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Is the leadership of the Brent-WTI threatened by China's new crude oil futures market?

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ABSTRACT

The recent listing of a new crude oil futures contract on the Shanghai International Energy Exchange (INE) has reopened the debate over whether crude oil produced in different countries or locations constitutes a unified world oil market. The aim of this paper is to study the information flows among Brent, West Texas Intermediate (WTI) and the new Medium Sour Crude Oil (SC) futures contract listed on INE futures markets to assess whether the trading of this new futures contract has altered the dominant role of the most traded oil benchmarks in the world. A multiple regression model identifies the Brent futures market as the most influential market in the oil price discovery process, while WTI appears to be the most sensitive. Furthermore, we have observed that SC does not influence any market and it is only sensitive to Brent news, even though WTI is the most heavily traded futures contract. Therefore, the launch of the SC futures contract has not yet altered the dominant role of Brent over WTI.

1. Introduction

Practitioners and academics have invariably chosen the Brent and West Texas Intermediate (WTI) futures contracts as the global oil benchmarks. However, the recent launch of a new yuan-denominated oil futures contract on the Shanghai International Energy Exchange (INE) on March 26, 2018 has reopened the debate about the relationship between Brent and WTI and the role they play in the oil price discovery process. There are several likely reasons for this renewed interest. Firstly, the low level of oil production in China and its increasing energy demand have converted China into the largest importer and the second largest consumer of crude oil in the world. This commercial hedging need may be behind the amazing trading volume that the Medium Sour Crude Oil (SC) futures contract has reached in a very short period. According to Zhang and Umehara (2019), the SC became the third-most-traded crude oil futures contract in the world within just three months of its listing. Secondly, from a practical point of view, it is common that physical crude oil is traded based on a premium or discount to a reference price, normally the Brent or WTI futures contract. If SC becomes an influential crude oil reference, Chinese physical crude oil traders may start to price crude oil cargoes based on SC. Thirdly, it seems that the SC futures contract has quickly captured the attention of foreign investors. Indeed, Ji and Zhang (2019) use high-frequency data in the first two

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trading months from the launch of the SC futures contract to study intraday seasonality and observe a sharp increase both in volume and volatility around 15:30 (GMT), which is interpreted as a possible influence from international investors, especially from the USA. Finally, the Chinese government has promoted supportive policies that have been offered by national ministries and commissions in order to provide the INE crude oil contract with a more robust base, so that INE can offer a more internationalised trading approach to domestic and global investors. Therefore, it appears that the SC futures contract is complying with some of the key components that, following Till (2015), determine the success of a new futures contract, namely, attracting a significant number of traders and being considered as a financial instrument of national interest.[1]

The aim of this paper is to study the information flows among the Brent, WTI and SC futures markets to assess whether the trading of the new futures contract launched by INE has altered the dominant role of the most traded oil benchmarks in the world. As far as we know, there is only one paper that has also explored the dynamic relationships between the newly launched Chinese crude oil futures and the international major crude oil futures markets. Specifically, Yang and Zhou (2020) have analysed at 5-minute intervals the first three months of the INE oil futures trading, from March 26, 2018 to June 26, 2018, to document evidence of cointegration relationships among the Chinese INE futures and the Brent, WTI and Oman futures markets. They observed that WTI oil futures returns cannot be predicted by their own lag and other lagged oil futures returns. In contrast, they determined that Brent oil futures returns can be predicted by their own lag and the lagged WTI futures returns, while the lagged Brent futures returns are a strong predictor of SC returns.

Our paper contributes to the previous literature in the following aspects. Firstly, the use of the model by Peiró, Quesada, and Uriel (1998) allows us to study the information flows among oil futures markets with different trading times from a new perspective because the effective influence of one oil futures market on another would arise from the interaction of the influencing ability of the first market and the sensitivity of the second one. Secondly, unlike the paper by Yang and Zhou (2020), we have used daily observations to avoid the presence of zero returns due to the infrequent trading. When returns are measured over very short trading intervals for new listed futures contracts, it is highly unlikely to have at least one trade in every consecutive interval. Finally, we present additional evidence of information flows among the major oil international futures markets and the Chinese SC futures contract for a longer analysis period, from March 26, 2018 to June 5, 2020.

Specifically, this paper is organised as follows. Section 2 briefly details the futures contract specifications, their market trading hours and the data used to perform the analysis. Section 3 describes the methodology and Section 4 presents the empirical results. Section 5 concludes and summarises.

2. Futures contract specifications and data

Data has been collected for the Brent, WTI and SC futures contracts. The underlying commodity of the three futures contracts is crude oil, which can be classified by the density (also known as gravity). The degree of density is based on the American Petroleum Institute (API) gravity measure.[2] The higher the API gravity of the crude oil, the higher the quality of the liquid petroleum and the “lighter” it is. The other feature is the amount of sulphur content by weight. The high percentage of sulphur in crude oil is a characteristic not desired by crude oil refineries as it is harder to process. Crude with a sulphur content less than 0.5 % is denominated “sweet”, while those with more than this value are classified as “sour”.

2.1. Contract specifications

The Brent futures contract is traded on the InterContinental Exchange (the ICE). Brent is a light sweet crude oil, with 38.1° API and 0.42 % sulphur content, being slightly worse in quality than WTI. Brent has been considered the global benchmark for Atlantic Basin crude oils and light sweet crude oils since 1970. The settlement method is based on Exchange for Physicals (EFP) with an option to cash settle against the ICE Brent Index price for the last trading day of the futures contract. The ICE Brent Index is calculated as the average trading price on the BFOE (Brent, Forties, Oseberg, Ekofisk and Troll) market in the relevant delivery month, as reported and confirmed by industry media.[3] This Index is published by ICE Futures Europe on the day after the expiry of the front-month ICE Brent futures contract. This delivery method is a particular Brent futures feature because, at expiry, the contract converges to the price of forward Brent, rather than to the spot price as is usual in futures contracts.[4]

The WTI is a light sweet crude oil futures contract quoted on the New York Mercantile Exchange (NYMEX). The WTI is high-quality crude oil, whose properties are 39.6° API and 0.24 % sulphur content. The WTI settlement method is physical

[1] For more information on the official support received by the INE futures market, please see http://www.ine.cn/en/news/news/517.html. (last visited 01/10/2019).

[2] The API grades indicate how light or heavy a crude oil is compared to water. There are four crude oil classifications depending on this measure: light (higher than 31.1º API), medium (22.3º to 31.1º API), heavy (10º to 22.3º API) and extra-heavy (below 10º API).

[3] The BFOE market is an over-the-counter forward market where cargos of Brent, Forties, Oseberg and Ekofisk are traded. From January 1, 2018, Platts also considers Troll crude oil for the BFOE.

[4] See www.theice.com for more details on this futures contract.

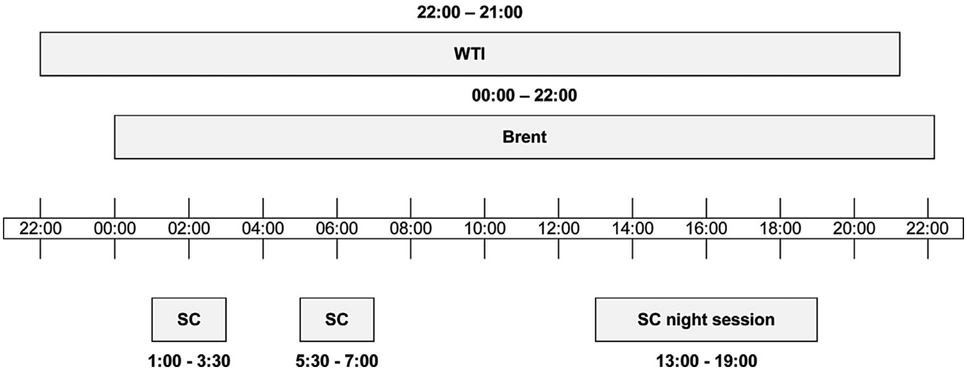

Fig. 1. Trading hours for the three futures contracts analysed. WTI, Brent and SC stand for West Texas Intermediate, Brent and Medium Sour Crude Oil futures contracts, respectively. Trading hours are expressed in Greenwich Mean Time (GMT). The trading times presented in this figure consider both daytime and overnight trading sessions.

delivery at Cushing, Oklahoma. The types of crude oil that could be delivered cover a range of domestic and foreign oils. WTI has been the United States crude oil benchmark for the last decade and is used for pricing crude oil imports into the US.[5]

The Sour Crude (SC) oil quoted on the Shanghai International Energy Exchange (INE) is a yuan-denominated crude oil futures contract listed on March 26, 2018. The INE is an international exchange open to global investors and is promoted by the Shanghai Futures Exchange (SHFE). Unlike the previous two futures contracts, SC's underlying asset is medium sour crude oil, whose quality specifications are 32.0° API and 1.5 % sulphur content. The settlement method is physical delivery. The INE has communicated the presence of seven bonded storage facilities at eight locations in China. The deliverable crude oil varieties include China's Shengli crude oil and six crude oils from the Middle East.[6]

The three markets analysed have different trading schedules. This implies that the knowledge and correct treatment of their trading hours is essential to determine the methodology and to interpret the results obtained. Fig. 1 shows the diagram of the trading hours for the three futures contracts. Firstly, WTI trading hours start at 22:00 and go until 21:00 Greenwich Mean Time (GMT), with a one-hour break per day between 21:00 and 22:00. Secondly, the Brent market starts its trading session at 00:00 and goes until 22:00 (GMT). Therefore, WTI and Brent futures contracts are traded almost 24 h a day. In contrast, the number of trading hours of the SC market is less than the two previous markets. Officially, the trading hours of the SC fluctuate between 1:00-3:30 and 5:30–7:00 (GMT). However, the INE, jointly with SHFE, established a "night session" for all their products with the aim of improving the internationalisation of the market. This session runs from 13:00 until 19:00 (GMT). Therefore, the Chinese market has two differentiated trading periods during the day: a daytime session and an overnight session that is more liquid and volatile (see Yang & Zhou, 2020).

Fig. 2 shows the daily settlement hours of Brent, WTI and SC for day t. The settlement price of SC is calculated at 7:00 (GMT), while Brent and WTI coordinate the calculation of the settlement prices at the same time: 18:30 (GMT). Apart from the official daily settlement time, the ICE publishes daily at 15:30 (GMT) the Brent PM price, also known as Brent Crude Futures Minute Marker. This price is calculated as a weighted average of trades made during the one-minute period from 15:29 to 15:30 (GMT) with the aim of coinciding with the time of the release of other OTC and standardised energy benchmarks, such as the European Spot Gas Market (ESGM) Prices published by ICIS or the Dated Brent published by S&P Global Platts and which is the daily assessment of the physical cargo price for North Sea Brent light crude.[7]

2.2. Data

The data consists of daily series of settlement prices and trading volumes for the Brent, WTI and SC futures contracts; the sample period runs from March 26, 2018 (the day the new Chinese oil futures contract was listed) to June 5, 2020. We also have data about the Brent PM reference for the same sample period. All the data have been collected from the Thomson Reuters database. Given that Brent and WTI futures contracts are quoted in US dollars per barrel and SC in yuan per barrel, SC prices have been converted into US dollars to homogenise the price series.

For our analysis, we have decided to use the near-to-maturity contract, as it is usually the most liquid contract. Moreover, to generate the daily closing price series, we have taken the closing prices of the nearest contract up to five days before its delivery. On this date, we have made the rollover to the next contract. The use of this criterion responds to the fact that the crude oil market participants normally close positions in the front contract five days before its expiry and, consequently, the

[5] See www.cmegroup.com for more details on this futures contract.
[6] See www.ine.cn for further details on this futures contract.
[7] For more information about Brent PM, ESGM price assessments, and Platts Dated Brent, please see www.theice.com, www.icis.com/explore/commodities/energy and www.spglobal.com, respectively.

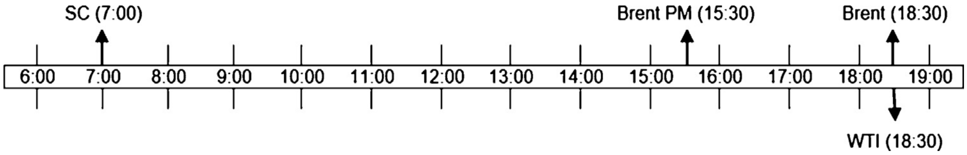

Fig. 2. Daily settlement times.
Notes: Daily settlement times for the three futures contracts analysed. WTI, Brent and SC stand for West Texas Intermediate, Brent and Medium Sour Crude Oil futures contracts, respectively. Brent PM indicates the Brent Crude Futures Minute Marker. Settlement times are expressed in Greenwich Mean Time (GMT).

liquidity passes to the next nearest contract. The series of daily returns follow the same criterion, with the particularity that when there is a change of contract, the return of that day is calculated with the price of the same contract, in order to avoid artificial jumps in the return series. Therefore, the price and return series have been calculated separately to consider the contract changes that take place during the entire sample period and to avoid falling into the error of mixing different contract prices. Finally, we have calculated crude oil returns using the following relation: $r_{OIL,t} = \ln(\frac{P_{OIL,t}}{P_{OIL,t-1}})$, where $P_{OIL,t}$ is the -th price level at time t and where OIL is Brent, WTI or SC.

Fig. 3 shows the daily movement of oil prices. As we can see, both Brent and SC prices were higher than WTI prices, with Brent being the most expensive contract. WTI is sweeter and lighter than Brent and SC, and thus it is supposed that WTI should have a higher average price than Brent or SC. Transporting costs may be behind these differences in crude oil prices. Brent is a seaborne oil grade because it is extracted from locations off the United Kingdom coast and well connected to global trade routes. The storage facilities of SC are also connected to the coasts of China. On the other hand, WTI must be transported from Cushing, Oklahoma by pipelines. These transporting differences are known as “location spread” and can help to explain the price differences among the three contracts.

Fig. 4 presents the evolution of the trading volume of the Brent, WTI and SC nearby contracts from April 2018 to May 2020. The trading volume is measured by the monthly volume of futures contracts. The average monthly volume for Brent, WTI and SC are 6,275,200, 13,458,700 and 1,666,500 lots, respectively. Therefore, WTI is the futures contract with the highest monthly volume, while the second is Brent; SC is far from reaching the monthly volumes of the leading benchmarks.

Finally, we have also studied the monthly trading volume of other crude oil futures contracts such as the DME Oman crude oil futures contract and the crude oil futures contract traded on the Multi Commodity Exchange (MCX) of India. On the one hand, the DME Oman monthly average volume is 46,517 lots. On the other hand, the average monthly volume of MCX is 3,570,102 lots, which may seem like a huge number at first glance. However, unlike the rest of the oil futures contracts in which the lot size is 1000 barrels, the lot size of the MCX’s futures contract is only 100 barrels of crude oil. Therefore, in terms of number of barrels, the monthly trading volume of these futures contracts is not comparable to Brent, WTI and SC and, consequently, they have not been included in the final analysis.

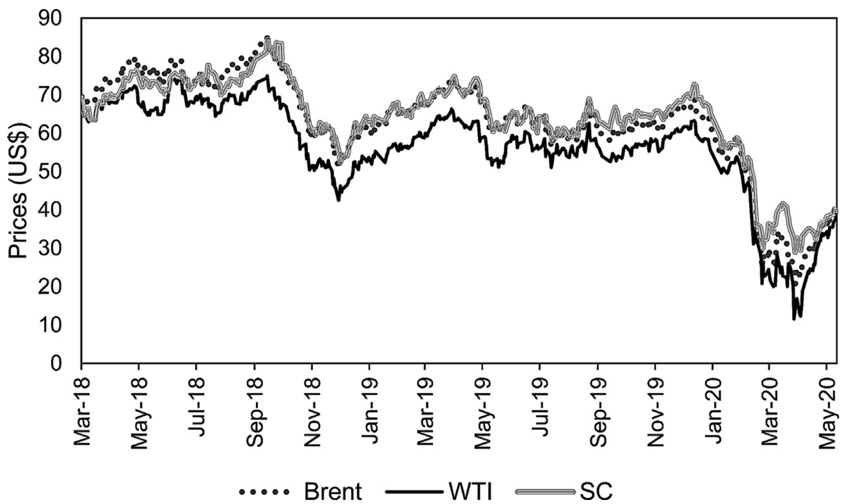

Fig. 3. Brent, WTI and SC prices.
Notes: Movement of the daily price of the three futures contracts analysed. WTI, Brent and SC stand for West Texas Intermediate, Brent and Medium Sour Crude Oil futures contracts, respectively. The figure covers the period from March 26, 2018 to June 5, 2020. All the prices are expressed in US$.

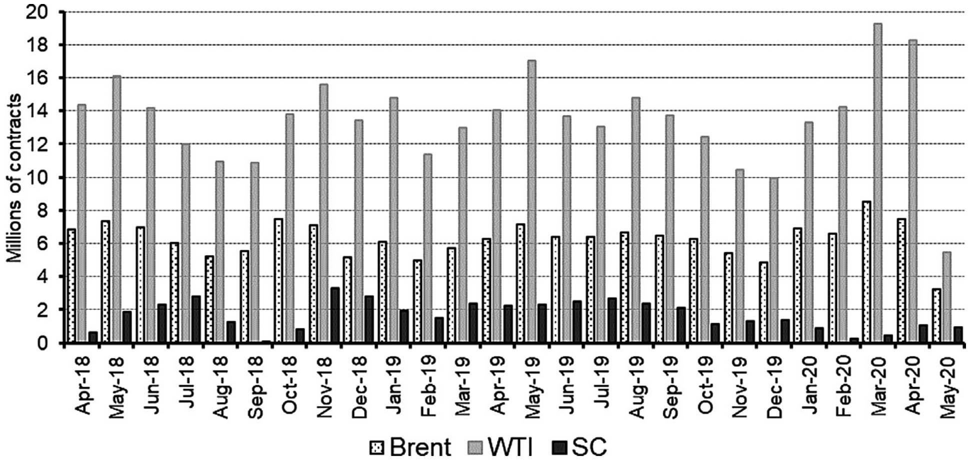

Fig. 4. Monthly volume.

Notes: Each bar represents the monthly volume figures of the nearby contract of Brent, WTI and SC. The sample goes from April 2018 to May 2020. The monthly volume series has been calculated by accumulating daily trading volume data. The unit of trading volume is one lot or one futures contract, which is counted as one-sided. The lot size of the three contracts is 1000 barrels of crude oil. The SC volume figures have been divided by two from April 2018 to January 2020, because for this period the INE market published its trading figures as double-sided counted. The average monthly volume of Brent, WTI and SC are 6,275,200, 13,458,700 and 1,666,500 lots, respectively. For more information about the statistical standard for the SC trading figures please see: http://www.shfe.com.cn/en/AnnouncementandNews/SHFENewsRelease/911335203.html.

3. Methodology

As we have previously described in Section 2, trading hours of the three futures markets we analyse do not perfectly overlap. Therefore, the non-simultaneity of trading hours for Brent, WTI and SC may affect the results of cross-correlations and regressions with daily observations. Peiró et al. (1998) proposed a multiple regression system to analyse the daily information transmission among markets in which the correlations of any two markets depend on the overlapping time periods running concurrently from the market-close on *t-1* to the close on time *t*. Furthermore, the model by Peiró et al. (1998) distinguishes between the influencing ability and the sensitivity of a market to being influenced, solving the problem of non-simultaneity.

Firstly, we have applied the model to the Brent, WTI and SC futures contracts, taking into account their official settlement prices. The system A is specified as follows:

$$r_{Brent,t} = \alpha_{Brent} + \beta_{WTI}\lambda_{Brent}r_{WTI,t} + \beta_{SC}\lambda_{Brent}r_{SC,t} + u_{Brent,t} \tag{1}$$

$$r_{WTI,t} = \alpha_{WTI} + \beta_{Brent}\lambda_{WTI}r_{Brent,t} + \beta_{SC}\lambda_{WTI}r_{SC,t} + u_{WTI,t} \tag{2}$$

$$r_{SC,t} = \alpha_{SC} + \beta_{Brent}\lambda_{SC}r_{Brent,t-1} + \beta_{WTI}\lambda_{SC}r_{WTI,t-1} + u_{SC,t} \tag{3}$$

where the oil price return series for Brent, WTI, and SC are denoted by $r_{Brent,t}$, $r_{WTI,t}$, and $r_{SC,t}$, respectively. The size of β determines the level of influence that one market has on the other markets, while λ_{Brent}, λ_{WTI} and λ_{SC} are measures of the sensitivity of each oil futures market to global factors. Note that in this system, Brent and WTI daily references are released at the same time.

Next, we have also estimated another system, denoted B, where the dependent variables are Brent PM (henceforth BPM), WTI and SC. As we have shown in Fig. 2, all these variables are non-synchronous and, therefore, this model allows us to observe Brent PM's influence on, and sensitivity to, the other two futures markets:

$$r_{BPM,t} = \alpha_{BPM} + \beta_{WTI}\lambda_{BPM}r_{WTI,t-1} + \beta_{SC}\lambda_{BPM}r_{SC,t} + u_{BPM,t} \tag{4}$$

$$r_{WTI,t} = \alpha_{WTI} + \beta_{BPM}\lambda_{WTI}r_{BPM,t} + \beta_{SC}\lambda_{WTI}r_{sc,t} + u_{WTI,t} \tag{5}$$

$$r_{SC,t} = \alpha_{SC} + \beta_{BPM}\lambda_{SC}r_{BPM,t-1} + \beta_{WTI}\lambda_{SC}r_{WTI,t-1} + u_{SC,t} \tag{6}$$

Table 1
Cross-correlation analysis.

Panel A	$r_{WTI,t}$	$r_{Brent,t}$	$r_{Brent\ PM,\ t}$
$r_{Brent,\ t}$	0.9215***		
$r_{Brent\ PM,\ t}$	0.6444***	0.7141***	
$r_{SC,t}$	0.2252***	0.1769***	0.2767***

Panel B	$r_{WTI,t}$	$r_{Brent,t}$	$r_{Brent\ PM,\ t}$	$r_{SC,t}$
$r_{WTI,\ t-1}$	−0.0068	−0.0346	0.1543***	0.5676***
$r_{Brent,\ t-1}$	−0.0148	−0.0319	0.1793***	0.5760***
$r_{Brent\ PM,\ t-1}$	0.0550	0.0157	−0.0386	0.6279***
$r_{SC,t-1}$	0.0219	−0.0059	−0.0783*	0.2247***

Notes: Panel A (B) shows Spearman's cross-correlation contemporaneous (non-contemporaneous) analysis. The variables considered are the logarithmic price differences of WTI, Brent, Brent PM and SC. The sample period consists of data from March 26, 2018 to June 5, 2020. The null hypothesis is that the Spearman's cross-correlation coefficient is equal to 0. The ***, ** and * indicate rejection of the null hypothesis at the 1 %, 5 % and 10 % level, respectively.

where β_{BPM} determines the level of influence that Brent PM has on the other markets and λ_{BPM} is the measure of the sensitivity of Brent to global factors when the Brent PM price, calculated from 15:29 to 15:30 (GMT), is used as the benchmark for the ICE futures market instead of the Brent price. In this system, no daily reference is issued at the same time.

One problem with this model is the equality of some parameters in the system of equations. To incorporate the restriction of equal parameters across equations, we have estimated each system jointly by stacking the variables. Furthermore, given the non-linearity of the parameters in systems A and B, we have estimated each system by non-linear least squares, applying the Gauss-Newton method. All the regression models carried out in this study have been obtained using the Newey and West (1987) correction to account for heteroskedasticity and serial correlation problems. Finally, we arbitrarily fix λ_{WTI} equal to 1. This implies that the values of the other parameters should be understood as their ratios to λ_{WTI}. [8]

4. Results

As a preliminary analysis, we have calculated the daily crude oil returns contemporaneous and non-contemporaneous cross-correlations coefficients among the returns of Brent, Brent PM, WTI and SC. Given the absence of normality in the oil returns, we have used Spearman's correlation coefficient, which is a nonparametric measure of rank correlation in a bivariate sample.

Panel A in Table 1 shows contemporaneous daily returns cross-correlations. WTI, Brent, Brent PM and SC have significant and positive cross-relationships among them at the 1 % level. Cross-correlations between WTI and Brent returns (92.15 %), between WTI and Brent PM returns (64.44 %), and between Brent and Brent PM returns (71.41 %) are the highest. Panel B in Table 1 reports the analysis among the correlations between non-contemporaneous daily returns. In this case, the SC returns are positively correlated (around 60 %) at the 1 % significance level with Brent, Brent PM and WTI returns lagged one period.

The trading hours of each futures market may help to explain the cross-correlation results. According to Peiró et al. (1998), the relationship between two markets should be more intense the greater the overlap of the respective determining periods. Firstly, the highest correlation is observed between contemporaneous returns of Brent and WTI. Note that Brent and WTI are futures contracts that can be traded almost 24 h a day and their settlement times coincide at 18:30 (GMT). Secondly, as we have previously mentioned, the SC settlement time is 7:00 (GMT), Brent PM is published at 15:30 (GMT), whilst Brent and WTI settlement prices are released three hours later. Therefore, it makes sense that the SC returns on day t are more correlated with the returns on day $t-1$ of Brent, WTI and Brent PM than with the returns on day t.

Taking into account the above results, the multiple regression model proposed by Peiró et al. (1998) should be very suitable to explain oil returns since the three markets of our focus are related in a contemporaneous and non-contemporaneous way, depending on their trading hours.

Table 2 shows the estimation of systems A and B. Panel A exhibits the joint estimation of Eqs. (1)–(3). We are interested in the relative values of these parameters with regard to $\lambda_{WTI} = 1$. Only the parameters $\beta_{Brent}$and λ_{SC} are significant at the 1% level. The Brent futures market is the only influential market since its β -value is positive and significant at the 1% level. The influencing parameters for the WTI and SC markets are not significant at any level. In other respects, WTI is the most sensitive market, as its ability to be influenced compared to SC is five times higher. It is interesting to note that the high sensitivity of the WTI futures market and the strong influence of the Brent market may explain the null predictive power of WTI and the high capacity to predict of the Brent futures contracts found by Yang and Zhou (2020), respectively.

The finding of the dominant leadership role of Brent over WTI is in line with the results obtained by Ji and Fan (2015), who investigated the dynamic integration of the international crude oil market and observed that WTI has been separated from the international crude oil market system since 2011. The leadership of Brent has also been found by Coronado, Fullerton, and

[8] See Peiró et al. (1998, pp.338-339) for further information about the problems that must be faced to estimate this model.

Table 2
Multiple regression estimation.

Market	$\hat{\beta}$	$\hat{\lambda}$
Panel A: Joint estimation of Eqs. (1), (2) and (3)		
Brent	1.3364*** (0.1649)	1.4856 (1.2942)
WTI	0.4084 (0.3484)	1.0000
SC	0.0325 (0.0463)	0.2107*** (0.0704)
R-sq.	0.7657	
Adj. R-sq.	0.7646	
Panel B: Joint estimation of Eqs. (4), (5) and (6)		
Brent PM	1.2013*** (0.1839)	0.1645 (0.1241)
WTI	0.9465 (0.6126)	1.0000
SC	−0.1083 (0.1533)	0.1729*** (0.0653)
R-sq.	0.4289	
Adj. R-sq.	0.4263	

Notes: Estimation of systems A and B are presented in this table. Each system has been estimated jointly by non-linear least squares applying the Gauss-Newton algorithm. The Newey and West (1987) correction is applied to account for heteroskedasticity and serial correlation problems in the error terms. The sample covers the period from March 27, 2018 to June 5, 2020. As a restriction, λ_{WTI} is fixed as 1. Numbers in parenthesis are the Heteroskedasticity and Autocorrelation Corrected (HAC) standard errors. *** indicates significance at the 1 % level.

Rojas (2018), who detected asymmetric unidirectional causality from Brent to WTI by analysing nonlinear co-movements between Brent and WTI daily returns. Bravo, Golpe, Iglesias, and Vides (2020) employed a permanent-transitory decomposition analysis and documented that the Brent–WTI price spread follows a long memory process, with Brent driving the Brent-WTI price structure. Finally, Wong and Zhang (2020) have shown that the global benchmark Brent prices generally appear to have more influence on Chinese listed stocks compared to the North American focused WTI future prices, particularly after the key Chinese oil pricing reform on March 27, 2013.

Panel B in Table 2 presents the joint estimation of Eqs. (4)–(6). In this case, the reference for the Brent futures market is the price that we have called Brent PM. The significance and size of the parameters of system B are similar to the estimates of system A. Thus, contrary to what previous empirical evidence by Ji and Zhang (2019) suggests, the Brent Crude Futures Minute Marker released at 15:30 (GMT) is more closely watched by Chinese oil futures markets than the WTI settlement price at 18:30 (GMT).

Several additional findings should be emphasised. Firstly, regarding the role of the SC futures contract, attention must be paid to the paper by Zhang and Umehara (2019) who argue that one of the biggest problems of such contracts is the vulnerability of the INE futures market caused by, among other reasons, the overdependence on international prices. Our results partially confirm this statement because we have observed that the SC futures contract is vulnerable to Brent news, but not to WTI news. Secondly, with respect to the leadership of Brent-WTI, Brent is found to be the most influential market and the most insensitive one; WTI does not have the ability to influence and SC receives information flows from the Brent futures market but not from WTI, despite both markets closing at the same time. Therefore, the most significant regressor is the return corresponding to the Brent market, independently of whether it is the most recently closed market or not. It is important to remark that these results cannot be explained by the magnitude of the trading volume in each futures market, given that the average monthly volume of Brent for the analysed period was lower than the average of WTI (see Fig. 4).

Lastly, we have performed several robustness checks for our baseline results by employing alternative samples. Specifically, in a preliminary version of the paper, the sample ran from March 26, 2018 to May 9, 2019, when the WTI and SC market structures were balanced between backwardation and contango while the Brent market was in backwardation (63.12 % of the trading sessions) on the majority of trading days. In the new extended sample period, from March 26, 2018 to June 5, 2020, the WTI and SC markets have shifted to contango (56.87 % and 53.38 %, respectively) whereas the Brent market remains in backwardation (67.50 %). However, the information flows regarding the influencing ability and the market sensitivity of the three markets in the increased sample are similar to those observed in the first analysis. Therefore, our results are robust to changes in both the length of the sample period and the structure of the forward curves of the WTI, Brent and SC futures markets.[9]

5. Conclusions

This paper has studied the information flows among the Brent, WTI and SC futures markets to assess whether the trading of the new futures contract launched by INE has altered the dominant role of the most traded oil benchmarks in the world. We have applied the model by Peiró et al. (1998) that measures the lead-lag relationships between markets, separating the ability that one oil futures market has to influence others from its sensitivity to being influenced by them.

[9] The preliminary results are not included for the sake of brevity, but they are available from the authors upon request.

Our results suggest that Brent is the only influential oil futures market and WTI is the most sensitive one. In addition, we have observed that the Medium Sour Crude Oil futures market has no influence on either the Brent or the WTI markets. Furthermore, we have found evidence that SC is only sensitive to Brent news, even though the WTI market has the highest trading volumes and despite the fact that both the WTI and the Brent futures markets close at the same time. In summary, our findings confirm that the Medium Sour Crude Oil futures contract cannot be considered an international benchmark and that the Brent futures contract continues being by far the main reference in the crude oil market.

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