Applying Cluster Analysis and Exponential Smoothing to Analyze the Exportation in Mongolia

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Abstract

This paper aims on analyzing the international market allocation of exportation from Mongolia and identifying who were the major trading cluster countries and the future exporting trend of Mongolia. This research used Mongolia export secondary data from the last 12 years since 2005 to 2016. The results of the cluster analysis of exportation in Mongolia indicated more than half of total exportation was to China market since 2012 to 2017. The results of the exponential smoothing pointed out the future trend of exportation in Mongolia will be continuously growing.

Keywords: Mongolian export, Cluster analysis, Exponential smoothing

1. Introduction

1.1 Mongolia economy

The Mongolia economy had shown unprecedented growth over the last two decades. A number of factors had driven the expansion of this resource-rich nation. Mongolia is a landlocked, eastern and central Asian country. Mongolia is bordered by Russia to the north, to the south, to the west, and to the east by China. Mongolia joined the WTO (World Trade Organization) with 159 members in 1997 and joined the CAREC (Central Asian Economic Cooperation Program) in 2001. Over the last 3 years, exportation had begun to intensively increasing since 2014. In 2014, Mongolia's economy grew 7.8%, which increasing had reached 52 million livestock and agricultural sector grew by 14.4%. Mongolia had a foreign trade with 136 countries and as a result of the total turnover of foreign trade for 2016 amounted $8274.5 million and export 4916.3 million (Table1).

Table 1 Mongolian foreign trade (2012-2017 years, million USD)

Year	Total	Export	Import	Balance
2012	11123.0	4384.7	6738.4	-2353.7
2013	10626.9	4269.1	6357.8	-2088.8
2014	11011.0	5774.3	5236.7	537.7
2015	8466.8	4669.3	3797.5	871.8
2016	8274.5	4916.3	3358.1	1558.2

Source: National Statistics Office of Mongolia (2016)

1.2 Mongolia export

Mineral products were the major exportation and directly related to total exportation in Mongolia. Exports increased by 5.3% or USD 248.1 million of last year. The reason was industry products export increased 2.6% and mineral products export increased 3.1%.In addition, Mongolia exported $1.606 million tons of copper concentrate and $ 968 million ton of crude oil the main reason for high growth in the mining sector (Table 2). Mongolia had exported goods to 131 foreign countries including China (85.0%), United Kingdom (10.7%), Russian Federation (1.1%) and 96.8% of whole export comes to these countries (National Statistics Office of Mongolia, 2016).

Table 2: Mongolian export products (2014-2016 years, million USD)

Type	2014	2015	2016
1.Mineral	5,184	4,092	4,238
1.1 Copper concentrates	2,574	2,280	1,606
1.2 Coal	849	555	968
1.3 Crude oil	635	387	336
1.4 Iron ores and concentrates	446	227	261
1.5 Semi-manufactured gold	405	421	758
1.6 Other	275	222	304
2.Livestock	361	329	316
2.1 Textile	294	252	242
2.2 Other	66	78	67
3.Agriculture	29	27	24
4.Industry	199	219	337
5.Other	2	2	1
Total	**5,774**	**4,669**	**4,916**

Source: National Statistics Office of Mongolia (2016)

The current study only focused on the export counties and future trend of major exportation for Mongolia. This paper aims on applying cluster analysis and exponential smoothing to analyze the major exporting countries and predicting the future exporting amount for each cluster countries. This study also provided recommendations for Mongolia government.

2. Literature Review

Currently, it had never been used Cluster analysis and Exponential Smoothing to analyze the exporting data in any research. This study proposed a new methodology to analyze the major exporting cluster countries for formulating and implementing global marketing strategy in Mongolia.

Batnasan (2000) emphasized the importance of promotion policy in exportation, through the tariff method to regulate the importation structure, and to develop national production policy then turn it for increasing exports. Amarjargal (2007) utilizing the gravity model indicated the Free Trade Agreement with Japan would increase foreign trade by almost fifty percent, and if Mongolia could join the Northeast Asia integration would be increasing less significantly.

Pomfret (2012) investigated the economics of seven countries in Asia with natural resources. He emphasized Mongolia had a small economy compared to other Asian mining extraction countries. Mongolia was able to lose its opportunities due to major challenges in the mineral sector as well as major competitors.

Davaakhuu, Sharma and Bandara (2014) developed export performance during economic transition in Mongolia by using the experience of Mongolia before 1990. They suggested export-oriented strategy and foreign investment positively impacted on Mongolian exports.

Dodo, Thampapillai, Hansen, and Bolat (2014) illustrated the depreciation of the mine was reduced by the reinvestment of the RRT (Resource Rent Tax) and other government revenues from mining. They emphasized Mongolian coal deposit Tavan-Tolgoi. They illustrated the impact of mining on Mongolia's macroeconomic performance.

Li, Gupta and Yu (2017) proposed natural resources could support economic growth for Mongolia. They concluded scaling up public investment could provide a boost to economic growth. They emphasized the fiscal policy and infrastructure investments to develop the Mongolian economy. In doing so, Mongolia's economy could grow steadily like developing countries.

3. Methodology

This study developed and compared Mongolia export for 106 countries by using secondary data from the last 12 years since (2005-2017). The main the source of the data is NSOM (National Statistics Office of Mongolia, 2016).

3.1 Cluster analysis

The clustering techniques are also called data segmentation techniques which could segment or group the available data. This study applied the nonhierarchical clustering program and the algorithm is as follows:

1. Select k to be initial seeds
2. Assign each observation into the clusters
3. Reallocate observations to one of the *k* clusters
4. Calculating the sum of each observation in clusters and *K* shall be the cluster desired number
5. The initial allocation of observation *a* to cluster C_a

$$C_a = \frac{(\mathrm{Sum(a)} - \mathrm{Min})(\mathrm{K} - 0.0001)}{Max - Min} + 1$$

3.2 Exponential Smoothing

Brown (1959) and Holt (1957) developed the exponential smoothing. Exponential smoothing is a predicting method that weights the time series data. Exponential smoothing is one of time series methods and forecasting the future trend for time series data. This study applied the exponential smoothing as follows:

For any fixed $a \in [0,1]$, the one-side moving average $\hat{A}_t = aX_t + (1-a)A_{t-1}, t = 2, \ldots, n$ and $\hat{A}_1 = X_1$

4.Results

4.1 Cluster analysis

Figure 1 displays the plot of means for 6 clusters. The cluster 1 is above all other clusters and means cluster 1 is a major exporting country for Mongolia. Mongolia main mineral exports trade partner is China. Mineral products are copper concentrate, coal, crude oil and iron ore (Custer 1). Mongolia exported most amount of gold to the United Kingdom. The amount of gold exports to UK directly depended on world - gold prices (Cluster 2). Italy, Luxemburg, South Korea, Russia, and the USA (Cluster 3) varieties of exporting trend were dynamic and unstable. Russia is the neighborhood country of Mongolia. Russia is the largest country in the world, but its overall exporting structure is similar to Mongolia which is mining. Therefore, Mongolia is limited to exporting mining products to the Russian. The Government of Mongolia ratified the "Foreign Relations Economy Program" in 2009 giving high priority to foreign trade and more emphasis on including export promotion policies in 2013. However, the results display the exporting trend was down and unstable. Mongolia exported products carpet to Canada (Cluster 4) and other products with very little percentage, the results insignificantly influenced on the exportation of Mongolia. Mongolia had exporting growth trend to Switzerland (Cluster 5) for last 4 years. The results indicated that Switzerland (Cluster 5) is a high growth market and Mongolia should aggressively operate this market. The cluster 6 is other countries but lower than zero insignificantly affect Mongolian economic.

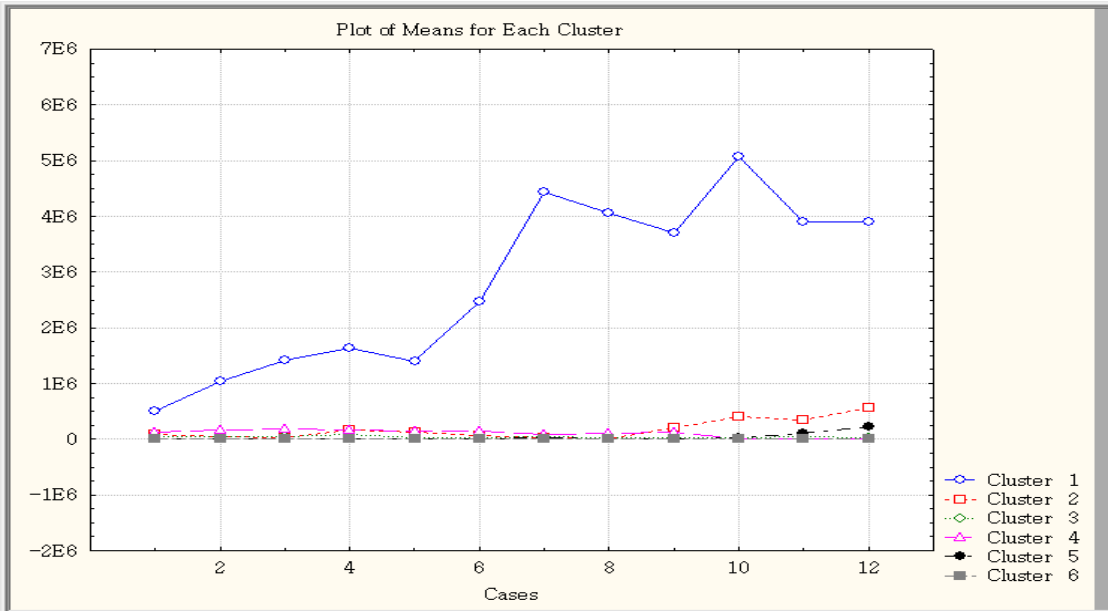

Figure 1: Plot of means for each cluster

4.2 Exponential smoothing

Table 2 shows the exporting future trend for six clusters. The results show that Mongolia exporting to China is increasing trend in the near future but probably saturated in the following years. The smoothed series data shows downtrend from 2005 to 2010 and growth up from 2011 to 2017. In the recent 7 years, Mongolia exporting to China continuously was growing. Therefore, Mongolia's mining exportation could also boost economic growth. The table 1 indicates Mongolia exported to UK increasing in the near future but probably saturated in the following years. The smoothed series results show downtrend from 2005 to 2008 and growth up in 2009 but went down from 2010 to 2013 then grew up again from 2013 to 2017. Mongolia exported to Luxemburg, South Korea and USA with downtrend, only Russia with growth trend. The smoothed series results show downtrend from 2009 to 2017. The results display Mongolia exported to Switzerland increasing trend in the near future. The smoothed series results show increasing from 2005 to 2017.

Table 2 The exporting future trends for each cluster by exponential smoothing

Year	China	United Kingdom	Italy	Luxemburg	South Korea	Russia	USA	Canada	Switzerland
2005	2796779	169511.3	40729	620.95	85663.78	35049	204118.6	165083.4	14479.0
2006	2568422	161270.2	39141	603.48	83070.93	55645	197611.7	159661.6	33939.2
2007	2416524	149002.7	39266	1748.43	76787.23	91544	189540.8	160714.1	51396.1
2008	2316007	136314.9	41013	1950.97	73213.85	145039	18062.7	162508.6	66151.2
2009	2247995	139265.9	41134	18112.30	68833.67	227826	173762.4	163730.3	78821.4
2010	2162586	138027.9	40166	20961.60	63437.93	344407	157607.8	162090.4	89537.9
2011	2192954	130963.8	39327	18849.34	60107.39	513403	142280.5	160021.8	98326.0
2012	2417645	119864.8	40376	16948.60	57857.88	754783	128402.3	153027.0	106944.0
2013	2581853	109068.2	39499	15244.95	53253.48	1089881	115778.7	149408.8	112809.7
2014	2694301	118235.3	40699	13713.52	49185.46	1550561	104465.7	148001.2	116406.4
2015	2932211	146285.8	41771	12336.95	45576.37	2180694	95452.8	133169.7	121257.7
2016	3030002	165425.1	41934	11099.59	47692.90	3035813	87693.9	119869.2	133614.5
2017	**31177185**	**204601.2**	**41098**	**9987.35**	**43735.67**	**4176950**	**79884.7**	**108123.4**	**157860.1**

5.Conclusion and Discussion

Mongolia's economy depends on neighbor countries as Russia and China. Mongolia trading with about 106 countries, China, Russia, Japan, South Korea, USA, Switzerland and Canada are major trading countries with high proportion of total exporting amount. Mongolia's exports of mineral are influenced by market prices in the world. Mining exportation significantly impacts on Mongolia's economic growth. According to the results, the global strategies for Mongolia should focus on major markets and high proportion exporting products to gain the national competitiveness. Formulating and implementing excellent global strategies will help this country have competitive advantage in the future and far away from economic depreciation. Mongolia livestock reached 61.5 million head in the 2016 year. Mongolia can export of meat 50-60 thousand tons on average per year. In Mongolia, exportation of meat, milk and dairy products can be a major diversification. To do this, the government needs to implement a meat-production reform program that will qualify for meat and meet the world meat market standards. Japan has high demand for copper concentrate. Transport costs are high, so the opportunity to sell in another country is limited. If transportation problem can be resolved, it is possible to sell mining products in highly developed countries such as Japan and South Korea.

Foreign trade is influenced by foreign currency exchange rates and the stability of the exchange rate creates the most favorable conditions for foreign trade. Therefore, the Government and the Bank of Mongolia shall pay attention to the stable currency exchange rate policy. The government need increase the number of key export partners and fewer export products (copper concentrate, zinc concentrate, gold, crude oil, coal, and cashmere). The world needs around 7.6 billion tons of coal a year, of which 50% is used by China alone. Mongolia exports coal to China but the price is less than Australia's coal price due to large quantity discount. The government needs an effective export promotion policy to enhance the national competitiveness.

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