ARE WEST TEXAS INTERMEDIATE (WTI) PRICES EXPLOSIVE?

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Overview

The oil market is widely conceived as the most liquid in the world. Crude oil is a commodity with spectacular fluctuations. Oil crises, like those of 1973 and 1978-1979, drove the prices up to considerable heights. Oil price history also had other inflationary periods like those up to 2008, and 2014, when oil reached record peaks. All of those periods were followed by spectacular busts. The oil price course can be described as having temporary explosive episodes. I apply the Phillips et al. (2011) and Phillips et al. (2015) methodology to test whether West Texas Intermediate (WTI) prices had explosions, and when these happened. Each episode of explosiveness should be separately examined for each causing factors.

Methods

I use the monthly spot WTI prices by Federal Reserve Economic Data (FRED) for the period between January 1947 and September 2018. I deflate the nominal prices by the seasonally adjusted monthly Consumer Price Index (CPI) for all the Urban Consumers by FRED in order to avoid inflation caused explosiveness. I therefore estimate a real oil price data series, consisting of 861 observations. Oil had several hikes and busts during this long period. I first test my data for stationarity with the Augmented Dickey Fuller (ADF) test and with the Zivot and Andrews (1992) test allowing for one structural break. I find that my data are stationary at first difference I(1).

I then test the explosiveness of oil price with Phillips, Wu and Yu (PWY) (2011) supremum ADF (SADF) statistic and Phillips, Shi and Yu (PSY) (2015) generalized sup Augmented Dickey-Fuller (GSADF) statistic. Table 1 presents the two statistic results. The critical values are obtained by 2000 replication of Monte Carlo simulations for 861 observations. The smallest window for my ADF regressions and calculations of critical values is 61 observations, which is derived by the application of the rule $r_0 = 0.01 + 1.8/\sqrt{861}$. I then apply the date-stamping procedures of PSY (2015) and PWY (2011) strategies to monitor the WTI bubbles.

Results

Table1. The SADF TEST and the GSADF TEST of the WTI Price

		Finite Sample Critical Values		
	Test Stat.	90%	95%	99%
SADF	4.91	1.25	1.49	1.99
GSADF	5.01	2.07	2.28	2.70

I can reach the conclusion that WTI prices had explosive subperiods from the critical SADF and GSADF statistics, as these critical values exceed the 1% right-tail critical values. The summary statistic tests present evidence that oil had explosive periods during the examined period.

I reach the conclusion that oil price had several explosive episodes by the date-stamping methods. The PSY (2015) presents evidence of explosiveness between July 1964 and August 1966, December 1968 and February 1969, January 1974 and February 1974, July 1979 and July 1981, August 2005 and September 2005, April 2006 and August 2006, and October 2007 and August 2008. The BSADF is much more sensitive than the BADF since it suggests more bubbles. What is hard to explain is that the BSADF suggests explosive episodes between 1964 and 1966, and 1968 and 1969, when the real WTI price did not present volatility. The PWY (2011) strategy is a more conservative method, recognising less bubbles in the oil market. These periods are between July 1979 and January 1982, and May 2008 and July 2008.

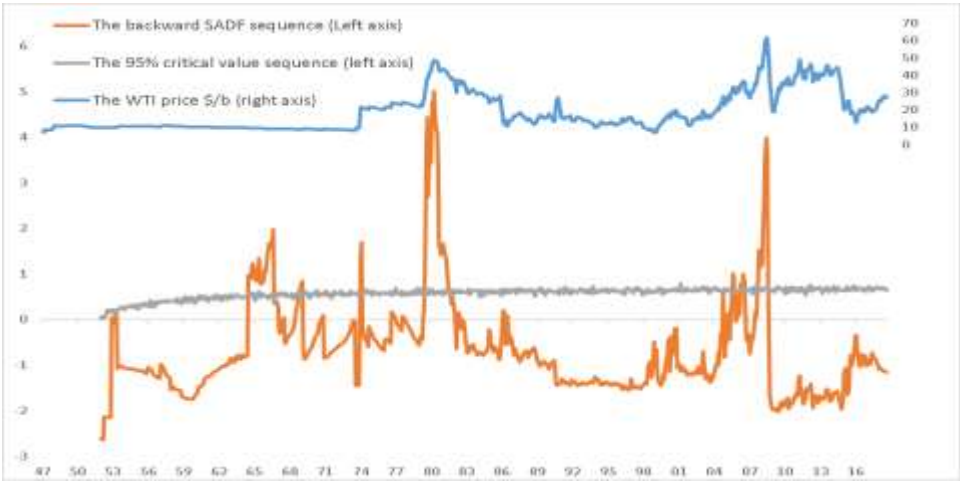

Figure 1Date-Stamping Explosive periods in the WTI prices: the GSADF Test

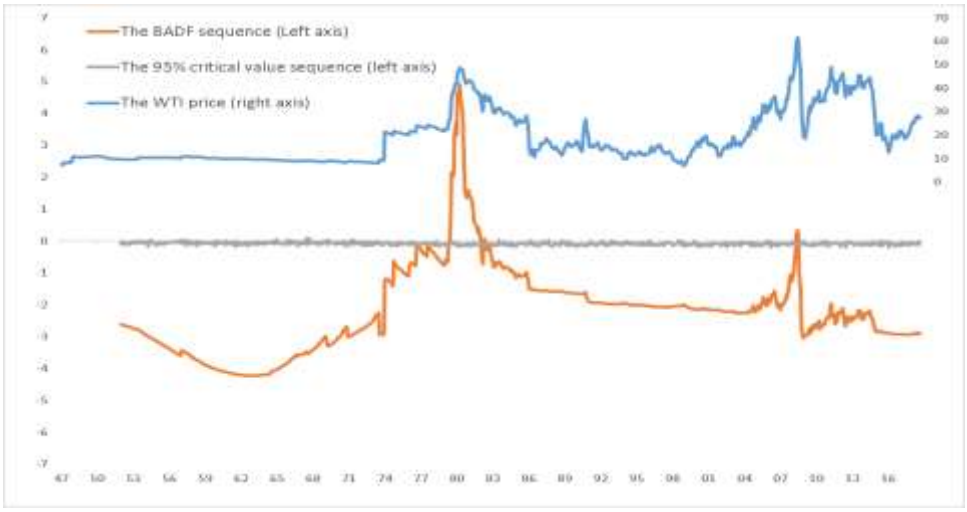

Figure 2 Date-Stamping Explosive periods in the WTI prices: the SADF Test

Conclusions

By examining WTI prices over the period January 1947 to September 2018, I can conclude that there were several explosive episodes in the crude oil market. The applied methodologies provide evidence of price explosiveness of the WTI prices in periods with excess volatility. The date-stamping procedures monitor periods when oil crises existed and market exuberance was present. These periods were periods with extreme volatility and should be separately examined whether they are fundamentally or speculatively driven. The BSADF sequence suggests two periods when no volatility was present, and this is hard to explain. Explosive episodes, in the crude oil market, are of crucial importance for policy institutions as they require thoughtful monitoring, if not interventions.

Acknowledgement

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References

Phillips, P. C. B., Shi, S. and Yu, J. (2015) “Testing for multiple bubbles: Historical episodes of exuberance and collapse in the S&P 500,” International Economic Review, 56(4), pp. 1043–1078. doi: 10.1111/iere.12132.

Phillips, P. C. B., Wu, Y. and Yu, J. (2011) “Explosive behavior and the Nasdaq Bubble in the 1990s: when does irrational exuberance have escalated asset values?,” International Economic Review, 52(1), pp. 201–226.

Zivot, E. and Andrews, D. W. K. (1992) “Evidence on the Great Crash the oil price shock and the unit root hypothesis,” Journal of Business & Economic Statistics, 10(3), pp. 251–270.

Said, Said E, Dickey, D. A. (1984) “Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order: Critical Comments,” Biometrika Trust, 71(3), pp. 599–607. doi: 10.2139/ssrn.2882101.