경제학석사학위논문

THE IMPACT OF COMMODITY PRICE ON MONGOLIAN ECONOMIC GROWTH

천연 자원 가격이 몽골경제성장에 미치는 영향

2018년 2월

서울대학교 대학원

경제학부 경제학 전공

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Abstract

THE IMPACT OF COMMODITY PRICE ON MONGOLIAN ECONOMIC GROWTH

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The resource curse refers to the paradox that resource abundant countries tend to have slower economic growth than countries that lack natural resources. Empirical works on the problem of the resource curse have more or less mixed results. While some researchers provide evidence in favor of the resource curse, others provide evidence against it. This dissertation investigates the problem of the resource curse for data from Mongolian economy. Mongolia, a country with abundant natural resources, enjoyed high economic growth for the period of a commodity boom of relatively recent years. Our analysis is based on the vector error correction model (VECM) that enables us to analyze both short-run and long-run effects of the commodity boom on economic growth. The results show that the commodity boom had positive short-run effects on the growth rate of Mongolian economy with no significant long-run effect on the growth rate. We have some other interesting results from the Granger causality test for the effects of changes of commodity prices and economic policies on the growth rate of the economy. Our robustness check confirms these findings of our analysis for different sets of control variables.

Keywords: commodity prices, natural resource curse, Mongolian economic growth

***Student Number**: 2016-22062*

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1. INTRODUCTION

“Resource curse” is defined that the natural resource abundant countries lean to grow slower than those who are not. The number of empirical research gives contradicting results to each other. While Sala-i-Martin and Subramanian (2008), Sachs and Warner (1995a, 2001) and Gylfason et al. (1999) predict negative effects of commodity booms on economic growth, research by Deaton and Miller (1995), Raddaz (2007), Alexeev and Conrad (2009) and Brunnschweiler (2008) give the contrary result that commodity booms significantly increase economic growth. The Mongolian growth acceleration during the period from 2010 to 2014 becoming one of the fastest-growing countries in the world[1] is clearly supporting these findings.

However, it is inappropriate to conclude easily that a resource curse exists. Many highly developed countries such as Canada, Norway and Australia have high natural capital. To explain these divergent experiences, researchers have tried to investigate why the difference occurs. The first indicator considered is the role of the institution. From the idea that the conclusive role of the institutions for economic development insisted in North and Thomas (1973), Engerman and Sokoloff (2000), and Acemoglu, Johnson and Robinson (2001), the divergence of growth among the resource abundant countries is mainly due to how resource income is distributed. The second indicator that causes to lower growth is the volatility in commodity prices. In this

[1] GDP growth rate of Mongolia in 2013 was 17.3%

paper, we suppose to study the impact of the volatility in copper price on Mongolian economy because the copper ore is the most exported commodity from Mongolia.

The resource curse literature that did research on the effects of commodity prices use various methodologies such as cross-sectional regression and panel regression. A cross-sectional growth regression is used in the early stage of research on the topic such as Deaton and Miller (1995). However, the methodology cannot address the long-run effects of a commodity boom on a country's economy. Thus, the next methodology used in empirical evidence is the panel data estimation such as Collier and Goderis (2008). The paper analyzes panel cointegration considering commodity price effect and gives the conclusion that commodity booms have positive short-run effects on output but not in the long- run. Additionally, it concludes that the resource curse effect is dependent on countries' institutional quality. As shown above, the greatly contradictory results are obtained from past empirical studies.

In this paper, we employ the Vector error-correction model (VECM) framework to analyze Mongolian quarterly data for 2001 to 2017 to distinguish the short- and long-run effects of commodity price especially copper price on Mongolian economic growth.

This paper finds evidence in support of the resource curse hypothesis in Mongolia. Particularly, commodity price affects in the short-run positively, but no determined conclusion about the long-run effect. Testing the effect of commodity price on the growth is an extremely critical issue to Mongolia whose economy is highly dependent on commodity export and vulnerable to world market shocks. Literature review points global commodity prices as one of the most important determinant of growth acceleration in Mongolia in the period of 2010 to 2014 when its economy was prospering at “two-digit” growth rate. But they also imply that the commodity boom brought up the adverse effect in the long run by making the growth acceleration almost to zero in 2016. Thus, the contribution of this paper is to provide analysis on the short- and long-run effect and suggest policy implication based on the result.

The rest of the paper is structured as follows. Section 2 presents the country background of Mongolia and its current condition of development. Then the research methodology and data description are defined in Section 3. Section 4 reports the estimation results and the short- and long-run effects of higher copper price on Mongolian economic growth. Section 5 concludes the main findings and suggests policy implications.

2. COUNTRY BACKGROUND

Mongolia is one of the most commodity-dependent countries in the world. According to the report of UN State of Commodity dependence 2016, the commodity exports of the economy account for around 98% of its total exports, which is about 42% of its total GDP in 2014. Largest exported goods of total commodity exports are Copper ores (33%), Coal briquettes (20%), Gold (15%), Crude Petroleum (7%) and Iron ore (5.1%) as shown in the Figure 1.

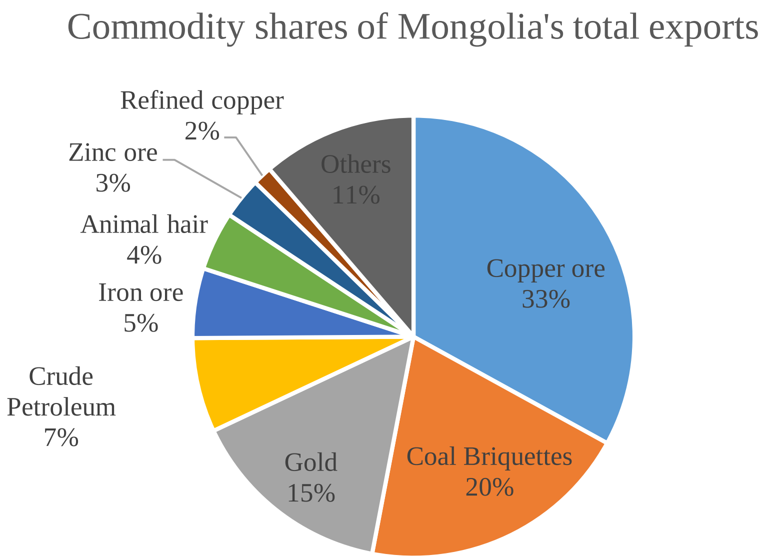


Figure 1. Commodity shares of Mongolia's total exports in 2016
Data source: Bank of Mongolia Database

Mongolia was once considered as one of the fastest growing countries in the world on the account of its mining industry and the world commodity price increase which was led by Chinese economic boom. On the back of large stock of natural resources and immense foreign direct investment(FDI) inflows to the mining sector, Mongolia's real GDP growth was 17.3% in 2011, but since then it decreased to 0.976% in 2016. When the Oyu tolgoi copper and gold deposit[2] attracted more than $6 billion in FDI for the first stage development in 2011, every economist was cautious about resource curse in Mongolia due to its scarce capital and limited absorptive capacity. Nevertheless, the economy has been prone to repeated boom-bust cycles and shocks to FDI and copper price fall in the world market directed to reserve losses and exchange rate depreciation since the beginning 2013. This is mainly due to the following reasons.

First, at the beginning of the 2010s, when commodity prices were high and economic boom was happening, the Mongolian government started expanding fiscal policies and increased social transfer expense more than ever. Thus, it has accumulated new debt at a rate that is much faster than savings. Instead of putting aside the revenues from exhaustible minerals for the future or investing in human capital or education, the government started social welfare projects such as the Child Money Program[3] which contributed to the growing public debt enormously. Given its universal coverage, the program has helped reduce poverty significantly.

[2] Oyu Tolgoi deposits, which was discovered in 2001, contain around 2,700,000 tons of copper and 1.7 million ounces (48,195,000 grams) of gold. Production began in 2013 and is scheduled to reach full capacity in 2021(Wikipedia).

[3] The Child Money Program is the largest program of the government's cash transfer and provides monthly payments of MNT 20,000 (approximately US$20) to about 1 million children (aged 18 and below)

However, its long-run economic effect was insignificant according to the studies. The off-budget expenditures reached 17% of GDP in 2016 and public debt dramatically increased to 100% of GDP in 2016. As suggested in Sala-i-Martin and Subramanian (2008), research done on the Nigerian case, the direct distribution of natural resource income through cash transfers like Child Money program in Mongolia has been recommended to help avoid the resource curse. The rationale is that by transferring the resources from the government, transparency will grow and the benefits of natural resources will be more equitably shared to the people of the country. However, it is not easy and effective as it is described according to the previous practices. Empirical research such as Liete and Weidmann (1999), Petermann, Guzma and Tilton (2007) and Collier and Venables (2009) suggest that the government seeks to acquire more power and the agents get involved in corruption more. Mongolia is the first developing country that has implemented the resources-to-cash scheme. The finding of Yeung and Howes (2015) concludes that direct cash distribution has been not successful up to date. Even though the program brought significant short-term benefits and significantly reduced the poverty, it was ineffectively implemented. It also suggests that the cash transfers contributed to higher price fluctuation in the 2010-2012 period as well.

Second, investment efficiency is unclear whether large-scale public investments financed by resource revenue were efficient enough. The Mongolian government's public investment lacks of choosing efficient projects and their effective implementation. Furthermore, lack of transparency and politically motivated contracts decreased the efficiency more (Li, Gupta and Yu, 2017).

Third, the abundance of natural resources also raised complicated political issues. In order to win elections, Mongolian political parties had great incentives to propose populist policies, such as the Child Money program. After recognizing the policies' inefficiency, the major parties agreed to limit the government debt and tried to decrease the budget deficit. Despite of the government's effort, Mongolian institutional quality is not strong enough yet according to the following measurements. Mongolia is ranked at the 87th out of 177 countries in the Corruption Perceptions Index 2016 and 129th out of 180 countries in Index of Economic Freedom by The Heritage foundation in 2017. It can be easily recognized from data that indices are going worse as time passes.

Last and most importantly, the heavy reliance on mineral exports makes the Mongolian economy greatly exposed to global shocks such as commodity price fluctuation and the biggest importer's economic slowdown. The price of mineral exports, however, is largely anchored by international market prices. This lack of diversification in sectors has made the economy greatly vulnerable ups and downs of China's commodity demand (Gauvin and Rebillard, 2015). As shown in Figure 2, the copper price and GDP growth rate share the same cyclical process. The large stimulus launched by Chinese authorities in 2009 substantially boosted demand for commodity and increased the commodity price, Mongolia's exports and the growth rate, while the following slowdown in China's growth resulted in a collapse of Mongolia's copper and coal exports and led to poor performance of the economy. The poor demand was accelerated by too much supply as well. The commodities boom, led by China's growth in 2012, caused metal producing companies to increase their production to the levels that the market cannot absorb. Moreover, since copper is priced in US dollar in major exchanges, a stronger dollar contributed to the fall of copper price. With the decline of copper price since 2012, the Mongolian economic growth rate fell into almost 0% in 2016.

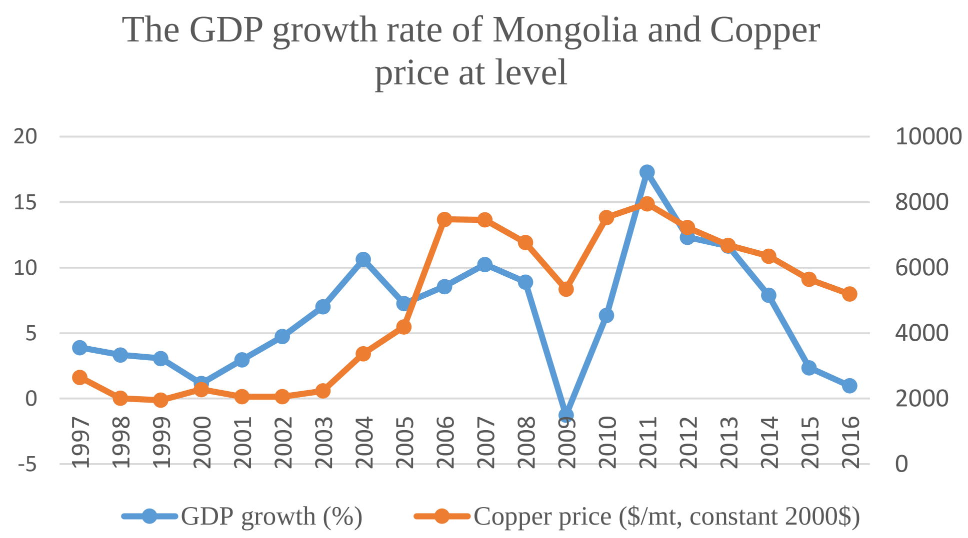


Figure 2. GDP growth of Mongolia and Copper price in the world market
Data source: World Development Indicators (WDI)

3. RESEARCH METHODOLOGIES

3.1 Empirical model and data

The goal of the paper is to do an analysis on the determinants of Mongolian economic growth, check the existence of cointegration relationship among the variables, describe long-run and short-run relationships, and verify the Granger causality.

Based on the studies performed on the determinants of economic growth rate, there are many causes that might give impact; however, given the scarcity of data in Mongolian economic indicators, coupled with avoiding problems of multicollinearity, all potential determinants cannot be included in a equation. Nevertheless, the linear regression model is found to be of interest to comprehensively analyze the relationships between economic growth rate and its determinants including copper price.

$$\text{GDPGROW}_t = \beta_0 + \beta_1 COPP_t + \beta_2 LOGGOV_t + \beta_3 LOGEXP_t + \beta_4 INT_t + \\ + \beta_5 INF_t + \beta_5 M2_t + \varepsilon_t \qquad (1)^{4}$$

where GDPGROW is the real GDP growth rate of Mongolia; COPP is the copper price in the world market at constant 2000$; LOGGOV is the government

[4] The result of a model that takes different control variables into consideration is introduced in Appendix. The conclusion of two models are found to be same.

expenditure of Mongolia; LOGEXP is the total export of Mongolia; INT is the policy rate of the Bank of Mongolia(BoM); INF is the inflation rate, M2 is the money supply. For efficiency of analysis, government spending, export, copper price and money supply were transferred to natural logarithmic form to decrease problems of heteroscedasticity. In addition, all variables are calculated at constant prices with the base year 2005 (2005=100). Quarterly data from 2001Q1 to 2017Q1 were acquired from Mongolian National Statistical Office and World Development Indicators (WDI).

3.2 Methodology specification

3.2.1 Unit root tests

The tests for stationarity of the variables are firstly performed in order to avoid the problems of spurious regression results in time series analysis. Even though the unit root test is not required in the case of using bounding testing cointegration suggested by Pesaran et al. (2001), the Augmented Dickey-Fuller(ADF) and the Phillips-Perron(PP) unit root tests are executed to make sure whether the variables are integrated of more than I(1). The reason is that the bounding testing approach result becomes invalid when the variables are cointegrated by more than order I(1).

3.2.2 Cointegration analysis

After it is assured that the variables are not integrated at the order more than I(1), the Autoregressive distributed lag model (ARDL) bounds testing approach is used to determine the presence of cointegration between Mongolian GDP growth rate and other determinants such as copper price index in the world market. The approach estimates the dynamic unrestricted error-correction model(ECM) by using ordinary least squares (OLS) and then the short-run dynamics and the long-run equilibrium are integrated as following:

$$\Delta Y_t = \alpha_0 + \alpha_1 T + \sum_{h=1}^{a} \delta_h \Delta Y_{t-h} + \sum_{i=0}^{b} \delta_i \Delta X_{t-i} + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + e_t \quad (2)$$

where Δ presents the first difference operator, α_0 is the drift component in the equation, T is the time trend, Y_t is the dependent variable, X_t is a vector of determinants of Y_t, δ's are the short-run coefficients, β's are long-run coefficients, and e_t is the error terms that are presumed to be independent and identically distributed.

Based on Pesaran et al. (2001), a joint F-test on the one-period lagged level variables can be used to check whether there is an existence of long-run equilibrium relationships between variables with the null hypothesis of no cointegration, $H_0\colon \beta_1 = \beta_2 = 0$, against the alternative hypothesis, $H_1\colon \beta_1 \neq \beta_2 \neq 0$. When F-statistics exceeds the upper bounds of the critical value of I(1), the null hypothesis is rejected and it means the variables in the model share significant long-run relationships. However, if the F-statistics is less than the lower bound level, the null hypothesis cannot be rejected. Moreover, any conclusive result cannot be obtained when the F-statistics falls between the upper and lower bound.

3.2.3 Analysis of the long-run and short-run relationship

After the ARDL bounds test declares the presence of long-run cointegration relationships among the variables, the following conditional error correction model (Pesaran et al. 2001) is estimated as:

$$\Delta \text{GDPGROWTH}_t = \alpha_0 + \alpha_1 T + \sum_{i=1}^{a} \delta_{1GDPGROWi}\, \Delta GDPGROW_{t-i} + \sum_{j=0}^{b} \delta_{2COPPj}\, \Delta COPP_{t-j} + \sum_{j=0}^{c} \delta_{3LOGGOVj}\, \Delta LOGGOV_{t-j} + \sum_{j=0}^{d} \delta_{4LOGEXPj}\, \Delta LOGEXP_{t-j} + \sum_{j=0}^{e} \delta_{5INTj}\, \Delta INT_{t-j} + \sum_{j=0}^{f} \delta_{6INFj}\, \Delta INF_{t-j} + \sum_{j=0}^{k} \delta_{7M2j}\, \Delta M2_{t-j} + \beta_1 GDPGROW_{t-1} + \beta_2 COPP_{t-1} + \beta_3 LOGGOV_{t-1} + \beta_4 LOGEXP_{t-1} + \beta_5 INT_{t-1} + \beta_6 INF_{t-1} + \beta_7 M2_{t-1} + e_t \quad (3)$$

where α_0 is the drift, T is the time trend and the assumptions on e_t are held. The assumptions are that the error term is serially independent and identically distributed. The conditional error correction model was selected for the paper, on account of its higher performance in giving optimal estimates and models with mixed ordered regressors.

3.2.4 Granger Causality

If cointegration amongst the variables exists, then the next step is to perform the Vector Error Correction Model (VECM) to test for short and long run Granger causality. In the case of cointegration, the following VECM equation is estimated:

$$\Delta\begin{bmatrix} GDPGROW \\ COPP \\ LOGGOV \\ LOGEXP \\ INT \\ INF \\ M2 \end{bmatrix}_t = \begin{bmatrix} \vartheta_1 \\ \vartheta_2 \\ \vartheta_3 \\ \vartheta_4 \\ \vartheta_5 \\ \vartheta_6 \\ \vartheta_7 \end{bmatrix} + \sum_{p=0}^{q} \begin{bmatrix} \omega_{11} & \omega_{12} & \omega_{13} & \omega_{14} & \omega_{15} & \omega_{16} & \omega_{17} \\ \omega_{21} & \omega_{22} & \omega_{23} & \omega_{24} & \omega_{25} & \omega_{26} & \omega_{27} \\ \omega_{31} & \omega_{32} & \omega_{33} & \omega_{34} & \omega_{35} & \omega_{36} & \omega_{37} \\ \omega_{41} & \omega_{42} & \omega_{43} & \omega_{44} & \omega_{45} & \omega_{46} & \omega_{47} \\ \omega_{51} & \omega_{52} & \omega_{53} & \omega_{54} & \omega_{55} & \omega_{56} & \omega_{57} \\ \omega_{61} & \omega_{62} & \omega_{63} & \omega_{64} & \omega_{65} & \omega_{66} & \omega_{67} \\ \omega_{71} & \omega_{72} & \omega_{73} & \omega_{74} & \omega_{75} & \omega_{76} & \omega_{77} \end{bmatrix}_p \times$$

$$\Delta\begin{bmatrix} GDPGROW \\ COPP \\ LOGGOV \\ LOGEXP \\ INT \\ INF \\ M2 \end{bmatrix}_{t-p} + \begin{bmatrix} \psi_1 \\ \psi_2 \\ \psi_3 \\ \psi_4 \\ \psi_5 \\ \psi_6 \\ \psi_7 \end{bmatrix} \times ECM_{t-1} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \\ \epsilon_4 \\ \epsilon_5 \\ \epsilon_6 \\ \epsilon_7 \end{bmatrix}_t \quad (4)$$

Where Δ represents the first difference operators; $\vartheta_i(\mathrm{i} = 1, \dots, \mathrm{n})$ present the intercepts of the model; $\omega_{ij} = 0\ (i, j = 1, \dots, n)$ stand for the short-run coefficients; ; $\psi_i(\mathrm{i} = 1, \dots, \mathrm{n})$ represent the long-run coefficients. Moreover, ECM_{t-1} is the one-period lagged error-correction term and its significance confirms the existence of long-run causality between the variables. Finally, ϵ_{it} are serially uncorrelated random error terms with zero mean. While, q's represent the lag lengths, p's stand for the lag orders of the model. Short-run causality can be obtained from the significant F-test statistics on the lagged variables.

4. EMPIRICAL FINDINGS

In this section, the results of the economic analysis described in Section 3 are reported. Table 1 reports the descriptive statistics and the correlation matrix of the variables employed in the model.

Table 1. Descriptive statistics and correlation matrix results

Variables	GDPGROW	COPP	LOGGOV	LOGEXP	INT	INF	M2
Mean	7.50	3.67	14.68	2.63	15.82	8.80	43.71
Median	7.49	3.77	14.97	2.67	15.07	7.15	25.22
Maximum	21.58	3.98	16.03	3.24	24.13	32.40	122.59
Minimum	-2.93	3.15	13.03	1.83	11.20	-1.92	2.70
Std. Dev.	6.01	0.26	0.98	0.41	3.51	6.97	39.23
Skewness	0.46	-0.84	-0.25	-0.37	0.78	1.17	0.64
Kurtosis	2.56	2.30	1.62	1.91	2.44	4.99	1.88
GDPGROW	1						
COPP	0.324	1					
LOGGOV	0.047	0.75	1				
LOGEXP	0.001	0.752	0.943	1			
INT	-0.178	-0.874	-0.892	-0.877	1		
INF	0.220	0.303	0.135	0.115	-0.143	1	
M2	-0.039	0.536	0.901	0.862	-0.793	-0.075	1

4.1 Unit root and Cointegration tests

Table 2 shows the result of the augmented Dickey-Fuller(ADF) and the Phillips-Perron (PP) unit root tests to confirm that none of the variables are integrated of order more than I(1). While the dependent variable and some independent variables such as inflation and government spending are ordered at I(0), the other independent variables are integrated at the order of I(1). On the account of the mixture of the orders, the ARDL bounding testing is the suitable method to check whether the cointegration lies between the variables. Since the result of bounds testing approach is greatly dependent on the choice of the lag order, the optimal lags are selected based on Akaike info criterion(AIC) for consistent estimators with the set of the maximum lag order of 7 quarters.

Table 3 reports the results of bounds testing approach to cointegration. The conclusion is that we can reject the null hypothesis of no cointegration at the 1% significance level for the main model indicating that the economic growth rate and its determinants have significant long-run equilibrium relationships.

As shown in Table 4, the model of interest is free from problems of serial correlation, heteroscedasticity, and model misspecification. To make sure the model is appropriately specified, the Breusch-Godfrey, Breusch-Pagan-Godfrey, ARCH LM, and Ramsey RESET tests are performed. Additionally, the high R-squared statistics of the model confirms the suitability of the selected model. Moreover,

Figure 3 shows the plots of cumulative sum of recursive residuals(CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) tests of the model with the critical bounds of the 5% significance level. It shows the model's reliability, stability and consistency estimates in the long-run as well.

Table 2A. ADF unit root test results

	ADF											
Variables	**I(0)**						**I(1)**					
Test statistics	**Constant**	**OL**	**No C or T**	**OL**	**C+Trend**	**OL**	**Constant**	**OL**	**No C or T**	**OL**	**C+Trend**	**OL**
GDPGROW	-5.12***	0	-1.86	1	-5.08***	0	-12.2***	0	-12.33***	0	-12.3***	1
COPP	-1.469	1	0.937	2	-1.137	1	-5.794***	0	-5.744***	0	-5.876***	1
LOGGOV	-1.287	3	1.367	3	-5.6***	1	-14.8***	2	-13.9***	0	-14.7***	2
LOGEXP	-1.37	4	1.748	4	-1.82	4	-4.45***	3	-3.876***	3	-4.546***	3
INT	-2.152	0	-1.902	0	-3.305	0	-10.87***	0	-10.52***	0	-10.92***	0
INF	-3.85***	2	-1.078	4	-3.800**	2	-6.57***	3	-6.638***	3	-6.63***	3
M2	0.950	2	2.01	2	-1.781	2	-3.227**	1	-2.270**	1	-3.671**	1

Notes: C stands for the constant term; T stands for the trend term; OL stands for the optimal lag order or bandwidth for the ADF and PP unit root tests, respectively. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 2B. PP unit root test results

	PP											
Variables	**I(0)**						**I(1)**					
Test statistics	**Constant**	**OL**	**No C or T**	**OL**	**C+Trend**	**OL**	**Constant**	**OL**	**No C or T**	**OL**	**C+Trend**	**OL**
GDPGROW	-5.20***	3	-2.65***	3	-5.16***	3	-17.1***	9	-17.2***	9	-18.0***	10
COPP	-1.669	4	0.847	4	-1.255	4	-5.56***	11	-5.58***	10	-5.82***	16
LOGGOV	-1.012	5	4.384	2	-6.0***	4	-21.5***	8	-14.9***	2	-24.4***	10
LOGEXP	-1.947	20	1.777	14	-5.5***	3	-18.3***	16	-12.8***	20	-19.3***	16
INT	-2.169	2	-2.20*	1	-3.25*	4	-11.1***	2	-10.5***	3	-11.2***	2
INF	-3.209**	3	-2.05**	2	-3.192*	3	-6.6***	1	-6.7***	1	-6.596	0
M2	2.16	0	4.47	2	-1.415	1	-7.66***	2	-6.1***	3	-8.4***	1

Notes: C stands for the constant term; T stands for the trend term; OL stands for the optimal lag order or bandwidth for the ADF and PP unit root tests, respectively. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 3. Results from the ARDL bounds testing approach to cointegration

No.		Model	ARDL	F-stat	Significance	Conclusion
1	F(GDPGROW|	COPP, LOGGOV, LOGEXP, INT, INF, M2)	(2,4,2,5,3,4,1)	8.220	***	Cointegrated
2	F(LOGGOV|	GDPGROW, COPP, LOGEXP, INT, INF, M2)	(3,3,1,3,5,5,5)	7.496	***	Cointegrated
3	F(LOGEXP|	GDPGROW, COPP, LOGGOV, INT, INF, M2)	(4,4,5,5,4,0,4)	7.846	***	Cointegrated
4	F(INT|	GDPGROW, COPP, LOGGOV, LOGEXP, INF, M2)	(5,5,4,4,5,5,1)	7.399	***	Cointegrated
5	F(INF|	GDPGROW, COPP, LOGGOV, LOGEXP, INT, M2)	(5,0,5,1,4,5,2)	9.071	***	Cointegrated
6	F(COPP|	GDPGROW, LOGGOV, LOGEXP, INT, INF, M2)	(5,2,2,1,0,5,4)	2.48		Not-cointegrated
7	F(M2|	GDPGROW, COPP, LOGGOV, LOGEXP, INT, INF)	(3,1,1,0,4,0,0)	3.51	**	Cointegrated
	Lower bound critical value for k=6		2.53*	2.87**	3.6***	
	Upper bound critical value for k=6		3.59*	4**	4.9***	

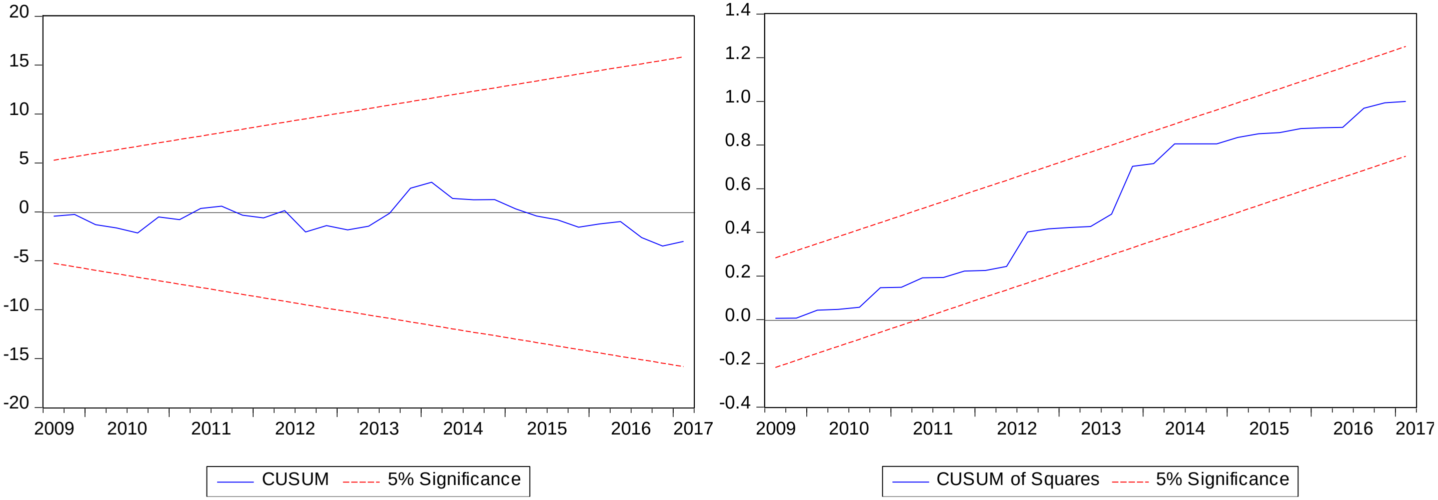
Notes: ARDL denotes the selected ARDL model based on the AIC; Critical values for lower and upper bounds were obtained from Pesaran et al.(2001) for case IV. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 4. Results of the diagnostic tests conducted on the model of interest

No.	Model	ARDL	F-stat	Breusch-Godrey serial correlation	Breusch-Pagan-Godprey	ARCH-LM	Ramsey RESET	R-squared	Adj.R-squared
1	F(GDPGROW| COPP, LOGGOV, LOGEXP, INT, INF, M2))	(2,4,2,5,3,4,1)	8.22***	1.274 (0.29)	1.222 (0.293)	0.01 (0.99)	2.1(0.13)	0.791	0.589

Notes: The AIC was used to select the optimal lag order; () refers to the p-values associated with the test. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Figure 3. The plots of CUSUM and CUSUMQ of the model F(GDPGROW| COPP, LOGGOV, INT, EXCH)



4.2 Long-run and short-run relationship analysis

Since the presence of cointegrating relationships is established, the next step is to investigate the long-run relationship between variables. The results for the long-run coefficients are reported in Table 5. The long-run coefficient of the copper price effect is positive not insignificant. Here any clear conclusion cannot be driven. After discussing the long-run effects of the most important variable in the model, now we turn to other significant variables with expected signs such as the exchange rate of Mongolian currency to USD which is significant at 1% level. Moreover, the result reports that the government spending and money supply have positive and significant effect on the Mongolian economic growth in the long run case. It can be concluded that higher interest rate increase and higher inflation rate lead to lower economic growth rate in Mongolia. More specifically, a 1% increase in the value of money supply would lead to a 0.3% increase in the growth rate. Out of the variables studied, LOGEXP was found not to have significant long-run effects of the growth.

Table 5. Long-run coefficients

Regressor	Coefficient	Standard Error	T-statistics
COPP	6.307	7.94	0.79
LOGGOV	30.06	4.61	6.51***
LOGEXP	7.923	9.403	0.84
INT	-2.38	0.89	0.01***
INF	-0.636	0.15	0.00***
M2	0.3	0.05	0.00***

Notes: * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

When we analyze the short-run relationships between GDP growth and its determinants, a completely different scenario is found. According to the results of Table 6, the short-run GDP determinants are assured with the expected sign. The contemporaneous also the first, third and fourth lag of the change in copper price are all positive and significant at 5% level. It suggests that an increase in the growth of copper price has the positive short-run effect on GDP growth rate. Hence, the short-run dynamics of commodity boom suggest a completely different result from long-run one even though it was insignificant. The positive short-run effect of commodity price is not only persistent with the results of research done on the same topic but also proves the resource curse in the case of Mongolia. Therefore, the short run effect results imply that Mongolian GDP is bolstered by the increase in natural resource income due to the better terms of trade(TOT).

The government spending lags have a significant expected sign at lag one. The size of the short-run positive impacts of LOGGOV, 18.498%, largely overweigh its long-run impacts on economic growth rate. We also can recognize that the effects of interest rate on the growth is the significant negative. Hence, the significant negative sign of the ECM (-1) at the 1% level suggests that any short-run disequilibrium will adjust towards the long-run equilibrium at the speed of -1.666.

Table 6. Short-run coefficients

Regressor	Coefficient	Standard Error	T-statistics
C	-600.111	71.876	-8.349***
@TREND	-4.465	0.552	-8.096***
D(GDPGROW(-1))	0.445	0.135	3.303***
D(COPP)	27.736	9.955	2.786***
D(COPP(-1))	-1.544	11.074	-0.139
D(COPP(-2))	22.395	10.371	2.159**
D(COPP(-3))	21.828	10.377	2.104**
D(LOGGOV)	18.498	3.342	5.534***
D(LOGGOV(-1))	-7.849	3.305	-2.375***
D(LOGEXP)	4.201	5.679	0.740
D(LOGEXP(-1))	-6.954	5.452	-1.276
D(LOGEXP(-2))	-13.900	5.387	-2.580***
D(LOGEXP(-3))	0.706	5.345	0.132
D(LOGEXP(-4))	9.063	5.055	1.793*
D(INT)	-2.912	0.670	-4.346***
D(INT(-1))	-0.355	0.706	-0.503
D(INT(-2))	-1.740	0.680	-2.559**
D(INF)	-0.848	0.154	-5.503***
D(INF(-1))	0.386	0.148	2.607**
D(INF(-2))	0.547	0.141	3.865***
D(INF(-3))	0.800	0.151	5.313***
D(M2)	-0.147	0.201	-0.732
CointEq(-1)*	-1.666	0.201	-8.287***
Diagnostic tests			
R-squared		0.79	
Adjusted R-squared		0.67	
F-statistics		6.42(0.00)***	

Notes: * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level. ECM(-1)= GDPGROW - (6.3075*COPP + 30.0644*LOGGOV + 7.9232*LOGEXP -2.3843*INT-0.6363*INF + 0.3007*M2)

4.3 Granger causality

An ascertainment about the direction of Granger causality between the variables using the VECM framework is necessary to strengthen the causing result since the cointegrating relationships between variables are proved with ARDL cointegration approach. As shown in Table 7, the significant sign of the one-period lagged error correction term at 1% level in Column (1) and Column (3) supports the results from the bounds test that suggest bidirectional causality between GDPGROW and COPP, LOGGOV, LOGEXP, INT, INF and M2. In the case of short-run Granger causality, the first column of the results reports unidirectional causality from copper price to a growth rate which is supportive to the short-run coefficient in Table 6. Furthermore, there are also unidirectional causality running from government spending and interest rate to Mongolian economic growth which support standard economic theories.

Moreover, the second column supports one of the arguments of Collier and Goderis (2008) that one of the benefits of using copper price is that it is normally not disturbed by the decision of individual countries. In other words, any Mongolian macroeconomic factor gives effect to copper price in the world market. The reason that I chose here copper price as a proxy to commodity price is also that copper price is merely affected by policies or international cartels like oil or gold.

Furthermore, bidirectional causality is also found between (1) GDPGROW and M2 and (2) INF and INT. It can be seen that the money supply and interest rate Granger cause export in short-run and copper price and money supply have unidirectional causality to interest rate.

Table 7. Granger causality results based on VECM framework

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	**ΔGDPGROW**	**ΔCOPP**	**ΔLOGGOV**	**ΔLOGEXP**	**ΔINT**	**ΔINF**	**ΔM2**
$\mathbf{\Sigma\Delta GDPGROW(t-i)}$		8.285 (0.14)	3.28 (0.65)	6.08 (0.29)	7.35 (0.2)	8.20 (0.14)	11.64 (0.04)**
$\mathbf{\Sigma\Delta COPP(t-i)}$	7.91 (0.1)*		5.87 (0.32)	5.75 (0.33)	31.78 (0.0)***	3.74 (0.58)	8.48 (0.13)
$\mathbf{\Sigma\Delta LOGGOV(t-i)}$	13.48 (0.02)**	4.401 (0.49)		6.75 (0.24)	5.25 (0.38)	3.74 (0.58)	3.39 (0.64)
$\mathbf{\Sigma\Delta LOGEXP(t-i)}$	7.21 (0.2)	1.754 (0.88)	7.24 (0.20)		8.81 (0.12)	3.32 (0.65)	2.54 (0.77)
$\mathbf{\Sigma\Delta INT(t-i)}$	9.83 (0.08)*	2.217 (0.82)	6.63 (0.24)	15.14 (0.01)**		12.94 (0.02)**	3.21 (0.66)
$\mathbf{\Sigma\Delta INF(t-i)}$	3.55 (0.61)	4.653 (0.46)	3.25 (0.66)	4.50 (0.48)	10.26 (0.07)**		3.30 (0.65)
$\mathbf{\Sigma\Delta M2(t-i)}$	12.74 (0.02)**	3.101 (0.68)	2.50 (0.77)	9.02 (0.1)*	10.33 (0.07)**	3.39 (0.64)	
ECM(t-1) (t-statistics)	-0.88(-2.97)***	----	-0.01 (-1.64)*	----	----	----	----
Direction of causality	COPP→GDPGROW			INT→ LOGEXP	COPP→INT	INT→ INF	GDPGROW → M2
	LOGGOV→ GDPGROW			M2→LOGEXP	INF→ INT		
	INT→ GDPGROW				M2→INT		
	M2→ GDPGROW						

Notes: () refers to the p-values; * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

4.4 Robustness check

I investigate the robustness of the model specifications by using different control variables from the main model. The alternative model specification includes the exchange rate of USD to Mongolia tugrug and excludes money supply due to the multicollinearity in Equation 5.

$$\Delta \text{GDPGROWTH}_t = \alpha_0 + \alpha_1 T + \sum_{i=1}^{a} \delta_{1GDPGROWi}\, \Delta GDPGROW_{t-i} + \sum_{j=0}^{b} \delta_{2COPPj}\, \Delta COPP_{t-j} + \sum_{j=0}^{c} \delta_{3LOGGOVj}\, \Delta LOGGOV_{t-j} + \sum_{j=0}^{d} \delta_{4LOGEXPj}\, \Delta LOGEXP_{t-j} + \sum_{j=0}^{e} \delta_{5INTj}\, \Delta INT_{t-j} + \sum_{j=0}^{f} \delta_{6INFj}\, \Delta INF_{t-j} + \sum_{j=0}^{k} \delta_{7M2j}\, \Delta EXCH_{t-j} + \beta_1 GDPGROW_{t-1} + \beta_2 COPP_{t-1} + \beta_3 LOGGOV_{t-1} + \beta_4 LOGEXP_{t-1} + \beta_5 INT_{t-1} + \beta_6 INF_{t-1} + \beta_7 EXCH_{t-1} + e_t \quad (5)$$

where GDPGROW is the real GDP growth rate of Mongolia; COPP is the copper price in world market at constant 2000$; LOGGOV is the government expenditure of Mongolia; LOGEXP is the total export of Mongolia; INT is the policy rate of the Bank of Mongolia(BoM); INF is the inflation rate, EXCH is the exchange rate of USD to Mongolian tugrug.

Table 8 reports the results of the bounding testing approach to cointegration of the alternative model used for robustness checks. It is clear that the null hypothesis of no cointegration can be rejected at 1% or 5% significance levels for the all models estimated except the model where the copper price is taken as the dependent variable. The result indicates that the growth rate and its factors have significant long-run equilibrium relationships. Furthermore, the diagnostic tests performed in Table 9 prove that the model is free from problems associated with serial correlation , heteroscedasticity, and other model misspecifications.

The long-run coefficient is negative but insignificant in case of copper price, consistent with the previous model and long-run resource curse effect. Higher copper export price does not affect significantly on the real GDP growth in the long-run in the case of Mongolia. Moreover, the only significant coefficient in the long run is the exchange rate impact at the significance level of 1%. It means that exchange rate depreciation reduces the growth rate in the long run.

Having discussed the long-run effects of copper price, the short-run effects are discussed. Even though the contemporaneous and first lag of the change in the copper price are insignificant in the robustness check model, the second and third lag of the copper price are significant and positive at 1% and 5% respectively. It suggests that an increase in the growth rate of copper price has a positive short-run effect on the growth. Hence, the short-run effects of a copper boom are greatly contrary to the long-run effects in the case of Mongolia. The coefficients of the other short-run coefficients enter with the expected sign. The coefficient of lagged growth is negative and significant at 1%. It means that speed of adjustment to long-run is significant. The first lag of the dependent variable is positive and significant at 10%. The lagged changes of government spending, export and interest rate have expected signs and significant as well. Higher government spending, higher export and lower interest rate lead Mongolian economy to higher economic growth according to Table 11.

From Table 12, we can easily see that the significant sign of the one period lagged error correction term at 1% level in Column (1) supports the results from the bounds test that suggest bidirectional causality between GDPGROW and its determinants. Furthermore, unidirectional causality exists between GDP growth and copper price.

Table 8. Robustness check- Results from the ARDL bounds testing approach to cointegration

No.		Model	ARDL	F-stat	Significance	Conclusion
1	F(GDPGROW|	COPP, LOGGOV, LOGEXP, INT, INF, EXCH)	(2,4,4,5,5,4,5)	8.84	***	Cointegrated
2	F(LOGGOV|	GDPGROW, COPP, LOGEXP, INT, INF, EXCH)	(3,3,1,3,5,5,5)	7.496	***	Cointegrated
3	F(LOGEXP|	GDPGROW, COPP, LOGGOV, INT, INF, EXCH)	(4,4,5,5,4,0,4)	7.846	***	Cointegrated
4	F(INT|	GDPGROW, COPP, LOGGOV, LOGEXP, INF, EXCH)	(5,5,4,4,5,5,1)	7.399	***	Cointegrated
5	F(INF|	GDPGROW, COPP, LOGGOV, LOGEXP, INT, EXCH)	(5,0,5,1,4,5,2)	9.071	***	Cointegrated
6	F(COPP|	GDPGROW, LOGGOV, LOGEXP, INT, INF, EXCH)	(5,2,2,1,0,5,4)	2.48		Not-cointegrated
7	F(EXCH |	GDPGROW, COPP, LOGGOV, LOGEXP, INT, INF)	(3,1,1,0,4,0,0)	3.51	**	Cointegrated
	Lower bound critical value for k=6		2.33*	2.63**	3.27***	
	Upper bound critical value for k=6		3.25*	3.62**	4.39***	

Notes: ARDL denotes the selected ARDL model based on the AIC; Critical values for lower and upper bounds were obtained from Pesaran et al.(2001) for case IV. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 9. Robustness check- Results of the diagnostic tests conducted on the model of interest

No.	Model	ARDL	F-stat	Breusch-Godrey serial correlation	Breusch-Pagan-Godprey	ARCH-LM	Ramsey RESET	R-squared	Adj.R-squared
1	F(GDPGROW| COPP, LOGGOV, LOGEXP, INT, INF, EXCH))	(2,4,4,5,5,4,5)	8.8 ***	1.75 (0.21)	0.93 (0.578)	0.65 (0.66)	1.9(0.13)	0.85	0.61

Notes: The AIC was used to select the optimal lag order; () refers to the p-values associated with the test. * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 10. Robustness check- Long-run coefficients

Regressor	Coefficient	Standard Error	T-statistics
COPP	-3.615	8.357	-0.433
LOGGOV	0.617	9.375	0.066
LOGEXP	-17.296	12.473	-1.387
INT	-0.551	1.292	-0.427
INF	-0.407	0.243	-1.672
EXCH	-138.455	32.786	-4.223***

Notes: * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

Table 11. Robustness check- Short-run coefficients

Regressor	Coefficient	Standard Error	T-statistics
C	672.603	72.473	9.281***
@TREND	1.353	0.144	9.405***
D(GDPGROW(-1))	0.197	0.109	1.814*
D(COPP)	-3.634	10.085	-0.360
D(COPP(-1))	17.238	11.006	1.566
D(COPP(-2))	38.647	11.599	3.332***
D(COPP(-3))	29.809	11.997	2.485**
D(LOGGOV)	12.761	3.753	3.400***
D(LOGGOV(-1))	24.353	5.336	4.564***
D(LOGGOV(-2))	21.536	4.926	4.372***
D(LOGGOV(-3))	11.555	3.777	3.060***
D(LOGEXP)	7.546	6.463	1.168
D(LOGEXP(-1))	24.215	5.696	4.251***
D(LOGEXP(-2))	9.955	5.469	1.820*
D(LOGEXP(-3))	23.085	5.980	3.860***
D(LOGEXP(-4))	14.875	5.708	2.606**
D(INT)	-3.139	0.674	-4.659***
D(INT(-1))	-3.385	0.844	-4.009***
D(INT(-2))	-2.061	0.858	-2.402**
D(INT(-3))	-0.923	0.777	-1.187
D(INT(-4))	-1.678	0.709	-2.367**
D(INF)	-0.568	0.155	-3.658***
D(INF(-1))	-0.031	0.151	-0.206
D(INF(-2))	0.563	0.151	3.714***
D(INF(-3))	0.564	0.149	3.777***
D(EXCH)	19.241	14.700	1.309
D(EXCH(-1))	343.404	55.480	6.190***
D(EXCH(-2))	141.522	53.191	2.661**
D(EXCH(-3))	93.057	47.786	1.947*
D(EXCH(-4))	192.544	44.581	4.319***
CointEq(-1)*	-1.448	0.155	-9.350***
Diagnostic tests			
R-squared		0.87	
Adjusted R-squared		0.73	
F-statistics		6.40(0.00)***	

Notes: * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level. ECM (-1)= GDPGROW - (-3.6150*COPP + 0.6172*LOGGOV - 17.2962*LOGEXP-0.5510*INT -0.4069*INF -138.4545*EXCH)

Table 12. Robustness check- Granger causality results based on VECM framework

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	**ΔGDPGROW**	**ΔCOPP**	**ΔLOGGOV**	**ΔLOGEXP**	**ΔINT**	**ΔINF**	**ΔEXCH**
$\boldsymbol{\Sigma\Delta GDPGROW(t-i)}$		1.96(0.85)	1.60(0.9)	1.81 (0.87)	1.15(0.94)	5.38(0.37)	0.66 (0.98)
$\boldsymbol{\Sigma\Delta COPP(t-i)}$	13.34 (0.02)**		7.85 (0.16)	2.75 (0.76)	10.07 (0.07)*	2.96 (0.71)	10.25 (0.06)*
$\boldsymbol{\Sigma\Delta LOGGOV(t-i)}$	4.48 (0.48)	4.58(0.47)		6.09 (0.29)	1.06 (0.95)	1.71 (0.88)	3.22 (0.66)
$\boldsymbol{\Sigma\Delta LOGEXP(t-i)}$	4.45 (0.49)	2.15(0.82)	4.75 (0.44)		6.22 (0.28)	2.05 (0.84)	4.10 (0.53)
$\boldsymbol{\Sigma\Delta INT(t-i)}$	6.57 (0.25)	2.26(0.81)	3.17 (0.67)	9.16 (0.10)*		9.36 (0.09)*	4.52 (0.47)
$\boldsymbol{\Sigma\Delta INF(t-i)}$	6.46 (0.26)	7.42(0.19)	2.25 (0.81)	1.15 (0.94)	5.55 (0.35)		1.42 (0.92)
$\boldsymbol{\Sigma\Delta EXCH(t-i)}$	10.25 (0.07)*	1.43(0.63)	2.41 (0.79)	7.20 (0.20)	0.92 (0.96)	3.29 (0.65)	
ECM(t-1) (t-statistics)	-0.38(-3.18)***	----	----	----	----	----	----
Direction of causality	COPP→GDPGROW			INT→ LOGEXP	COPP→INT	INT→ INF	COPP → EXCH
	EXCH→ GDPGROW						

Notes: () refers to the p-values; * denotes significance at the 10% level; ** denotes significance at 5% level; and *** denotes significance at 1% level.

5. CONCLUSIONS

This paper investigated the determinants of Mongolian GDP growth rate especially copper price effect by analyzing the short and long-run relationships among growth rate, copper price, government spending, export, interest rate, inflation and money supply. To do so, the unit root test, cointegration test, and Granger causality test within VECM framework were performed.

Conclusively, the results confirm significant short- and long-run relationships between growth and its factors. However, the variable of interest most – copper price did not show significant long-run effect, unfortunately. But significant one, three and four lagged effect in the short-run were successful enough result to highlight Mongolian economy's excessive dependence on commodity export. Additionally, it shows the importance of government spending.

This finding suggests that Mongolia is too vulnerable to world market shocks due to its high dependence on commodity export and inability to change the commodity price in the world market, it has to strengthen another sectors such as agricultural and manufactural sectors to avoid Dutch disease. Hence, a main question to be arisen is whether Mongolia has enough "immunity" to protect itself from radical inconstancy in its terms of trade. The Mongolian government has to urgently implement to conduct countercyclical macroeconomic policies and save during a boom to be able to maintain its expenditure during a crisis and prevent itself.

Nevertheless, we can easily recognize that the Mongolian government had difficulty to implement these policies in practice and reached to almost zero growth rate in 2016.

Moreover, as mentioned in many empirical papers, institutional quality makes a huge difference when taken into consideration suggesting that the resource curse can be avoided by the improvement in the quality of governance. A weak institution leads to not only inefficient redistribution in short-run but also resource curse in the long-run. Thus, adding more control variables such as quality of government such as rule of law and indicators of monetary and fiscal policies' efficiency is necessary for the further research.

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국문 초록

천연 자원 가격이 몽골경제성장에 미치는 영향

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경제학부 경제학 전공

Gankhuyag Oyunkhand

자원부국의 경제성장이 자원빈국에 비해 느린 경향을 일컬어 자원의 저주라고 한다. 이 문제에 대한 실증연구의 결과들은 분명하지 않고 상반된 결과를 제시하고 있다. 본고에서는 천연 자원이 풍부할 뿐만 아니라 원자재가 총수출의 98%를 차지하는 몽골 경제를 분석대상으로 하여, 원자재 시장이 호황이거나 불황일 때 몽골 경제가 어떠한 영향을 받는지 단기와 장기로 구분하여 검정하였다. 이를 검정하기 위해 백터오차수정모형(VECM)을 이용하였으며 그레인저 인과관계 분석을 통하여 몽골 경제성장율과 세계시장에서의 구리광 가격 간의 인과관계를 검정하였다. 분석결과로 원자재 호황이 단기적으로는 유의한 긍정적인 효과를 미치나 장기적으로는 아무 영향을 안 주는 것으로 나타났다. 그레인저 인과관계 분석 결과로는 구리광뿐만 아니라 정부 총지출, 기준금리와 통화량이 유의한 영향을 주는 것으로 검정 되었다. 통제변수를 변경하면서 실시한 강건성(robustness) 분석에서도 동일한 결과를 확인할 수 있었다.

주 요 어 : 원자재 가격, 자원의 저주, 몽골경제성장

학　번 : 2016-22062