

GROUP 141 - FINAL YEAR PROJECT ORAL PRESENTATION



THE SIGNIFICANCE OF IMPACT FROM INTERNATIONAL CRUDE OIL PRICE ON CHINESE MACRO ECONOMY

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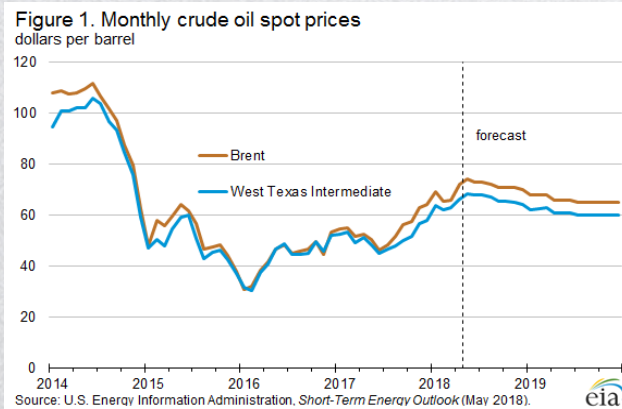
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INTRODUCTION

- ▶ Statement of problem
- ▶ Literature review
- ▶ Object of study
- ▶ Hypothesis



Crude oil : One of the crucial resources to the economy and the development of a country



A number of international events

- West Texas Intermediate (WTI) - NYMEX
- **Brent** Crude - IPE
- Dubai Crude
- Western Canadian Select (WSC)



The fluctuation of crude oil price



Confidence of investors changes dramatically





Factors driving the trend of the oil price:

1. Organization of Petroleum Exporting Countries (OPEC)



2. The innovation of shale oil exploiting technology (U.S.)



3. Substantial reserves of shale oil resources found in China



“the concentration of organic carbon in Chinese oil shale is high” &
“resources in China are abundant with a high potential for exploitation” (Liu, et al., 2017)

4. Demand for crude oil in Asia



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1. Macroeconomic responses to the oil price fluctuation

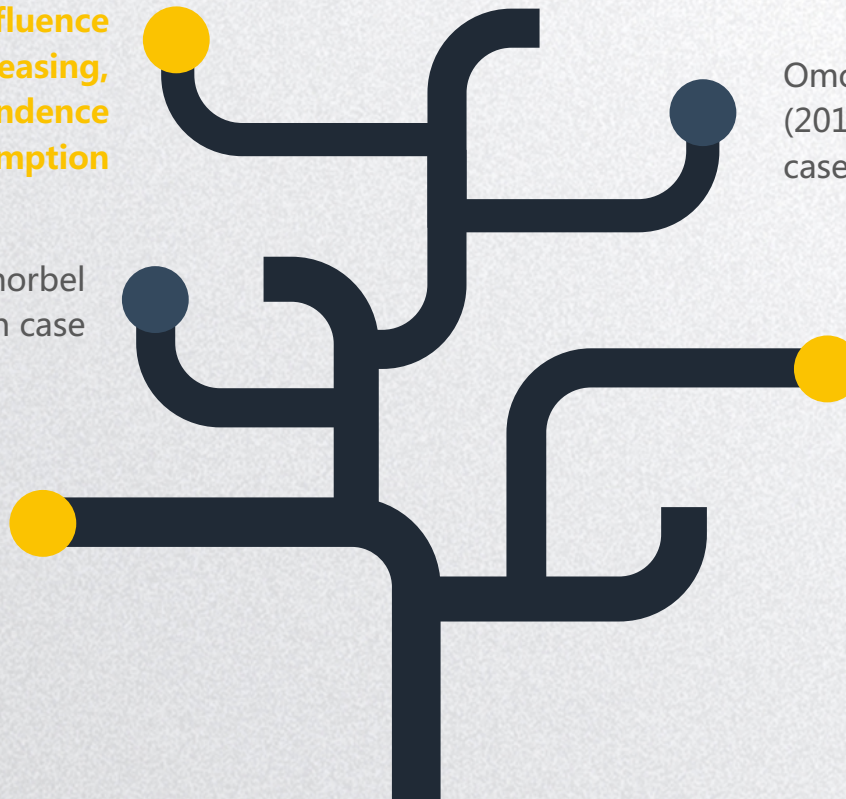
Du, He and Wei (2010): influence of oil price shock is increasing, resulting from the dependence on oil import and consumption

Jbir and Zouari-Ghorbel (2008): Tunisian case

Lorde, Jackman and Thomas (2009): impact of oil price in Trinidad and Tobago

Omojolaibi (2014): Nigeria case

Rafiq, Sali and Bloch (2008): Thai economy case





2. Impacts of change in global energy market structure

Brune (2015): investigated the impact from shale oil to the market and U.S. economy

Baumeister and Kilian (2016): confirm the influence of shale oil technology



3. Asymmetric effects of oil prices in economic variables

Mohanty, Tawfeek and Bugshan (2012) used Auto-Regressive Distributed Lag model (ARDL) model to estimate the effect of oil price on state income in the United States

Mansor H. Ibrahim and Rusmawati Said (2017): oil price has positive impact on inflation in South Africa



4. Chinese researches on domestic economic responses to international oil prices

Liu and Jiang (2009):
detected the impact on
the variance of domestic
product oil

Liu (2008): the fluctuations
of oil prices have nonlinear
and asymmetric effects on
Chinese domestic output

Li Z. and Li L. (2011)
proved the response of
domestic macro economy
was lagged to the
fluctuation of oil prices

Tilak Abeysinghe
(2001): oil price effect
on GDP growth are
both direct and
indirect



To provide **predictions on influencing significance** of international oil price toward Chinese macroeconomy in better accuracy and make certain **comparison among various relationships between crude oil price** in global market **and different economic indicators** in respect of significance



The impact of oil prices toward gross national production and inflation are investigated and the mutual influences among the three variables are also tested



1

The change of oil price will positively influence the sensitivity of change in GDP

2

The sensitivity of CPI change rate will positively influence the sensitivity of change in GDP

3

Previous rate of changes in GDP will have positive effect present rate of change in GDP



2

METHODOLOGY

- ▶ Data source
- ▶ Data description
- ▶ Modelling



Data source

Part Two Methodology



Variables

Daily Brent Oil Futures Prices

China Seasonal Gross Domestic Product

China Monthly Consumer Price Index



Time range

Quarterly data from 1995:1 to 2016:12

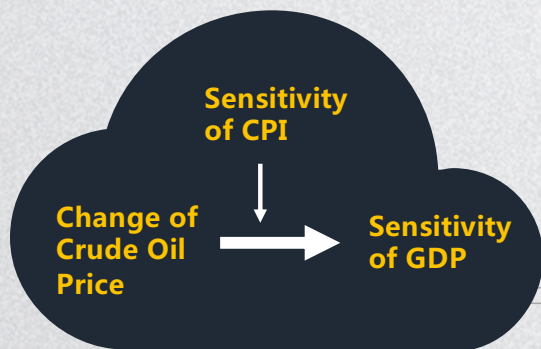


Secondary data from database of U.S. Energy Information Administration (EIA) and the National Bureau of Statistics of China official website





- Δy ---**change** in GDP between one value and its former value
- Δo ---the **differences** between two adjacent data of oil prices
- Δx ---the **differences** between two adjacent data of CPI



1

The new concept that Hamilton (2003) created called **[net oil price change]** was used to eliminate the influence of exogenous factors like political factors

2

The framework of the analysis is to investigate the influence of change in oil prices (IV) to GDP (DV) with sensitivity of CPI (CV)

3

The change in crude oil price is assumed to impose influence on the sensitivity of GDP and the sensitivity of CPI is assumed to affect the IV-DV relation.

4

The formula is established to measure the mutual effects and former data effect by using the **Autoregressive Distributed Lag Model (ARDL)**



The change in GDP depends on its lagged data, the change in oil prices and the change in CPI during the previous quarters. All these three variables are **expected to have positive effects** on change in GDP

$$\Delta y_t = \alpha + \sum_{i=1}^{96} \beta_i \Delta y_{t-i} + \sum_{i=1}^{96} \delta_i \Delta o_{t-i} + \sum_{i=1}^{96} \gamma_i \Delta x_{t-i}$$

$$y_t = GDP$$

$$o_t = oilprice$$

$$x_t = CPI$$



3

RESULT DESCRIPTION

- ▶ Unit root test
- ▶ ARDL model
- ▶ Implication



Unit root test

Part Three

Result



Necessity

Only the stable data can be tested in time series or it would be bias for forecasting



Assume

Assume unit root exists, run the test to verify the significant level of the assumption that the data is stable



Detect

Notice whether the p-value is smaller than 0.05, the stability would be verified



Longitude

The time length is from 1992 to 2017, so there are 96 items for each variables after adjustment

Procedure

- Based on the order, detect the status of trend, including linear, constant and none, in which the level, 1st difference and 2nd difference should be tested respectively;
- Detect the result that the p-value is lower than **0.05** and find the lowest p-value. If more than one situation satisfies the requirement, then compare the **AIC, HQ and SC**, choosing the lowest one.



Unit root test

Part Three

Result

Null Hypothesis: D(GDP,2) has a unit root			
Exogenous: None			
Lag Length: 3 (Automatic - based on SIC, maxlag=12)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.094059	0
Test critical values: 1% level		-2.588772	
5% level		-1.94414	
10% level		-1.614575	
*MacKinnon (1996) one-sided p-values.			

Test for GDP

All the three situation of 2nd difference satisfies the requirement.

	intercept	intercept and trend	none
Akaike info criterion	17.14449	17.16042	17.13378
Schwarz criterion	17.27637	17.31868	17.23929
Hannan-Quinn criter.	17.19783	17.22444	17.17646

Test for CPI

All the three situation of 1st difference satisfies the requirement.

	intercept	intercept and trend	none
Akaike info criterion	3.23712	3.251555	3.220454
Schwarz criterion	3.368187	3.408835	3.325308
Hannan-Quinn criter.	3.29015	3.315191	3.262878

Null Hypothesis: D(CPI) has a unit root			
Exogenous: None			
Lag Length: 3 (Automatic - based on SIC, maxlag=12)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.969432	0
Test critical values: 1% level		-2.58853	
5% level		-1.944105	
10% level		-1.614596	
*MacKinnon (1996) one-sided p-values.			



Test for Brent

All the three situation of 1st difference satisfies the requirement

Null Hypothesis: D(BRENT_OIL) has a unit root			
Exogenous: None			
Lag Length: 0 (Automatic - based on SIC, maxlag=12)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			
Test critical values: 1% level		-9.154207	0
5% level		-2.587831	
10% level		-1.944006	
		-1.614656	
*MacKinnon (1996) one-sided p-values.			

	intercept	intercept and trend	none
Akaike info criterion	7.60472	7.623234	7.606724
Schwarz criterion	7.682397	7.726804	7.632459
Hannan-Quinn criter.	7.636166	7.665162	7.617145

As all the three variables are verified stable, the adjusted data will be loaded into the model



ARDL model

Part Three

Result



The original data is noted as I(2), I(1) and I(1) and all the three converted to I(0) after difference.



In order to get consistent estimation of t-test of ARDL model, HAC (Newey-West) should be used to get consistent estimation if there exists Heteroscedasticity or Autocorrelation.

- The result of lag for three variables are respectively **6, 1 and 0**;
- The **forth lag of GDP, the first lag of CPI and C** cannot be used rationally, the other items can be used into the formulas directly.

Number of models evaluated: 648				
Selected Model: ARDL(6, 1, 0)				
Note: final equation sample is larger than selection sample				
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LLGDP(-1)	-0.820273	0.132329	-6.198733	0
LLGDP(-2)	-0.86247	0.112932	-7.637058	0
LLGDP(-3)	-1.122359	0.122392	-9.170175	0
LLGDP(-4)	-0.130521	0.123939	-1.053108	0.2952
LLGDP(-5)	-0.296396	0.088499	-3.34915	0.0012
LLGDP(-6)	-0.250959	0.065775	-3.815425	0.0003
LCPI	0.572509	0.118713	4.822651	0
LCPI(-1)	0.329051	0.166796	1.972776	0.0517
LOIL	0.016996	0.005864	2.898076	0.0048
C	-0.001055	0.001262	-0.836283	0.4053



ARDL model

Part Three

Result



The three criteria named **AIC, SC and HQ** are **small enough** that two of them are even lower;



R square and adjusted-R square indicates the independent variables can account for more than 99 percent of the change of dependent variable;



The value of Durbin-Watson statistic is **2.05609** which is nearly equal to 2, suggesting **no conditions of Heteroscedasticity**.

R-squared	0.99721	Mean dependent var	-0.000669
Adjusted R-squared	0.996918	S.D. dependent var	0.218481
S.E. of regression	0.01213	Akaike info criterion	-5.887935
Sum squared resid	0.012654	Schwarz criterion	-5.620816
Log likelihood	292.6209	Hannan-Quinn criter.	-5.779961
F-statistic	3414.87	Durbin-Watson stat	2.05609
Prob(F-statistic)	0		



Serial correlation LM test

After the estimation of the lag numbers of ARDL model, the serial correlation LM test is used to detect whether there is any serial correlation for residuals;

The F-statistic is about **0.45** and the F-statistic for degree of freedom to **83** and lag times to two is about **3.11**. F-value is about **0.64** which shows that the residual has **no serial correlation**.

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.451496	Prob. F(2, 83)	0.6382
Obs*R-squared	1.033185	Prob. Chi-Square(2)	0.5965
Test Equation:			
Dependent Variable: RESID			
Method: ARDL			
Date: 01/22/09 Time: 17:02			
Sample: 1994M01 2017M04			
Included observations: 96			
Presample missing value lagged residuals set to zero.			



$$\Delta y_t = -0.001055$$

$$\begin{aligned} &+ \sum_{i=1}^{96} -0.820273 \Delta y_{t-1} \\ &+ \sum_{i=1}^{96} -0.86247 \Delta y_{t-2} \\ &+ \sum_{i=1}^{96} -1.122359 \Delta y_{t-3} + \sum_{i=1}^{96} -0.296396 \Delta y_{t-5} + \sum_{i=1}^{96} -0.250959 \Delta y_{t-6} \\ &+ \sum_{i=1}^0 0.572509 \Delta x_t + \sum_{i=1}^{96} 0.016996 \Delta o_t \end{aligned}$$

$$y_t = GDP$$

$$o_t = oilprice$$

$$x_t = CPI$$

From the final formula, the effect can be noticed that the **former GDP has a significant negative effect** on the change of GDP but **the CPI and the oil price have a small positive effect** on the change of GDP.



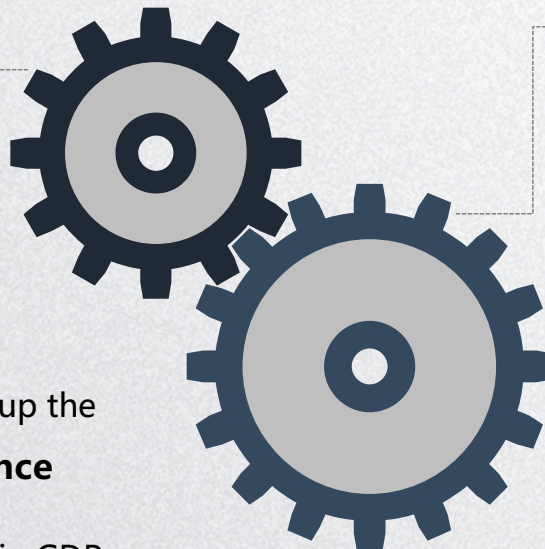
Implication

Part Three

Result

the coefficients of the differences between changes in GDP are **only significant in the first to third time-lags**, while the fourth time-lag seems not significant from the data, **disagreed by the expectation**

Coefficients



R-square & Adjusted R-square



(first four time-lags) back up the **government interference**



(4th one) changing trends in GDP are **supposed to be small** because of seasonal pattern and **not to be firm** because of economic fluctuation

- ARDL model consider GDP as one of the independent variables by the way of **time lag effect**;
- Historical data of GDP plays an important role in **shifting the growth rate direction**;
- Results from the Five-Year Plans



stable and steerable vibration

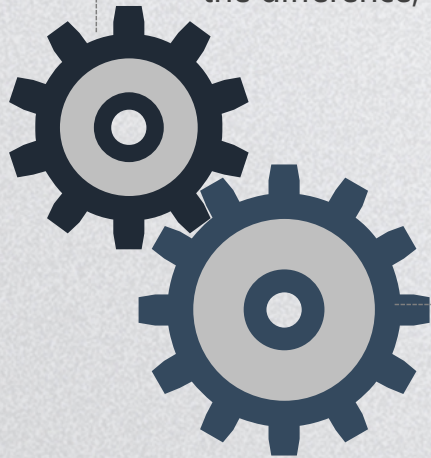


~~sustained economic growth~~



Oil time-lag effect

1. Accumulated effect of all the time-lags of oil price can explain the **1.6%** of the difference;
2. The time-lags indicates the price & cost effect will **not deliver the influence on the current production cost**;
3. The change rate of oil price may affect the future change rate of GDP by means of **influencing the expectation of the economic growth** in the domestic market.



CPI time-lag effect

CPI has one time-lag effect (one quarter). Because CPI data is collected monthly, on which the **fiscal policy and price regulation** launched are based



Article written by Chen (2009) also suggests that there is long-term stable equilibrium relationship between the economic growth and the inflation of prices.



4

CONCLUSION

- ▶ Summary
- ▶ Comment



Instant seasonal impact ► on GDP from oil prices and from CPI, while the past GDP contribute considerable effect on the current GDP in six time-lags

┌ The continuous growth in **CPI** and **Oil Price** will **boost** the future growth in GDP ┐



◀ **This paper** investigates the impact of international crude oil price on China economy, while also tests the influences from CPI and the effect of time lag between current GDP and its historical data

◀ **There are** always time lags between current GDP with historical CPI data and historical crude oil prices respectively in the model



Significant influence from CPI and seasonal changing trends in historical GDP growth, suggesting there are instant effect and time-lag effect respectively. Such results from the significant coefficients provide evidence pointing toward **governmental regulation on macroeconomy** and **interference in the production patterns**.



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THANK YOU!



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