lado, este artigo não encontra o comportamento de manada quando somente especuladores são observados.

IMPLICAÇÕES PRÁTICAS

Aspectos do mercado futuro, tais como a influência de instituições financeiras em *long hedgers* e estratégias de *feedback* positivo similares de *short hedgers*, denotam a importância de considerar a análise de manada para estratégias de *hedge* nesse mercado.

PALAVRAS-CHAVE

Comportamento de Manada, Especuladores e *Hedgers*, Mercado Futuro

OBJECTIVE

This paper verifies the presence of herding behavior of speculators and hedgers in commodities future market. U.S. Future contracts of five commodities (Cotton, Coffee, Wheat, Soybean and Sugar) and Brazilian spot market returns are considered.

METHODOLOGY

This paper uses the cross sectional absolute deviation (CSAD) of Chang et al. (2000) for herding effect estimator and applies the conditional quantile regression of Koenker (2005).

RESULTS AND CONCLUSIONS

As results, it verifies the herding presence considering only hedge ratio strategies in future market. On the other hand, this paper does not find herding behavior when only the speculators are observed.

PRACTICAL IMPLICATIONS

Aspects of future market, such as the influence of the financial institutions in long hedgers and similar positive feedback strategies of short hedgers, denote the importance of considering herding analyzes for hedge strategies in this market.

KEYWORDS

Herding Behavior, Speculators and Hedgers, Future Market

INTRODUCTION

Herding behavior is a phenomenon where a large number of investors can act together in the same way and at the same time. When the herding presence is confirmed, the rationality of investors (defended by rational asset pricing as the Capital Asset Pricing Model) could be contested. Recent works confirm the herding: Fu et al. (2010) verify asymmetric reactions to good and bad news regarding monthly returns of China equity market and confirm the presence of herding during extreme market conditions. Yao et al. (2013) observe the presence of herding for Chinese domestic investors and foreign investors on the Shanghai Stock Exchange and Shenzhen Stock Exchange. Kremer and Nautz (2013) consider elements such as size of assets, trading volume, feedback of investors from past returns, risk management and volatility returns in herding behavior for the daily returns of three major German stock indices and observe that herding intensity is dependent on the characteristics of those markets. Badhuri and Mahapatra (2013) apply alternative tests for capturing symmetry in return distributions in Indian equity market and confirm stronger herding presence during the crisis period.

Further, an approach to find the herding considers the negative relation between the dispersion returns and market returns as estimators for the herding behavior, where the dispersion decreases at a rate corresponding with the portfolio market return. This relation evidences a situation in which the investor ignores his private information and follows the portfolio market performance (Bikhchandani and Sharma 2001). As methodology, we follow the studies based on cross sectional return dispersion developed by Christie and Huang (1995) and Chang et al. (2000). Different empirical studies use this approach, such as Demirer and Kutan (2006), Blasco and Ferreuela (2008), Tan et al. (2008), Caporale et al. (2008), Demirer et al. (2010) and Chiang and Zheng (2010). However, given the leptokurtic distribution of financial returns and the presence of herding in periods of higher volatility, other works present the quantile regression as an alternative to observe the herding behavior along the distribution returns, such as Chiang et al. (2010), Gebka and Wohar (2013) and Zhou and Anderson (2013).

Despite this methodological review, most works do not consider the influence of strategies and the type of investors in a determined market. Goldstein et al. (2014) shows that different trading conditions for different traders, such as speculators and hedgers, could determine unexpected consequences for market efficiency and other aspects of asset prices, such as reduction of price informativeness and the increase of the cost of capital. One important scenario to represent this situation is the commodities future market, where different types of traders present different responses to one same information: financial institutors are limited to trade in futures contracts for speculation purposes and commodity producers trade the futures considering the hedging in spot contracts of product markets. Other papers verify the behavior and performance of speculators and hedgers in futures markets (Wang, 2003) and future trading volume (Yung and Liu, 2009). Considering the herding behavior in futures markets, Chunrong et al. (2006), Adrangi and Chatrath (2008) and Steen and Gjolberg (2013) confirm the absence of herding with excessive comovements. Considering market volatility impact, Gleason et al. (2003) did not find evidences of herding, but Demirer et al. (2013) found herding behavior in high volatility periods.

However, this paper analyses the herding based in the segmentation of the commodities future market in speculators and hedgers, as well as considering the hedging of emerging market investors for this behavior. For hedging scenario, this paper applies the static minimum variance hedge ratio (Ordinary Least Square estimator) and the time-varying minimum variance hedge ratio of Bekkerman (2011). For a herding model, this paper uses the cross sectional absolute deviation (CSAD) of Chang et al. (2000) for dispersion estimator and apply the conditional quantile regression of Koenker (2005), which allows to recover the marginal effects at quantiles of the conditional distribution of cross sectional absolute deviation given the return and volatility of assets.

Thus, to identify the herding behavior considering different future market investors, we intend to answer the following question: **Is it possible to find evidence of herding behavior considering speculators and hedgers influences in future market volatility?**

Further, this paper aims to verify the presence of herding behavior of speculators and hedgers in commodities future market. For speculation scenario, we consider the daily returns of the first futures contracts of five U.S. commodities (Cotton, Coffe, Wheat, Soybean and Sugar). For hedging scenario, we consider the daily returns of Brazilian spot commodities of these commodities. The commodities chosen represent well the Brazilian agricultural exportation, and for the U.S. Futures market, these commodities are its landmark. The collection of dataset returns comprises the period of July, 30 2004 to July,12 2013, considering the same period of action of speculators and Brazilian hedgers. For the Brazilian market, the works are restricted in comparison to other equity markets (see works of Alemanni and Ornelas (2006), Chiang and Zheng (2010) and De Almeida et al. (2013) and mutual funds (Kutchukian and Kutchukian, 2013).

The structure of this paper is followed by a literature review about the evolution of herding behavior in different markets and futures markets. After, it is presented the methodological aspects concerning herding estimation in speculation and hedging scenarios. Finally, this paper presents the results and conclusions of the empirical study.

HERDING: PREVIOUS EVIDENCES

The herding is a pattern of behavior where investors copy the action of other investors in buying and selling a determined asset or dataset of assets. The investors are motivated for herd when the market denote some situations such as: i) better access to information (CHARI and KEHOE, 2004); ii) maintenance of trade reputation (SWANK and VISSER, 2008); iii) excess volatility (GABAIX et al., 2006; KREMER and NAUTZ, 2013); iv) other imperfections in market information such as size of assets, trading volume, feedback of investors from past returns and risk management (KREMER and NAUTZ, 2013).

Beside these aspects that influence the investors to herd, most empirical studies use the cross sectional return dispersion method developed by Christie and Huang (1995) and Chang et al. (2000) in different scenarios, such as: Demirer and Kutan (2006) and Tan et al. (2008) apply in Chinese stocks market, Blasco and Ferreuela (2008) verify th'e presence of herding in familiar assets. Caporale et al. (2008) observe in Greek stock exchange. Chiang and Zheng (2010) verify in global stock markets.

However, given the leptokurtic distribution of financial returns and the presence of herding in periods of higher volatility, empirical studies use the quantile regression as an alternative to observe the herding behavior along the distribution returns. Chiang et al. (2010) confirm the presence of herding behavior in daily Chinese stock markets. Gebka and Wohar (2013) analyze changes of herding over time of 32 countries and 5 sectors (basic materials, consumer goods, financials, industrials, oil & gas), which resulted in a sample for the period from 06 January 1998 to 02 January 2012 and differences in herding across 9 sectors (basic materials, consumer goods, consumer services, financials, health, industrials, oil & gas, telecommunications, and utilities) for the sample of 27 countries in the period from 01 November 2007 to 02 January 2012. Here, the authors observe that there is no presence of herding in global information, but there are indicators of irrationality in some sectors, especially in basic materials, consumer services, and oil and gas. Zhou and Anderson (2013) analyze the herding behavior in U.S. Real Estate Investment Trusts according to different observations of returns (daily, weekly and monthly) from January 1980 to December 2010 and confirm the herding presence in high quantiles of the REIT return dispersion. The herding in these quantiles implies one situation which the investors tend to herd under turbulent market conditions. Moreover, the herding is more likely to occur and become stronger in declining markets than in rising markets.

In futures markets, Pindyck and Rotemberg (1990) verify that excessive comovements of commodity prices could determine a herd behavior in this market. In the same line, Chunrong et al. (2006) reject speculation and herding related to price co-movements. Adrangi and Chatrath (2008) reject herding when considering excess co-movements of hedgers, speculators and small investors positions. Steen and Gjolberg (2013), regarding correlation patterns and principal components analyses of 20 commodities for the period of 1986–2010, confirm that there is no evidence of herding in excessive co-movements.

However, these works do not consider the market volatility. Thus, Gleason et al. (2003) use the cross-sectional deviation (CSSD) of Christie and Huang (1995) in European commodities and find no presence of herding in thirteen commodities future contracts traded on three European exchanges. Demirer et al. (2013) use cross sectional absolute deviation (CSAD) of Chang et al. (2000) and extend the herding behavior in regime-switching approach in U.S. commodity futures, which find evidence of herding in high volatility periods and observe no impact of the stock markets on herd behavior of commodities future market.

METHODOLOGICAL ASPECTS

HERDING BEHAVIOR

Christie and Huang (1995) and Chang et al. (2000) propose methods to detect the herding behavior. Christie and Huang (1995) suggested the use of cross-sectional standard deviation of returns (CSSD) to represent return dispersion. This model believes in the hypothesis that during those times, individuals tend to suppress their own beliefs and base their investment decisions on the collective actions of the market. Thus, commodity returns will not deviate too far from the overall market return. Here, the herding occurs in an opposite situation. But this model is restrict to study herding during periods of market stress, and ignores the fact that herding could also take place during normal periods.

Chang et al. (2000) extended the CSSD measure with the cross-sectional absolute deviation of returns (CSAD), which is less sensitive to return outliers in equation (1).

$$CSAD_t = \frac{1}{N} \sum_{i=1}^{N} |R_{i,t} - R_{m,t}|. \quad (1)$$

This model considers the nonlinearity in the relationship between dispersion and market return, and set up a new equation to test for herding in (2).

$$CSAD_t = \gamma_0 + \gamma_1 |R_{m,t}| + \gamma_2 R^2_{m,t} + \varepsilon_t. \quad (2)$$

Where $R^2_{m,t}$ is the nonlinear term. The reasoning of rational asset pricing models is conditioned to linear relationships between return dispersion and market return. When the linearly of relationships do not hold, there is the presence of herding. If the coefficient γ_2 of the nonlinear item is found to be significantly negative, then herding is said to occur.

$$CSAD_t = \gamma_0 + y^U_1 (D^U_t)|R_{m,t}| + y^L_1 (D^L_t)|R_{m,t}| + y^U_2 (D^U_t) R^2_{m,t} + y^L_2 D^L_t R^2_{m,t} + \varepsilon_t. \quad (3)$$

Where for the existence of herding, the parameters y^U_2 and y^L_2 should be significantly negative or positive.

However, these models are based in Ordinary Least Squares (OLS) estimator and focused on the mean as a measure of location. Further, the presence of OLS heteroskedastic errors produce biased and misleading parameter estimates and the estimation of the regression over different quantiles can be necessary. This paper performed the Breusch and Pagan (1979) test to confirm the presence of heteroskedasticity of linear regressions. Considering different quantiles, the conditional quantile regression proposed by Koenker (2005) provides a better configuration of herding analyses with conditional distribution between return dispersions and market return, not restrict to median quantiles. The generic form of quantile regression can be written in equation (4).

$$y_i = x'_i \beta_\tau + u_{\tau t}. \quad (4)$$

Where y_i is the dependent variable ($CSAD_t$), x_i is a vector of independent variables ($R_{m,t}$ and $R^2_{m,t}$), β_τ is a vector of parameters and $u_{\tau t}$ is the error term. The subscript $\tau \in (0,1)$ indicates the quantile. The τ^{th} conditional quantile of y given x is defined as $Quant_\tau(y_i|x_i) = x'_i\beta_\tau$. As τ increases continuously, the conditional distribution of y given x is traced out. The quantile regression estimator $(\widehat{\beta_\tau})$, can be found by minimizing a weighted sum of absolute errors, as represented in equation (5).

$$\widehat{\beta_\tau} = arg\min_{\beta}\left(\sum_{i y_i > x_i'\beta_\tau} \tau|y_i - x_i'\beta_\tau| + \sum_{i y_i < x_i'\beta_\tau} 1 - \tau|y_i - x_i'\beta_\tau|\right). \qquad (5)$$

Where weights of regression are dependents on quantile values. Considering that most of the papers that use quantile regression in herding behavior, such as Chiang et al. (2010), Gebka and Wohar (2013) and Zhou and Anderson (2013), this paper use the following quantile scale: 0.10, 0.25, 0.50, 0.75 and 0.90. When $\tau = 0.50$, the quantile regression becomes the median regression. The quantile regression is not restrictive at the median level; it allows us to estimate the interrelationship between a dependent variable $CSAD_t$ and its explanatory variables $R_{m,t}$ and $R_{m,t}^2$ at any specific quantile.

HEDGE RATIO FOR HEDGING

The herding behavior above is commonly observed for speculators investors in commodities future market. The speculators invest directly in future assets and aim gains in dispersion of returns. On the other hand, another type of investor in commodities future market is the hedger. The hedger aims the protections of market dispersions considering the relation between spot and future prices of one commodity. The commodities future market is represented by two important hedgers: i) the short hedger, which is the investor that invests in sale futures contract to protect against the possibility of losses in futures prices or negative returns. The short hedger is commonly associated to producers of a certain commodity, and; ii) the long hedger, which is the investor that buys futures contracts to protect against increase in prices or positive returns. The consumers of a determined commodity and/or speculators are represented as long hedgers.

The hedging in commodity markets presumes that the returns of external markets reflect the variation of domestic markets. In commodities future market, the domestic returns of one commodity is a function of its future external returns, represented by U.S. future commodity returns of trading in Chicago Board of Trade (CBOT) and New York Board of Trade (NYBOT). This postulate determines a long term relationship between external and domestic markets. The long term relationship is validated through the co integration analyses of Engle and Granger (1987). The Dickey-Fuller Augmented test confirms the existence or not of the long term relationship. The relationship between domestic (spot) and external (future) returns is presented in Equation 6.

$$R_{H,t} = S_{i,t} - h_{sf,t} F_{i,t}. \quad (6)$$

Where R_t is the return from holding a portfólio of spots ($S_{i,t}$) and future ($F_{i,t}$) returns of commodity i in t period. The optimal hedge ratio $h_{sf,t}$ minimizes the variance of this portfolio return. The optimal minimum variance hedge ratio is described in Equation 7.

$$h_{sf,t} = \frac{cov(S_{i,t}, F_{i,t})}{var(F_{i,t})}. \quad (7)$$

Where, $h_{sf,t}$ is the hedge ratio of spots ($S_{i,t}$) and future ($F_{i,t}$) returns of commodity i in t period; $var(F_{i,t})$ is the variance of future returns of commodity i in t period; $cov(S_{i,t}, F_{i,t})$ is the covariance between spot and future returns of commodity i in t period. If the co integration presence is confirmed, the hedge strategies between spot and future returns is validated.

Based on a theoretical approach, this paper assesses the co integration based in OLS hedge ratio defined in Equation 8.

$$S_{i,t} = \alpha + \beta F_{i,t} + \varepsilon \quad (8)$$

Where, ($S_{i,t}$) and ($F_{i,t}$) are the spot and future returns of commodity i in t period, α is the intercept, β the slope coefficient which is similar to $h_{sf,t}$ and ε is the regression residuals. After, this paper defined the hedge portfolio returns and applied the herding analysis considering the wide-market and up (down) market hedge scenarios as presented in Equation 9 and 10.

$$CSAD_{Ht} = \theta_0 + \theta_1 |R_{H,t}| + \theta_2 R_{H,t}^2 + e_t. \quad (9)$$

$$CSAD_{H,t} = \theta_0 + \theta_1^U (D_t^U)\left|R_{H,t}\right| + \theta_1^L (D_t^L)\left|R_{H,t}\right| + \theta_2^U (D_t^U) R_{H,t}^2 + \theta_2^L D_t^L R_{H,t}^2 + e_t. \quad (10)$$

Where $\mathrm{CSAD_{H,t}} = \frac{1}{N}\sum_{i=1}^{N}|\mathrm{R_{i,t}} - \mathrm{R_{H,t}}|$, in which $\mathrm{R_{H,t}}$ is the cross-sectional average return of the N assets in the hedge portfolio at time t, and $\mathrm{R_{H,t}^2}$ is the hedge portfolio volatility, θ_2 is the nonlinear item in wide-market hedge scenario and θ_2^U and θ_2^L is the up-market and down-market hedge portfolio scenarios. The significant presence of herding is determined through t test where the values are significant at 5% level.

DATA

This paper collects data related to the configuration of investors. The first is the speculator, that trade commodity prices in future market with large risk, especially with respect to anticipating future price movements. They assume more volatility market in exchange for the potential gain. Thus, we consider daily returns of the first future contracts of five U.S. commodities (Cotton, Coffee, Wheat, Soybean and Sugar), worldwide trade references. The other investor is the hedger, that protects of market dispersions and trade in according to future price movements. We use daily spot returns of principal Brazilian agricultural commodities, and we used respective U.S. Future market benchmarks. For that, the collection of dataset returns comprises the period of July, 30 2004 to July, 12 2013, with 2.444 observations for speculation portfolio and 2.338 observations for hedger portfolio, considering the same period of action of speculators and Brazilian hedgers.

LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Despite this paper reaching the proposed problem, this study is limited to one specific market portfolio and its peculiarities, and do not attempt to consider other risk aversion and assess the hedge effectiveness. This paper suggests other hedge strategies, which include risk aversion of hedgers as well as dynamic hedge ratio to posterior analyzes. Further, we suggest additional advances considering other elements of commodities future market that motivate the investor to herd, such as the size of assets and trade volume, as well as the relationship with other investments. Cruz et al (2013) find no impact of future contracts in investment portfolios, but including individual commodity hedging could provide new information to risk mitigation.

RESULTS

SPECULATOR HERDING

The speculators trade commodity prices in commodities future market with large risk, especially with respect to anticipating future price movements. They assume more volatility market in exchange for the potential gain. In this sense, this paper verifies if these investors present herd behavior. Previously to display the herding in wide and up (down) market scenario, this paper examines if linear regressions come without heteroscedastic effects in standard errors in Table 1.

Table 1 – Breusch-Pagan test for heteroscedasticity for speculator herding in wide-market, and up (down) market scenarios

Scenario	Statistic	p-valor
Wide-market	458,1450	<0,001
Up(down) Market	460,1006	<0,001

This table presents the estimation of Breusch-Pagan test for heteroscedasticity presence future wide-market according to Eq. 2: $\mathrm{CSAD_t} = \gamma_0 + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \varepsilon_t$ and future up (down) market according to Eq.3: $\mathrm{CSAD_t} = \gamma_0 + y_1^U(D_t^U)|R_{m,t}| + y_1^L(D_t^L)|R_{m,t}| + y_2^U(D_t^U)R_{m,t}^2 + y_2^L D_t^L R_{m,t}^2 + \varepsilon_t$. Null hypothesis defines significant no heteroscedasticity in OLS regressions at 5% level.

In Table 1 the results reject the null hypothesis of homoscedasticity of OLS regressions in wide-market and up (down) market scenarios. Thus, it is required the analysis over different quantiles of distribution of variables and to confirm the application of quantile regression in herding estimation in these scenarios.

Wide-market scenario

This paper considers the action of speculators in commodities future wide-market scenario, considering the investors which have access only to one risky asset (U.S. commodity contracts) in this market. Table 2 verifies the presence of herding behavior, based in wide-market $\mathrm{CSAD_t}$ regression. The wide-market $\mathrm{CSAD_t}$ is based in equation (X), where $\mathrm{CSAD_t}$ are the cross-sectional absolute deviations of commodities future market portfolio, γ_1 is the coefficient of market return $\mathrm{R_{m,t}}$ and γ_2 is the coefficient of market ty$\mathrm{R^2_{m,t}}$.

Table 2 - Estimated results of herding of speculators in future wide-market.

	γ_0	γ_1	γ_2	R^2
	0.0257*	0.4346*	1.8048	0.0801
OLS	(44.3460)	(5.4010)	(0.8800)	
Quantile regression				
	0.0145*	0.4094*	-5.1264	0.0474
τ = 0.10	(44.0616)	(3.2608)	(-1.1894)	
	0.0201*	0.3970*	-2.5003	0.0936
τ = 0.25	(79.4885)	(5.0552)	(-1.0342)	
	0.0279*	0.3931*	0.7405	0.1318
τ = 0.50	(87.6264)	(3.5706)	(0.8378)	
	0.0376*	0.4383*	5.5411	0.1188
τ = 0.75	(87.2901)	(3.2287)	(1.2322)	
	0.0486*	0.5453*	7.7412	0.0748
τ = 0.90	(68.8632)	(2.1465)	(0.8920)	

This table reports the estimated results of herding in future wide-market portfolio according to Eq. 2: $CSAD_t = \gamma_0 + \gamma_1|R_{m,t}| + \gamma_2 R^2_{m,t} + \varepsilon_t$, where $CSAD_t$ is the cross-sectional absolute deviations of future portfolio returns, and $R_{m,t}$ is the cross-sectional average return. In parentheses are t-values. *A significant positive value of γ_2 suggests the existence of herding a significant at 5% level.

Table 2 presents the performance in OLS and quantilic regressions. As results, the γ_1 coefficients, for OLS and quantilic estimators, are significantly positive, indicating that $CSAD_t$ increases during the analyzed period. Further, the nonexistence of significant negative values of γ_2 evidence the absence of herding behavior in wide-market scenario. These results follow the results of Gleason et al. (2003), in the use of the cross-sectional deviation (CSSD) in Europe commodities and evidence the absence of herding in thirteen commodities future contracts traded on three European exchanges.

Up-market and down-market scenarios

At this point, this paper verifies herding presence for speculators in commodities future market up market and down-market scenario. Table 3 presents the OLS and quantile estimators in this scenario related to equation (5), where $\mathrm{CSAD_t}$ are the cross-sectional absolute deviations of commodities future market portfolio, y_2^U is the coefficient of up-market dispersion $(D_t^U)R_{m,t}^2$ and y_2^L is the coefficient of down-market dispersion $(D_t^L)R_{m,t}^2$.

Table 3 - Estimated results of herding in the future up-market and future down-market for speculators

		Up Market		Down Market		
	γ_0	y_1^U	y_2^U	y_1^L	y_2^L	R²
OLS	0.0256* (44.1020)	0.3978* (4.0640)	1.8793 (0.6310)	-0.4899* (-5.3840)	1.1096 (0.4660)	0.0810
Quantile regression						
τ = 0.10	0.0145* (40.5443)	0.3845* (2.5999)	-4.2511 (-0.7713)	-0.4355* (-3.4252)	-5.7409 (-1.4040)	0.0474
τ = 0.25	0.0202* (76.8946)	0.3693* (4.0734)	-2.5690 (-0.8439)	-0.4309* (-4.3048)	-2.9080 (-0.8328)	0.0936
τ = 0.50	0.0279* (85.4871)	0.4331* (3.1781)	-2.3592 (-0.4401)	-0.4344* (-3.1646)	0.8412 (0.1642)	0.1316
τ = 0.75	0.0375* (86.7707)	0.4960* (4.2480)	2.1311 (0.8763)	-0.4834* (-3.1250)	4.8756 (0.9066)	0.1187
τ = 0.90	0.0486* (70.8158)	0.4496* (1.4931)	10.4587 (0.8666)	-0.6309* (-2.3217)	6.3837 (0.6925)	0.0742

This table reports the estimated results of herding in future up-market and down-market portfolio according to Eq. 3: $CSAD_t = \gamma_0 + y_1^U(D_t^U)\left|R_{m,t}\right| + y_1^L(D_t^L)\left|R_{m,t}\right| + y_2^U(D_t^U)R_{m,t}^2 + y_2^L D_t^L R_{m,t}^2 + \varepsilon_t$., where $CSAD_t$ is the cross-sectional absolute deviations of future portfolio returns, and $R_{m,t}$ is the cross-sectional average return. In parentheses are t-values. *A significant negative value of y_2^U and y_2^L suggests the existence of herding a significant at 5% level.

In table 3, the coefficient of linear term of up-market in OLS and quantile regressions y_1^U is positive and significant, while OLS and quantile regressions of down-market present coefficient y_1^L negative and significant. Further, we evidence the absence of significant $y_2^U$and y_2^L and confirm no herding evidence in up-market and down-market scenarios. Thus, these results provide strong support favor to rational asset pricing prediction in which there is a linear relation between CSAD and the absolute market return. Demirer et al. (2013), who used cross sectional absolute deviation (CSAD) and extend the herding behavior in regime-switching approach in U.S. commodities future market, found evidence of herd behavior in high volatility periods. However, in this paper, high volatility values represented by 0.90th quantile of up (down) scenarios, present no herd evidence and display different findings.

However, both works of Gleason (2003) and Demirer et al. (2013) do not consider the influence of hedging strategies in commodities future market. The section 4.2 verifies if there is herd behavior in commodities future market with static hedge ratio strategies.

HEDGER HERDING

Another type of investor in futures commodity market is the hedger. The hedger aims the protections of market dispersions considering the relation between spot and future prices of one commodity. This paper examines if these investors present herd behavior. Before displaying the herding in wide and up (down) market scenario, this paper performs heteroscedasticity test in standard errors of OLS regressions in Table 4.

Table 4 – Breusch-Pagan test for heteroscedasticity for hedger herding in wide-market, and up (down) market scenarios

Scenario	Statistic	p-valor
Wide-market	400,2748	<0,001
Up(down) Market	407,2645	<0,001

This table presents the estimation of Breusch-Pagan test for heteroscedasticity presence future wide-market according to Eq. 9: $CSAD_{Ht} = \theta_0 + \theta_1 |R_{H,t}| + \theta_2 R_{H,t}^2 + e_t$ and future up(down) market according to Eq.10:$CSAD_{H,t} = \theta_0 + \theta_1^U(D_t^U)|R_{H,t}| + \theta_1^L(D_t^L)|R_{H,t}| + \theta_2^U(D_t^U)R_{H,t}^2 + \theta_2^L(D_t^L)R_{H,t}^2 + e_t$ .Null hypothesis defines significant no heteroscedasticity in OLS regressions at 5% level.

In Table 4, the results reject the null hypothesis of homoscedasticity of OLS regressions in wide-market and up (down) market scenarios. As identified in Table 1, the test confirms the application of quantile regression in herding estimation in these scenarios.

Further, this paper presents in Table 5 the Dickey-Fuller Augmented test in order to verify if it confirms or not the long term relationship defended by co integration.

Table 5 – ADF-Augmented test values for spot and future commodities returns

Variables	Statistic	p-valor	Hedge ratio
Spot Cotton	-14,3067	<0,001	
Future Cotton	-32,7772	<0,001	0.1248
Residuals Cotton	-14,5726	<0,001	
Spot Coffee	-29,1757	<0,001	
Futuro Coffee	-27,6130	<0,001	0.7821
Residuals coffee	-31,8057	<0,001	
Spot Wheat	-13,2155	<0,001	
Futuro Wheat	-15,8457	<0,001	0.0854
Residuals wheat	-13,3988	<0,001	
Spot Soybean	-32,9480	<0,001	
Futuro Soybean	-35,1521	<0,001	0.1394
Soybean residuals	-32,9474	<0,001	
Spot Sugar	-10,5819	<0,001	
Futuro Sugar	-15,5532	<0,001	0.1302
Residuals sugar	-10,3640	<0,001	

This table presents the estimation of ADF-Augmented test for stationary presence of Brazilian spot and U.S. future returns of Cotton, Coffee, Wheat, Soybean and Sugar commodities. Null hypothesis defines significant non-stationary time series at 5% level.

As results in Table 5, both spot and future returns of commodities analyzed are stationary. When applying residuals of long-term model, the residuals are stationary in all commodities. Thus, a long-term relationship occurs and the hedge ratio estimation is validated. Confirming the use of hedging in commodities future markets, this paper verified herding evidence for hedgers in wide-market scenario and up (down) market scenario.

Wide-market scenario

In wide-market scenario, considering the protection of five Brazilian spot commodities (Cotton, Coffee, Wheat, Soybean and Sugar) in first contract of respective U.S. commodities future market. Table 6 verifies the presence of herding behavior, based in wide-market $CSAD_{H,t}$ regression. The wide-market $CSAD_{H,t}$ is based in Equation (11), where $CSAD_{H,t}$ is the cross-sectional absolute deviations of commodities future market portfolio, θ_1 is the coefficient of market return $R_{H,t}$ and θ_2 is the coefficient of market volatility $R_{H,t}^2$.

Table 6 - Estimated results of herding in speculation future wide-market.

	θ_0	θ_1	θ_2	R^2
	0.0129*	0.2180*	1.6306	0.0473
OLS	(44.577)	(4.4410)	(1.2040)	
Quantile regression				
	0.0065*	0.0909*	-1.6424*	0.0226
τ = 0.10	(43.8098)	(2.2654)	(-2.8359)	
	0.0092*	0.1360	-0.6943	0.0458
τ = 0.25	(62.0030)	(1.8965)	(-0.1987)	
	0.0132*	0.1882*	0.5840	0.0654
τ = 0.50	(87.3106)	(3.2081)	(0.2474)	
	0.0180*	0.2600	4.8483	0.0612
τ = 0.75	(64.8224)	(1.8036)	(0.6995)	
	0.0241*	0.2617	6.1315	0.0395
τ = 0.90	(55.6819)	(1.3375)	(0.7906)	

This table reports the estimated results of herding in hedge commodities future market for hedgers according to Eq. 9: $CSAD_{Ht} = \theta_0 + \theta_1|R_{H,t}| + \theta_2 R_{H,t}^2 + e_t$, where $CSAD_t$ is the cross-sectional absolute deviations of hedge future portfolio returns, and $R_{H,t}$ is the cross-sectional average return. In parentheses are t-values. *A significant negative value of θ_2 suggests the existence of herding a significant at 5% level.

Table 6 presents the performance in OLS and quantilic regressions. As results, in OLS regression, the absence of a significant parameter θ_2 evidences no herding presence and confirms a rational pattern view in the speculator scenario. However, in quantilic regression the θ_1 coefficient is significantly positive only in 10% and 50% quantiles. Further, this paper verifies significant negative θ_2 coefficient in 10% quantiles and evidence herding behavior in the least values of dispersions of wide-market. Thus, hedge investors can ignore their assessment of individual hedging and follow market information when considering small market volatility. This situation follows the Falkenstein's (1996) theory, which argues that herding appears as investors generally are attracted to less risky assets. An ideal configuration is that hedge investors, motivated by protection in high dispersions, follow the market information over three situations: i) when the impact of volatility of spot and return prices are worthwhile to acquire new information only if other agents do, ii) when one possible similar portfolio composition of investors due price pressure of financial institutions may be inducing the same asset allocation in lowest volatility, and iii) information cascade, where investors ignore private information and follow observed actions of previous agents. Devenon and Welch (1996) define this configuration as rational herding, in which rational agents all act alike without any countervailing force. Kremer and Nautz (2013) affirm that rational herding involves imitating the other market participants, resulting in simultaneous buying or selling of the same stocks regardless of prior beliefs or information sets. However, characteristics such as shown by Falkestein denote irrational herding where external influences determine the investor´s behavior and provides inefficiencies to rational herding (BIKHCHANDANI and SHARMA 2001).

Up-market and down-market scenario

At this point, this paper considers the protection by long and short hedgers in future up-market and down-market, respectively. The long hedger protects against increase of returns, and short hedger protects in decrease of returns. Table 7 presents the OLS and quantile estimators in this scenario related to Equation (10), where $CSAD_{H,t}$ are the cross-sectional absolute deviations of commodities future market portfolio, θ_2^U is the coefficient of up-market dispersion $(D_t^U)R_{H,t}^2$ and θ_2^L is the coefficient of down-market dispersion $(D_t^L)R_{H,t}^2$.

Table 7 - Estimated results of herding in the future up-market and future down-market for hedgers

		Up Market		Down Market		
	θ_0	θ_1^U	θ_2^U	θ_1^L	θ_2^L	R²
OLS	0.0136*	0.1442*	3.4741*	-0.3334*	-2.4863	0.0451
	(45.7070)	(2.5470)	(2.0850)	(-5.6760)	(-1.4540)	
Quantile regression						
τ = 0.10	0.0069*	0.0929*	-1.2209*	-0.1214	-0.6460	0.0233
	(48.0287)	(2.5418)	(-1.9722)	(-1.6297)	(-0.2177)	
τ = 0.25	0.0097 *	-0.0007	4.0039	-0.1869*	-2.1726	0.0473
	(63.9910)	(-0.0068)	(0.6840)	(-2.6884)	(-0.8804)	
τ = 0.50	0.0136*	0.1912*	0.4814	-0.3885*	-5.7193*	0.0684
	(80.9683)	(3.0790)	(0.2257)	(-7.2448)	(-7.6236)	
τ = 0.75	0.0190*	0.2538*	5.3671*	-0.5016*	-7.79978	0.0642
	(70.3150)	(2.8760)	(4.0618)	(-4.2801)	(-1.4972)	
τ = 0.90	0.0253*	0.2746*	5.3536*	-0.4816*	-0.8156	0.0412
	(58.6634)	(2.6741)	(3.7817)	(-2.3205)	(-0.1088)	

This table reports the estimated results of herding in future up-market and down-market portfolio according to Eq. 10: $CSAD_{H,t} = \theta_0 + \theta_1^U(D_t^U)|R_{H,t}| + \theta_1^L(D_t^L)|R_{H,t}| + \theta_2^U(D_t^U)R_{H,t}^2 + \theta_2^L(D_t^L)R_{H,t}^2 + e_t$., where $CSAD_{H,t}$ is the is the cross-sectional absolute deviations of hedge future portfolio returns, and $R_{H,t}$ is the cross-sectional average return. In parentheses are t-values. *A significant negative value of θ_2^U e θ_2^L suggests the existence of herding a significant at 5% level.

As results, in Table 7, the linear term of up-market θ_1^U in OLS and quantile regressions are positives and significant, while down-market linear coefficients θ_1^U are negative and significant in OLS and quantile regressions. Further, there are evidence of herding presence in 10% quantile of up-market and 50% quantile of down-market, due to negative and significant values of $\theta_2^U$and θ_2^L coefficients. Thus, these results provide strong support against the linear relation between $CSAD_{H,t}$ and the absolute hedge commodities future market returns.

In down-market scenario, represented by long hedgers, there is similar conjecture in wide-market in section 4.2.1, where investors that use futures contract to protect against increase in positive returns follow the market information in small volatilities. For short hedgers, represented by volatilities in up-market, there are herding pattern in 50% quantile of market volatility and in no other quantile. A possible explanation is that the information cascade related to the performance of minimum variance hedge ratio makes these investors follow the market information when defining a hedge risk.

CONCLUSIONS

This paper verifies the presence of herding behavior of speculators and hedgers in commodities future market. For speculation scenario, we consider the daily returns of the first future contracts of five U.S. commodities (Cotton, Coffe, Wheat, Soybean and Sugar). For hedging scenario, we consider the daily returns of Brazilian spot commodities of these commodities. We apply co integration analyses to confirm the utility of minimum variance hedge ratio as estimator of hedging in wide-market and up-market and down-market, considering the impact of herding in long and short hedgers, respectively. For herding estimation, this paper measures the cross sectional absolute deviation (CSAD) of Chang et al. (2000) for dispersion estimator and apply the conditional quantile regression of Koenker (2005).

As results, there is no herding evidence in wide-market, up-market and down-market scenarios for speculators. However, this paper finds herding evidence in wide-market, up-market and down-market for hedger scenario with quantilic estimator. The hypothesis of information acquisition and principal agent problem of Devenon and Welch (1996) can be used to explain one ideal configuration of rational herd behavior for long and short hedgers. Thus, one irrational herding related to small values of market dispersion in wide market, as well as common risk management practice in down-market, attempt to possible inefficiencies of rational herding that lead to an increase in the volatility and systemic risk and should be the focus of agents involved in this commodities future market (BIKHCHANDANI and SHARMA 2001). For more theoretical comprehension of irrational forces and respective impact in financial market, see work of Maluf (2010). Thus, these inefficiencies are innovative in commodities future market of herding analysis if compared to previous works such as Gleason (2003) and Demirer et al. (2013).

PRACTICAL IMPLICATIONS

The herding presence has important impacts in futures market analysis, especially in long and short positions of hedging strategies, once the investor, knowing certain behavior patterns, can make better decisions to mitigate their risks.

For long strategies, Brunetti and Buyuksahin (2009) affirm that the presence of herding may be associated to: i) the perception that other agents have superior information and infer information about the quality of investment holding from one another; ii) the performance between institutions that imitate other market participants, and iii) common shocks of volatility, where investors react to same information signals (SHLEIFER and SUMMERS, 1990). These authors find that speculative activity in hedging (which also can be represented by long hedger) do not cause price movements, but reduces risk by enhancing market liquidity. Thus, the long hedger cannot have destabilizing effect in the market.

On the other side, the presence of herding for short strategies can represent destabilizing impacts on volatility returns when positive feedback strategies of these investors occur. Positive feedback is associated to a situation where investors employ similar risk models for long periods. The herding in short hedge may lead to creation, or at least contribution, of bubbles and crashes in this market (KREMER and NAUTZ ,2013). Thus, this paper verifies a irrational herding result of common risk management practices, and warns that there may be failures in the view of market investors (BIKHCHANDANI and SHARMA 2001).

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