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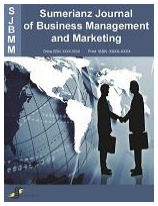

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A Study on the Integrated Property of A Chinese Petroleum Firm Stock Prices

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Abstract

This paper argues that a significant historical event (such as the PetroChina listing) may have been a shock to Chinese stock markets. Similar energy stock prices might not be mean-reverting. Applying trading data from 1997-2017 and the ADF, PP unit root and Perron break-point tests, this study suggests that the Geo Jade Petroleum stock prices are integrated of order one and trend-stationary. The date of the structural shift occurred in May 2007 is almost synchronously with that of the PetroChina listing event. The prices are not mean-reverting.
Keywords: Mean reversion; Structural shift; Petroleum; Stock price; Unit root.

1. Introduction

Historical events may produce a shock to stock property prices and accordingly, change their trend over time. Oil price shocks are a good example (Bondia *et al.*, 2016; Broadstock *et al.*, 2014; Perron and Pierre, 1989;1997). In Chinese A-share Markets, the PetroChina Company Limited listing in November 2007 was a great event. PetroChina is the largest state energy company in China. Its market capitalization was even the largest in the world when it was traded in November 2007. During the PetroChina listing, the Shanghai Composite Index dropped by 4.80% on October 25 and 4.85% on November 8, 2007, respectively.

Hence, prices of similar energy firms' stocks are considered to have been markedly influenced by the PetroChina listing. As Unit Root Theory indicates, similar stock prices may have a permeant memory of the PetroChina listing shock and accordingly would tend to not return to its long-term balance (Beveridge *et al.*, 1981). In other words, prices may not be mean-reverting (Campbell *et al.*, 1987). This paper primarily aims at testing for the mean reversion of prices of a petroleum development company (Geo Jade Petroleum Corporation) stock listed in the A-share market in China.

Geo Jade Petroleum Corporation was established in August 1984. It mostly conducts petroleum exploration and development, petrochemical project investment. It carries out production, sales and warehousing of petrochemical products. Crude oil and natural gas business contribute 65% of the firm's 2017 total income. Geo Jade Petroleum Corporation was listed on the Chinese A-Share Market on August 8, 1996. The reported shares trading in the A-Share market were 2258.18 million in August 2018. Geo Jade Petroleum Corporation's market capitalization was RMB6.5 billion in November 2018.

2. Literature Review

A unit root may suggest a non-mean reversion for a time-series variable. The persistence claim can be used to deal with macroeconomic fluctuations (Campbell *et al.*, 1987). Nonstationary time series variables may lead to spurious regressions (Engle and Granger, 1987; Granger and Newbold, 1974). Past studies often related the unit root and predictability of stock prices to the efficient market hypothesis (EMH) (Caporale *et al.*, 2002; Hasanov and Mübariz, 2009). Stock prices in South Korea contain a unit root (Narayan *et al.*, 2004). However, a nonlinear unit root test shows that the South Korea's stock price does not contain a unit root (Hasanov and Mübariz, 2009). There isn't a lasting effect in stock prices in the US stock market due to near I(0) series (Caporale *et al.*, 2002).

3. Methods

The study tested for unit root using the ADF test (Dickey and Fuller, 1979; Dickey *et al.*, 1984) and the PP test (Phillips and Perron, 1988). A structural shift could lead to incorrect inferences (Perron and Pierre, 1989;1990;1997; Sen and Amit, 2003). This paper conducted a break date test applying Model C proposed in Perron and Pierre (1989). The Perron Model C can be in the form of Perron and Pierre (1997):

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + dD(TB)_t + \alpha y_{t-1} + \sum_{i=1}^{k} \Delta y_{t-i} + \varepsilon_t \quad (1)$$

Where $D(TB)$ and DU represents a change in the level and a change in the slope, respectively. $DT = tDU$, t is the trend. Under the null hypothesis a unit root, $\mu \neq 0$ (in general), $\beta = 0$, $\theta = 0$ (except in Model C), $\gamma = 0$, $d \neq 0$, and $\alpha = 1$. Under the alternative hypothesis of trend-stationary, $\mu \neq 0$, $\beta \neq 0$, $\theta \neq 0$, $\gamma \neq 0$ (in

general), $d = 0$, and $\alpha < 1$. The null is tested using the *t*-statistic for $\alpha = 1$. The break date T_b is endogenously selected by minimizing the *t*-statistic for $\alpha = 1$; the minimal is termed t_α.

4. Data

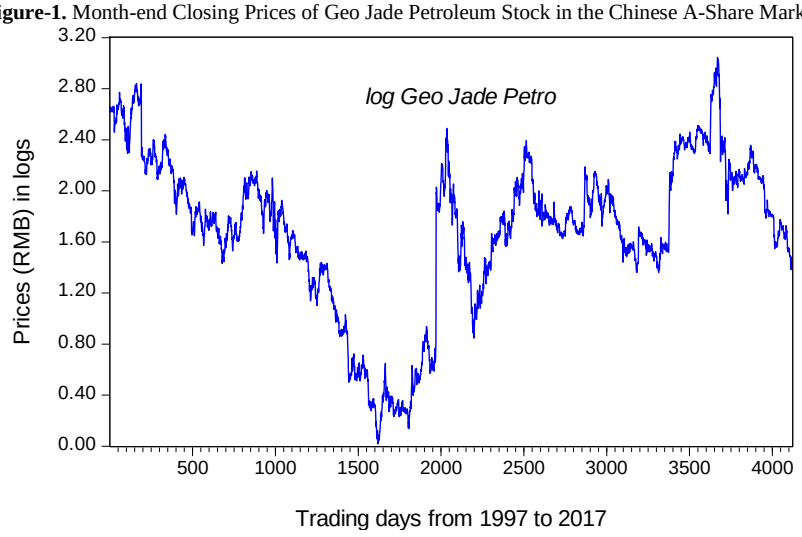
Data were stock prices of Geo Jade Petroleum Corporation. Daily trading prices were the closing values (Table 1). The sample is for the period from 1997-2017. Prices were transaction prices measured in nominal RMB each share. Series were downloaded from an online trading system: <http://www.dfzq.com.cn/dfzq/i/orientsec-software.jsp>. The stock prices were plotted in Figure1.

Table-1. Descriptive Statistics for the Data

Energy firms:	**Geo Jade Petroleum Corporation**
Price variable	*Geo Jade Petro*
Mean	6.34
Median	5.86
Max	21.00
Min	1.02
Std. Dev.	3.35
Skewness	0.91
Kurtosis	4.28
Jarque-Bera	852.75
p-value	0.00

Price is measured in RMB each share.

Figure-1. Month-end Closing Prices of Geo Jade Petroleum Stock in the Chinese A-Share Market



5. Results and Discussions

5.1. Empirical Results

Both the ADF and PP tests show that ***Geo Jade Petro*** contained a unit root (Table 2). Also, in Table 3, $\mu \neq 0$, $\theta = 0$ and $\alpha = 1$, which implies a unit root. However, the estimated t_α equaled to 494.7, and $\beta \neq 0$, $\gamma \neq 0$, $d = 0$, which indicates a trend-stationary.

Overall, ***Geo Jade Petro*** contained a unit root as well as a structural break. The Perron test showed a structural change occurred on 22 May 2007.

Table-2. The Unit Root Tests

Log variable	**Period**	**Method**	***k***	**Level**	***k***	**First difference**
Geo Jade Petro	Jan 1997-Dec 2017	ADF	22	-2.37	21	-14.71***
		PP	7	-2.47	12	-58.76***

All tests contain an intercept as well as a trend according to Hamilton (1994); Hendry *et al.* (2000). The value of a lag order (*k*) was decided using the *t* test for the ADF test (Ng *et al.*, 1995), and the Newey–West (NW) bandwidth technique for the PP test (Newey and West, 1987). ***denotes rejection of a unit root at the 1% level.

Table-3. The Break Date Test: Perron Models C

Parameter & variable	**Coefficient**	**Standard Error**	***t*-Statistic**	***P*-value**	T_b
k=12					
θ	-0.006	0.005	-1.144	0.253	
β	0.000	0.000	-3.525	0.000	
γ	0.000	0.000	2.942	0.003	
d	0.037	0.038	0.970	0.332	
α	0.991	0.002	494.685	0.000	May 22, 2007
Lagged term					
1	0.091	0.016	5.824	0.000	
2	-0.020	0.016	-1.273	0.203	
3	0.025	0.016	1.588	0.113	
4	-0.039	0.016	-2.507	0.012	
5	-0.016	0.016	-1.028	0.304	
6	0.010	0.016	0.646	0.518	
7	0.014	0.016	0.861	0.389	
8	0.001	0.016	0.054	0.957	
9	-0.006	0.016	-0.414	0.679	
10	0.029	0.016	1.860	0.063	
11	-0.004	0.016	-0.237	0.813	
12	0.039	0.016	2.477	0.013	
Intercept	0.022	0.006	3.945	0.000	
R-squared	0.996	Mean dependent var	1.684		
Adjusted R-squared	0.996	S.D. dependent var	0.606		
S.E. of regression	0.038	Akaike info criterion	-3.686		
Sum squared resid	5.979	Schwarz criterion	-3.658		
Log likelihood	7588.667	Hannan-Quinn criteria.	-3.676		
F-statistic	60473.770	Durbin-Watson stat	2.015		

Notes: Variable was in logarithmic values. The trimming fraction is 0.15 (Banerjee *et al.*, 1992). Truncation lag orders k (between 2 and 14) were selected (Ng *et al.*, 1995; Ng *et al.*, 2001; Perron and Pierre, 1997). T_b is the possible break date selected. *t*-statistic for $t - k \geq 2.0$.

6. Concluding Remarks

China is the second largest crude oil consumer in the world. Petroleum development company stocks can be crucial assets that bring long-term returns for investors. This paper tested for the mean reversion of petroleum stock prices in the Chinese share market. In order to improve the test robustness, the study conducted a Dickey-Fuller *t* test (ADF) and a non-parametric PP test. Tests suggest that ***Geo Jade Petro*** stock price series are integrated of order one. It also contains a structural shift occurred in May 2007. The break detected occurred earlier than the listing date, which can be largely attributed to the spreading of information on the PetroChina listing among investors.

Stock prices are not mean-reverting. The PetroChina listing event or other events may impose a permanent effect on the change in Geo Jade Petroleum stock prices. The stock price contains a long memory.

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