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Failure to Trade: The Curious Case of Two Argus Futures Contracts

Yiuman Tse[a] and Michael Williams[b]

[a]University of Missouri - St. Louis, College of Business Administration

[b]Governors State University, College of Business and Public Administration, University Park, Illinois

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Abstract: On January 1, 2010 the Saudi state-run oil company, Aramco, switched its oil-pricing index away from the West Texas Intermediate (WTI) index to the Argus Sour Crude index. In an attempt to profit from this move, both the New York Mercantile Exchange and Intercontinental Exchange Inc. independently launched futures contracts based on the Argus index. However, despite many months passing, not one trade has been placed on either contract. We examine the impact of the Argus contract launches on WTI-Brent crude oil futures spreads. Not surprisingly, we find evidence that the introduction of the Argus futures contracts had little if any impact on WTI, Brent, or WTI-Brent spread dynamics. Thus, both the Saudi index switch and the launch of two alternative futures contracts failed to significantly remedy WTI/Brent pricing anomalies. We attribute the lack of impact not on inadequate contract design but rather on the "Winner Takes All" phenomena. Specifically, market participants refused to switch from the WTI and Brent contracts given those contracts' pre-existing liquidly advantages as well as the fact that a WTI/Brent cross-hedge could already effectively hedge sour crude positions.

JEL Code: G12; G14; Q4

Key Words: Oil Pricing Index; Oil Futures Contracts; Pricing Anomalies

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1. Introduction

Beginning in 2007, large divergences between West Texas Intermediate (WTI) and Brent crude oil prices appeared indicating that fundamental factors were no longer completely determining oil prices. Given the wild swings in international oil prices, the Saudi oil company, Aramco, switched from the WTI pricing index to one provided by Argus Media Limited that is based on a heavier, "sour" variety of oil. Attempting to exploit the new interest in the Argus index, the New York Mercantile Exchange (NYMEX) and the International Mercantile Exchange (ICE) separately launched futures contracts based on the Argus index. We examine the initial impact of these contracts' introduction on WTI and Brent prices.

Despite there being almost 200 different regularly-followed oil price indexes, 25% and 50% of the world's oil exports are priced using the WTI and Brent indexes, respectively (Blas and Meyer, 2009). Oil indexes have price spreads determined mostly by fundamental factors such as infrastructure conditions, grade differences, and shipping costs. Given that heavier (sour) oils are more expensive to refine than lighter (sweet) oils, sweet oils trade at a premium to sour oils. The WTI-Brent spread typically is bounded between $1.50 and $1.75 with the sweeter WTI trading at a premium to the more sour Brent (Montepeque et al., 2009).

Given their importance on both direct oil and general commodity prices, futures exchanges trade contracts based on both the WTI and Brent price indexes. For example, the WTI trades on both the ICE and the NYMEX. The NYMEX WTI contract is particularly favored by commodity index fund managers and by those hedging oil production. As a result, the NYMEX contract is one of the most liquid oil futures contracts in the world (Morse, 2009). While other exchanges trade the Brent contract, the majority of trading activity resides on the ICE (Baskin and Bunge, 2009). Finally, other less active oil futures contracts exist such as the Middle Eastern Sour Contract traded on the ICE and the Oman Sour Crude contract traded on the Dubai Mercantile Exchange (Blas and Meyer, 2009).

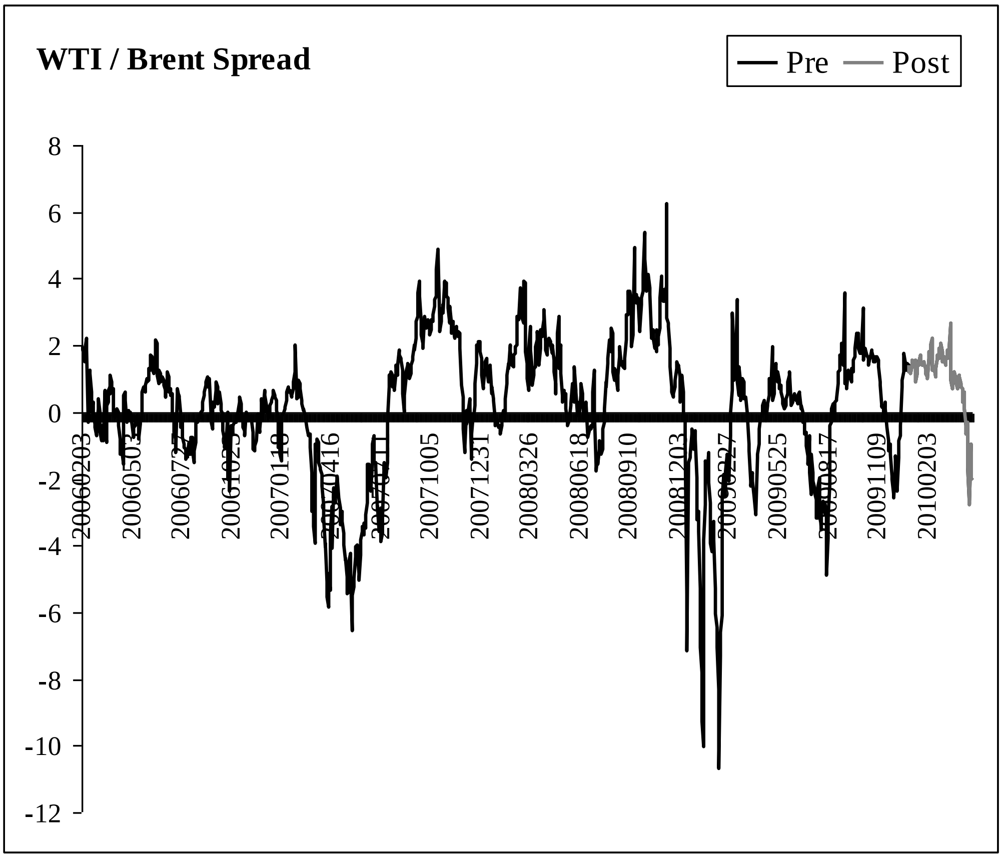
While international oil prices are mainly determined by fundamental forces, distortions can arise. In the case of the WTI contract, local supply conditions greatly impact its price. The WTI index is provided by Platts of the McGraw-Hill Company (Baskin and Bunge, 2009) and is based on oil shipping and storage activity in Cushing, Oklahoma. Yet, the lack of storage transparency allows physical oil traders to manipulate prices based on their storage information advantage. Thus, the WTI is highly influenced by local supply conditions, which, in turn, have significant pricing influence on international oil prices (Montepeque et al., 2009).

Beginning in 2007, problems with storage in Cushing caused large distortions between the WTI and other international oil prices, especially the Brent contract (Montepeque et al., 2009). Specifically, increased sour Canadian oil flows into Cushing crowded out existing stocks of light sweet crude leading to abnormal WTI-international price spreads (Morse, 2009). The chart below shows the WTI-Brent spread from 2006 to 2010 based on the closest-to-expiration WTI and Brent futures contracts traded on the ICE.

Figure 1 shows that the WTI-Brent spread, which historically moved in a range of $1.50 to $1.75, became considerably distorted exhibiting both large positive and negative swings.

Figure 1 - Long Sample Oil Futures Price Spread

The following figure plots the difference between the West Texas Intermediary (WTI) crude oil futures price and the price of Brent oil futures. Note that the post-sample (Post; grey) line spans January 1, 2010 to April 23, 2010.



In addition to being one of the world's most actively traded oil contracts, the WTI was also used by the Saudi-controlled oil company, Aramco, to price its crude exports. Even though Saudi Arabian oil is of a heavier grade (Blas and Meyer, 2009), Saudi oil exports were based on the WTI index after their shift from fixed- to market- based oil pricing in 1984 (Middle East Energy, Oil, and Gas News Wire: Oct. 29, 2009). Given the recent distortions between WTI and Brent prices, concerns arose about the validity of the WTI index to correctly price sour oils. Specifically, the Saudis were concerned that their oil exports were not being priced competitively in a way free of supply-side manipulation while the Saudis' customers were concerned that oil prices at the time of delivery were markedly different from their purchase prices (Husain, 2009).

In response to the wild fluctuations in the WTI-Brent spread, Aramco announced on November 1, 2009 that it would price all of its oil exports according to the Argus Sour Crude index (effective January 1, 2010; Husain, 2009). The Argus Sour Crude index began in May 26, 2009 and is provided by London-based Argus Media Limited (Massey, 2009). The Argus index is based on the prices of three sour crude varieties extracted from the Gulf of Mexico (i.e. Mars, Poseidon, and Southern Green Canyons; Blas and Meyer, 2009) where the Mars blend is the most influential in terms of index construction (Market News International: Nov. 13, 1009).

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In an attempt to exploit the surge in Argus based interest, two futures exchanges launched a series of derivative contracts based on the Argus index. Specifically, the NYMEX of the Chicago Mercantile Exchange Group and the ICE developed, among other contracts, two separate Argus futures contracts which were authorized for initial trading on November 23, 2009 and January 1, 2010, respectively (Haffenberg, 2009; Asia Pulse: Nov. 12, 2009). Yet, despite Saudi actions and a barrage of press releases from the two exchanges, the Argus contracts have not traded even once on either exchange (Futures and Options World: Feb. 19, 2010).

In some respects, the new contracts' failure is not surprising. For example, sour crude futures contracts already exist on the ICE (Middle Eastern Sour Crude) and on the Dubai Mercantile Exchange (Oman Sour Crude; Blas and Meyer, 2009). Also, the NYMEX has made four previous attempts at introducing a sour contract but have been thwarted by the lack of Middle Eastern oil producer participation (TendersInfo: Nov. 2, 2009) and the fact that contracts based on Gulf of Mexico crudes are susceptible to hurricane-based price distortions (Blas and Meyer, 2009).

Despite the lack of trading activity of either Argus contract, the Argus index and the existence of Argus-based oil futures contracts still may have an impact on international oil prices. For example, the existence of a market alternative to distorted contracts could, at least intuitively, discipline the market by shifting trading interest to the relatively less-distorted market. We study whether this is the case by examining WTI prices, Dated Brent prices, and the WTI-Brent price spread shortly before and after the introduction of the two futures contracts. We find that while WTI and Brent price volatility declines in the post introduction period, the WTI-Brent spread increases. Further, the spread still exhibits negative swings. These negative spreads indicate that WTI and Brent prices are still impacted by non-fundamental factors (e.g. supply manipulation).

We also find that WTI and Brent returns become increasing correlated while returns transmission disappears in the post introduction period. Given that these findings are based on daily data, we conclude that cross-market price impacts are more quickly incorporated into prices. However, WTI-Brent spreads become significantly persistent in the post introduction period. The increase in average spreads, the continued presence of negative spreads, and the significant spread persistency in the post introduction period indicates that the availability of Argus contracts failed to tame pricing discrepancies between the WTI and Brent contracts. Also, in an event study analysis, we find that contract introductions, Aramco announcements, and the Aramco price index switch failed to consistently decrease contract price or spread volatility. Again, while our study is only preliminary in nature, neither the Argus index nor oil futures contracts based on said index improve pricing conditions in the major oil futures markets.

Our results are likely a product of the "Winner-Takes-All" phenomenon (WTA). WTA arises when established markets with considerable activity dominate all other markets. Established markets with a loyal following of market participants enjoy a virtuous cycle of order flow wherein existing liquidity and activity entices further, increasingly entrenched, trading interest. The increased level of trading interest then leads to lower transactions costs, higher liquidity, and more efficient price discovery (e.g. see Pirrong, 1999, 2002, 2003; Hendershott and Jones, 2005). In addition to order flow consolidation, the WTA phenomenon also implies that competing exchanges wishing to attract order flow away from the established exchange will face an almost impossible task.

An alternative possibility for the Argus contracts' failure to trade is the failure to design an appropriate contract. For example, successful futures contracts typically have underlying markets with sufficiently large cash markets where cash prices exhibit a sufficient amount of volatility (e.g. see Carlton, 1984; Black, 1986; Tashjian and Wissman, 1995; Borsen and Fofana, 2001; Hung et al., 2010; and many others). Yet, the Argus contract was designed to coincide with the exports of one of the world's largest oil exporter where a fair amount of spot market transactions occur and where those prices are subject to daily fluctuations. Ioannides and Skinner (1999) note that a poorly defined underlying index can lead to poor contract design and therefore contract failure. However, the Argus contracts are based on the Argus Sour Crude Index whose underlying component prices are readily available and where the index weights are transparently calculated. Thus, contract design was not likely a key component in contract failure.

Successful futures contracts also tend to have no close substitutes (Black, 1986). Duffie and Jackson (1989) note that successful contracts generally do not have underlying spot prices that are strongly correlated with other, pre-existing contract prices. In the case of the Argus contract, it would not be surprising if sour crude prices are highly correlated to WTI and Brent prices, despite the oil grade differences. This substitution oversight may have doomed the Argus futures contracts. Also, Borsen and Fofana (2001) and Cusatis (2008) find that, in some cases, pre-existing cross-hedges may be preferred over a new contract if the cross-hedges are associated with higher levels of liquidity. While a contract's inability to appropriately hedge risk obviously leads to its demise (Martinez-Garmendia and Anderson, 1999), Economides and Siow (1985) show that traders may prefer existing cross-hedges even if the new contract has a superior ability to hedge. Thus, it is possible that high Argus/WTI/Brent correlations and the existence of pre-existing cross-hedges rendered the Argus contract redundant, unneeded, and hence untraded.

As further evidence of this, Chowdhry and Nanda (1991) note that dominant contracts first attract non-discretionary liquidity traders who attract discretionary liquidity traders who then attract informed traders. Unsuccessful contracts, however, are not able to entice the initial non-discretionary liquidity traders and therefore fail. A highly plausible addition to the WTA phenomena is that the WTI and Brent crude oil contracts already offered highly liquid cross-hedging opportunities to traders before the arrival of the Argus contract. As a result, the lack of initial (non-discretionary) hedging demand (Corkish et al., 1997) and high relevant switching costs (Pirrong, 2003) for the Argus contract led to a failure of additional, order-flow-sustaining trader participation.

In summary, despite the benefits of trading in an Argus based futures contract, the existing liquidity, transactions cost, and cross-hedging advantages of the established contracts (i.e. the WTI and Brent) eroded any trading benefits of the Argus contracts. As a result, traders have not moved to the Argus contracts and WTI/Brent marketplace dynamics remain mostly unchanged. Thus, if marketplace conditions remain unaltered, the Argus contract will fail, as do two-thirds to three-quarters of all new futures contracts (Silber, 1981).

2. Data and Methodology

We use both daily and intraday oil futures data. The daily data originates from Commodity Systems Incorporated where both the WTI and Brent contracts trade on the International Mercantile Exchange (ICE). Oil futures prices are obtained from the closest contract to expiration and contract rollovers occur the day before expiration. All returns are adjusted for contract rollovers and all returns used in the study are the difference in log prices.

Our intraday oil futures data originates from TickData.com where the WTI contract is traded on the NYMEX (Chicago Mercantile Exchange Group) and the Brent contract trades on the ICE. While we would have preferred to use intraday data from similar exchanges, the Brent futures contract does not trade on the CME. We select the most liquid contract available where returns are calculated using the log difference in interval open-to-close prices. Thus, opening and overnight effects are eliminated from returns. Also, returns are dropped from the dataset when contract rollovers occur intraday. Finally, we only use intraday data during the mutually-overlapping open outcry sessions given that both markets are most active during these times.

We construct two samples using both daily and intraday data. The first sample (pre) spans September 2, 2009 to December 31, 2009. The second sample (post) spans January 1, 2010 to April 23, 2010. The sample date cutoffs are chosen for two reasons. The first reason is that this break date allows for a roughly equal number of observations in both samples. The second reason is that both Argus contract rollouts occur near this date. Using rolling contemporaneous and lagged cross correlations, we find that the correlation and causality results are not sensitive to break date selection (e.g. choosing November 31, 2009 as opposed to December 31, 2009).

3. Results

3.1. Descriptive Statistics

We begin our analysis with a descriptive examination of daily oil futures returns.

Table 1-Panel A reports that the mean and standard deviation of oil futures returns decreased after the structural break. However, the spread between the WTI and the Brent contracts increased while the volatility of the spread decreased. These results provide initial evidence that introducing the Argus futures contracts had little positive impact on reducing pricing imbalances between the WTI and Brent contracts. Of course, given that the return characteristics are different over the two samples, it is possible that fundamental changes in the oil market itself could have led to the increased spread.

Returning back to Figure 1, we find that the WTI/Brent Spread becomes negative during both the pre and post samples. Given that the WTI/Brent spread should be positive due to fundamental oil market factors, negative spreads reappearing indicates that the two Argus contracts were not responsible for correcting price distortions between the two oil markets and that fundamental changes in the oil markets did not lead to lower spread volatility.

Table 1 - Descriptive Statistics

The following table panels report daily descriptive statistics (Panel A) and correlations (Panel B) for the West Texas Intermediary (WTI) and Brent crude oil futures contract returns. Note that returns are defined as the difference in log daily prices. The first sample (Pre) spans September 2, 2009 to December 31, 2009. The second sample (Post) spans January 1, 2010 to April 23, 2010.

Table 1, Panel A - Descriptive Statistics

	WTI		**Brent**		**Spread**	
	Pre	Post	Pre	Post	Pre	Post
Mean	0.183	0.068	0.167	0.121	0.744	1.024
Std. Dev.	2.000	1.660	2.052	1.646	1.322	1.055

Table 1, Panel B - Return Correlations

	Correlations	
	Pre	Post
Corr(WTI, Brent)	92.6%	94.4%
p-Value	0.000	0.000

3.2. Market Interactions

To examine market interactions, we begin by examining cross-market contemporaneous correlations at daily intervals. From Table 1-Panel B, we find that daily cross-market return correlations are significant and positive for both the pre and post samples. Also, we find that while the correlation magnitudes are quite high for both periods, the contracts' correlation is higher in the post sample. This result provides evidence that the two oil futures contracts are more similar in their returns behavior in the post sample.

Table 2 reports daily cross-market regressions for both samples. Specifically, we estimate the following two models for each sample separately using the Newey-West (1987) heteroskedasticity and serial correlation correction:

$$r_{W,t} = \alpha_W + \sum_{i=1}^{5} \beta_{W,i} r_{W,t-i} + \sum_{i=1}^{5} \gamma_{W,i} r_{B,t-i} + \varepsilon_{W,t} \quad (1)$$

$$r_{B,t} = \alpha_B + \sum_{i=1}^{5} \beta_{B,i} r_{B,t-i} + \sum_{i=1}^{5} \gamma_{B,i} r_{W,t-i} + \varepsilon_{B,t} \quad (2)$$

where r_W are WTI log returns, r_B are Brent log returns, and p(Zero) is the p-value for the following joint coefficient hypothesis test of cross-market causality:

$$\gamma_{1,j} = \ldots = \gamma_{5,j} = 0$$

Table 2 – Daily Granger Causality Tests

The following table reports p-values from Granger Causality coefficient restriction tests calculated on the following OLS estimations with the Newey-West (1987) heteroskedasticity and serial correlation correction:

$$r_{W,t} = \alpha_W + \sum_{i=1}^{5} \beta_{W,i} r_{W,t-i} + \sum_{i=1}^{5} \gamma_{W,i} r_{B,t-i} + \varepsilon_{W,t}$$

$$r_{B,t} = \alpha_B + \sum_{i=1}^{5} \beta_{B,i} r_{B,t-i} + \sum_{i=1}^{5} \gamma_{B,i} r_{W,t-i} + \varepsilon_{B,t}$$

where r_W are WTI daily log returns, r_B are Brent daily log returns, and p(Zero) is the p-value for the following joint hypothesis test of cross-market causality:

$$\gamma_{1,j} = ... = \gamma_{5,j} = 0$$

Note that returns are defined as the difference in log daily prices. The first sample (Pre) spans September 2, 2009 to December 31, 2009. The second sample (Post) spans January 1, 2010 to April 23, 2010.

	Cross-Causality			
	WTI –to Brent		Brent-to-WTI	
p(Zero)	Pre	Post	Pre	Post
	0.013	0.570	0.012	0.180

We find that significant, bidirectional cross-market returns transmission occurs during the pre sample. Thus, price impacts from one market would take between one and five days to be incorporated into the other market's price. Also, this implies a somewhat inefficient transmission mechanism between the markets suggesting that cross market price discovery is not as fast as one would expect in liquid and efficient commodity futures markets.

During the post sample, we find that daily returns transmission disappears in both directions. In isolation these results could indicate that the cross market price discovery process has broken down completely. However, when the above results are coupled with the correlation results, higher contemporaneous cross market correlations and the lack of daily causality suggests that cross market price discovery is faster and more efficient, post Argus-index introduction. Thus, it is possible that actions by Aramco or the introduction of the two Argus contracts led to enhanced cross-market price discovery.

A result of more efficient price discovery may be that pricing imbalances could be eliminated faster given that the market is functioning better in the post sample. We examine this possibility by looking at daily spread persistency. We do so by estimating the following model for both samples separately while using the Newey-West (1987) correction:

$$\Delta Spread_t = \alpha_0 + \sum_{i=1}^{5} \lambda_i \Delta Spread_{t-i} + \varepsilon_t \qquad (3)$$

where *ΔSpread* is the change in the price of the WTI contract and the price of the Brent contract and p(zero) is the p-value of the following joint coefficient restriction test:

$$\lambda_1 = ... = \lambda_5 = 0$$

Table 3 - Spread Persistency

The following table reports the p-values of coefficient restriction tests on the following equation estimated by OLS with the Newey-West (1986) heteroskedasticity and serial correlation correction:

$$\Delta Spread_t = \alpha_0 + \sum_{i=1}^{5} \lambda_i \Delta Spread_{t-i} + \varepsilon_t$$

where *ΔSpread* is the daily change in the price of the WTI contract and the price of the Brent contract and p(zero) is the p-value of the following joint coefficient restriction test:

$$\lambda_1 = ... = \lambda_5 = 0$$

The first sample (Pre) spans September 2, 2009 to December 31, 2009. The second sample (Post) spans January 1, 2010 to April 23, 2010.

	Spread Persistency	
	Pre	Post
p(Zero)	0.375	0.010

As seen in the Table 3, spreads were not statistically persistent in the pre sample but became persistent during the post sample. If Aramco or the new contracts had price stabilizing effects, we should see spreads either becoming less persistent or not persistent at all. This would indicate that pricing imbalances and distortions between the two contracts are easily resolved within the more efficient futures market place. Yet, we find that persistency becomes significant during the post period indicating that Aramco's actions, introducing two Argus contracts, and the increased market efficiency detected earlier did not lead to faster resolution of cross market price distortions (in isolation or combination). In other words, arbitrage efforts to align pricing differentials to steady, fundamental levels did not arise due to the Argus contracts.

3.3 Daily and Intraday Intervention Analysis

An unfortunate possibility of the methodologies used above is that the impacts of different interventions may have confounding and offsetting effects. This is because Aramco first announced the index switch, then NYMEX rolled out its Argus based contract, and finally ICE launched its own Argus contract. To disentangle confounding results, we estimate the following three regressions for the two samples separately using the Newey-West (1987) correction:

$$|r_{W,t}| = \alpha_W + \sum_{i=1}^{k} \beta_{W,i} |r_{W,t-i}| + \theta_{W,1} Annc_t + \theta_{W,2} NYMEX_t + \theta_{W,2} ICE_t + \varepsilon_{W,t} \quad (4)$$

$$|r_{B,t}| = \alpha_B + \sum_{i=1}^{k} \beta_{B,i} |r_{B,t-i}| + \theta_{B,1} Annc_t + \theta_{B,2} NYMEX_t + \theta_{B,2} ICE_t + \varepsilon_{B,t} \quad (5)$$

$$|\Delta Spread_t| = \alpha_S + \sum_{i=1}^{k} \beta_{S,i} |\Delta Spread_{t-i}| + \theta_{S,1} Annc_t + \theta_{S,2} NYMEX_t + \theta_{S,2} ICE_t + \varepsilon_{S,t} \quad (6)$$

where *Annc* is an indicator variable equal to one after Aramco announced the switch to the Argus index, *NYMEX* is an indicator variable equal to one after NYMEX launched its Argus futures contract, and *ICE* is an indicator variable equal to one after ICE launched its Argus contract (actual Saudi switch also occurred on this day; all indicator variable are equal to zero otherwise). Results are reported for estimations using 6 (5) lags for the intraday (daily) estimations to take into account volatility persistency.

Equations 4 and 5 model WTI and Brent return volatility as a function of own volatility and exogenous market events. If the introduction of any of the two futures contracts led to a decrease in oil price volatility, we should see that $\theta_{j,2}$ and $\theta_{j,3}$ are statistically negative. Equation 6 is similar to Equations 4 and 5 in that it models WTI-Brent spread volatility as a function of spread volatility persistency and exogenous impacts. If the introduction of the two contracts led to a decline in pricing error variability, we should see that $\theta_{S,2}$ and $\theta_{S,3}$ are statistically negative. Finally, given the size of the intraday (daily) dataset of 5310 (163) observations, we will use the one (five) percent significance level cutoff.

Table 4, Panel A reports estimation results for the full sample using intraday data sampled at ten minute intervals.

For the WTI contract, we find that the ICE/Switch indicator variable is significant at the one percent level and negative. This result indicates that either the launch of the ICE Argus contract or the actual Aramco switch to the Argus index is associated with decreased WTI price volatility. The effect is not economically significant and is not apparent in the Brent contract. On the one hand, we would expect that the interventions should have a negative impact on the WTI volatility and not on the Brent volatility given that supply manipulations were/are mainly occurring in the WTI contract. However, a decrease of less than two one hundredths of a percent is likely not appreciable, even at 10 minute intervals. Also, given that the NYMEX launch is not significant but that the ICE/Switch variable is significant, it is likely that the Aramco switch and not the Argus contract introduction is responsible for the decreased price volatility.

For WTI-Brent spread volatility, we find that the Aramco announcement had no impact while the NYMEX rollout and ICE rollout/Aramco switch did have significantly negative impacts. While this may seem to provide evidence that the Argus contracts impacted volatility, we must note that the NYMEX and ICE/Switch coefficients have approximately equal but opposite signs. This could indicate that the NYMEX Argus contract actually increased pricing distortions while the ICE Argus contract decreased pricing distortions. These results could alternatively indicate that the introduction of both Argus contracts increased pricing distortions between the two oil futures markets but that the combined effect of the Aramco switch led to a negative coefficient (i.e. the Aramco switch overwhelmed the impact of ICE Argus contract rollout). While a definitive answer is not apparent, the fact that the NYMEX rollout did not have an impact on WTI price volatility, the spread volatility results provide limited evidence for the former conclusion. Note that the above results are robust to different (own) lag specifications.

Table 4 - Event Study Regressions

The following table panels report estimation results for event study models using intraday (Panel A) and daily (Panel B) data across the entire sample of September 2, 2009 to April 23, 2010. Specifically, we estimate the following three equations using OLS with the Newey-West (1987) heteroskedasticity and serial correlation correction:

$$|r_{W,t}| = \alpha_W + \sum_{i=1}^{k} \beta_{W,i} |r_{W,t-i}| + \theta_{W,1} Annc_t + \theta_{W,2} NYMEX_t + \theta_{W,2} ICE_t + \varepsilon_{W,t}$$

$$|r_{B,t}| = \alpha_B + \sum_{i=1}^{k} \beta_{B,i} |r_{B,t-i}| + \theta_{B,1} Annc_t + \theta_{B,2} NYMEX_t + \theta_{B,2} ICE_t + \varepsilon_{B,t}$$

$$|\Delta Spread_t| = \alpha_S + \sum_{i=1}^{k} \beta_{S,i} |\Delta Spread_{t-i}| + \theta_{S,1} Annc_t + \theta_{S,2} NYMEX_t + \theta_{S,2} ICE_t + \varepsilon_{S,t}$$

where *Annc* is an indicator variable equal to one after Aramco announced the switch to the Argus index, *NYMEX* is an indicator variable equal to one after NYMEX launched its Argus futures contract, and *ICE* is an indicator variable equal to one after ICE launched its Argus contract (actual Saudi switch also occurred on this day; all indicator variable are equal to zero otherwise). Results are reported for estimations using 6 (5) lags for the intraday (daily) estimations.

Panel A - Intraday Event Estimations

		Annc	NYMEX	ICE/Switch
WTI	Coef.	-0.014%	-0.004%	-0.019%
	p-Value	0.102	0.671	0.008
Brent	Coef.	-0.013%	-0.010%	-0.011%
	p-Value	0.115	0.281	0.103
Spread	Coef.	-0.008%	0.014%	-0.012%
	p-Value	0.014	0.000	0.000

Panel B - Daily Event Estimations

		Annc	NYMEX	ICE/Switch
WTI	Coef.	-0.148%	-0.371%	-0.032%
	p-Value	0.679	0.226	0.878
Brent	Coef.	-0.300%	-0.715%	0.081%
	p-Value	0.394	0.024	0.733
Spread	Coef.	-0.155%	0.123%	-0.063%
	p-Value	0.162	0.087	0.373

From Table 4, it appears that the Aramco announcement, the introduction of the NYMEX and ICE Argus contracts, and the actual Aramco switch had no statistical impact on the oil contracts' price volatility or the pricing error (spread volatility) between the two contracts. The only exception to this finding is that the NYMEX Argus contract rollout is associated with a decrease in Brent oil futures price volatility. This last result is statistically significant at a 5% level and is economically significant.

While these last results may appear to indicate that the NYMEX Argus contract decreased pricing errors within the oil futures markets, we must remember that the WTI contract and not the Brent contract is responsible for pricing distortions between the two exchanges. Further, none of the intervention indicator variables are significant in the last daily regression indicating that none of the interventions alleviated pricing distortions between the two markets. Also, the statistical and economic significance of the intervention parameters are highly sensitive to changes in lag specifications. Thus, it appears that none of the intervention variables improved the manipulation-born distortions between the WTI and Brent oil futures markets at daily intervals. There is some evidence, however, that either the ICE Argus rollout or the Aramco switch did lead to lower intraday WTI price volatility and a marginal decrease in cross market pricing errors.

4. Conclusion

Aramco, the Saudi-controlled oil company, switched from the light sweet crude based WTI pricing index to the heavier (sour) crude Argus pricing index. In an attempt to profit from this move, both the NYMEX and ICE futures exchanges independently introduced Argus index based oil futures contracts. Despite the potential benefits to trading in such contracts, neither exchange attracted a single trade during the sample period. We study whether the actions of Aramco or the introduction of any of the two Argus contracts led to an improvement in WTI-Brent crude oil pricing dynamics. We find that both markets were relatively unaffected and that WTI-Brent spread distortions sill exist.

We attribute our findings to the Winner-Takes-All phenomena wherein the established WTI and Brent contracts' preexisting volume, liquidity, and cross-hedging advantages erode any trading benefits of the newly introduced, competing contracts. In the case of volume and liquidity advantages, the WTI and Brent crude oil futures contracts are some of the most liquid and efficient oil futures contracts available. This fact alone might lead to the Argus contracts' failure to trade given that trading activity tends to consolidate to a limited (if not singular) number of contracts. Further, securing trading interest is almost impossible unless the new contract is sufficiently unique.

With respect to the cross-hedging advantages, the WTI and Brent contracts likely sufficiently cross-hedged any sour crude pricing risk. As a result, neither of the Argus contracts could attract the initial non-discretionary hedging demand necessary to attract other, more discretionary trading interest. Thus, beyond the fact that the Argus contracts were not perceived by the marketplace as being sufficiently differentiated from existing contracts, Argus contract design was not the reason for the Argus contracts' failure. Rather, both contracts failed to secure trading interest due to pre-existing advantages in the WTI and Brent contracts.

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