Financialization of Commodity Markets – Evidence from European Certificates Markets

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Abstract

In view of the ongoing discussion about the influence of financialization on commodity markets, we conduct a European investigation of the impact of retail investment products on commodity prices. By using a unique dataset of 15,137 commodity linked securities (certificates) we extend previous research in two ways: First, we are able to confirm the empirical results of Henderson et al (2015) for U.S. commodity linked notes (CLNs) and relating price effects on the date of issuance and following days. Second, we also find a significant impact of the days preceding the issuance day, which gives rise to the question whether we observe a possible endogeneity problem between commodity prices and investment flows when analyzing issuances of CLN and certificates.

Keywords: financialization, commodities, certificates, event study, CLN

JEL Classification Codes: G12, G14, Q02, Q31

1. Introduction

Meanwhile the phenomenon of financialization of commodity markets has been substantially acknowledged by public and science. We have seen exponential increases and flows of commodity related investments by financial institutions as well as by retail investors in many commodity markets through the last decades. (Among others see Gilbert (2010), Stoll and Whaley (2010)). However, we still observe an intense academic debate about potential implications of this development. It is far from clear, whether the rising presence of financial investors impacts commodity prices, volatility, co-movement of commodities or even market functioning or not.

A number of researchers tried to shed light on this question in the last years, whereas the approaches and methodologies differ to a great extent. Fattouh et al. (2013) argued for studies on the oil market that most of these approaches can be condensed in at least six strands of literature: Analysis on the co-movement between commodity and stock prices, the influence of futures trading positions on future prices, the relationship between future and spot prices, the relationship between prices and inventories, the effect of supply and demand shocks, and the influences of time-varying risk premia. In another comprehensive and more general review on financialization Cheng and Xiong (2014) structure related studies regarding the mechanisms that are subject to the functioning of these markets: storage, risk sharing, and information. Thereby they discover that financialization has substantially changed commodity markets through these mechanisms. Both summaries show that the results of the diverse studies find seemingly confusing evidence in either direction. Regarding the most common used methodologies, Cheng and Xiong (2014) criticize standard correlation analysis and Granger causality tests, as these tend to be inconclusive.

One of the most recent studies on the topic of Henderson et al. (2015) does not fit clearly to any of these patterns and opens a new field of research on the financialization of commodity futures markets. This study promises new evidence analyzing the impact on prices of issuances and related hedging activities of commodity-linked notes (CLN) for the U.S. market. CLNs are structured products that are designed especially for retail investors to participate from commodity price developments. The economic theory behind is, that the CLN issuing institution hedge their liabilities by taking long positions in the respective

futures markets. This futures demand in turn may impact commodity futures or even spot prices. Using the instrument of an event study the first time in this context, the authors in fact identify a significant price movement in the commodities futures markets around the issuing dates of those products. They conclude that the necessary trading activities on the commodity futures markets to hedge the issued CLNs are reason for these results. However, as it is the first study of this regard, limited to a single market (U.S. OTC CLNs), there is lack of general evidence and clear need for further confirmation of these results in other derivative and geographic markets.

We fill this research gap by replicating and extending Henderson et al. (2015) on the European and especially German retail investment market, in which all kinds of commodity-linked structured products are traded. These investment vehicles, like CLNs in the U.S. market, enable retail investors, as well as institutional investors to gain exposure to commodities without holding the physical resource. The most common comparable product to CLNs in the European Market, are the so-called "certificates". These have been object of different studies especially regarding the issuer's (hidden) margin. But to the best of our knowledge there is no analysis of the influence of certificates on the underlying commodity prices. In addition to the study of Henderson et al. (2015) we obtained further information on the issuing process. From direct discussions with several issuing institutions, we discovered that changes in market conditions due to strong movements in prices might cause issuances of new CLN products through automated processes. Therefore, it is possible to observe endogeneity applying the approach of Henderson et al. (2015).

Within this study, for the first time, we examine issuances of certificates in the European market. Thereby we use a unique, comprehensive and exclusive dataset of 15,137 certificates from 2002-01-30 to 2012-10-29 issued at the German EUWAX in Stuttgart, which is the largest exchange for structured products in Europe. Using this dataset, which is nearly eight times larger than the one of Henderson et al. (2015), we are able to replicate their study on the U.S. OTC CLN market on the European market. Furthermore, we provide further insights to the issuing processes and relating phenomena, through the use of a broader also pre-event window and a more detailed dataset, including specific product characteristics such as product type or barriers.

We confirm the empirical results of Henderson et al. (2015), as we find significant dependencies between the issuance of certificates and movements of commodity futures prices around the issuing date. In addition to Henderson et al. (2015), we obtain indication that these coherences in the European market might not only be the results of hedging activities. The issuance of certificates, furthermore, seems to be scheduled corresponding to price movements in the underlying. The theory regarding hedging activities as sole cause could therefore be a fallacy, as we observe a potential endogeneity of mutually influential effects.

2. Literature

As previously stated Henderson et al. (2015) is the first work, which analyzes the effects of commodity derivatives on the underlying spot market. Thereby the authors conceivably open a new strand on the effects of financialization. The influence of the introduction of derivatives on their underlying markets, however, has been more intensively studied. Therefore, we first have a look at literature examining financial markets in general, before we, in the second part of this section, try to give a detailed classification of this new topic to the previous literature on the financialization of commodity markets.

Besides theoretical works of Ross (1976), Detemple and Selden (1991), or Avellaneda and Lipkin (2003), which analytically show and deduce an impact of options introduction on the underlying markets from a theoretical perspective, the research topic has been particularly empirically tested. Furthermore, early works of Branch and Finnerty, (1981), Conrad (1989), and Detemple and Jorion (1990) consistently find evidence for permanent price increases in the underlying security within the period 1974 to 1986 due to option introduction. Regarding the price increases, the latter two studies show that these are gradual over up to two weeks around emission. Conrad (1989), furthermore, terminates the beginning of the price effects of approximately three days prior to introduction. Detemple and Jorion (1990) as well as Damodaran and Lim (1991), in addition, find significant decreases in volatility of the underlying stocks that take place when new options are listed.

Subsequent studies, however, produce a more heterogeneous picture. Ho and Liu (1997) for the period from 1983 to 1990 show, that the base prices are rising permanently before the introduction of options,

but turn to be negative few days prior to emission. Furthermore, the price effects is accompanied by increases in trading volume. The ambivalence is demonstrated by Sorescu (2000). Using a two-regime, switching means model, he determines for the years from 1973 to 1980 a positive, and for second period from 1981 to 1995, a negative price effect of option introductions on underlying stock prices.

A more recent study of Faff and Hillier (2005) for the period between 1978 and 1999, again finds significant positive and negative price effects around option listings. However, they argue that price movements around emissions are more reflective of informed traders' expectations of the future values of the underlying assets than effects of options introduction.

Research examining the impact of new option listing in equity markets finds evidence for abnormal returns around, before and after emissions. The question is, whether the potential reason of an abnormal return is actually hedging, if an abnormal return appears prior to an emission, or otherwise, if a product emission is due to changing market conditions in terms of strong price movements. The discussion, however, has not reached a consensus regarding the exact date of occurrence of the phenomenon of significant abnormal returns as well as of the underlying cause.

Regarding the current literature on financialization of commodity markets, many studies have tried to identify dependencies among investors' behavior and commodity prices. The underlying argumentation is, that financialization affects price building in futures and spot markets along a causal chain: Increased futures trading (particularly of financial market participants) leads to changes in futures prices, which in turn indirectly affects prices and volatility in underlying commodity spot markets. Apart from studies, which among other analyze the co-movement of commodities and stock indices, this hypothesis in prior literature is primarily tested with vector autoregressive regressions, like the Granger-Causality test. Therefore most of these studies relate to two strands, outlined by Fattouh et al. (2013). The first strand concerns the influence of futures trading positions on futures prices, and the second one examins the relationship between futures and spot prices. Most authors thereby use weekly Commitments of traders (COT) reports published by the CFTC, to test whether futures trading positions show a significant causal correlation with future or spot returns. However, the results are quite heterogeneous. There are some authors, who find evidence for future trading positions influencing prices, for example see Gilbert

(2010), Mayer (2012) or Singleton (2014). While there is at least an equivalent number of studies, which reject the hypothesis for financialization driving commodity prices, among others see Stoll and Whaley (2010), Irwin and Sanders (2011, 2012), Büyüksahin and Harris (2011) or Mayer et al. (2015). Reasons for this ambiguity are apparent: Varying timeframes, commodities, trading positions, aggregations or definitions are used. In addition, Cheng and Xiong (2014) point to data issues of the commonly used CFTC data, such as categorization of traders, missing swap data or netting problems. The same authors argue, that studies using unconditional tests assume that observed changes in positions are all due to shifts in the demand curve of financial traders. However, also other market participants like hedgers may vary their trading behavior and respective positions. Hence, using classical autoregressive analysis, it might not be possible to capture these dynamically changing effects. On the one hand, it is important to focus on the specific economic mechanism and on the other hand, sharper tests are required to isolate specific financial trades and to identify potential impacts (Cheng and Xiong (2014)).

The aforementioned study of Henderson et al. (2015) tries to bridge this gap. The work does not fit clearly to the previously established strands of financialization literature. It examines the impact of investor flows on commodity prices via issuances of CLNs for the U.S. market and related hedging activities by applying an event study the first time in this context. The authors use a novel CLN dataset, which comprises of around two thousand CLN issues spanning from January 2003 through January 2014, sorted into various groups of commodities. The general underlying economic hypothesis thereby is that commodity prices are driven significantly by hedging activities of CLN issuing institutions as a necessary part of the CLN issuing process. Almost simultaneous to the issuing of the CLNs, the issuer needs to hedge its risks by taking long (or short) positions in the respective underlying. This additional futures demand may lead to price movements in the futures market. As the futures markets are directly and indirectly linked to spot markets, there also might be an influence on the spot prices. To prove this hypothesis, the use of this type of product and novel dataset, as well as the application of an event study in particular analyzing the effect on underlying prices seems to be a promising complementary approach to existing studies. Therefore, it is possible to analyze individual points of time more detailed than for instance with Granger causality tests based on weekly published Commitments of Traders (COT) data

by the Commodity Futures Trading Commission (CFTC). Regarding the results of the study of Henderson et al. (2015), the authors in fact identify a significant price movement in the commodities futures markets at the issuing dates and following days of those products. From these findings they conclude that necessary trading activities on the commodity futures markets to hedge the issued CLNs are reason. Hence, the study of Henderson et al. (2015) in a broader sense also emphases the influence of trading positions on future prices using novel data and methodology, pointed out by Fattouh et al. (2013).

To sum up, the established literature on the introduction of options finds ARs in the respective underlying prior and past the emission. However, the question of what is first is reminiscent to the old debate about "chicken-or-egg". On the other side Henderson et al. (2015) suggests new evidence in the discussion about financialization of commodity markets, analyzing the issuances of CLNs on commodity prices, limited to a single market. This study concededly reveals analogy to historical literature on options introduction and the related question of endogeneity. According to the general lack of evidence and the open questions, whether ARs can be observed prior to the emission, further confirmation and prove of these results in other derivative and geographic markets is required. Therefore, we analyze in the present study, whether prices of underlying commodities are driven significantly by the issuing of commodity-linked certificates in the European market. Furthermore, we use an additional pre-event window and a much larger dataset from the EUWAX.

3. The European Market for structured products

The market for structured financial products (SFPs) developed continuously within the last years due to the introduction of innovative products on various underlyings like stocks, indices and commodities. This development is based on a number of reasons, especially the growing number of retail investors demanding for new and innovative products on the one side, and institutions expecting additional revenues on the other side (e.g. Tufano 2003, Henderson and Pearson 2011). Commodity-linked products are of special interest for retail investors, as they offer the possibility to invest in commodity markets which otherwise show high market entry barriers in general. In this study, we use a unique dataset of commodity-linked certificates, traded at the EUWAX. Certificates are securities, issued by an institution

and traded either OTC or at an exchange. Certificates can be distinguished in *investment products* and *leverage products*: Investment products offer a lean, low risk and mostly long-term-oriented investment opportunity especially within volatile market situations or sideward movements of the underlying price. *Discount certificates* for instance track the value of its underlying with a reduced price for the investor but also with a maximum value of profit. *Bonus Certificates* include a price barrier that protects the investor against decreasing prices. On the other side, *leverage products* like knock-out products or mini-futures imply higher risks for investors as the products expire worthless, when passing (over or under, respectively) a barrier. All certificates are structured similar to bonds or notes in the American market and hence are suitable for our replication study for the European market.

As described above, the certificates are traded OTC and at the EUWAX. Furthermore the issuer acts as market maker. Thus, these products offer a high liquidity and low price spreads in the secondary market. The fact sheets of the issuing institution for each product are available online. These documents contain, among others, information about the issuing prices, barriers, caps as well as a detailed description of the underlying and pay-off profile.

The European market for structured products caused an exchange turnover of 41.1 billion Euro regarding investment products and 75.0 billion Euro for leverage products in 2014, whereas German exchanges are responsible for the majority with a share of 54% of investment and 29% of leverage products (EUSIPA, 2015). The EUWAX as German market leader concerning structured products, itself achieved a market share of 61.75% for investment products and 66.49% for leveraged products in Germany. The EUWAX generated 28.2 billion Euro of revenue in 2014 whereas 13 billion of revenue can be ascribed to leveraged products (Börse Stuttgart, 2015). For our study it is further mentionable that commodities are the third biggest group of underlyings (after stocks and indices). For instance, relating to knock-out-products, they represent a revenue share of 7.44%.

Data

Our data set consists of issuing data of 15,137 commodity-linked certificates[1] which are responsible for 95% of EUWAX's revenue relating to commodity products issued in 2009 to 2012. This data contains information of the issuer, underlying, product type, issuing date, determination date or knock-out barrier, cap, security and bonus level.

Table 1: Number of issuances sorted by underlying, product type, and option type (call/put)

No. of issuances (call/put)	Brent	Gold	Copper	WTI	Nickel	Palladium	Platinum	Silver	Other underly-ings
Total	1875/668	4997/1098	215/144	857/236	89/33	348/38	305/12	3448/490	256/24
Investment products	318/51	465/19	15/6	57/13	2/-	17/-	18/-	326/9	5/2
Bonus	207/43	243/19	11/6	25/11	2/-	9/-	16/-	168/9	5/2
Discount	111/8	222/-	4/-	32/2	-/-	8/-	2/-	158/-	-/-
Leverage products	1410/614	4379/1078	177/138	723/221	70/33	304/38	256/12	3055/480	147/22
Warrants	352/67	1146/292	12/10	148/20	9/2	56/3	16/-	1137/157	19/1
Knock-out products	1058/547	3233/786	165/128	573/201	61/31	247/35	239/12	1918/323	128/21
Other products	147/3	153/1	23/-	79/2	17/-	28/-	32/-	67/1	104/-

Note: "Other unterlyings" include certificates, which have several commodities as underlyings and underlyings with a total sample of less than 30 different certificates. "Other products" consist of products that cannot be listed under the subgroups "Bonus", "Discount", "Warrants", or "Knock-Out products".

We can split our data set according to the EUWAX in investment and leverage products. There exist more call based products (81.9%) than put based products (18.1%). The biggest product sub-group are knock-out certificates with a share of 64.1% of the full sample. Most products have the precious metals gold (40.3%) and silver (26.0%) as an underlying and only few are available for nickel (0,8%), platinum (2,1%) and palladium (2,6%).

Our sample consist of actively traded certificates during the range from 2002-01-30 to 2012-10-29. The distribution of the issuing dates can be seen exemplarily for gold certificates (call based) in figure 1. The issuers of the certificates are mainly European banks whereas the Commerzbank is the biggest issuer with a total share of 23.4%. The distribution of the issuers can be taken from table 2.

[1] The author gratefully acknowledges data from Boerse Stuttgart

Figure 1: Issuing dates: Example of daily cumulated issuances over time using all gold call certificates

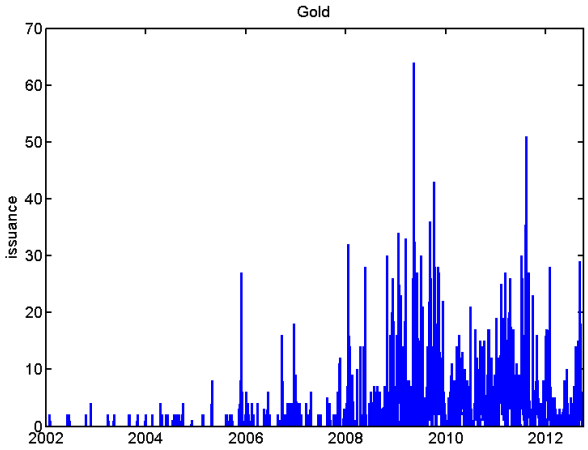

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Table 2: Number of certificate issuances sorted descending by issuer.

Issuer	No.	Issuer	No.	Issuer	No.
Commerzbank	3548	Citigroup	303	Landesbank Baden-Württemberg	40
BNP Paribas	2428	UBS	213	Hypovereinsbank	21
Deutsche Bank	2144	Raiffeisen Centrobank	156	WestLB	17
Société Générale	1241	Lang und Schwarz	150	Barclays	15
ABN AMRO	1177	J.P. Morgan	121	Österreichische Volksbanken	8
Goldman Sachs	1164	Dresdner Bank	82	Merrill Lynch	6
Royal Bank of Scotland	723	Sal. Oppenheim	66	Bayerische Landesbank	5
DZ Bank	536	Macquarie	57	ING	3
HSBC Trinkaus & Burkhardt	416	Erste Bank	55		
Vontobel	396	UniCredit	46		

For our event study, we use spot prices of the underlying commodities and nearest futures prices if spot prices are not available. The prices are obtained from Thomson Reuters Datastream. Indices and further variables for the market model are retrieved by Thomson Reuters Datastream, Bloomberg Terminal and the homepage of the U.S. Federal Reserve.

4. Methodology

Regarding existing research in the area of financialization, as described above, most authors use weekly traders' positions by CFTC and mostly adopt vector autoregressive regressions. With this methodology it is not possible to identify short-term effects on spot and future prices. This can be achieved with the methodology of an event study as described by e.g. MacKinlay (1997). The basic idea is to extract

abnormal returns ($AR_{i,t}$) from (realized) returns ($R_{i,t}$) and test these ARs for statistical significance. For this purpose we need an expected or normal (benchmark) return ($NR_{i,t}$) as

$$AR_{i,t} = R_{i,t} - NR_{i,t} \ , \tag{1}$$

where $R_{i,t}$ is the day t log-return for event i of a specific underlying and certificate type. One event day is defined as a day, when at least one new certificate was issued. There are two common approaches to derive the NR. The market model approach consists of a linear factor model. To ensure comparability we use the same factors as Henderson et al (2015) which are motivated by Singleton (2014) and Tang and Xiong (2012):

$$\begin{aligned} NR_{i,t}^{MM} &= \beta_0 + \beta_{i,EM} \cdot R_{EM,t} + \beta_{i,EM,t+1} \cdot R_{EM,t+1} + \beta_{i,S\&P} \cdot R_{S\&P,t} + \beta_{i,USD} \cdot R_{USD,t} \\ &+ \beta_{i,TBond} \cdot R_{TBond,t} + \beta_{i,VIX} \cdot R_{VIX,t} + \beta_{i,BDI} \cdot R_{BDI,t} + \beta_{i,INF} \cdot R_{INF,t} + \beta_{i,lag} \cdot R_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{2}$$

The market is represented by the returns of the MSCI Emerging Markets Asia Index (R_{EM}), the S&P 500 index ($R_{S\&P}$), the U.S. Dollar Index futures contracts (R_{USD}), the JP Morgan Treasury Bond Index (R_{TBond}) and the Chicago Board Options Exchange Volatility Index (R_{VIX}). Additionally two macroeconomic control variables are used: R_{BDI} (returns of the costs of transport by ship) and R_{INF} (ten-year breakeven inflation rate change). To avoid autocorrelation effects lagged returns of the commodity prices are also included.

McKenzie et al. (2004) are pointing out, that the constant mean approach often is more suited to obtain the NR compared to the market model. NR for the constant mean return model is calculated with

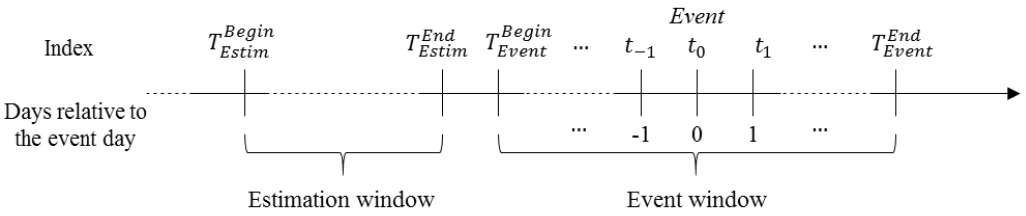
$$NR_{i,t}^{CRM} = \frac{1}{L_{Estim}} \sum_{t=T_{Estim}^{Begin}}^{T_{Estim}^{End}} R_{i,t} \quad , \tag{3}$$

where L_{Estim} is the length, T_{Estim}^{Begin} the beginning and T_{Estim}^{End} the end of the estimation window

All parameters for the NR (the βs and the mean return respectively) are estimated in a window directly preceding the event window. According to Henderson et al. (2015) we use a 60-day-estimation window, which is in line with McKenzie et al. (2004).

Though the issuance date is specified, it is not clear when exactly issuers hedge their positions. Furthermore, as described above, it is of interest, if significant abnormal returns are also present before certificates are issued. This could be an indication that issuance of certificates is following abnormal returns instead of abnormal returns following issuance and thus hedging activities.

Figure 2: Timeline of the event study



For these reasons we do not only focus on the single issuance date (0) and subsequent days (0,1) but also consider a broader event window with days prior to the issue date (-15, 15). The event window length is always just as long as needed.

All $AR_{i,t}$ are calculated with the estimated $NR_{i,t}$ of the issue date itself.

For the analysis of specific days within the event window the non-parametric test of Corrado (1989) is used: Let $K_{i,t}$ be the rank of the abnormal return of the estimation and event window, $L = L_{Estim} + L_{Event}$ the corresponding length. N is the number of events, where $AR_{i,\tau_j} \leq AR_{i,\tau_{j+1}}$ implies $K_{i,\tau_j} \leq K_{i,\tau_{j+1}}$ and $1 \leq K_{i,\tau_j} \leq L$ with $T_{Estim}^{Begin} \leq \tau_j \leq T_{Event}^{End}$. Then the test statistic is

$$\theta(\hat{T}) = \frac{\frac{1}{N}\sum_{i=1}^{N}\left(K_{i,\hat{T}} - \frac{L+1}{2}\right)}{\sigma(K_i)} \sim t_{N-1} \tag{4}$$

with $T_{Event}^{Begin} \leq \hat{T} \leq T_{Event}^{End}$ and

$$\sigma(K_i) = \sqrt{\frac{1}{L}\sum_{t=T_{Estim}^{Begin}}^{T_{Event}^{End}}\left(\frac{1}{N}\sum_{i=1}^{N}\left(K_{i,t} - \frac{L+1}{2}\right)\right)^2}\,. \tag{5}$$

An advantage of such a non-parametric test is that there is no need of any distribution assumption of the abnormal returns at all.

For robustness tests we use an additional parametric test. This test needs the assumption of normal distribution but is able to cumulate effects of different days. Therefore it is possible to analyze effects within a window if it is not clear when the effects occur or if effects occur on different dates within a window. As outlined above this may be the case. Furthermore it is possible to present the data and possible trends with this method in a convenient way.

We apply the cumulative abnormal returns (CARs) to analyze the ARs within the whole event window. The CAR of time $\hat{T}$ is calculated, following e.g. McKinley 1997 via:

$$\overline{CAR}(\hat{T}) = \frac{1}{N}\sum_{i=1}^{N}\left(\sum_{t=T_{Event}^{Begin}}^{\hat{T}} AR_{i,t}\right) \quad , \tag{6}$$

with $T_{Event}^{Begin} \leq \hat{T} \leq T_{Event}^{End}$ and $\sigma^2\left(\overline{CAR}(\hat{T})\right) = \sum_{t=T_{Event}^{Begin}}^{\hat{T}} \sigma^2\left(\overline{AR}\right)$ as standard deviation. The standard deviation $\sigma(AR_i)$ is calculated following MacKinlay (1997) as:

$$\sigma^2\left(\overline{AR}\right) = \frac{1}{N^2}\sum_{i=1}^{N}\frac{1}{L_{Estim}-1}\sum_{t=T_{Estim}^{Begin}}^{T_{Estim}^{End}}\left(AR_{i,t}\right)^2 \tag{7}$$

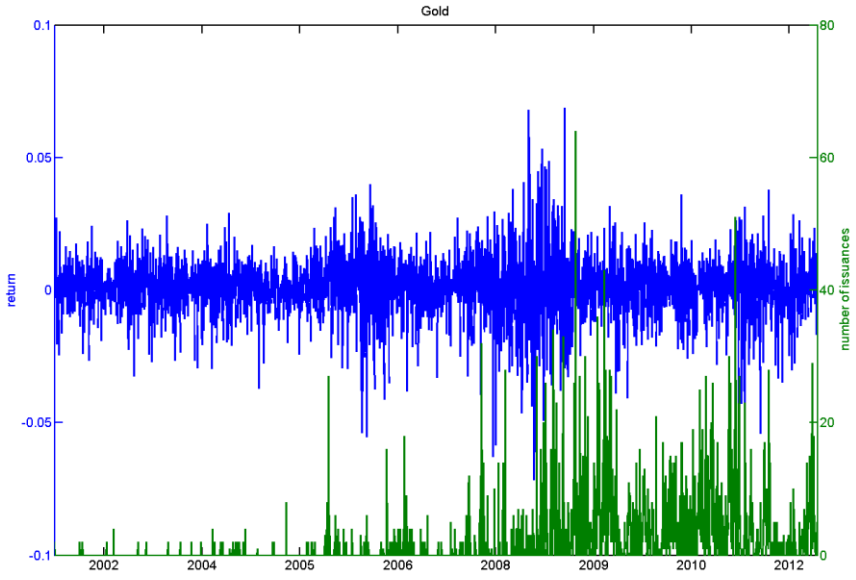
Here the test statistic is

$$\theta\left(\hat{T}\right) = \frac{\overline{CAR}(\hat{T})}{\sigma\left(\overline{CAR}(\hat{T})\right)} \sim t_{N-1} \quad . \tag{8}$$

5. Results

By way of preliminary observation, Figure 1 exemplarily shows the number of issuances of gold call certificates, the largest commodity group in our sample, and relating price changes.

Figure 3: Number of issuances of gold call certificates and gold price return

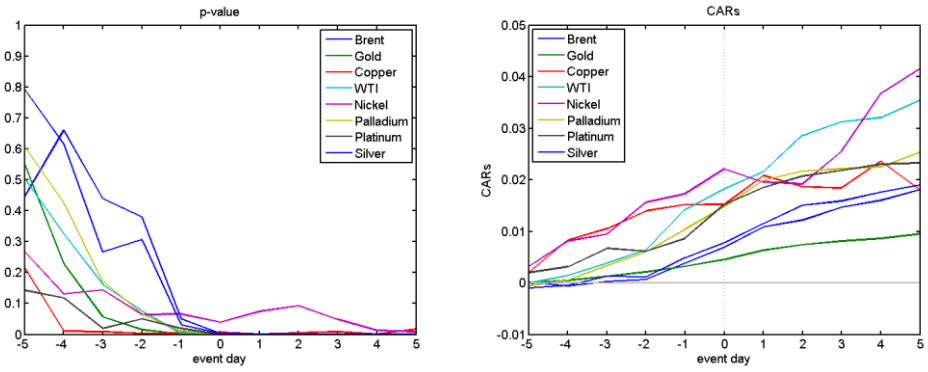


Note: Number of gold call certificate issuances are marked in green and reference to the right vertical axis. Gold price return is mapped to the left vertical axis and highlighted in blue.

At a first sight there seems to be an apparently high amount of certificate emissions at levels of high price volatility. This rough estimate can also be observed within other commodities, as well as in different types of option certificates (call and put) in our sample, and could be interpreted as a first indication of a causal relationship, irrespective of the direction. For the further examination, we primarily focus on commodity certificates referencing to call positions.

With a view to the detailed results of the empirical analysis conducted by an event study framework, presented in Section 3, Figure 4 from a general perspective displays commodities CARs and related p-values of certificate issuances covering all product types around issuance dates. One can observe, that CARs of all commodities show strong increases around the issuance dates. The left diagram confirms the first impression, as all CARs except palladium are statistically significant different from zero at 5.0% level no later than the event date.

Figure 4: Overall commodity p-values and CARs across all products around emission date (CMR)

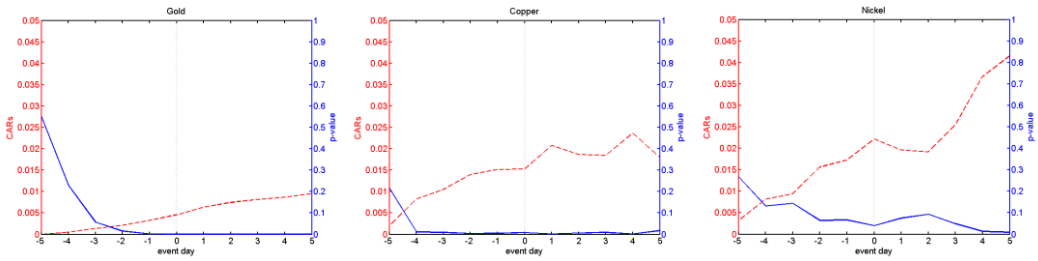


Note: Right diagram shows commodities CARs (calculated see formula 6) in an event window 5 days prior and past the date of the certificate emission using the constant mean return model (CRM). The left diagram shows the relating p-values whether the CARs are statistically different from zero. For both diagrams emissions of all type of call certificates are considered.

The identical phenomenon of significant effects, however in the other direction, is also evident for put certificates (see Table 6, attached).

Another interesting finding is, that CARs of industrial metals - as it is the case for nickel and copper - show the largest positive price movements, which seem to start even a few days prior to the event date, whereas CARs of more common financial traded precious metals like gold and silver start rising closer to the event date and to a lesser extent (see also Figure 5).

Figure 5: P-Values and CARs across all products around issuance date of gold, copper and nickel

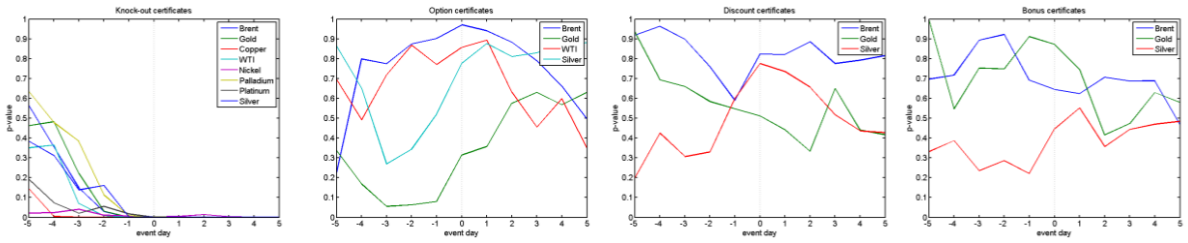


Note: Diagrams each show commodities' CAR (calculated see formula 6) in an event window 5 days prior and post the date of the certificate issuance using the constant mean return model (CMR). The CARs relate to left vertical axis and are marked red and dashed. On the right axis there are corresponding p-values in blue color.

So far, we have considered the results from a general view across the whole sample of products. As our dataset offers high quality and deep, we separate the sample into subsamples for each commodity and specific type of product. Therefore, in Figure 6 p-values of commodity CARs, calculated with

CMR subdivided into the specific certificate types *knock-out*, *option*, *bonus* and *discount* are presented.

Figure 6: P-values of knock-out, option, discount and bonus certificates around issuance (CMR)



Note: Diagrams show p-values in an event window 5 days prior and past the date of the certificate emission using the constant mean return model (CMR) and a parametric test. Knock-out, option, discount and bonus certificates are represented in the diagram from left to right.

What is striking from this representation is the fact, that only knock-out certificates show CARs, which are statistically different from zero, and thus have identical characteristics as in the overall analysis. However bonus, discount and option certificates do not show significant CARs during the whole event window at all. Therefore we conclude, that in the general examination across all product types only knock-out certificates, also the largest group in our sample, account for the significant results.

In addition to the CMR and a parametric test we also apply the market model (MM) used by Henderson et al. (2015) with a non-parametric test to conduct the certificate issuance event study on a daily basis.

Table 3: P-values and ARs for different commodities

	p-value			**ARs**		
Day	[-1]	[0]	[1]	[-1]	[0]	[1]
Brent	0,0016 **	0,0010 ***	0,0003 ***	0,0028	0,0027	0,0035
Gold	0,0060 **	0,0010 **	0,0000 ***	0,0005	0,0007	0,0011
Copper	0,2547	0,7067	0,0132 *	0,0030	0,0019	0,0073
WTI	0,0002 ***	0,0069 **	0,0540	0,0078	0,0041	0,0034
Nickel	0,4049	0,4966	0,6568	0,0028	0,0059	-0,0013
Palladium	0,0331 *	0,0508	0,0601	0,0023	0,0024	0,0031
Platinum	0,0143 *	0,0005 ***	0,0309 *	-0,0005	0,0036	0,0002
Silver	0,0002 ***	0,0122 *	0,0016 **	0,0037	0,0029	0,0036

Note: Significances and ARs for individual days of the event window [–1 to 1] with a preceding 60 day estimation window. NRs are calculated with the market model; p-values are calculated with a non-parametric test; *, **, and *** denote significance at the 5%, 1%, and 0,1% levels, respectively

Examining Table 3, both the event date abnormal returns are positive and the three-day returns during days [-1 to 1] statistically significant at a 10.0% level for the total sample of almost all commodities except nickel and platinum. Gold and Brent thereby are significant at 1.0%, WTI and silver at a 5.0% and copper and palladium at a 10.0% level. Hence, it appears, that the larger the market the more significant are the results. The relating event date abnormal returns are all positive and range from 0,07% for the extensive gold market to 0,59% for the much smaller nickel market.

Further evidence

Despite all efforts it is still debatable if significant abnormal returns are due to issuances (*hedging-theory*) or if issuances are trigged by price shifts (*reaction-theory*). The explanation for the latter one is, that due to price movements the investors demand alternative investment opportunities (e.g. certificates, which are closer to the new price and therefore have a higher leverage). There is no need to issue new certificates due to price movements regarding products without a knock-out criteria. Their "sweet spot" can be above and below the current underlying price. Therefore other investment opportunities with (now) favorable parameters - which were already tradable and don't need to be newly issued- become of interest to the investors if the price changes. Yet knock-out products cannot be present above (in the case of call knock-outs) or below (in the case of put knock-outs) the current underlying price. Consequently, new call-like certificates need to be issued in case of price movements to completely fulfill the investor demands, and vice versa for put-like certificates.

To further examine this issue, we analyze issuances around high returns. If issuances trigger returns, then high returns must be observable at the day of the issuance itself and at the consecutive days. If, however, high returns trigger issuances then at the day of high returns and the consecutive days issuances need to be found. For the analysis we use "Best Unlimted" gold knock-out certificates, as this is the broadest data base on a single certificate type. This product also yields highly significant results in the event study.

We measure the percentage of days with an issuances that occur on the day of a high return or on the consecutive days (reaction-theory) (see Table 4). Table 5 shows the percentage of days with a high return following issuances (hedging-theory). As same day issuances and high returns ("day 0") are for

both possibilities the same, the values for "day 0" are identical. For both tables the quantile states which percentage of all (ranked) returns is defined as high returns.

Table 4: Explanatory power of the reaction-theory

Quantile	Days relative to high return days				
	[0]	[0 to 1]	[0 to 2]	[0 to 3]	[0 to 4]
20,0%	35,80%	57,41%	64,81%	69,14%	72,22%
10,0%	35,90%	58,97%	61,54%	69,23%	69,23%
5,0%	28,21%	58,97%	64,10%	74,36%	74,36%
2,5%	27,27%	59,09%	59,09%	68,18%	68,18%
1,0%	27,27%	54,55%	54,55%	63,64%	63,64%

Note:. The quantile states which percentage of all returns is defined as high returns. If there is an issuance within the (forward looking) time window corresponding to a high return according to the chosen quantile it is counted. The sum is divided by the quantity of all high returns: $Value = \frac{\sum_t \begin{cases} 1, \text{if issuance between } [(t) \text{ to } (t+day)] \text{ and if return at } t > quantil \\ 0, \text{otherwise} \end{cases}}{\sum_t \begin{cases} 1, \text{if normal return at } (t) > quantil \\ 0, \text{otherwise} \end{cases}}$

Table 5: Explanatory power of the hedging-theory

Quantile	Days relative to high return days				
	[0]	[-1 to 0]	[-2 to 0]	[-3 to 0]	[-4 to 0]
20,0%	35,80%	51,23%	55,56%	63,58%	66,05%
10,0%	35,90%	48,72%	51,28%	61,54%	64,10%
5,0%	28,21%	41,03%	43,59%	56,41%	61,54%
2,5%	27,27%	40,91%	40,91%	54,55%	59,09%
1,0%	27,27%	27,27%	27,27%	27,27%	36,36%

Note:. The quantile states which percentage of all returns is defined as high returns. If there is an issuance within the (backwards looking) time window corresponding to a high return according to the chosen quantile it is counted. The sum is divided by the quantity of all high returns: $Value = \frac{\sum_t \begin{cases} 1, \text{if issuance at } t \text{ and if return between } [(t) \text{ to } (-day+t)] > quantil \\ 0, \text{otherwise} \end{cases}}{\sum_t \begin{cases} 1, \text{if normal return at } (t) > quantil \\ 0, \text{otherwise} \end{cases}}$

The two tables indicate, that the reaction-theory could be more likely. To further investigate this matter, we conduct two additional event studies, where we exclude the event days corresponding to each theory. If a theory is (solely) correct, there shouldn't be significances anymore.

The hedging-theory supposes, that abnormal returns are due to issuances. We consequently eliminate all event days in our window, where high returns follow an issuance. To cover delayed effects we use a

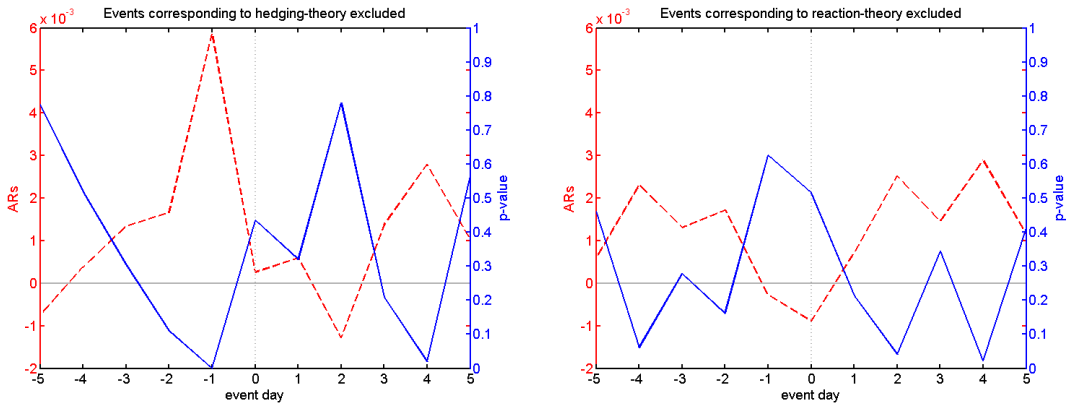
window of three days [0 to 2] relative to the issuance day (if a high return followed up to two days after an issuance the respective issuance is eliminated for this event study).

We do the same vice versa for the reaction-theory: We eliminate all events, with high returns followed by issuances. We also use a window of three days [-2 to 0] relative to the issuance as discussed above. This means, that all issuances which took place up to two days after a high return are excluded from the event study.

As we hereby try to eliminate all significant effects, which are caused by either of the theories, we choose a relative low quantile of 80% as a criteria of a high return to be cut. The quantile is one-sided. Symmetrical quantiles however show the same behavior. We are specifically interested on the daily effects. Therefore we conduct the non-parametric test of Corrado (1989).

Figure 7 shows, that there are still highly significant abnormal returns prior to the event, if we consider the hedging-theory event study. In contrast, there are no highly significances (lower 1%) in the event study for the reaction-theory.

Figure 7: P-values and ARs of event studies with excluded events regarding to the hedging- or reaction-theory respectively, calculated with a non-parametric test



Note: Diagrams each show commodities ARs (calculated see formula 1) of gold best unlimited (knock-out) certificates in an event window 5 days prior and past the date of the certificate emission calculated with a non-parametric test of Corrado (1989) using CMR. The ARs relate to left vertical axis and are marked red and dashed. On the right axis there are corresponding p-values in blue color. On the left: Excluded events regarding the hedging-theory; on the right: excluded events regarding the reaction-theory

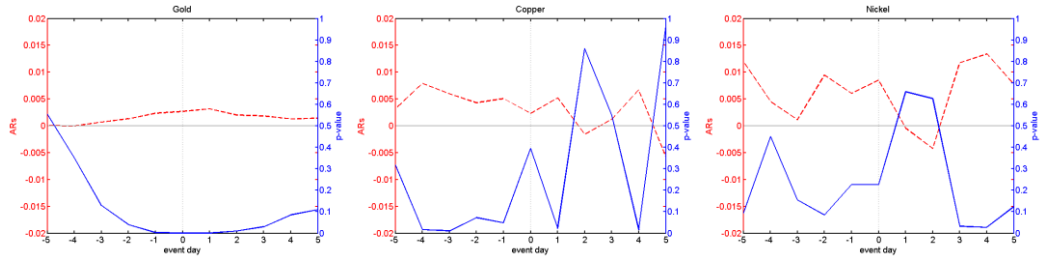
As the results show, there are still significant days when we eliminate all days related to the hedging-theory. Whereas with all days eliminated according to the reaction-theory there are no significant values. This means, only the reaction-theory is be able to explain the significances.

In conclusion, we reject, that issuances have an abnormal impact on the underlying prices. Rather, price movements mainly affect the issuance process.

Robustness

Furthermore, we performed a row of robustness checks. We conducted the entire event study analysis including all sub-samples with different product types and alternative test methodologies. As previously mentioned when analyzing put certificates instead of call type, CARs consequently are negative showing the identical patterns regarding significance levels for all commodities, products and sub-samples. As some studies use the non-parametric event study framework of Corrado (1989), we additionally conducted our whole analysis with this type of test. The procedure is rank-based and considers each day separately. Therefore, the sometimes criticized distribution assumptions of other tests are not required. Figure 8 shows an overview of the results for gold, copper, and nickel.

Figure 8: P-values and ARs of knock-out certificates around emission date of gold, copper and nickel calculated with a non-parametric test



Note: Diagrams each show commodities ARs (calculated see formula 1) of knock-out type certificates in an event window 5 days prior and past the date of the certificate emission calculated with a non-parametric test of Corrado (1989) using CMR. The ARs relate to left vertical axis and are marked red and dashed. On the right axis there are corresponding p-values in blue color.

Again, returns are significant around the date of issuances of knock-out certificates and frequently traded precious metal prices reaction is of a more short-term nature. We also used future prices with

different maturity dates instead of spot prices without a change of the general results. To summarize, for all adaptions, the overall results are identical regardless of the used test method.

6. Discussion

As we describe in the previous section, our empirical outcomes confirm the results of Henderson et al. (2015) in general. We are able to find evidence for abnormal returns in the prices of underlying commodities around the issuing dates of commodity certificates in the European market. On the first sight, our results are also in line with former research for option introduction like Faff and Hillier (2005) or Detemple and Jorion (1990) who also identify significant changes in prices around the issuing date of options. By detailed examination we can find striking differences in the results and the according interpretations. Faff and Hillier (2005) identify significant abnormal returns in their full time frame study only at the issuing day itself and at least for CARs at day +1. They find no significant results prior to the issuing date. However, earlier studies like Conrad (1989) discover significant abnormal returns for -3 up to +1 days around the issuing date und thus even few days before the issuing date, which is in line with our results for certificates. Also Detemple and Jorion (1990) confirm these results within their study, where they identify abnormal returns one week before and one week after the respective option issuing. Unfortunately, Henderson et al. (2015), who are the first analyzing the introduction of commodity linked notes, do not report if there are any abnormal returns on the underlying price before the issuing date itself. Within our study for commodity certificates in the European market, we can identify abnormal returns up to -4 days prior to the issuing date.

As we mentioned, this detail is of special interest: If the abnormal return is the result of hedging activities by the issuer, as proposed for instance by Conrad (1989) and others, these hedging activities would take place even a few days before the market introduction of the products. By this time, the theory expects the issuer to buy long or short contracts at the underlying market, according to the composition of the issued product (hedging-theory). Although the market for commodity certificates in Europe had some growth within the last years, its volume seems to be far too small to generate abnormal returns within the global prices for commodities. Therefore we have certain doubts that the issuing of retail investment products on commodity underlying in the German and European market can influence global commodity prices significantly.

At this point, we need to discuss the days before issuing date, as there is a second and more plausible theory for the abnormal returns around the issuing date, which has been neglected in recent literature so far: The issuance of certificates is not scheduled several weeks or months in advance, as we got affirmed by interviews with issuers. They have nevertheless generalized long-term permits by financial authorities for issuances of specific product groups. Thus, they have the opportunity to react on changing market conditions like sudden price developments within a few days by issuing new products. This is mostly driven by automated processes and trading algorithms, which identify abnormal market movements and thus incomplete market coverage of the traded products. As mentioned above, we confirmed this theory by discussions with experts of different European banks (reaction-theory).

Within our study, we identify abnormal returns for a number of underlying commodities even up to -4 days before market introduction. On the one hand this result could confirm the reaction-theory as about 1-5 days are needed to issue a new product. On the other hand it might be that hedging activities take place a few days before the issuing date and cause the abnormal returns. As we can see, the overall results do not supply clear evidence either for the hedging-theorie or for the reaction-theory and there is need for further clarification.

We can observe the phenomenon of the significant results a few days before issuing especially for industrial metal markets like copper or nickel, where we find abnormal returns up to -4 days before issuing. Regarding gold and silver we also find abnormal returns before issuing, but mostly only -1 day prior. It is doubtful that hedging activities in the copper and nickel markets take place -4 days before the issuing date. Hence, as trading volume and activities of retail investors are much higher within the gold market than in copper and nickel markets it is reasonable that issuers may react faster within the gold markets than within the copper or nickel markets to issue new products to fulfill the investors' needs.

We can find further indication for the reaction-theory by analyzing the product-specific results of our event study. Here, we can observe that the overall significant results are based on the majority of knock-out products in our sample and that only this sub group shows significant results. Most of these products are traded near their knock-out barrier, where they offer high leverage effects. Thus, with sudden price movements there can be a whole series of products pushed away from the knock out barrier. By this

time, the remaining products in the certificates market may not fulfill the investors' needs any more. Thus it is necessary to issue new products to complete the market. Furthermore, knock-out products are designed for trading within volatile market situations as they offer high leveraged returns for the investors. As abnormal returns are indications of such situations, it is obvious that in this case, knock-out products are primarily issued in contrast to investment products like discount or bonus certificates, which are mainly designed for sideward movements of the market. Moreover, option certificates also offer leverage possibilities for the investor, but on a lower level as they do not have a knock-out barrier. Thus, the issuing of option certificates may not be the pure result of sudden price movements and missing products for the investors' needs. Our results show indication for this hypothesis, as discount, bonus and option certificate issuances show no significant abnormal returns. One may respond that this is evident, as knock-out products are the biggest group of certificates in our sample and a bigger sample in general leads to higher or more significances. But also within the option certificates which are at least half of the quantity of knock-out certificates we cannot find any significances.

Of course, the reaction-theory requires further examination: We claim that abnormal returns in the underlying markets initiate a one to a few days lasting issuing process of new knock-out products. Hence, in further research we have to test the event study "backwards". We need to analyze, if there is a significant number of issuing processes, if an abnormal return in the underlying price occurs.

7. Conclusion

Concluding, within this study, we examine the European market for commodity certificates and its impacts on the global market prices of the underlying commodities. Based on existing research in the area of financialization of commodity markets, we conduct an event study with a unique sample of 15,137 commodity linked certificates traded from 2002-01-30 to 2012-10-29 at the German EUWAX.

We confirm the empirical results of Henderson et al. (2015) for the European market and are able to find significant abnormal returns around the issuing date of commodity linked certificates. By detailed examination we are able to ascribe those significances on knock-out products. Regarding existing literature, these abnormal returns are the consequences of hedging activities by the issuing banks. Based on

interviews and discussions with a number of issuers, we find indication for an alternative theory, why there exist abnormal returns around the issuing date of commodity certificates. We argue that abnormal returns are not only the results of certificate issuances, but that certificate issuances can also be the results of abnormal returns itself.

Within this paper we are not able to show, which of the both is the prevailing theory, but introduce these new insights in the market for structured products and the current discussion of financialization of commodity markets. Further research has to be done regarding the two theories. For instance, we need to conduct a backward test to examine, if abnormal returns lead to a significant number of issuances.

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Appendix

Table 6: P-values and ARs for different commodities with a put option type

	p-value			ARs		
Day	[-1]	[0]	[1]	[-1]	[0]	[1]
Brent	0,9999 ***	0,9996 ***	0,9790 *	-0,0054	-0,0047	-0,0016
Gold	0,9898 *	0,9999 ***	0,9942 **	-0,0029	-0,0041	-0,0026
Copper	0,6749	0,9986 **	0,9111	0,0024	-0,0033	-0,0015
WTI	0,9345	0,9852 *	0,9959 **	-0,0004	-0,003	-0,0043
Silver	0,5599	1,0000 ***	0,9597 *	0,0021	-0,0078	-0,0016

Note: Significances and ARs for individual days of the event window [–1;1] with a preceding 60 day estimation window. NRs are calculated with the market model; p-values are calculated with a non-parametric test; *, **, and *** denote significance at the 5%, 1%, and 0,1% levels, respectively