IMPROVE THE COMPETITIVENESS OF MONGOLIAN MINING INDUSTRY

By

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Abstract

Mining industry is important and main determinant sector of country economic development. Especially the natural resource is highest limited in the world. In recent decades, demand of mining products has grown explosively in high industry, construction and infrastructure sectors. Therefore, mining industry is required right policy and high technology from country for using wisely. Specially mining resource has two side of sword. It can only give a high benefit and profit to the country when produce final mining products. On the other hand, it can give negative impact on country development, if the resource has traded by raw. Therefore, understanding the mining industry is related with industry development of country, outside market demand and competitive position in the world market.

This study investigates whether and how factors (technology, financial resource, transportation and logistics management and maturation of mining companies) influence competitiveness of Mongolian mining industry by exporting relationship between variables. Furthermore, research has two main objectives, which are first main objective is to analyze the contribution of mining industry on the Mongolian economy. The second objective is to analyze the export competitiveness of Mongolian mining industry. To do this, the research is based on secondary data. Data was collected from statistical reports, global competitive report, financial annual report of listed mining companies and outside research papers. Different statistical methods were employed to analyse the data. These methods include stochastic model, constant market share model, revealed competitiveness advantage (RCA), trade specialization index (TSI), multinomial logit model and multiple regression.

The findings provide an explanation why some mining industry has strengthen in world market, what kind of effort was influenced and how did country policy makers behave. On the basis of the research result, some suggestions were made for strategies of Mongolian mining industry competitiveness.

Mongolian listed mining companies report may be one of limitations in this study and future studies may investigate financial capability of Mongolian mining companies. Although the present study showed some limitations, this study has significance for strategy on mining industry level development.

I. Introduction

1.1 Background

Mongolia has transferred free market economy since 1990. During the last twenty years, the mining industry has grown fast and become main sector of economy. The contribution of mining GDP has constantly improved over the years from 17 percent in 2000 into 36 percent in 2010. From 2000 until 2010, the output of mining industry increased for 65.4 percent of national industrial output and 42.7 percent of its export revenue.

On the other hand, Mongolia is a country rich of natural resources and mineral sector employs more than 39,800 people which is 32 percent of total work force of industrial sector.

Besides the contribution to the GDP and employment, mining sector is also important sector in science and technology development through operation of processing industry. Today mining industry has accumulated experience of 60 years in science and technology sectors. During this period, the processing manufacture has developed two major parts: mineral exploration manufacture and processing manufacture. Although mining industry has required huge investment and good infrastructure. Today Mongolian mining industry arrives to transfer next stage of industry development that processing minerals and improve the competitiveness of mining industry in world market.

The objective of developing mining industry is to increase the value creation of per produced minerals and contribute the heavy industry development of country. And mining industry is main base of country for transferring development of heavy industry.

Since 80 percent of mining products is exported, the main issue of mining industry is not complete without discussion mining industry competitiveness and improvement of value creation. The main concern is how to achieve highest competitiveness level and what measures have been taken to increase the export competitiveness.

1.2. Research objectives

This research has two main objectives and several specific objectives. The first main objective is to analyze the contribution of mining industry on the Mongolian economy. Meanwhile the specific objective is to analyze the linkage of mining industry with private mining companies, technology and infrastructure.

The second objective is to analyze the export competitiveness of Mongolian mining industry. Furthermore, the specific objective is to analyze the determines of Mongolian export competitiveness comparing with Australia.

1.3. Measuring competitiveness

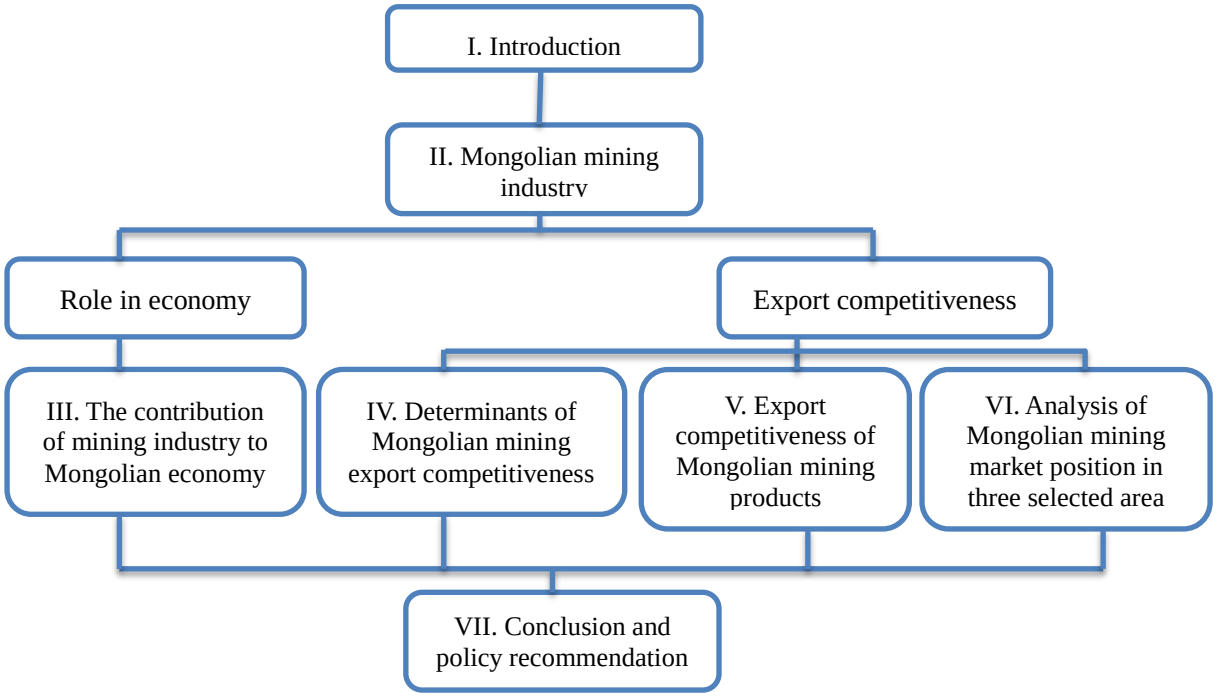
The many researchers have to define competitiveness. The definition varies depending on which level of product and industry is selected. For example, the definition of competitiveness of a country level will be different from that on the firm level. Moreover, the competitiveness can be measured at the national, industry or firm level. In this research, competitiveness will be analyzed on a product basis, with the resource as minerals, and on a manufacture level, with the countries as Mongolia or compared with Australia.

After determining the level of the analysis, the next issue is the method of measuring competitiveness. On a product and national level, there are two approaches, the producer approach and market approach. The producer approach measures competitiveness using price (Institutional of international economics, 2012) and productivity and efficiency (Latruffe, 2010). Meanwhile, for the market approach, one of the most common measurement is market share (Torok, 2008) and purchasing power (Institution of international economics, 2012).

1.4. Dissertation outline

The dissertation consists of seven chapters. Beginning with the introduction and followed by the brief overview of Mongolian mining industry. The main part consists of four chapters, which can classified into two parts. The first part regarding the contribution of mining industry in Mongolian economy, which consists of one chapter and the second part, export competitiveness of Mongolian mining product. The second part consists of three chapters: the determinants of Mongolian mining export competitiveness, export competitiveness of Mongolian mining products and Mongolian mining market position in three markets. Lastly, conclusion and policy recommendation are presented. The dissertation flow is presented in figure 1.1.

Dissertation outline

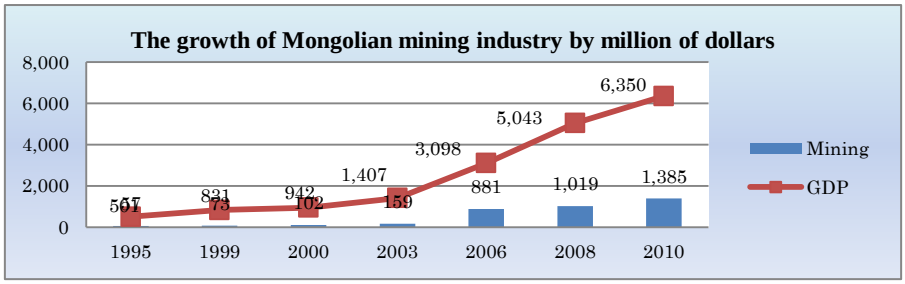


I. About Mongolian mining industry

1.1 Introduction

Mining industry is one of contributor of economy and developed since 1911 in Mongolia. In 1990, Mongolia has transferred to the free market system and reformed main economy of country. Since 2000, Mongolian mining industry has grown fast and contributed significantly in Mongolian economy. Figure 1.1 is shown the growth of Mongolian mining industry.

Figure 1.1: The growth of Mongolian mining industry by millions of dollars



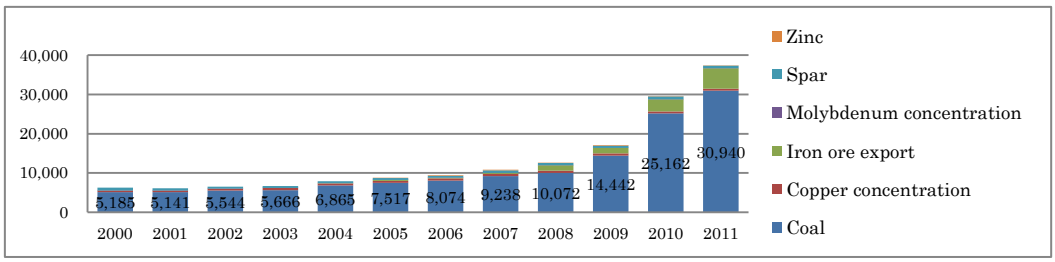
Source: Mongolian government agency, annual report 2011

The mining industry's main development is based on privatisation of economy and internal market demand, which is pursued to establish private entrepreneurs in mining industry. Today Mongolian main mining products are considered copper, coal, iron ore and gold. Figure 1.2 is shown the main mining production of Mongolia from 2000 to 2011.

Although today Mongolian mining industry is faced main problem that competitiveness in world market. The main reason is depends on 3 main factors that 1) raw mining ore is exported to the outside market with low price, 2) weak development of processing industry and 3) few gates in railroad to the final markets.

Therefore, today Mongolian mining industry arrives next stage of industry development and improves the competitiveness in world market.

Figure 1.2: Mongolian mining production, 2000-2011

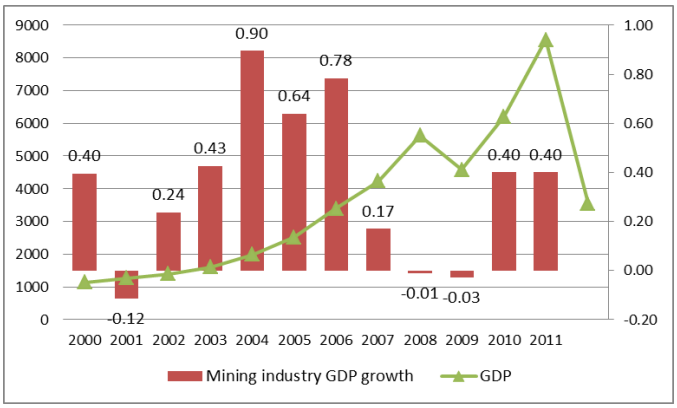


Source: Mongolian government agency, annual report 2011

1.2. GDP contribution

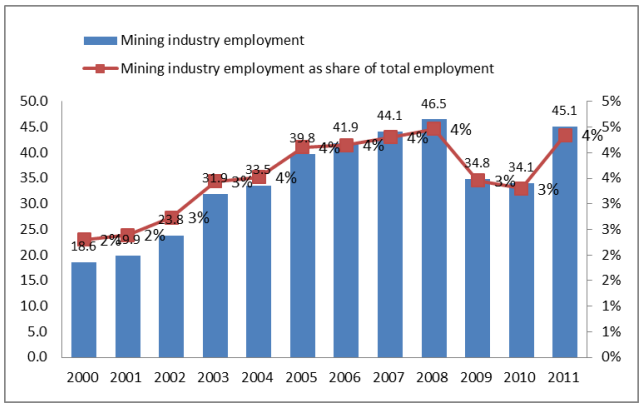
The mining sector is an important contributor to the country's GDP. Between 2000 and 2011, mining industry added, on average, approximately $525 million annually to Mongolia's real GDP. The mining industry represents approximately 15% of country's GDP. Real GDP growth in the mining industry has experienced a significant amount of volatility over the past decade, as a result of fluctuations in mineral prices, in particular for coaking coal, copper concentration, iron ore and production costs in recent years (see Figure 1.3 below). This volatility however, is not specific to mining industry and has also been observed in the overall mining sector. Commodity prices in general, including coal, copper and iron ore, have experienced significant swings over the past 10 years, reaching record highs at the end of 2008 to then collapse as the global recession ensued in 2009 and rebound again in 2010 and 2011. Sudden change in global activity cause commodity prices to fluctuate, which in turn makes the GDP growth of commodity-related sectors quite volatile.

Figure 1.3: Percentage GDP growth 2000-2011



Source: National statistic commission of Mongolia

Figure 1.4: Direct employment 2000-2011



Source: National statistic commission of Mongolia

1.3. Employment

The mining industry has also been an important source of employment in the country. In 2011, roughly 45.1 thousand people were directly employed in mining industry activities in Mongolia, with the industry adding approximately 30,000 jobs between 2000 and 2011. Mining industry employment has been rising steadily since 2005, both in level terms and as a share of total mining employment (see figure 1.4 above). In 2011, mining industry represented approximately 5% of total Mongolian mining employment compared to approximately 2% in 2000.

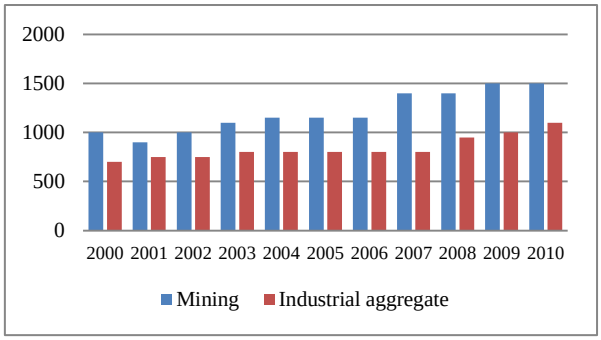
1.4. Wages and labor productivity

The rapid development of Mongolia's mining industry over the past decade has resulted in an acute and persistent shortage of qualified workers in the industry. Mining has not been the exception. Some of the factors contributing to the labour shortage in mining include an aging workforce, competing labour demands from other industries, and the rural and remote location of mines. In light of history high mineral prices, mining companies have responded to these labour shortages by offering relatively high salaries

and wages to their employees.

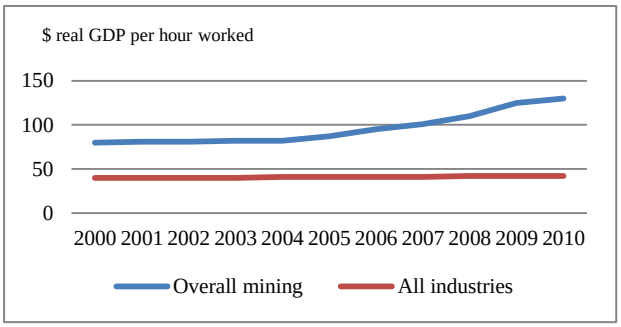
Between 2000 and 2010, average monthly wage (including overtime) in Mongolia's mining industry rose 31% to $1445, more than doubling the average monthly wage in Mongolia's overall industrial sector. In the mining sector the increase has been even higher. The Statistical Mongolia publishes average monthly wages for mining industry to 2010 (see figure 1.5 below). The represents a 37% increased from the levels recorded in 2000, and slightly higher than the average for the mining sector.

Figure 1.5: Average monthly wage, 2000-2010



Source: National statistic commission of Mongolia

Figure 1.6: Labour productivity, 2000-2010



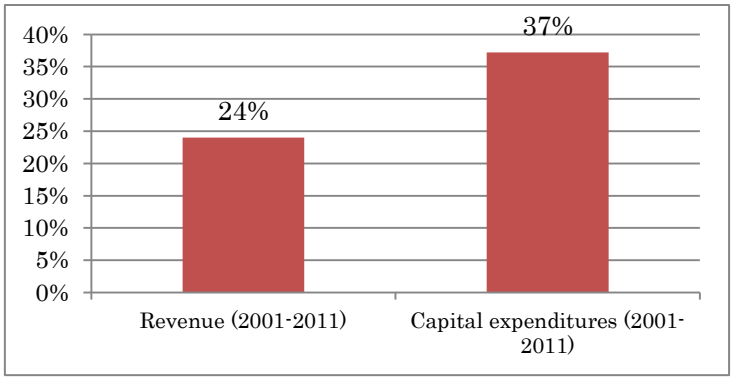
Source: National statistic commission of Mongolia

Historically, labour productivity in mining industry has been consistently higher than across all industries of the economy. The labour productivity advantage has been improved the over the year from $80 per hour worked in 2000 to $130 per hour worked in 2010. Figure 2.6 above shows that the increases in labour productivity, positively impacted by skilled labour and world market demand. A consequence is that labour productivity in mining sector has become high productive, meaning that each additional hour of work produces more output.

1.5. Capital investment and revenue growth

Mongolia's mining industry has experienced remarkably strong rates of growth in revenue and capital investment in recent years. As figure 1.7 below shows, an increased demand for coal in China market, coupled with rising energy prices, results in the total value of the sector's output growing at an average annual rate of 24% between 2000 and 2010. Similarly, capital investment in the sector grew at the average rate of 37% per year during the 2000 to 2011 period.

Figure 1.7: Revenue and capital investment average annual growth rate

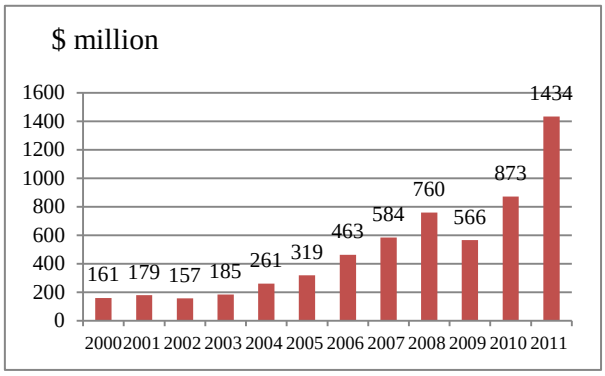


Source: National statistic commission of Mongolia, Goverrnment agency report 2000-2011

While production volumes have increased constant, the total value of mining production reached on $1.4 billion in 2011, marking a historical record and representing 9 times increase from the $105 million registered in 2000. As shown in figure 1.8 below, the value of Mongolian mining production started to increase in 2006 in response higher meneral prices.

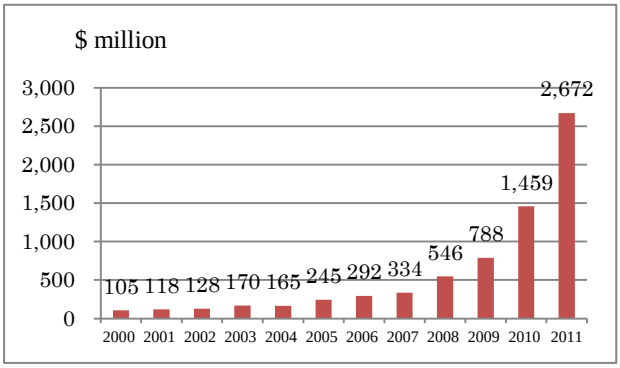
Mongolia's mineral extraction sector, as financing sources for large-scale projects increased sharply from 2000 to 2011. In 2011, capital expenditure were $2.8 billion and $495 million ten year average (see figure 1.9 below).

Figure 1.8: Mining production value 2000-2011



Source: government agency report

Figure 1.9: Capital investment 2001-2011



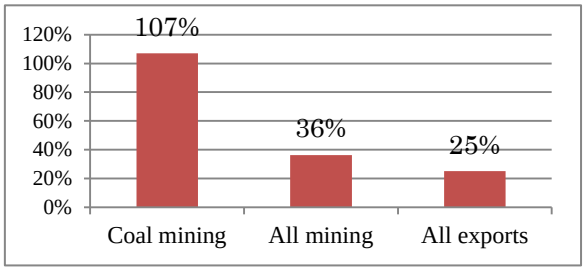
Source: National statistic commission of Mongolia

1.6. Trade performance

Exports from Mongolia's coal sector, measured in dollar terms, grew at an average rate of 107% during the past decade, well above the 25% average annual growth rate observed in Mongolia's overall exports and in line with the growth rate experienced by the overall mining sector (see figure 1.10).

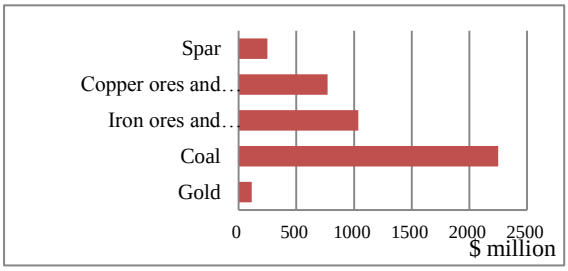
From an international trade perspective, coal accounts for an important portion of Mongolia's mining exports. Between 2000 and 2011 the sector contributed, on average, approximately 20% of the country's mineral exports. Indeed, as shown on figure 1.11 below coal exports, in dollar terms, were first in 2011. Mongolia's coal sector has benefitted from higher production and export volumes in recent years.

Figure 1.10: Average annual growth of exports, 2000-2011



Source: National statistic commission of Mongolia

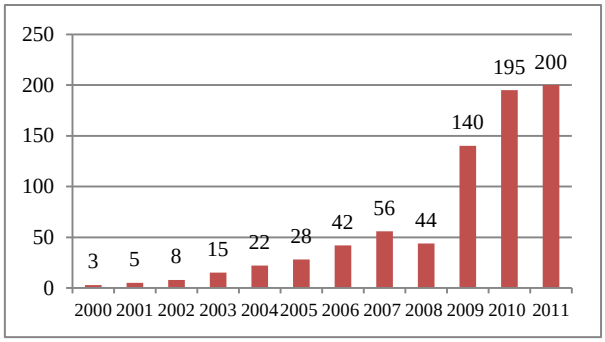
Figure 1.11: Exports of selected commodities in 2011



Source: National statistic commission of Mongolia

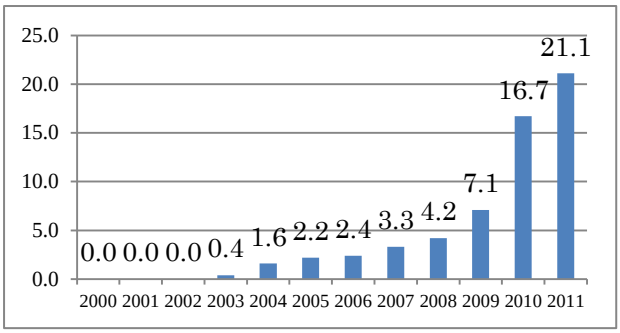
Sustained economic growth in emerging markets, particularly in China, has contributed to the increase in global coal consumption observed over the past decade. As shown in figure 1.12, China's coal consumption has increased sharply since 2009, as high industrialization and urbanization rates persisted in these economies throughout decade. Mongolia has benefited from the increase in global demand, as the country capitalizes on the vast amount of coal resources. For example, the total output of coal exports reached a high record of 21.1 million tons in 2011 (Figure 1.13).

Figure 1.12: China coal import by million tons



Source: China Statistical Yearbook

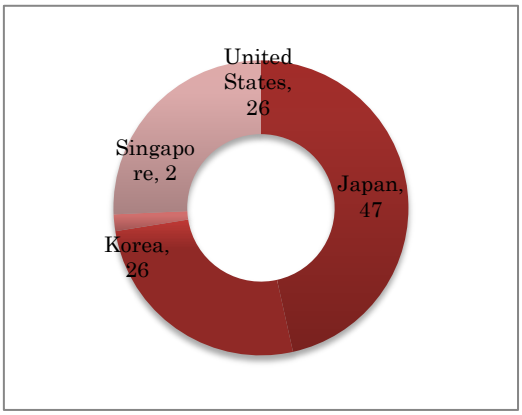
Figure 1.13: Mongolian coal export by million tons



Source: National statistic commission of Mongolia

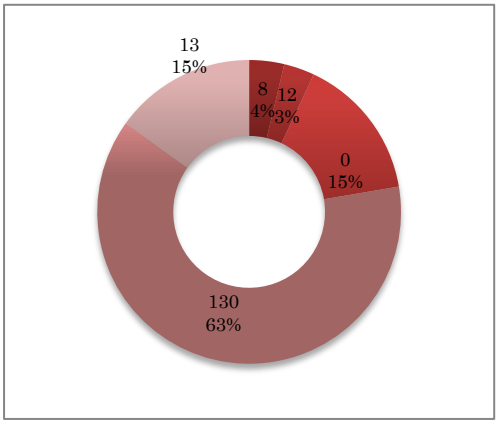
As indicated previously, most of mining products explored in Mongolia is exported while the large majority of mining products such as coal produced is used domestically for energy purposes. China (90%), Russia (2%) and Korea (2%) are the main market destination for Mongolian mining industry, followed by Japan (1%) and USA (1%). Figure 1.14 is shown the export markets. The majority of exported products are coal, copper, iron ore, gold and zinc.

Figure 1.14: 2011 exports of coal ore, $2.3 billion



Source: National statistic commission of Mongolia

Figure 1.15: 2011 exports of copper, $963 million

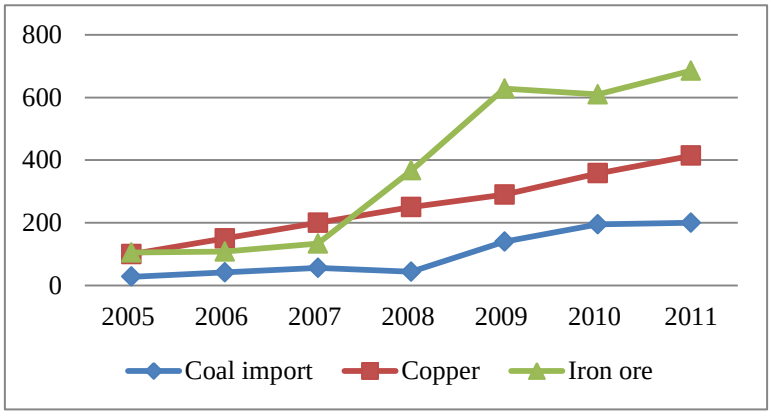


Source: National statistic commission of Mongolia

1.7. Mineral price trends

Prices for both coal and iron ore prices have increased since 2005. As with other commodities, the price of coal reached an all-time high in 2008. However, with global economy entering into recessionary territory and the financial crises in full swing, coal prices dropped sharply in 2009, losing some of the gains made in the prior year. However, coal prices have remained well above historic price level, even during the recent recession. The following graph shows prices for thermal and metallurgical coal over the past 10 years.

Figure 1.16: Coal and iron ore prices



Source: National statistic commission of Mongolia

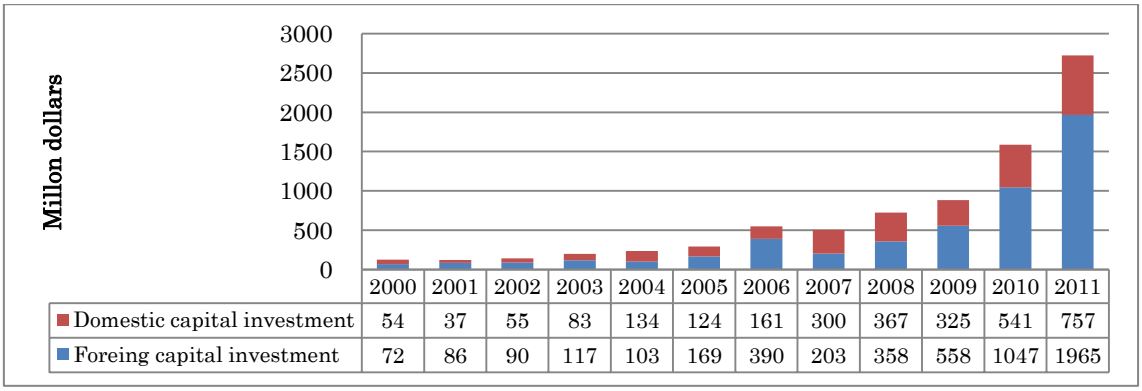
1.8 Foreign direct investment

Since the economy was opened up in 1990s, foreign investment has been increased. The foreign investment law of Mongolia and various changes are taken by the government. As a result, favorable external and internal legal environment was established and contributed business environment. Incentives such as tax exemptions, deductions and policies aimed at encouraging exports under foreign investment law and other related laws, this has had important factors to increase the foreign investment.

From 1990 to the end of 2011, 9750 foreign investment companies from 75 countries were registered with the government, implementing total direct investment of about $3.1 billion. In 2011, there were 3868 companies registered with total investment of $1.97 million. Figure 2.17 is shown the foreign direct investment inflows of Mongolia.

The mining industry was highly attracted foreign direct investment since 2000. The figure 2.18 and 2.19 is shown the foreign direct investment by sectors and countries.

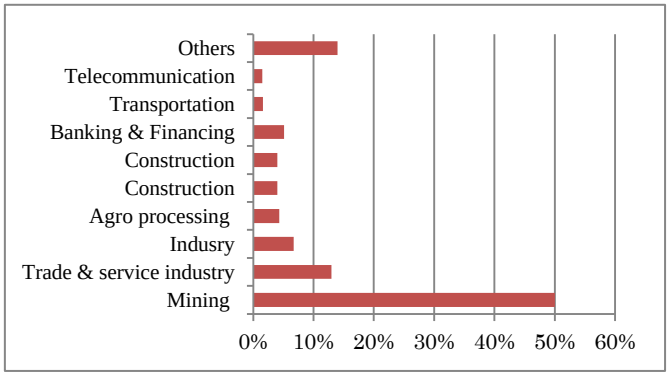
Figure 1.17: Foreign direct investment inflows by year



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Domestic capital investment	54	37	55	83	134	124	161	300	367	325	541	757
Foreing capital investment	72	86	90	117	103	169	390	203	358	558	1047	1965

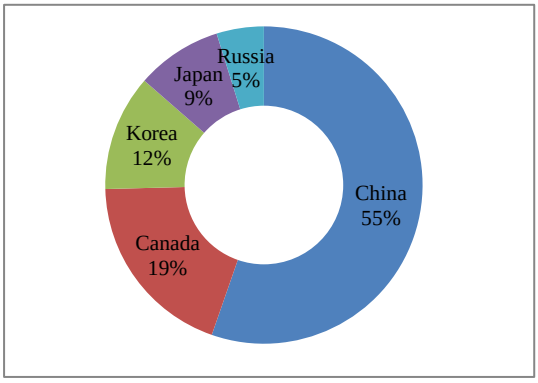
Source: Mongolian national statistical report, 2000-2011

Figure 1.18: Cumulative sectorial distribution of FDI inflows up to 2011



Source: Dashnyam, 2011. Trends in international investment flows

Figure 1.19: FDI by country



Source: Mongolian statistical report, 2011

The foreign investment companies have created more than 67,000 new jobs from domestic workforce and 2,500 foreign employers are working at the professional, technical and management levels. Foreign investment companies operating in Mongolia provided totally MNT10.5 billion as tax incomes to the state, which posses 14.2% of the total tax incomes in 2000 (Mongolian statistical report, 2011).

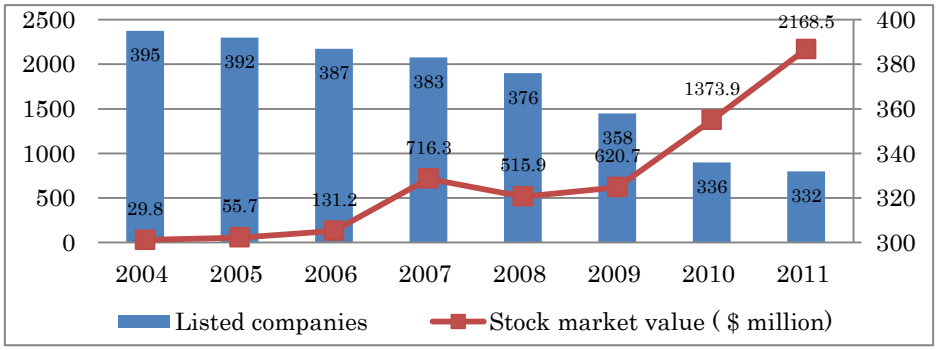
1.9 Security market development

Mongolian secondary market has begun in 1995 by regulation role of Mongolian Stock Exchange. In 2011, total listed companies are 476 in Mongolia. However stock market liquidity has fallen between 1997 and 2003. In 1997, the sharing value was 15 million, then fell sharply to $3.1 million in 1999 and $0.2 million in 2003. There have following main reasons. First, high ownership concentrations, significance decrease the demand and supply of shares. Secondly, in 1996 government policy for privatization method changed. Government has preferred the auction method of privatization. In the period from 1995, many of the original stockholders sold out. In addition, from 1996 the government continued the privatization process by selling down its stakes in partly

privatized companies by auction run by the State Property Committee. It reduces new issuing shares by the government through Mongolian Stock Exchange. Thirdly, unfavorable market climate caused by the high real interest rate, low household saving rate, high inflation and unemployment rate and weak financial sector development were influenced the activity of the equity market (Bolormaa, 2004).

However, Mongolian Stock Exchange has been rapid growth in the past five years. In 2006, the stock exchange was $83 million, although it has grown $406 million in 2008. In 2011, Mongolian stock market has increased sharply again until S$2 billion. As of March 2012, it has 332 listed companies with a combined market capitalization of US$2.3 billion (Figure 1.20).

Figure 1.20: Mongolian stock market development



Source: Mongolian statistic report, 2004-2011

1.10 Legal framework

The Mongolian mining companies related main legislation, such as tax laws, environment and mineral laws, business operation laws, economic relation regulations and labor relations laws.

Foreign investment law. Mongolia has adopted a comprehensive investment law, established framework for foreign investment. The first Foreign Investment Law enacted in 1993. According to the Law the company has at least 25% of foreign interest is classified as foreign-invested company (Khulan, 2005).

Company law. The company law of Mongolia is the main authoritative legislation the governs all operations and activities of business entities in Mongolia. The Mongolia company law permits creation of two basic forms of business entities (Khulan, 2005):

1. An open of joint stock company whose shareholders' capital is divided into shares which is traded by the public. The name is registered "XK" (joint-stock company).
2. Or limited liabilities company whose shareholders' capital is divided into shares where the right to dispose of such shares is limited by the company's charter. The name is registered as "XXK" (limited liability company).

Capital investments for company shares made in cash, contributing assets or intellectual property. Owners' equity in "XK" shall be at least MNT10 million and in "XXK" is shall be at least MNT 1 million.

Contract law. Contract involving legal entities or land, as well as most other contracts shall be in writing and be certified by notary public. Performance of contractual obligations secured by penalties, pledges, including security loans by banks, money deposits and sureties.

Labor law. The labor law enacted in 1999 and amended in 2001 governs labor relations of state entities and foreign enterprises with Mongolian nationals, as well as purely Mongolian employment contracts. According to the labor law, the standard working day is set at 8 hours and the maximum working week is 40 hours. Basic annual leave for workers is 21 days.

II. The main contributions for Mongolian mining industry

2.1. Introduction

Over the year mining industry has grown significantly. In term of mining output has increased 12 times in 2011 to 2000, meanwhile the revenue increased by 9 times during the same period. Furthermore, the new companies entered in mining industry were increased in last 5 years. Today mining industry is highly determined by technology capability, the willing of companies and transportation advantages. These three factors are made main contributions for mining industry.

The mining industry is highly related with technology. The minimum cost of industry and high value creation are main core competence of firm. For that reason, the technology efficiency and resource productivity is main measurement of cost structure in mining industry. However, the location of mining companies and capability are made differences in technology efficiency side. Especially, the central region of larger mining industry has high productivity than rural area of mining industry.

The other important part of mining industry is capital allocation and financing. Today Mongolian bank sector is main contributors of financing for mining industry. For the purpose of capital allocation, the domestic investment was $54 million in 2000 to $754 million in 2011 with lower than 10% of interest rate. Also the foreign investment was increased $72 million in 2000 to $1965 million in 2011. As a result, the mining export and national manufacturing value-added has increased in last 5 year under national capital allocation.

The main objective of this chapter is to analyse the main contributors in mining industry with three specific objectives which is to analyse the technology efficiency,

capital allocation and financial performance of Mongolian mining industry. As a result, the main performance of mining industry consist the effect on cost reduction, value creation in mining industry for contributing economic development of country and improving capacity in world market.

2.2. Literature review

Technological efficiency: In recent years, there have been many studies on efficiency in developing countries. Economic efficiency takes on to increase output without using more conventional inputs. The use of existing technologies is more cost-effective than applying new technologies (Belbase and Grabowski, 1985; Shaprio 1977). Economic efficiency can be classified in two: technical efficiency and allocative efficiency. Technical efficiency measures the ability of a firm to achieve the maximum output with given and obtainable technology, while allocative efficiency tries to capture firm's ability to apply the inputs in optimal proportions with respective prices (Farrell 1957; Coelli et al. 2005).

Measuring technical efficiency is to use inputs and output quantity without introducing their prices. Technical efficiency can be decomposed into three components such as scale efficiency (the potential productivity gain from achieving optimal size of a firm), congestion (increase in some inputs could decrease output) and pure technical efficiency (Farrell 1957). The value of TE ranges between 0 and 1, and represents the degree of technical efficiency. If TE is equal to 1, telling the firm produces with fully technical efficiency.

Capital allocation: An important factor in wealth creation in an economy is the efficiency with which scarce capital is allocated to profitable investment opportunities. This requires firm's managers to allocate capital to positive net present value (NPV) projects, avoid projects that generate negative NPVs (Ahsan, 2008).

Financial ratio: A financial analysis assists in identifying the major strengths and weaknesses of company. It indicate whether a company has enough cash to meet obligations; a reasonable accounts receivable collection period; an efficient inventory management policy; sufficient plant, property, and equipment; and an adequate capital structure- all of which are necessary if a company is to achieve the goal of maximizing shareholder wealth (Moyer & Rao, 2008). The ratio is divided into 5 categories: (1) liquidity ratio, (2) asset management ratio, (3) Debt management ratio, (4) Profitability ratios, (5) Market value ratios (Brigham & Houston, 2009).

2.3. Methodology

Analytical framework of Technical efficiency

There are two methods widely used in the literature to estimate technical efficiency. The first one is an econometric approach which aims to develop stochastic frontier models based on the deterministic parameter frontier of Aigner and Chu (1968). The second is Data Envelopment Analysis (DEA), which uses a nonparametric approach or mathematical programming method that is useful for multiple-input and multiple-output production technologies.

This study focuses on the use of an econometric approach for measuring technical efficiency based on the production frontier model.

A production frontier model can be written as

$$Y_i = f(X_{ij}; \beta) + e_i \qquad (1)$$

Where Y_i is output of the i firm, X_{ij} is a vector of inputs used by farm i, and e_i is a "composed" error term. The error term e_i is equal to $v_i - u_i$. The term v_i is a two-sided $(-\infty < v_i < \infty)$ normally distributed random error $(v \sim N[0, \delta_v^2])$ that represents the stochastic effects outside the firm's control (e.g., weather, natural disasters, and luck), measurement errors, and other statistical noise. The term u_i is one-sided $(u_i \geq 0)$ efficiency component that represents the technical inefficiency of firm (Coelli et al.2005). The distribution of terms u_i can be half-normal, exponential, or gamma (Aigner et al. 1977; Meeusen and Broeck 1977). The assumption of term u_i in the study is a half-normal distribution $(u \sim N[0, \delta_u^2])$ mainly used the other studies. The two components v_i and u_i are also assumed to be independent of each other.

Equation (1) estimated by the maximum likelihood analysis creates consistent estimators for $\beta, \lambda \, and \, \sigma$, where β is a vector of unknown parameters, $\lambda = \sigma_u/\sigma_v$, and $\sigma^2 = \sigma_u^2 + \sigma_v^2$. The technical inefficiency of individual firms can be estimated by using the conditional distribution of u_i given the fitted values of ε and the respective parameters (Jondrow et al. 1982). If we assume that $v_i \, and \, u_i$ are independent each other, the conditional mean of u_i given ε is identified by:

$$E(u_i \parallel \varepsilon_i) = \sigma \left[\frac{f^*(\varepsilon_i \lambda/\sigma)}{1 - F^*(\varepsilon_i \lambda/\sigma)} - \frac{\varepsilon_i \lambda}{\sigma} \right] \qquad (2)$$

Where $\sigma^{*2} = \sigma_u^2 \sigma_v^2/\sigma^2$, f^* is the standard normal density function, and F^* is the distribution function, both functions being estimated at $\varepsilon\lambda/\sigma$.

With the assumption of half-normal model, a simple z-test will be used for examining

the existence of technical inefficiency, the null and alternative hypothesis are $H_0: \lambda = 0$ and $H_1: \lambda > 0$ (Coell et al.2005).

The test statistic is:

$$z = \frac{\tilde{\lambda}}{se(\tilde{\lambda})} \sim N(0,1) \qquad (3)$$

Where $\tilde{\lambda}$ is the maximum likelihood estimator of λ and $se(\tilde{\lambda})$ is the estimator of its standard error. The technical efficiency of firm will be determined by using the following equation:

$$TE_i = exp(-\widehat{u_i}) = exp\big(-E(u_i \parallel \varepsilon_i)\big) \qquad (4)$$

TE_i is greater than zero and less than 1. The maximum-likelihood estimates of the parameters of function (1) and the firm-level TE in (4) formula are achieved by using PASW version 10 software.

Efficiency of capital allocation

To measure the efficiency of capital allocation, Wurgler (2000) uses the United Nations' General Industrial Statistic (the IDSTAT-3) as a source of basic manufacturing statistics. It contains gross fixed capital formation, value added, and output for up to twenty-eight three-digit ISIC manufacturing industries. He uses the following simple regression estimate to determine the country-specific electricity measure.

$$\frac{lnI_{ict}}{I_{ict-l}} = \alpha_c + \frac{\eta_c lnV_{ict}}{V_{ict-l}} + \varepsilon_{ict} \qquad (5)$$

Where I is gross fixed capital formation, V is value added, i indexes manufacturing industry, c indexes country, t indexes year and ln represents log transformation. The slope estimate in equation (1) (η) measures the extent to which country C increases investment in its growing industries and decreases investment in its declining industries

2.4. Empirical result

Source of data

The data is based on annual statistical reports of Mongolia from 2000 to 2010 and Global competitiveness report from 2007 to 2011 about Mongolia. Moreover, the research is based on financial data of sample mining companies from 2006-2011 and has been taken from Mongolian stock exchange's (MSE) data base.

2.4.2. Analysis of Technical efficiency

Empirical model

There are several functional forms for estimating the physical relationship between inputs and output. Since the Cobb-Douglas functional form is preferable to other forms if there are three or more independent variables in the model (Hanley and Spash, 1993), the Cobb-Douglas production function with nine independent variables was applied in this study. These independent variables were *Hired labour, Fixed assets, Working capital, Inventory, Electricity cost, Heating cost, Small tools, Labour cost, other mining expenditures.* Electricity and Heating is measured by kilobits and Gkal, respectively. The inputs were calculated from the expenditure in U.S dollars currency (thousand). The Cobb-Douglas stochastic frontier model is written as:

$$lnY_i = \beta_0 + \sum_{j=1}^{9} \beta_{ij} lnX_{ij} + v_i - u_i \qquad (1)$$

In the second step, the Tobit function with a dependent variable of technical efficiency was applied to determine factors that have an effect on the technical efficiency of Mongolian mining. The Tobit function is given by:

$$TE_i = \delta_0 + \sum_{k=1}^{7} \delta_k W_{ik} + w_i \qquad (2)$$

Where Y_i is the mining production in thousand tons; X_{ij} is the nine used inputs mentioned above; v_i is the two sided random error; u_i is the one-sided half normal error; TE_i is the level of technical efficiency; W_{ik} is the variable representing socio-economic characteristics of mining companies to explain technical efficiency; k is sub variables that *Primary school* (k=1), *Secondary school* (k=2), *High school* (k=3), *High school* (k=4), *Experience* (k=5), *Age* (k=6), *Value of mining industry* (k=7); w_i is an error term of Tobit function.

In fact, data is mainly to measure performance and production of mining companies, the result of technical efficiency was estimated in the sum of mining production a year with the assumption of no big differences in land and technology used by operating manufacture across the country.

Table 2.1 presents the descriptive statistics of some important variables applied in stochastic frontier production model and some farm specific characteristics. The result also shows that mining companies have much experience on manufacture operation with the mean of nearly 20 years while their average education is more than 8 years. The total value of manufacture industry that profit is averagely $233 million. The result reveals that mining industry in Mongolia have high education level and small-scale, but with much experience in mining operation.

Table 2.1: Descriptive statistic of some important component in mining industry

Items	Mean	Std.Dev	Min	Max
Stochastic frontier variables				
Mining production	11,154	8409	5,141	30,940
Hired labor	35	10	19	47
Fixed assets	2,428,567	2540595	298,050	6,868,000
Working capital	1,209,129	615395	532,400	2,262,400
Inventory	561,955	243499	260,400	888,800
Electricity cost	3,589,017	530034	2,946,000	4,536,400
Heating cost	7,645	653	6,597	8,683
Small tools	728,570	762178	89,415	2,060,400
Labor cost	181,674	102955	65,100	363,600
Other mining expenditures	242,857	254059	29,805	686,800
Mining-specific variables				
Education of employee				
Primary school	7	1.93	4	9
Secondary school	10	2.89	6	14
High school	17	4.81	9	23
Experience	21	5.14	10	27
Age	40	3.72	35	45
Total value of mining activies	232,933	158982.38	106,016	604,283

Note: currency is thousands of dollars
Unit in sum of production output a year
Source: Own estimates, data based on annual statistic information of Mongolia

Technical efficiency

The OLS estimate for choosing the relevant variables and stochastic frontier production for estimating technical efficiency are shown in Table 2.2. The variables estimated in the OLS and MLE models are statistically significant at 0.1 percent. The coefficient R^2 is equal to 0.98, showing that around 98 percent of the dependent is explained by independent variables in the OLS model.

The presence or absence of technical efficiency was tested in the study using the important parameter of log likelihood in the half-normal model $\lambda = \sigma_u/\sigma_v$. If $\lambda = 0$ there were no effects of technical inefficiency, and all deviations from the frontier were due to noise (Aigner et al. 1977). The estimated value of $\lambda = 2.13$ significantly

different from zero. The null hypothesis that there is no inefficiency effect was rejected at the 0.1 percent level using the Z-statistic, suggesting the existence of inefficiency effects for mining industry in Mongolia.

Table 2.2: OLS production estimation

Variables	Coefficients	Standard error	t-Ratio
Hired labor	-0.464	0.35	-1.326
Fixed assets	-0.945	0	-4.987
Working capital	0.162	0.677	0.24
Inventory	-1.203	1.492	-0.806
Electricity cost	5.671	3.707	1.53
Heating cost	0.005	2.126	0.003
Small tools	-0.831	0	-2.591
Labor cost	1.442	1.853	0.779
Other mining expenditures	-0.512	0.707	-0.724
Constant	-72.459		
Function coefficient	3.926		
F-statistical model	30.802		
F-statistical CRTS			
Variance	0.363		
Standard error skewness	0.17		
Lhamda	2.135294118		
Log Likelihood	56.865		
R2	0.982		

Note: Indicate statistical significance of the 0.01 level
The sum of estimated coefficients
Source: Own estimates, data based on annual statistic information of Mongolia

The study also examined the null hypothesis that there is a proportional output change when inputs in the model are varied or mining industry explore ore with constant return to scale. The function coefficient of OLS is 3.926, showing the possibility of Mongolian mining companies increasing return to level in mineral production. The restricted least square regression with the null hypothesis of constant returns to scale was estimated. The computed F statistic of 30.802 was more than the critical value F at the 1 percent level of significance. Thus, the null hypothesis is rejected and the study concluded that technology does not exhibit constant returns to scale.

The result of the frequency distribution of technical efficiency of mining companies is presented in table 2.3 based on the estimate of the frontier function. The study reveals technical efficiency (TE) of Mining companies ranging from 70 percent to 91 percent, with an average of 84 percent. It indicates that the average company in the sample could save 8 percent (i.e.,1-[84/91]) of costs and the most technical inefficient could realize a 23.1 percent cost saving (i.e.,1-[70/91]) compared with the TE level of his most efficient counterpart. In addition, the highest TE level ranging from 80 percent to 90 percent comprises 425 companies, which is 50.82 percent of total. The lowest TE score of fewer than 50 percent comprises 850 employees, or 3.61 percent, indicating that almost all companies in Mongolia achieve high technical efficient production.

Table 2.3: Frequency distribution of technical efficiency for mining industry

TE level (%)	Number of employee	Percent (%)
>90<100	15-75	23.12
>80<90	150	50.82
>70<80	250-350	10.54
>60<70	450	7.23
>50<60	650	4.68
<50	850	3.61
Mean TE (%)	0.84	
Minimum TE (%)	0.70	
Maximum TE (%)	0.91	

Source: Own estimates, data based on annual statistic information of Mongolia

Factors affecting technical efficiency

The Tobit model is applied with TE as a dependent variable and some key socio-economic independent variables related to technical inefficiency presented in the equation (2) . The results of Tobit function estimate are performed in the Table 2.4. All the coefficient, except those *primary school, secondary school and age* variables, in the model are significantly positive.

Table 2.4: Factors associated with technical efficiency

Variables	Coefficients	t-test
Education of employee		
Primary school	-19.545	-0.911
Secondary school	-0.377	-0.909
High school	18.91	0.877
Experience	0.844	1.192
Age	-2.102	-0.949
Total value of mining activies	1.156	4.201

Notes: 1) Statistical significance at the 0.01, 0.05 and 0.1 level respectively.
2) The number of observation is 452 companies
Source: Own estimates, data based on annual statistic information of Mongolia

The study shows that one of the most important factors affecting an increase of technical efficiency of mining companies is the experience of employee in industry because the coefficient of *Experience* variable is statistically significant and bigger compared to other variables at the level of 1 percent. Moreover, the results determines the factor of high school education plays the very important and essential role in mining industry. Employee with well performance more efficiently than those primary and secondary school of education, represented by the significant coefficient of high school variable at 1 percent level in the model.

High school and Secondary school variables are dummy variable. The expected coefficient of this variable has a negative sign because mining industry is required the high level of education. The result reveals there is training and learning is important part of mining industry by companies and government. Possible explanation could be that companies has to some specific people, for instance, the poor who might operate manufacture less technically efficiently or that education quality is not strong enough to help mining companies improve their manufacture performance and more technical efficiency in mining industry.

Age variable is also sub variable. The expected coefficient of the variable has a negative sign because industry is related some of physical activity. Employee who has young to improve the efficiency use inputs more productively.

Summary

The analysis estimated the TE level to be 84 percent. These result suggest that increase in output and decrease in cost could be obtained using available technology. The suggestion is that high education and experience of output increase by using inputs more efficiently.

The study also examined the relationship of the various attributes with the technical efficiency of mining companies. The Tobit model was applied to analyse the equation of TE, demonstrated as functions of improve companies' social-characteristics and other specific variables leading to technical efficiency. The results revealed that experience in mining industry is most important factor in helping companies increase the technical efficiency of improve value of production. The second most important is high school education. Employee who has high knowledge is more efficient than those in primary and secondary school education. The third important factor is intensive labor is contributing the company increase the efficiency in obtaining higher TE. The study also investigated that the electricity cost is most important determinant of technical efficiency.

Therefore, to gain the TE score of mining industry, the company or government should invest on education and training the skills of employees to operate more efficiently in terms of the ability. In addition, the government should consider the experienced workforce and increase the level of quality about new technology

applications and restructure the management. Moreover, company should focus on encouraging employees to produce more efficiently in terms of the utility of labor. These activities are also needed to be reform and developed more effectively. Furthermore, all members currently should contribute to study more or attend short training and improve the quality of experience. Also, company should save their electricity cost by renewing the technology.

However the study revealed there was no positive relationship between TE and age. The reason is currently the mining industry is based on labor intensive and less dependence from technology. Therefore, government should support to equip by technology for mining companies and improve the level of experience through new technology and science. Moreover, the primary and secondary school education have no positive relationship with TE. Therefore, government should consider the quality of University and training centers of specialists. Also, the private companies should to invest their employee education and training of skills. An in-depth study is needed to discover the current quality of education; and research and science on the technical efficiency of mining industry, and determine the reasons of and solutions of these research and development field.

2.4.2. Analysis of Capital allocation

There are several functional forms for estimating the relationship between manufacture value added and capital allocation. The dependent variable is *Manufacture value added.* Independent variables are *Domestic loan, Domestic investment, Foreign investment and Fund raising.* The multiple regression model is written as:

$$Ln\ MVA\ (t) = \alpha + \beta_1 \ln Bank + \beta_2 \ln DInvestment + \beta_3 FInvestment + \beta_4 Stock + \beta_5 GDP + \varepsilon$$

In the second, the sub-variables were analysed to associated with capital allocation. The regression analysis is given by:

$$Y_i = \alpha + \beta_1 Factor\ 1 + \beta_2 Factor\ 2 + \beta_3 FD + \beta_4 GPT + \beta_5 LR + \beta_6 I + \beta_7 Tech + \beta_8 TA$$

Where Y_i is Value added (Manufacture value / Export value); *Factor 1* is Business sophistication, *Factor 2* is Governance disclosure, *FD* is financial development, *GPT* is government procurement of advanced tech products, *LR* is legal rights, *I* is innovation, *Tech* is technological readiness, *TA* is firm level technological absorption.

Table 2.5 presents the descriptive statistics of variables in multiple regression model and some specific characteristics. The Mongolian average manufacture value addition is $229 million. Furthermore, the most financing is came from domestic loan, average loan is $11 trillion with range of $1 million to $37 trillion for mining industry. The result also shows that financial development is reached on high level with 0.49 point than other factors. Moreover, the government procurement of advanced tech product is high with 0.45 point. The result reveals that Mongolian mining industry is basically financed by bank loan and Mongolian financial sector is highly developed. On the other hand, Mongolian government is highly considered the advanced technological products for mining industry.

Table 2.6 presents correlation analysis. The manufacture value added is significantly positively correlated with fund raising or stock. As predicted, the correlation between the efficiency measure and the overall bank loan is significantly positively correlated with Foreign investment. However domestic investment is highly related with

fund-raising. As result, fund raising or stock market will promote mining industry than other financial sectors. Domestic investment is promote stock market. However, the bank sector is mainly based on foreign investment in Mongolia.

Table 2.5: Descriptive statistic of variable

Items	Units	Mean	Median	Std.Dev	Min	Max
Dependent variable						
Manufacturing value added (MVA)	million dollars	229	165	163	76	604
Primary independent variables						
Business sophistication/Total score (Factor 1)	score (1-7)	0.44	0.44	0.01	0.43	0.45
Governance disclosure/ Total rank (Factor 2)	rank (1-139)	0.12	0.11	0.03	0.10	0.16
Independent variables						
Domestic loan (Bank)	million dollars	11407	7698	11284	1156	37729
Domestic investment	million dollars	64	38	58	10	196
Foreign investment	million dollars	522	232	710	91	2475
Fund raising (Stock)	million dollars	17	3	24	1	77
Initial wealth (GDP)	million dollars	3541	2960	2353	1137	8558
Special variables						
Financial development (FD)	score (1-7)	0.49	0.49	0.03	0.46	0.52
Government procurment of advanced tech products (GPT)	rank 139	0.45	0.46	0.04	0.39	0.48
Legal rights (LR)	score (1-7)	0.43	0.43	0.22	0.09	0.63
Innovation (I)	score (1-7)	0.40	0.40	0.01	0.40	0.42
Technological readiness/Total score (Tech)	score (1-7)	0.43	0.40	0.09	0.37	0.59
Firm level technological absorption (TA)	score (1-7)	0.35	0.36	0.20	0.09	0.64

Source: Own estimates, data based on annual statistic information of Mongolia and global competitiveness report

Table 2.6: Correlation analysis

	MVA	Bank	Domestic investment	Foreign investment	Stock	GDP
Manufacturing value added (MVA)	1.000					
Domestic loan (Bank)	0.938	1.000				
Domestic investment	0.959	0.934	1.000			
Foreign investment	0.950	0.946	0.923	1.000		
Fund raising (Stock)	0.967	0.882	0.929	0.926	1.000	
Initial wealth (GDP)	0.987	0.953	0.981	0.931	0.942	1.000

Source: Own estimates, data based on annual statistic information of Mongolia

Capital allocation

The OLS estimate for choosing the relevant variables and multiple regression model for estimating capital allocation is shown in table 2.7. The variable estimated in statistically significant at 0.1 percent. The coefficient R^2 is equal to 0.99, showing that around 99 percent of the dependent variable is explained by independent variables.

Table 2.7: OLS Regression estimation

Variables	Coefficients	Standard error	t-Ratio
Domestic loan (Bank)	-0.083	0.101	-0.817
Domestic investment	-0.244	0.128	-1.915
Foreign investment	0.144	0.088	1.627
Fund raising (Stock)	0.099	0.054	1.834
Initial wealth (GDP)	1.016	0.24	4.228
Constant	-2.213	1.215	-1.821
Function coefficient	5.066		
F-statistical model	165.313		
Variance			
Standard error skewness	0.078		
R^2	0.993		

Source: Own estimates, data based on annual statistic information of Mongolia and global competitiveness report

The study also examined the null hypothesis. The function coefficient of OLS is 5.066, showing the possibility of Mongolian country increasing capacity of capital allocation. The restricted least squares regression with the null hypothesis of constant returns to scale was estimated. The computed F statistic of 165.313 was more than the critical value F at the 1 percent level of significance. Thus, the null hypothesis is rejected and the study concluded that capital allocation has high possibility to increase the investment.

The study shows that one of most important variables affecting an efficiency of capital allocation is foreign investment, because the coefficient is statistically significant and bigger compared to other variables at the level of 1 percent. Moreover, the result

also determines the variable of fund raising (stock) is important factor and essential role in capital allocation.

Factor affecting capital allocation

To analyse which factor could have an impact on the mining technical efficiency. The result of regression analysis is revealed in table 2.8. All the coefficients, except those of *government disclosure and innovation* variables, in the model are significantly positive, revealing that efficiency of capital allocation can be influenced by these determinants in the model.

Table 2.8: Factors associated with capital allocation

Variables	Coefficients	t-Test
Primary independent variables		
Business sophistication/Total score (Factor 1)		139.14
Governance disclosure/ Total rank (Factor 2)	-0.032	9.624
Special variables		
Financial development (FD)		42.976
Government procurment of advanced tech products (GPT)		29.287
Legal rights (LR)	0.016	4.353
Innovation (I)	-0.526	101
Technological readiness/Total score (Tech)		10.983
Firm level technological absorption (TA)	0.02	3.966

Source: Own estimates, data based on annual statistic information of Mongolia and global competitiveness report

The study shows that one of most important factors affecting an efficiency of capital allocation is firm level of technological absorption and bigger compared to other variables at the level of 1 percent. Furthermore, the result also determines the factor of legal rights plays the very important and essential role in capital allocation. The well legal environment is influenced to improve the efficiency of capital allocation.

Summary

The analysis estimated that main factors and relationships of capital allocation. The study reveals that the most financing is provided by bank loan for capital allocation and financial development could reach on high level in Mongolia.

The multiple regression analysis is applied to estimate the equation of capital allocation. The result revealed that foreign investment is most important factor in helping mining companies for acquiring capital. The second most important is fund raising by stock market. The stock market will allow higher contribution to increase the efficiency of capital allocation in mining industry.

Also, the analysis is examined the relationship of the various attributes with the capital allocation in mining industry. The social and market characteristics are used to determine the relationship. The result revealed that firm level technological absorption is the most important factor in capita allocation. The second most important is legal right determines the efficiency of capital allocation.

However the government has variety of financing policies that target technological level, they have not been successful. The study revealed there was no positive relationship between the national innovation and capital allocation. A possible explanation is that mining companies which received support are poor, and thus they might operate manufacture less efficiently than others. Another possible interpretation is that policies are not sufficiently strong or effective in helping mining companies operate manufacture more efficiently. An especial research is needed to discover the impact of these policies on the capital allocation for mining industry, and determine the reasons of and solutions to these ineffective policies.

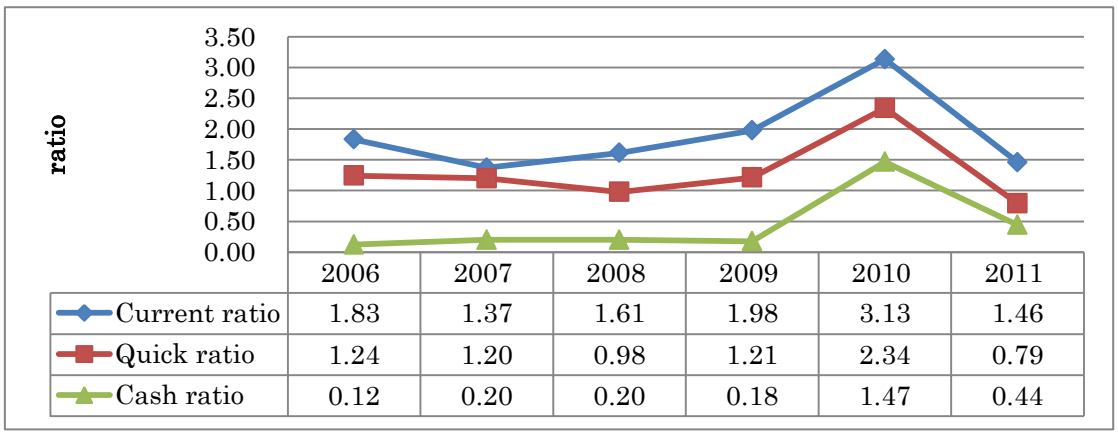
2.4.3 Financial ratio analysis

The maturation of mining companies is important factor for contribution Mongolian mining industry development. For that reason, the financial performance of mining companies was analysed by five main sections: (1) liquidity ratios, (2) asset management ratios, (3) debt management ratios and (4) Profitability ratios.

Liquidity ratios

Liquidity ratios were analysed to determine the financial ability of Mongolian mining companies according to the scenario. Figure 2.1 below illustrates the liquidity ratios of mining companies. The current and quick ratios are shown strong in key financial indicators. However, the cash ratio is revealed the weak. As a result, Mongolian mining companies have high sales and receivable performance. However, low cash has been on the hand in the mining companies, which is possibility factor to weaken by financial ability in daily operations.

Figure 2.1: liquidity ratios of Mongolian mining companies



	2006	2007	2008	2009	2010	2011
Current ratio	1.83	1.37	1.61	1.98	3.13	1.46
Quick ratio	1.24	1.20	0.98	1.21	2.34	0.79
Cash ratio	0.12	0.20	0.20	0.18	1.47	0.44

Asset management ratios

Asset management ratios were analysed to determine the asset efficiency of Mongolian mining companies according to the three scenarios. Table 2.9 and Figure 2.2 to 2.3 below reveal the asset efficiency ratios of mining companies. Total asset turnover and fixed asset turnover is not significantly strong in key asset management. Although average collection period has decreased; it is still indicated long period for collecting sales performance. As a result, Mongolian mining companies have high fixed assets; and long collection period.

Figure 2.2: Asset management of Mongolian companies

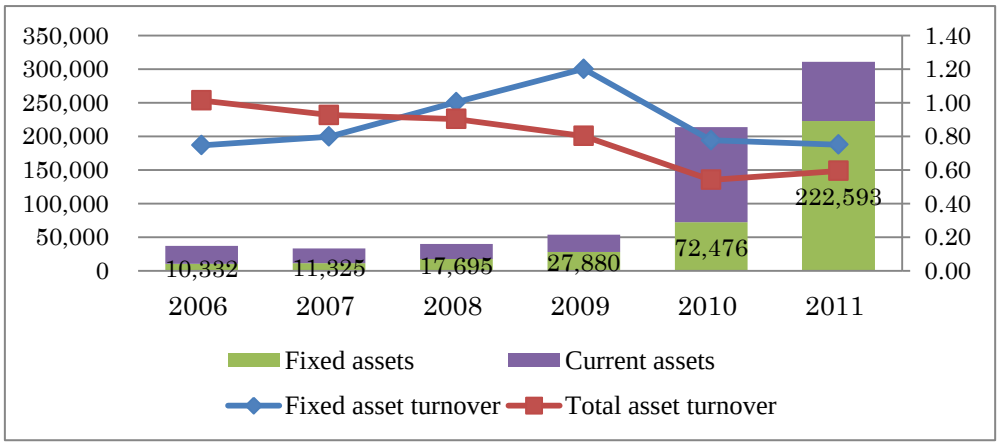


Figure 2.3: Receivable and collection periods of Mongolian mining companies

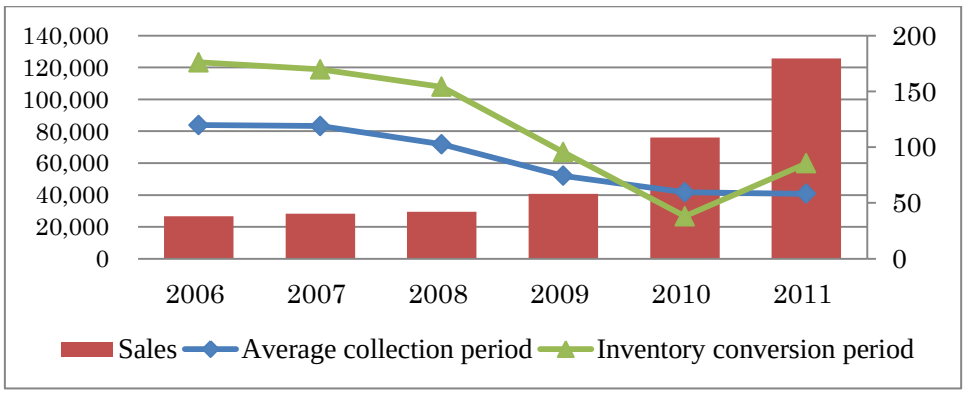


Table 2.10: Asset management ratios of Mongolian mining companies

	2006	2007	2008	2009	2010	2011
Inventry turnover	2.07	2.15	2.37	3.82	9.60	4.27
Receivable turnover	3.05	3.07	3.56	4.91	6.13	6.27
NWC turnover	1.10	1.17	1.13	1.30	0.96	1.31
Fixed asset turnover	0.75	0.80	1.00	1.20	0.78	0.75
Total asset turnover	1.01	0.93	0.90	0.80	0.54	0.59

Debt management ratios

Debt management ratios were analysed to determine that how mining companies have financed according to the three scenarios. Table 2.11 and Figure 2.4 to 2.5 below illustrate the debt management ratios of mining companies. Total debt ratio is considered high. However, long-term debt ratio is not significantly high, which is indicate that short-term loan is main financial tools in current Mongolian mining companies. Although debt and equity ratio has decreased in 2011; it is still keep their high leverage trends. As a result, Mongolian mining companies have high debt, and main financial approach is short-term loan.

Figure 2.4: Debt management in Mongolian mining companies

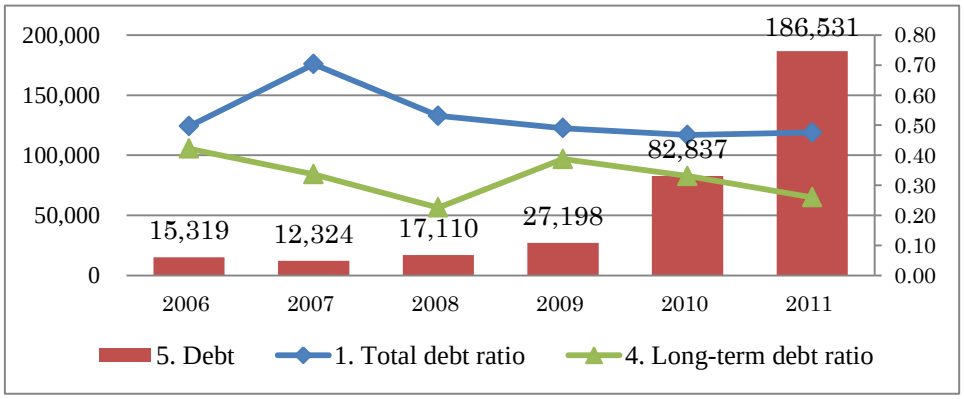


Figure 2.5: Debt and equity ratios in Mongolian mining companies

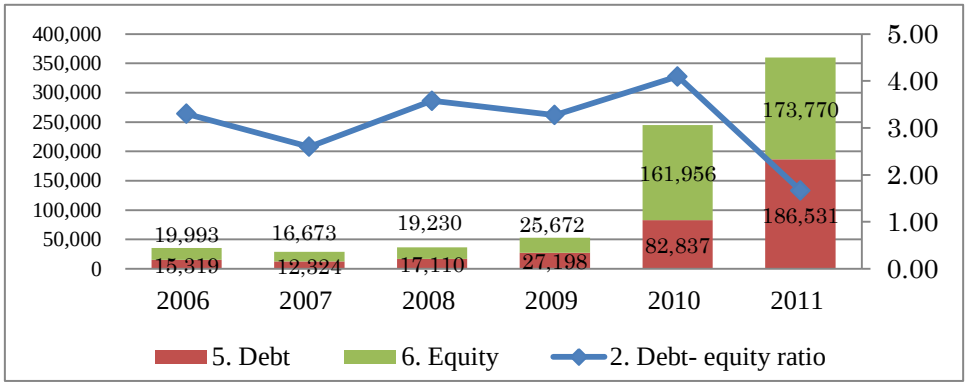


Table 2.11: Debt management ratios in Mongolian mining companies

	2006	2007	2008	2009	2010	2011
Total debt ratio	0.50	0.70	0.53	0.49	0.47	0.48
Debt-equity ratio	3.30	2.60	3.58	3.28	4.10	1.67
Equity multiplier ratio	5.89	4.01	5.44	4.69	5.16	2.75
Long-term debt ratio	0.42	0.34	0.23	0.39	0.33	0.26

Profitability ratios

Profitability ratios were analysed to determine value creation of Mongolian mining companies according to the two scenarios. Table 2.12 and Figure 2.6 below illustrate the profitability ratios. Profit margin and ROA are significantly low, although net income has increased between 2010 and 2011. Therefore, it is revealed that receivables are high sales of mining companies and asset management is weak. Also, ROE is determined high, it indicate that leverage is significantly high in Mongolian mining companies. As a result, Mongolian mining companies low profit and high debt in key financial performance.

Figure 2.6: Profitability ratios of Mongolian mining companies.

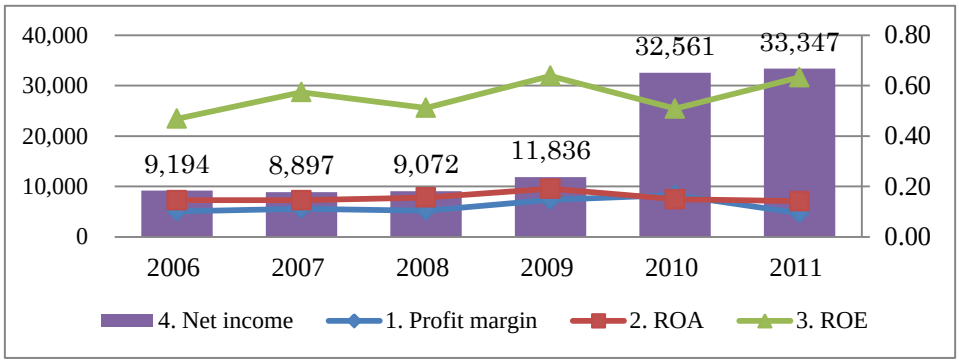


Table 2.12: Profitability ratios of Mongolian mining companies

	2006	2007	2008	2009	2010	2011
Profit margin	0.10	0.11	0.10	0.15	0.17	0.09
ROA	0.15	0.15	0.16	0.19	0.15	0.14
ROE	0.47	0.57	0.51	0.64	0.51	0.63

2.5. Conclusion

This chapter is focused on three main parts for determining the main contribution of mining industry, which are (1) technical efficiency, (2) capital allocation and (3) financial ratio analysis of Mongolian mining industry. The main features of mining industry are highly related with technology level, financial support and capacity of mining companies.

Today Mongolian mining industry has positive side on using capacity of technology. The main influenced factors that high technology efficiency is high education and well experience of employee. Moreover, Mongolian mining companies presently need to invest their fixed asset. However, the main financing approach is based on bank loan with high interest charge. On the other hand, Mongolian government supports variety of financing policy, mining companies received support

are not enough. Therefore, today foreign investment and financial security market development is important and contribute significantly for improving capacity of Mongolian mining companies. Furthermore, the mining companies should improve their ability of technological absorption level, which is useful for improving efficiency of capital allocation.

Today Mongolian mining companies sales improve significantly by increased export output. However, the receivable is high and collection period is long, approximately 60 days. Therefore, this is main reason about lack a cash of current mining companies. On the other hand, sales are improved significantly; the profit margin and ROA are low in Mongolian mining companies, which mean the mining industry's value creation is low.

III. Determinant of Mongolian mining export competitiveness

3.1. Introduction

In recent decades, Mongolian firms are faced with growing trade liberalization, business integration, and competition from the world markets. As a result, an ever-increasing number of Mongolian firms have opted to engage in export operations. Many Mongolian firms, therefore, are beginning to participate in international operations, especially exporting mining products from the home country. Through exporting, firm can utilize idle operating capacity and improve production efficiency. Second firms can raise the technological quality, and production standards in the organization. Third, exporting enables firms to increase their profits and to obtain higher rates shareholders and employees. Hence, it will in turn generate more funds for future reinvestment and growth.

These improvements result from both an increase in pricing competitiveness and the non-price competitiveness (skills of work force, quality mining resource, delivery time, customer service and reliability). Among the causes forming non-price competitiveness and improving export growth improvement of processing industry is important. Competitive advantages in the global market are derived from the ability to develop and commercialize new technologies more rapidly than other firms, and from the ability to promote and start a processing operation. However, firm is a more suitable unit for measuring technological efficiency in export behavior because it is at the firm level that innovative strategies and resources allocation plans are formulated. Typically, the mining company can benefit from processing industry: in terms of cost reductions, new markets and potential monopoly rents. In order to succeed with respect to export

development strategies and promotion programs, we must identify the key components of Mongolian firm's export performance in terms of technology, processing industry development and number of other structural factors.

3.2. Literature review

Trade and economic growth

Today the global economy has positive relationship between trade and long-run economic growth. Many empirical studies show a strong correlation between a country's trade share and its economic growth performance (c.f. Edwards, 1992; Sachs & Warner, 1995; Frankel & Romer, 1999; Dollar & Kraay, 2004; Romalis, 2007). Exporters on average are more productive, capital intensive, larger and pay higher wages than non-exporters (Bernard et al, 2007).

Competitiveness and productivity

The many economist determined the competitiveness. The economist view competitiveness as something experienced only at the firm level, and dismiss notions of "national competitiveness" (Krugman, 1996), while others believe the lack of attention to broader national-level notions of competitiveness has been a glaring failure of economic research and policy (Porter, 1990). While countries many not actually compete in global markets, locations clearly shape firm-level competitiveness (positively or negatively) through natural endowments, human capital, market access institutions, and a host of other factors. Indeed, competitiveness is normally achieved by entrepreneurs exploiting sources of comparative advantage that are unique to location. In an increasingly integrated economy where low transport and coordination costs allow

firms substantial choice over where they locate, the notion of place-based competitiveness is important. Moreover, while competitiveness is not necessarily a zero-sum game (Ciampi, 1996; Krugman, 1996), in traded goods markets, relative competitiveness does matter.

The national competitiveness is productivity-specifically total factor productivity. Fundamentally, productivity determines the rates of return on investment, which in aggregate determines long-run growth rates (Porter, 1990). Numerous studies affirm the link between productivity and export growth (c.f. Kunst & Marin, 1989; Alcala & Ciccone, 2004). The relationship has been shown to be recursive, with trade itself raising productivity through knowledge spillovers and efficiency effects of greater market competition, contributing to the exit of least productive firms and growing market share of the most productive, as demonstrated by Melitz (2003).

The outcomes of trade and export competitiveness

Assessing export competitiveness starts with defining the objectives of an export strategy and understanding relative outcomes. The most common outcome measures include: the level (volume share) and growth of exports; diversification of exports; and quality or sophistication of exports.

Export volume and growth

The much empirical researches support a strong association between trade growth and economic growth. The product specialization can observed in levels of intra-industry trade, which is derived from specialization stages of production as well as from specialization at different levels of the quality ladder. At the intensive margin, a critical

indicator of competitiveness is the survival rate of export flows. Recent research (Besedes and Prusa, 2006; Brenton & von Uexkull, 2009; Lederman, 2009).

Diversification

Export diversify- both in terms of products and markets – is strong associated with economic growth (Hesse, 2009; Lederman & Maloney, 2009), particularly for developing countries. Although much of the focus on diversification in low income countries tends to focus on concerns over a "natural resource curse" , there is increasing evidence that it is not natural resource per se that is the problem but rather concentration of exports (Lederman & Maloney, 2007). But others caution there is no firm link between diversification and productivity (Harrison & Rodrguez- Clare, 2009) This would suggest that it may be quality upgrading rather than product diversification that is the key route to competitiveness.

The second aspect of diversification relates to markets. Research has shown that the majority of export growth at the extensive margin is achieved not through new products (discovery) but by expanding existing exports to new markets (Brenton & Newfarmer, 2009). Most developing countries export to a relatively narrow range of markets, far fewer than developing countries exporting in the same sector. Expanding market research in products that have already proven to be competitive in at least some export markets can offer a substantial channel for growth. Yet to do so typically requires overcoming some barriers to competitiveness as transport costs, standards, or access to market information (Thomas, Jose & Swarnim, 2010).

Quality/ sophistication

Remaining competitive in a dynamic context requires constant upgrading. For countries to maintain export competitiveness while also providing higher returns to workers they must continually improve relative productivity, as knowledge and technology diffusion (which contribute to productivity growth on a global level) well erode rents. This can only be achieved by reducing the costs per unit produced or by increasing the unit price (Thomas, Jose & Swarnim, 2010).

One key debate is whether export competitiveness is best achieved through an evolutionary process of upgrading- selling lower quality goods to regional markets and building capabilities before moving into more competitive, sophisticated global markets- or leapfrogging immediately to sophisticated goods and/ or rich country markets. Rodrik (2006) suggests that countries experience faster productivity growth by exporting more sophisticated goods. Hausman, Hwang and Rodrik (2007) and subsequent concepts of "product space" (Hidalgo, Klinger, Barabasi & Hausman, 2007) argue that certain goods provide greater opportunities for growth because of greater potential to upgrade vertically within the industry and benefit from inter-industry spillovers of knowledge (e.g. through exposure to higher quality technologies and higher productivity possibilities) to redeploy resources horizontally into more sophisticated industries. Other (Harrison & Rodriguez-Clare, 2009; Lederman & Maloney, 2009b), question these conclusions and suggest that competitiveness and growth are achieved by having innovative firms (in whatever sector) not necessarily by participating in sophisticated sectors (Thomas, Jose & Swarnim, 2010).

Adjustment

Price and demand are related issues. Industries and places faces constant change. Some of this is evolutionary, while other forces of change act as exogenous shocks. These can take many forms, including: social and environmental, political and economic (e.g. trade rules, tax, exchange rates, non-tariff barriers); innovation and "disruptive" technologies. All of these change the bases of competitiveness in the short or medium term. Therefore, what matters for competitiveness is not only the capability to be productive in a static or slowly evolving external environment, but also the ability to adjust and adapt to structural changes (Thomas, Jose & Swarnim, 2010).

Integration and linkages

One of leading indicator in country's export sector is integrated with its wider economy through forward and backward supply linkages. However, natural resources based export sector have shown far less integration with local economies than manufacturing sectors. The infrastructure and skills needed to process raw materials are different from those needed to extract them (Thomas, Jose & Swarnim, 2010).

The elements of a framework for diagnosing competitiveness

The concept of improving competitiveness is exist number of framework. First, broad economic competitiveness is important rather than export competitiveness. Second, most approaches fail to assess competitiveness at the appropriate operational level which would allow them to be effective. The typical approach is to analyse competitiveness at the national level, comparing one economy against another. Finally, most analysis of export competitiveness uncover a series of issues that a country would

need to address in order to achieve more success in export market. Therefore, it necessary to identify competitiveness factors (Thomas, Jose & Swarnim, 2010).

3.3. Methodology

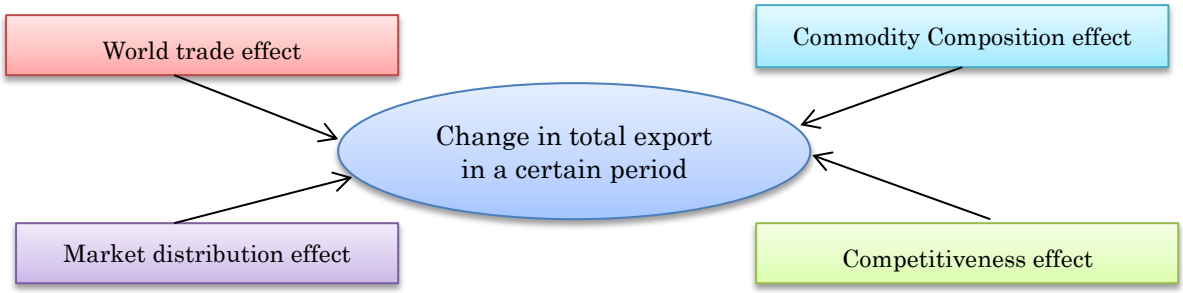
3.3.1 The constant market share model

The Constant Market Share (CMS) model was first proposed by Tyszynski (1951) for application in the analysis of export growth. Fleming and Tsiang (1956) suggested that a change in export share results not only from a change in competitiveness, but also from changes in the conditions of demand of the world market; hence they believed that the demand effect finds its origins in the change in export revenues, and on account of this they analyzed variations in export via the difference between export revenues and constant export share revenues, applying the CMS method to long-term analyses (Yaacob, Mohamad, Ismail, 2007). This method solved the problem, raised by Tyszynski, of the adaptability of different countries in the face of changes in the world's trade pattern (Chien, 2005).

3.3.2. Model of study

The study examines the determinants of Mongolian mining export competitiveness. Two models are used. First, CMS analysis will be used in this part in order to examine Mongolian mining export growth and competitiveness attributable to world trade effect, commodity composition effect, market distribution effect and competitiveness effect. The CMS model can be expressed in a schematic representation as shown in figure 3.1. Second, linear multiple regression analysis is used to determine the export competitiveness of mining companies.

Figure 3.1: Constant market share (CMS) model



World trade effect indicates that part of Mongolian mining export growth is attributable to the general increases in major importers in this study (China, Japan and Korea). The magnitude of this effect shows the potential increase of Mongolian export if it were able to maintain its share of major importers. Commodity composition effect shows whether Mongolia has concentrated on the export of mining for which markets have been expanding rapidly, or on mining for which market have been expanding less rapidly. This effect reflects the factor endowment of the export country (for instance, Mongolia endowed with technology and labour intensive) and the income and price elasticity of demand for the products in which that country specializes.

The constant market share model (CMS) is a method that has been frequently used during the last decade to analyse international trade (Chen and Duan, 2000; Ferto, 2004). The main principle of model is based on the same level of competitiveness, an industry's market share should remain constant. Therefore, an export change is caused by a competitiveness change. CMS model is decomposed the Mongolian mining export into two levels of CMS decomposition were used. In the first, the CMS model decomposes the change in exports into three components: (1) The structural effect (the change in exports due to the change in the world mining imports); (2) The competitive effect (the change in exports due to the change in the exporting region's competitiveness) and (3) The second-order-effect (the change in exports due to the interaction of the change in an exporting region's competitiveness and the change in the world mining imports)

With the second-level decomposition is structural effect, which is decomposed into: (1) The growth effect, (2) The market effect, (3) The commodity effect and (4) The interaction effect The competitive effect is split into (1) general competitive effect and (2) Specific competitive effect. Second order effect is divided into (1) pure second-order effect and (2) The dynamic structural effect (Yaacob, Mohamad, Ismail, 2007).

Model-I

The first level:

$$\Delta\bar{E} = \sum I \sum S_{ij}\Delta Q_{ij} + \sum i \sum j\, Q_{ij}^{0}\, \Delta S_{ij} + \sum i \sum j\, \Delta S_{ij} Q_{ij}^{0}$$

(Structural effect) (competitive effect) (Second-order effect)

The formula can be further decomposed into the following components:

$$\Delta\bar{E} = S^{0}\Delta Q + \left(\Sigma_i \Sigma_j S_{ij}^{0}\Delta Q_{ij} - \Sigma_i S_i^{0}\Delta Q_i\right) + \left(\Sigma_i \Sigma_j S_{ij}^{0}\Delta Q_{ij} - \Sigma_j S_j^{0}\Delta Q_j\right)$$

Growth effect Market effect Commodity effect

$$+\left(\left(\Sigma_i S_i^{0}\Delta Q_i - S^{0}\Delta Q\right) - \left(\Sigma_i \Sigma_j S_{ij}^{0}\Delta Q_{ij} - \Sigma_j S_j^{0}\Delta Q_j\right)\right) + \Delta S Q^{0} + \left(\Sigma_i \Sigma_j \Delta S_{ij} Q_{ij}^{0} - \Delta S Q^{0}\right)$$

Structural interaction effect General competitive effect Specific competitive effect

$$+\left(\frac{Q^{1}}{Q^{0}} - 1\right)\Sigma_i \Sigma_j \Delta S_{ij} Q_{ij}^{0} + \left(\Sigma_i \Sigma_j \Delta S_{ij} Q_{ij} - \left(\frac{Q^{1}}{Q^{0}} - 1\right)\Sigma_i \Sigma_j \Delta S_{ij} Q_{ij}^{0}\right)$$

Pure second-order effect Dynamic structural effect

Whereby

$\bar{E} =$ Mongolian export value/ volume of commodity $_{\text{j}}$ to destination $_{\text{j}}$

$S =$ Mongolian share of the world export of mining product world market

$S_j =$ Mongolian share of the world export of mining product in destination $_{\text{j}}$

$S_i =$ Mongolian share of the world export of commodity

$S_{ij} =$ Mongolian share of the world export of commodity $_{\text{I}}$ in destination

$Q =$ an total world export of mining products

$Q_j =$ total world export of mining product to destination $_{\text{j}}$

$Q_i =$ the total world export of commodity $_{\text{i}}$

$Q_{ij} =$ total export of commodity $_{\text{I}}$ in destination $_{\text{j}}$

Superscript i= represent export commodities (here, semiconductor); and j represents export destination (here, the China, Japan and Korea).

Model-II

The basic model postulated that Mongolian mining export for a firm depends on structural and firm-related variables.

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8$$

Where Y_i is dependent variable that *Mongolian mining export* by value, X_{ij} is the 8 used independent variable mentioned above that *GDP per capita* (x=1), *Population* (x=2), *Rail lines* (x=3), *Railways, goods transported* (x=4), *Business* (x=5), *Foreign market size* (x=6), *Trade tariff restrictiveness index* (x=7), *Innovation* (x=8).

3.4. Empirical result

Source of data

The research focuses on mining exports and statistical data of macro economy from 2000 to 2011. Also, CMS estimates the growth in mining exports in each of three sub-periods; 1995-1999, 2000-2004, 2005-2011 The mining export is mainly represented by copper products.

3.4.2. The Constant Market Share analysis

The main objective of the research is to analyse the export competitiveness of Mongolian mining industry. Under CMS technique, the three structural component of the market shares model were calculated under the assumption that base period export shares were maintained in other market period II (2000-2004) was analysed in composition to period I (1995-1999). Next Mongolian mining export period III (2005-2011) was analysed in composition to Period II.

Finally the mining export during period I and III were analysed. The three periods represents five years average.

The CMS technique decomposes the change in export value into eight components: growth effect, market effect, commodity effect, interaction effect, general competitive effect, specific competitive effect and pure second order effect, dynamic effect. The study selected three importing countries namely China, Japan and Korea. They are most significant importers of mining products. The average result of yearly decomposition of the charge in Mongolian mining export for the period 1995-1999, 2000-2004 and 2005-2011 are provided in table 3.1.

Table 3.1: Result of yearly decomposition of change in Mongolian export value of mining products (thousands of dollars)

Periods	1995-1999		2000-2004		2005-2011	
	Value	%	Value	%	Value	%
Change in export value	1,750,902,131	100%	47,428,742,250	100%	8,171,283,181	100%
Structural effect	355,073,327	40.73%	-5,424,996	42.92%	-1,050,085,113	162.58%
Growth effect	32,513	0.02%	324,152	0.20%	4,536,101	1.05%
Market effect	381,372,548	41.61%	70,509,915	42.20%	900,757,435	162.67%
Commodity effect	-173,525	-0.895%	1,422,235	0.53%	-15,613,121	-0.70%
Structural interaction effect	-26,158,209	0.01%	63,338,531	0.15%	-138,250,657	0.61%
Competitive residual	1,571,261,317	0.33%	47,419,907,382	0.35%	8,792,439,193	0.01%
General competitive effect	23,922,601	0.004%	1,184,790,352	0.16%	3,615,398,664	0.41%
Specific competitive effect	1,547,338,716	0.33%	46,235,117,030	0.19%	5,177,040,530	-0.40%
Second order effect	-175,432,513	-139%	14,259,865	-9%	428,929,100	0.04%
Pure second order effect	1,995,111	0.08%	15,858,928	0.27%	5,828,459	0.02%
Dynamic structural residual	-177,427,624	-138%	-1,599,063	-9.17%	423,100,641	0.02%

Source: Own estimates, data based on annual statistic information of Mongolia

Table 3.1 shows decomposition of Mongolian mining gain or loss between periods. This table presents the relative contribution of each effect on the change in the mining export between the three sub-periods.

Change in export value

Change in export value was define as an increased or decreased in export in conjunctions to the contribution of structural effect, competitive effect and second order effect.

Structural effect

Growth effect

Growth effect measure the change in export for Mongolian mining products due to the change in the total world import of mining products. It means any increment in the total world import of mining product will cause the total export of Mongolian mining products increase. Over the period 1995-1999 the growth effect accounted for 0.02%. And growth is constantly improved to 0.20% in 2000-2004 and increased to 1.05% in the sub period between year 2005-2011. Therefore, the increase in Mongolian mining export in year 2005-2011 mainly attributed by the general increase in the total world import of mining products.

Market effect

Market effect is referring to the change in export due to the market distribution of an exporting country's of mining products. In 1995-1999, the market effect registered 41.61% and period in 2000-2004 market effect was 42.2%. It means the world market mining import was high and constant level. Although the market effect is improved fast by 163.3% in 2005-2011, which means the demand of main markets are increased during this period.

Commodity effect

The commodity effect shows the change in exports due to the commodity composition of exporting country's of mining products. It measures either Mongolia export mining products

which experience high demand in the importing countries (China).

Over the period 1995-1999, the commodity effect accounted for -0.89%. It shows that Mongolian mining export products had little bit low demand in importing countries. Even though it is improved in 2000-2004 at 0.53%, which means the demand has increased during these periods. However, year 2005-2011 it shows the negative effect that -0.70%, which means that demand of importing countries are reducing now.

Interaction effect

The interaction effect indicates whether the country is specialized in those sectors in which it also enjoys a competitive advantage. Therefore, the interaction effect will be positive in values if the country specialized on export where it has or enjoy a competitive advantage or produce little of the exports in which it has no such advantage (disadvantage). In 2005-2011, the interaction effect account for 0.61% which is highest recorded throughout the period studied. However, the all three periods (1995-2011) have low percentage of interaction effect, which is indicate that Mongolian mining industry hasn't specialized in world mining market yet.

Competitive residual effect

Competitive effect

The competitive effect estimates change in export about the similar products of exporting country's competitiveness. Positive sign of competitive effect, meanwhile the interaction effect indicate in low level that Mongolia has weak their competitiveness and changing export composition are increased in 2005-2011.

The specific competitive effect estimated 0.33% in year 1995-1999. A positive specific competitive effect indicates that the change in Mongolian export structure revealed favourable

interaction in world market. In the net term, the increase in general competitive effect and specific competitive effect resulting in an increase in overall competitive residual in the period 1995-1999 and 2000-2004. Therefore, during these periods the competitiveness is rising in exporting markets (China, Japan and Korea).

However, in 2005-2011, the competitive residual dropped tremendously to 0.40%. It indicates that Mongolian competitiveness of mining products in the third period appeared to deteriorate rapidly compared to that in the first period.

Second order effect

The second order effect measures the change in export for interaction of the change in an exporting country's competitiveness and the change in the total world market import of mining products. In 2000-2004, the second order effect estimated 0.27% but dynamic structural effect estimated -9.17% for the period 2000-2004. Dynamic structural effect measure the change in export due to the interaction of an exporting country's export competitiveness and import of specific commodities in specific world market.

The second order effect accounted a shape increased to 4% in period of 2005-2011. In the second period Second order effect and dynamic structural effect contributed 0.02% and 0.02%, which is indicate that Mongolian mining export is mainly attributed to the general increase in the total import of mining products and interaction effects. A positive result of competitive residual and interaction effect revealed that Mongolia mining industry has high capacity to strengthen their competitiveness in world market.

Summary

It can be concluded that based on the results on CMS analysis, the total change in export value which is amounted to $47,428,742,250 in the period of 2000-2004 was mainly contributed by Competitive residual as compared to period I and III which was mainly contributed by structural effect. Therefore it can conclude that main contributor to the change in export value is appeared in period 2 (2000-2004 years). During this period, the general increase in competitiveness contribute positively to the improve in Mongolian mining export value of mining products. Therefore, Mongolia has produced and exported mining products which is highly demanded by world market. Although, increasing in general and specific competitiveness effect is considered low and market share is small in China, Japan and Korea. In period III, structural effect reached on highest level. Although the indication is shown that Mongolian mining product hasn't specialized in world market yet.

3.4.3. Analysing the export competitiveness

In this part, data is measured the main factors of mining exports and competitiveness. The result of mining export competitiveness was estimated the mining export performance and market. Table 3.2 presents the descriptive statistics of some important variables applied for mining export. The result shows that average mining export has reached on $1.2 trillion and GDP capita average is $2979. The foreign market size is estimated small to middle level. Also result reveals that productivity of mining industry is middle, however the innovation is estimated in low level.

Table 3.2: Descriptive statistics of some important component of mining export

Items	Units	Mean	Std.Dev	Min	Max
Mining export	million dollars	1,237,663	958451	393,000	3,585,263
GDP per capita	dollars	2979	780	1950	4290
Population	million people	2.58	0.13	2.41	2.80
Rail lines	total route-km	7931	1983	4293	11000
Railways, goods transported	million ton-km	1811	1.81	1810	1814
Ease of doing business	score 1-7	3.03	0.12	2.90	3.20
Foreign market size	score 1-7	2.63	0.12	2.00	2.40
Trade tariff restrictiveness index	score 1-7	4.54	0.05	4.50	4.60
Total factor productivity	score 1-7	4.50	0.00	4.50	4.50
Innovation	score 1-7	2.71	0.09	2.60	2.80

Source: Own estimates, data based on annual statistic information of Mongolia

Export competitiveness

The regression analysis is estimate for choosing the relevant variables for estimating export competitiveness is shown in Table 3.3. The variables estimated in the multiple regression is statistically significant at 0.1 percent. The coefficient R^2 is equal to 0.98, showing that around 98 percent of the dependent is explained by independent variables in the regression analysis.

Table 3.3: Export competitiveness estimation

Variables	Coefficients	Standard error	t-Ratio
GDP per capita	0.835	2.74	0.302
Population	12.55	21.807	0.842
Rail lines	-0.103	0.827	-0.038
Logistics performance index	-183.809	267.793	-0.246
Ease of doing business	3.866	2.066	0.6
Foreign market size	-1.697	1.908	-0.281
Trade tariff restrictiveness index	1.65	5.768	0.114
Total factor productivity			
Innovation	-3.08	3.986	-0.372
Constant	1208.354	1739.284	
Observations	12		
R-squared	0.98		

Notes: 1) Statistical significance at the 0.01 level. 2) The number of observation is 10 years statistical reports.

Source: Own estimates, data based on annual statistic information of Mongolia

The study shows that one of most important factor affecting is ease of doing business in mining sector because the coefficient of *Ease of doing business* variable is statistically significant and bigger compared to other variables at the level of 1 percent. Moreover, the result determines the

factor of trade tariff restrictiveness plays the very important role in mining export competitiveness. The tariff restrictiveness is low for mining companies, which is represented by significant positive coefficient at 1 percent level in the model.

Logistics performance index and *rail lines* variables are also main independent variables. The expected coefficients of the variables have a negative sign. The possible explanation could be the railway line has high cost and transports longer time to final market customers.

Foreign market size is main measure of export competitiveness. However, the coefficient of variable has negative sign. The possible explanation could be that final customer market is few. Therefore result reveals that mining industry should increase their market of customers and improve their service for final customers such as quick delivery and best quality.

Innovation is one of important part of Mongolian mining export competitiveness. However, the coefficient of variable has negative sign. The result is reveals there is technology and research and development are important part of mining industry. Possible explanation could be that companies invest not enough fund for technology and research sections.

Summary

It can conclude that based on the result from multiple regression analysis, the ease of doing business and low tariff restriction policy in mining sector are mainly contributed to improve value of export. Although today Mongolian mining companies faces the problem that trade unlocking potential, because logistic performance index and rail lines are not good level for delivery of mining companies. Therefore good transportation and fast delivery is main

competitiveness of Mongolian mining industry than competitors.

Foreign market size is one of determinants of export competitiveness. Mongolian main markets are considered in China, Japan and Korea. Although Mongolian mining biggest market customer is China, meanwhile competitors are dominated in Japan and Korea. But study is revealed that foreign market size is still small and we need to expand and diversify to the other markets.

Innovation is main instrument for improving competitiveness of mining companies in world market. But today research and development section is weak and need to invest and improve the potential of Mongolian mining companies.

3.5. Conclusion

Manufacture and exports are main instruments for economic growth in country. In 2000-2004, Mongolian mining export is increased highly and strengthens the competitiveness in world market. The main reason is considered on the increases of world market demand. Although today market share has estimated still small in China and need to penetrate other markets. Moreover the specialization is one of determinant in export competitiveness. In 2005-2011, the Mongolian mining industry's specialization has improved highly, but still interaction effect in world market is low and not yet reaches on high level of specialization.

Today Mongolian mining companies faces the problem that trade unlocking potential: in addition to policy considerations such as tariffs, quotas, and exchange rates, factors like gateway infrastructure, standards and certification, and sector-level coordination in marketing and logistics all play an important role in determining the competitiveness of individual exporting firms. Identifying and prioritizing these constraints can help the country choose appropriate policy levers for Mongolian mining companies.

IV. Export competitiveness of Mongolian mining products

4.1. Introduction

Mongolian mining export has significantly increased over the years. From 2000-2011, export has increased by 9 times (Annual statistical report, 2011). Today steel and iron is main products for the world heavy industries and construction. Therefore, in the last 10 years, Mongolian main export is based on coal, iron ore and copper concentration. The world steel and iron demand has reached on 1316 million tons. Furthermore, this demand is forecasted to reach 2000 million tons in 2030, depending on the economic environment (World mining statistics, 2011).

Meanwhile, in Mongolia, the mining industry has grown significantly over the years. By 2011, coal had increased 6 times and iron ore had increased 4 times their level in 2007. This tremendous growth was caused by several factors, especially the high demand of international market, and government policy which supports the development of the mining industry.

Eighty percent of the mining products in Mongolia is exported. As a result, the export market has played an important role in the growth of the mining industry. By 2007, mining industry has increased to 4 times than level of 2000 years. The 42 percent of revenue is came from the copper. Although the export has increased to 9 times in 2011 than level of 2000 year, 47% of revenue is came from the coal. The main market destination of Mongolian mining industry in 2011 was China with 90%, following by Russia with 7% and others with 3%.

The objective of this paper is to analyse the competitiveness of Mongolian mining products in the three markets: China, Japan and Korea. The change in market share is

employed to analyse the competitiveness of Mongolian mining products. In addition to market competitiveness, revealed competitive advantage (RCA) and Trade specialization index (TSI) are utilized to search for source of the change in market shares.

4.2. Literature review

There are several methods in measuring competitiveness or specifically export competitiveness on the producer's approach. The common method is using constant market share analysis (CMS) and calculating indexes such as revealed comparative advantage (RCA) or domestic resource cost (DRC) ratio.

The RCA approach, pioneered by Balassa (1965), assumed that the true pattern of comparative advantage can be observed from post-trade data. The RCA in theory provides an index measure of change in comparative advantage. The positive impact of trade liberalization and expansion can indirectly be measured by the RCA (Bender and Li, 2000).

Selangor (2007) calculated the export competitiveness of Malaysian Electrical and Electronic products. The author used to calculate the Constant Market Share (CMS) approach, and Revealed Comparative Advantage (RCA) for determining the export competitiveness and main products.

RCA, MCA and TSI approaches are used by Ki-Heung Kim (2009) in his study on industrial competitiveness and trade effects between South Korea and India. As a result study can revealed the export competitive products and market effects on trade.

Most of the studies have focused on the export market growth. This study therefore, is a probe for further insights, in attempt to fill the research gap in this area by assessing the export competitiveness of products.

4.3. Methodology

For the purpose of comparing competitiveness of mining products between Mongolia and Australia, this study classified by 5 products and used competitiveness with revealed competitive advantage (RCA) and Trade specialization index (TSI) are classified into 5 products of mining industry (coal, copper, iron ore, gold and zinc).

1) Revealed competitiveness advantage (RCA)

Revealed Comparative Advantage (RCA) is a method to review the structure of competitiveness advantages and defined as the "Formula 1". RCA is designed to compare competitiveness between countries with different size of economy considering market share at country and product level. RCA index trade performance index representing adjustment by the importance of products and the size of countries. Therefore, this index is to compare trade variables between countries and industries such as export or net export (export-import) that reflects competitive advantage. This index represents (total export ratio of country j in global market) compared to (export ratio of product i of country j in global market). If the RCA of a specific product is larger than 1, corresponding country has a competitive edge in that product (Ki-Heung, 2008).

$$RCA_{ij} = \frac{X_{ij}/X_{iw}}{X_j/X_w} \qquad \text{(Formula 1)}$$

RCA_{ij}: revealed competitive advantage of country j's product i

X_{ij}: Global export amount of country j's product i,

X_{iw}: The world's export amount of product i

X_i: country j's total export amount, X_w: The world's total export amount

2) Market comparative advantage (MCA) per market

Market Comparative Advantage is a concept to compare and analyze the ratio of trade with a specific trading partner out of the total trade volume regarding import and export of a specific industry. Here, i specific industry classification. MCA index is the ratio calculated by (proportion of product I from the total export in country j) out of (proportion of product i from the export amount to market h in country j).This index describes the relative importance of market h in exporting product i in country-j (Ki-Heung, 2008).

"Formula 2": revealed competitive advantage index for product in country

- Export amount of product i to market h in country j
- Export amount to market h in country j
- Country j's global export amount of product i
- Total global export amount of country j

3) Analysis on Trade Specification index (TSI)

Trade specification index is to analyze competitiveness between two countries in a specific market calculated by dividing the net difference of export and import of a specific product from total trade amount (total amount of export and import). This index shows relative competitive advantage in export which is calculated under the

assumption that a competitive product is export more than its import in bilateral trade. In order for the difference between export and import to be affected by trade volume, the difference between export and import is to be divided by trade volume (Ki-Heung, 2008).

TSI is defined as “Formula 3” and the value range from -1 to 1. Larger than 0 TSI means export specialization and lower than 0 TSI means import specialization. When the index is closer to 1, the industry has high export specialization but if the index is closer to -1, it means the industry has high import specialization. This index is to evaluate whether a specific industry in a specific country has competitiveness to its trading partner. Also, comparing TSI of Mongolia to that of Australia will compare and analyze export and import specialization item with trading partners.

“Formula 3”: Trade specialization for product in country

- Export amount of country’s product
- Import amount of country’s product

4.4. Empirical result

4.4.1. Revealed competitiveness advantage (RCA)

Table 4.1: result of RCA index, Mongolian mining industry

Mining products classification	Mongolia's RCA to the world				
Year	2007	2008	2009	2010	2011
Coal	4.29	3.11	9.02	12.99	20.01
Copper	5.40	2.13	3.96	3.36	1.58
Iron ore	0.91	2.77	6.58	6.43	4.16
Gold	10.94	25.47	18.88	5.32	1.92
Zinc	33.26	29.30	48.61	18.86	10.43

Source: own estimation, based on Mongolian national statistical report & World mineral statistical report

Table 4.2: result of RCA index, Australian mining industry

Mining products classification	Australia's RCA to the world				
Year	2007	2008	2009	2010	2011
Coal	4.99	2.89	7.18	4.14	3.12
Copper	0.39	0.19	0.21	0.32	0.21
Iron ore	4.12	5.86	5.40	3.96	2.59
Gold	4.32	5.02	6.55	4.44	2.71
Zinc	4.83	3.88	2.11	1.99	1.20

Source: own estimation, based on Australian mineral statistical report & World mineral statistical report

According to Mongolian mining industry's RCA index to the world, Mongolia has a competitive edge in basic metal products, coal, copper, iron ore and zinc. However, the gold and copper have long been keeping their competitive edge until recently. According to Australia's RCA to the world coal, iron, gold and zinc have a competitive advantage in mining industry. However, Australia's copper has disadvantage competitive edge. Also the gold and zinc's competitive advantage has decreasing from 2007 to 2011. Mongolia has a strong competitive advantage coal, iron ore and zinc, while Australia has an export advantage in coal and iron ore. However, both countries have a similar competitive edge in exporting basic mining products.

Table 4.3: Industries with competitive advantage

	Mongolia	Australia
Industry with competitive advantage	Coal Iron ore Zinc	Coal Iron ore

4.4.2. Market comparative advantage (MCA) per market

Definition of MCA shows the importance as export market for a specific product in importing countries to the global market. This index is interpreted as a different concept of RCA. Therefore, MCA should be used as a supplementary with RCA, meanwhile former revealed industrial importance in bilateral trade after recognizing competitive

advantage of each industry. For the analysis, MCA index independently as a term "competitive advantage" is used in caution both in terms of representation and interpretation.

Table 4.4.: MCA per each category

	Mongolia's export MCA to China					Australia's export MCA to China				
Year	2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
Copper	0.18	0.23	0.28	0.29	0.38	0.14	0.10	0.08	0.16	0.12
Coal	0.01	0.01	0.01	0.01	0.02	0.14	0.10	0.08	0.16	0.12
Iron ore	0.01	0.02	0.01	0.02	0.04	3.63	4.40	3.06	4.68	4.31
Zinc	0.40	0.52	0.42	0.78	1.23	0.01	0.01	0.00	0.00	0.01

Source: own estimation based on Mongolian national statistical report; China statistical report; Australian mineral statistical report, World mineral statistical report

According to the analysis of Mongolia's export MCA to China in 2011, Mongolia has a competitive advantage in copper and zinc. However Mongolian coal and iron ore have disadvantage in China market. Industries with competitive advantages and competitive disadvantage have been consistently sustained for the last 5 years. Australia is estimated to have an export competitiveness in copper, coal and iron ore in China market. Based on the analysis result of mining products with competitive advantage in both markets as of 2011, Mongolia has an export competitiveness in copper and zinc in China.

Table 4.5: Mining products with competitive edge in the market of trading partner

	Mongolia	Australia
Industry with competitive edge	Copper Zinc	Copper Coal Iron ore

On the other hand, if the MCA of the Mongolia's representative export products (RCA.1) to China such as copper and zinc are less than 1, the importance of the China market is relatively low compared to other countries and competitors. However, this does not mean that these mining products are not of competitive disadvantage in general sense.

4.4.3. Analysis on Trade Specification index (TSI)

According to the Mongolia's TSI index analysis to the world of 2011 shows that Mongolia has a competitive advantage in exporting copper and coal. However, the TSI value is negative in iron ore and zinc, which is indicating the import specialization. TSI value of iron ore has increased negatively in 2010 and 2011. However, the main reason is net difference of export and import of mining products from total export amount, shows relative competitive advantage in export which is calculated under the assumption that a competitive product is exported more than its import in bilateral trade.

Table 4.6: Mongolia's TSI toward the world

	TSI to the world				
Year	2007	2008	2009	2010	2011
Copper	9.34	-19.72	-27.81	185.36	-15.50
Coal	-4.00	-3.25	-7.16	22.88	4.94
Iron ore	-3.48	-3.24	-6.68	-25.64	-20.17
Zinc	-5.78	-3.68	-6.60	-5.65	-4.67

Source: own estimation, data based on Mongolian national statistical report & World mineral statistical report

Analysis result of dynamic changes in TSI

In order to analyze dynamic changes of TSI, this section compares and analyzes the average TSI of 2007 and 2009 and that of 2010 and 2011. The following 6 types can be classified to show how TSI have changed from the standard point and compared point.

Table 4.7: Type of classification for dynamic changes of competitiveness

	Sub class	TSI		
High competitiveness	1	$0 < TSI_0 < TSI_t$	Increase competitiveness as export specialization product	Major export product
	2	$TSI_0 < 0 < TSI_t$	Convert from import specialization to export specialization	Strategic export product
	3	$TSI_t < TSI_0 < 0$	Reduce import specialization as import specialization product	Possible to become export product
Low competitiveness	4	$0 < TSI_t < TSI_0$	Reduce competitiveness as export specialization product	Method to increase competitiveness is needed
	5	$TSI_t < 0 < TSI_0$	Convert from export specialization to import specialization	Relocate production line to overseas due to the lack of competitiveness
	6	$TSI_t < TSI_0 < 0$	Enhance import specialization	Restructuring is needed (Consider to expand strategic import)

Source: Ki-Heung, K., (2008). Analysis of industrial competitiveness and trade effects

Low subscripts of 0 and 1 in TSI represent base time and compared time respectively. Competitiveness improvement can be classified as high competitiveness in export specialized product, the conversion from import specialization product into export specialization product and less import dependency of import specialization product. Weakening competitiveness are classified as reducing competitiveness of export specialization product, the conversion of export specialization product into import specialization product and increased import dependency of import specialization product. The reason for classifying changes in competitiveness per each industry is to analyze the trend in dynamic changes according to time flow (Shin Hyun Soo.Lee Won Bok 2003). Export enhancing is increased the competitiveness of product export. On the other hand, export competitiveness of certain products decrease is weakened due to reduction in the market share (Ki-Heung, 2008).

Table 4.8: Mongolia's dynamic changes per industrial TSI

	TSI to the world	
Year	2007-2009 average	2010-2011 average
Copper	-12.73	84.93
Coal	-4.80	13.91
Iron ore	-4.47	-22.90
Zinc	-5.35	-5.16

Source: own estimation, data based on Mongolian national statistical report & World mineral statistical report

Table 4.9: Analysis of Mongolia's industrial competitiveness according to TSI dynamic changes

Classification	Economic signification	Based on TSI to the world
Competitiveness increase	TSI (07-09)<0< TSI (10-11) Conversion from import specialization to export specialization	Copper product Coal product
Competitiveness decrease	TSI(10-11)<TSI (07-09)<0 Increase in import specialization → restructuring is needed (consider strategic extension of import)	Iron ore product
	TSI (07-09)< TSI (10-11) <0 Decrease the level of import specialization due to import specialization product	Zinc product

The dynamic analysis of Mongolia's TSI to world shows increasing competitiveness in copper and coal product. According to this analysis, copper and coal products have converted from import specialization to export specialization. Moreover, the iron ore and zinc product's competitiveness is decreasing in the world market. Therefore, the restructuring is required for decreasing import specialization and relocate the market.

4.5. Conclusion

Mongolia has experienced a significant increase in export and market share for mining products in world market. The increase can be explained by the shift in demand and increasing competitiveness. The shift in demand is mainly caused by the stable economic situation and trade liberalization policy imposed by the importing countries, which reduces trade barriers in the form of import duties. The other reason is that Mongolia has competitive advantage in export at lower prices; the aggressive marketing strategy by Mongolian exporter company is also a factor.

The Mongolian trade accounts for 3% of the world and the major export goods consist of mining products such as copper, coal, iron ore, gold and zinc. Therefore, Mongolia is not yet in a position to compete in the global market. However, the export ratio of coal and iron ore has increased. In analysis of mining industry, the coal and iron ore are expected to increase with the highest speed.

This study classifies currently traded products into 4 stages of export specialization product category, absolute import specialization product category, products with weak competitiveness and products subject for trade protection. For this categorization, this study used import/export data ranging from 2007-2011 using TSI, export growth rate index, TSI with Australia and RCA. Competitive industries of the two countries on the basis of RCA in 2011, represented industrial characteristics of the two countries. Mongolia has a competitive advantage in copper, coal and zinc while Australia has an export advantage in copper, coal and iron ore.

According to Mongolia's RCA index to the world, Mongolia has a competitive edge in mining products, copper and zinc in China market. However, the gold and copper have long been keeping their competitive edge until recently. However Mongolia has

competitive disadvantage in coal and iron ore products in China market. On the other hand, Australia has strong competitive advantage in copper, coal and iron ore products in China market. According to the dynamic analysis of TSI index, copper and coal products have converted from import specialization to export specialization. And, the iron ore and zinc product's competitiveness is decreasing in the world market. For that reason, the restructuring is required for iron ore and zinc; and have relocate the market.

In the future, Mongolia must penetrate the existing market in which it has a low market share. This includes Japan and South Korea in Asia and north European countries.

V. Analysis of Mongolia's mining market position in three selected countries

5.1. Introduction

World coal demand in 2010/2011 reached on 4.5 trillion ton, this number has increased by 6 percent annually since 2000 (Global Coal Statistic, 2011). Moreover, iron ore demand has reached on 2.6 trillion ton, which is constantly increased by 11% since 2003. Around 98 percent of iron ore is used to make steel and goes directly to primary steel plants (World mineral statistic, 2011). Furthermore, copper demand in 2010/2011 reached on 16.2 million ton, this is increased by 2.43 percent annually since 2000 year (World mineral statistic, 2011).

The largest market of coal, iron ore and copper on the same year was China, Japan and Korea respectively. These three countries used almost 33 percentage of the total world mining production in 2010/2011. For Mongolia, main mining export is based on coal, copper, gold, iron ore and zinc, meanwhile the China mostly imported mining products from Mongolian and Japan and Korea market is closest with Mongolia.

Mongolia and Australia are the main exporters of coal in the China. In 2010/2011, 30.3 percentage of the China coal production came from these two countries. During the same year, Mongolia exported 21 million tons of coal and Australia exported 10.8 million tons of coal. The Mongolian coal export was increased by 48.5 percent annually in average since 2005; meanwhile Australia's export has decreased by 3 percent annually (Mongolian statistic report 2011, and Australian mineral statistic 2011).

Mongolia and Australia are the main exporter of iron ore in the China. In 2011, Mongolia exported iron ore 5.75 thousand tons to the China. Meanwhile in the same year, Australia exported 44.2 million tons of iron ore.

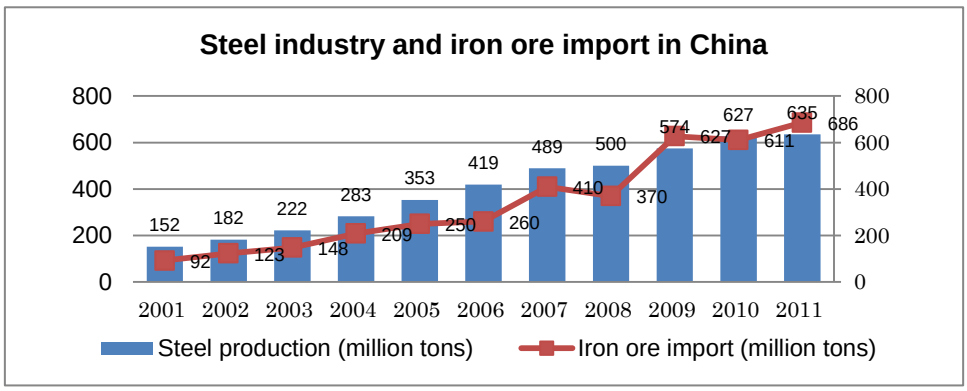
In the imported side, the largest importer in 2011 was China. China imported $4.3 trillion, Japan $82.7 million and Korea $30.5 million (Mongolian statistical report 2011).

The large increase of coal and iron ore export is caused by two reasons. First, it is cause by the increase in steel industry as shown in figure 5.1. Second, the China's construction and ship building are increased as shown in figure 5.2 and depending heavily on the source of mining products from two countries, Mongolia and Australia, through trade.

This paper has two main objectives, to estimate the competition between Mongolian coal and iron ores with its competitor especially Australia. The comparison is conducted in three countries: China, Japan and Korea, which is largest importer of coal, iron ore and copper. After determining Mongolian position in these three markets, strategy to enhance Mongolian position is formulated.

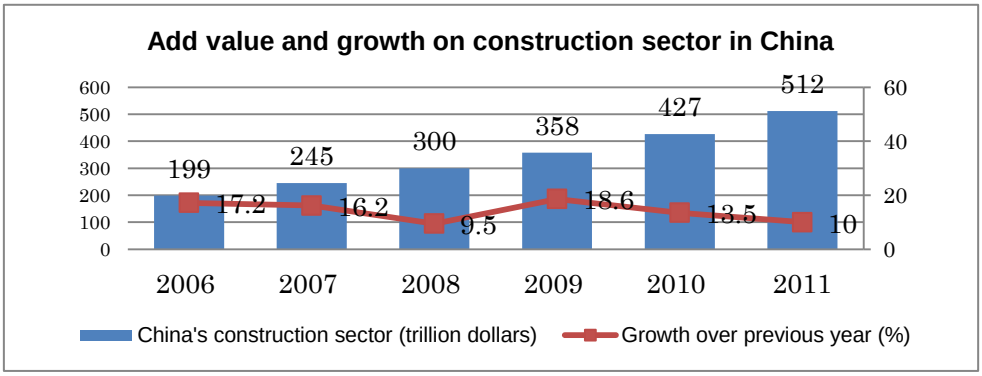
This chapter is organized as follows. The next section discusses literature review and the coal, copper and iron ore markets in China, Japan and Korea followed by the methodology utilized in this paper. The next part determines on the results and lastly conclusion is presented.

Figure 5.1: China's steel industry



Source: World steel industry statistic, 2011

Figure 5.2: China's construction sector



Source: Research report of China's construction industry

5.2. Literature review

There are as many strategic positioning avenues as there are products, markets and business strategies. Successful position can be based on the competitive strategy, options (Aaker, 2001). Ries and Trout say that competitors have three possible strategies they may follow. First, the firm may choose to strengthen its current leadership position by reinforcing the original concepts that lead to the first position in the mind of the customer. Second, to establish a new position is looking for new openings in a market. Third, to attempt to de-position or re-position the completion. Often position is based upon a series of perceptual maps (Blythe, 2009).

Market share seems to be an important variable to focus on in the choice of product market given its key role in the strategic marketing planning process and its frequent role as the key strategic objective in that process (Jacobson and Aaker 1985). In fact, Bower and Grada (1985) have suggested that a distinguishing characteristic of "market driven" companies is their use of share rather than volume or profit as the primary measure of success.

5.2.1. Industry concentration

By definition, the combined market share of all competing firms will be dispersed over fewer firms in a more concentrated industry than in a less concentrated industry. Therefore, a positive relationship would exist between market share and industry concentration. Meanwhile, the relationship between market structure and profit performance can be addressed in reference to the structure-conduct performance (SCP) paradigm (Bain 1951, 1956), which posits that industry structure variables influence the firm's strategy to eventually affect its performance. Embedded in the SCP perspective is the view that the firm attempts to control the output in the market by (1) colluding with other firms to drive up prices and profits or (2) exercising monopoly power. Therefore, more concentrated industries are expected to be more profitable (cf., Domowits, Hubbard, and Petersen 1986; Martin 1983; Weiss 1971).

5.2.2. Relationship between competitive strategy variables and market share/ profit

Choice of product market segments to target

The present research suggests some variables that might be determinants of market share achievement. The other major stream of research focuses directly on market share achievement or changes in market share of individual firms or business units and has involved both economists and researchers in marketing. Economists in this stream, such as Shepherd (1979), have tried to relate these changes in market share to various aspects of market structure.

Market growth and product life cycle stage

High growing market is generally viewed as relatively more attractive by business because of the high margins and growing demand that characterize them. Consequently, it would be expected that most firms would show a propensity to exit low or moderate growth markets and enter high growth markets. Therefore, everything else being equal, the combined market share of all competing firms in relatively high-growth markets will be dispersed over a larger number of firms in such a way that market growth rate and market share would be inversely related (David et al. 1993).

In addition, markets experiencing high rates of growth can be characterized by high marketing costs, rising productivity, increased investment to keep pace with growth, low or negative cash flow, and high levels of buyers spending. The net effect of these cost reductions and increases and rising profit margins and sales seems to be increased profits (Buzzell and Gate , 1987); in turn , profitability and market growth rate should be positively related (David et al. 1993).

Product customization

A priori, it is difficult to predict whether producing customized goods (versus standardized goods) will lead to more or fewer sales for the business. On one hand, customized products could satisfy the heterogeneous needs of buyers better than standardized goods, thereby leading to more sales. On the other hand, customized products can be more expensive to produce because they eschew economies in production, and these higher costs may lead to higher prices, fewer sales, and lower market share (David et al. 1993).

The effect of producing customized products on profits is also equivocal. However, customizing products can mean higher production costs, as noted above. Therefore, it is difficult to predict beforehand whether the premium prices that firms often charge for customized products more than offset, just offset, or fail to offset the higher costs of manufacturing customized goods (David et al. 1993).

Product price

Economic theory suggests that for rational and informed customers, price and quantity sold would be inversely related (David et al. 1993). In addition high market share business could charge higher prices without losing sales when high market share endows a business with greater market power (Montgomery, 1985). These equivocal relationships between price and market share are reflected in the mixed empirical findings on this relationship. A number of PIMS based studies have arrived at either an insignificant or a significant and positive association between price and market share (e.g., Buzzell and Wiersema 1981a; Jacobson and Aaker 1985; Phillips, Chang and Buzzell 1983; Robinson and Fornell 1985), whereas Gale and Branch (1982) found lower costs rather than higher prices account for most of the greater profitability of high market share businesses. Whether the effect of price on profit is positive or negative is also difficult to predict a priori. It depends on the form of the demand curve and where along the curve business are operating (David et al. 1993).

Market share measure

Absolute market share (the ratio of business' sales to total sales in the served market) and relative market share (the ratio of a business' market share to the combined market

share of its three largest or largest competitors) are two different measures of market share that could contribute to the variance in market share elasticities found across studies. Absolute measures of market share, for example, are preferred when specific industries are studied, because the sum constraint (the market shares of individual firms should sum to 100%) and bound constraint (market shares of individual firms should be between zero and 100%) can be satisfied. Relative market share, on the other hand, is preferred when cross-sectional data is pooled across industries, because (1) the sum constraint and bound constraint cannot be satisfied (Varadarajan and Dillon, 1982), and (2) the business' scale and bargaining effects in its served market are thought to be captured better with relative market share measures (Buzzell and Gale, 1987). Furthermore, while absolute market share is measured in percentages, relative market share being a ratio of market shares, the percentages in the numerator and denominator of the measure cancel out. These differences in scale properties could yield different estimates of the market share elasticity.

5.3. Mining market in China, Japan and Korea

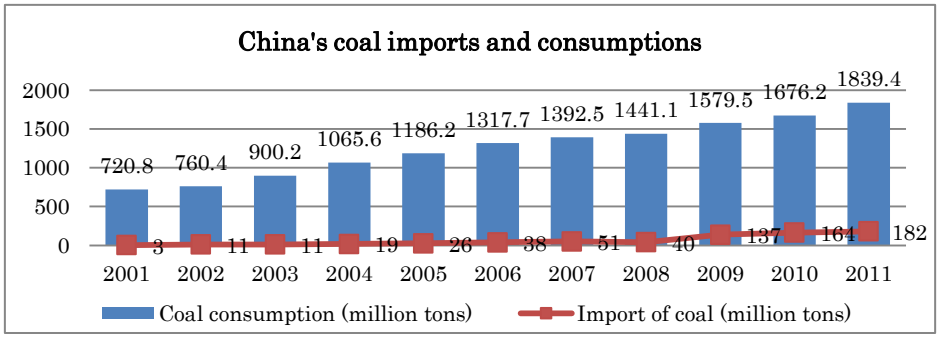
5.3.1. China

China is largest market for coal and iron ore. In 2010/2011 the country used 29 percent and 61 percent of total world coal and iron ore respectively. All of it were imported.

Regarding the source of coal import, 45 percent of its import came from Mongolia and 23 percent came from Australia in 2012 (China coal resource report). Australia has dominates the China's market since Australia mainly exported in the form of coaking coal (world mining news 2011). Although the share has decrease over the years, in 2000 Australia's market share was 30 percent meanwhile Mongolia was only 5 percent

(Mongolian statistical report). The difference of coal, the country produced coal and only 9.8 percent of domestic consumption is imported (figure 5.3).

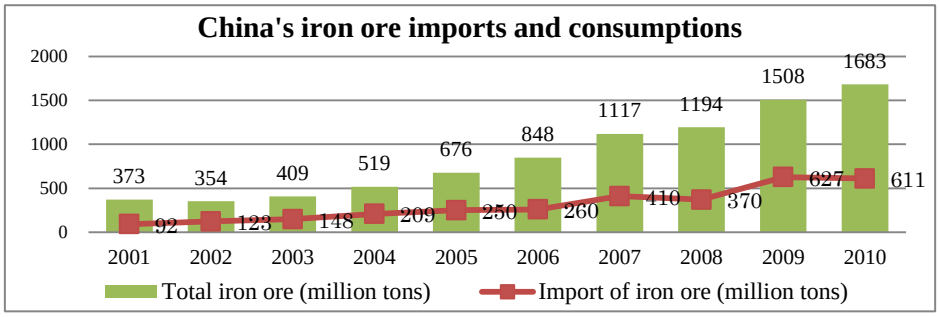
Figure 5.3: China's coal market



Source: Statistical review of world energy report & China's statistic data

The iron ore is second main import in China. The country is imported 36.3 percent of domestic consumption of iron ore. The 90 percent of iron ore is mainly utilized in steel industry. The increase in the coal and iron ore consumption in the country is mainly caused by three reasons (MPOC, 2009): high economic growth, improved technology and huge population

Figure 5.4: China's iron ore market



Source: World steel statistic yearbook, 2011 & China's statistic data

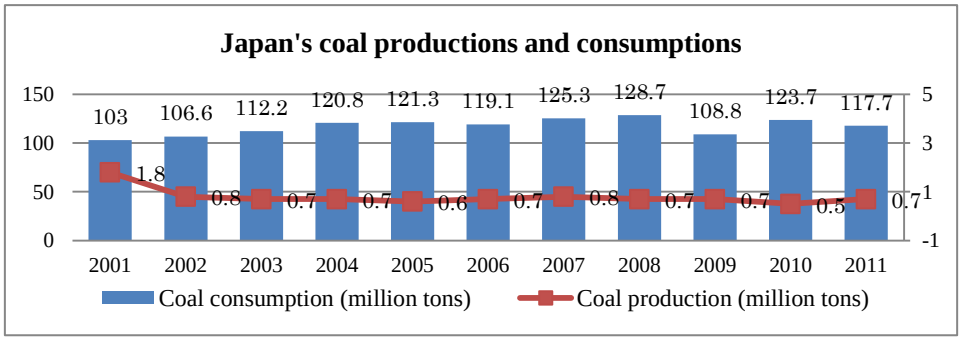
Australia is the largest source of iron ore imports into China. China has pursued a policy of locking in foreign sources of iron ore, especially from Australia. Today, many of Chinas major steel mills and suppliers are targeting new iron or opportunities in

Australia's iron ore mines. Australia dominates the China's market since 2004. Regarding the source of import, 37.6 percent of its import came from Australia, 24.1 percent came from India, 22.1 percent came from Brazil and 5.3 percent came from South Africa (Global economic outlook and steel demand trends, 2011).

Japan

Japan is second largest importer of coal and copper. In 2010/2011 the country consumed 117.7 million ton, but difference from China the country has few domestic energy resources and is only 16 percent energy self-sufficient as figure 5.5 is shown a feature of Japan's coal market. In addition, 17.1 percent of the country coal import in 2011 was in the from of Australia (Australian mineral statistic report, 2011).

Figure 5.5: Japan's coal market

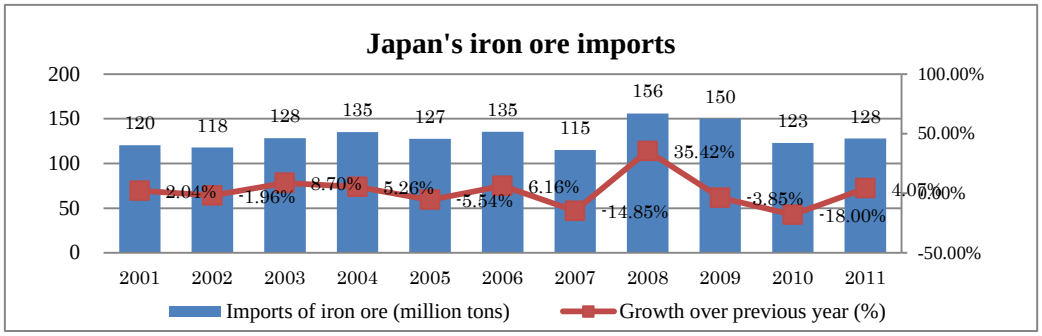


Source: World coal statistic report, 2011

The iron ore is important product for steel industry in Japan. In 2011, Japan was imported 128 million ton iron ore. Figure 5.6 is shown the Japan's iron ore market. The source of import, 18.5 percent came from Australia. Specially, Australia is being Japan's second largest source of imports. Japan was Australia's largest market of iron ore until 2003 (Australian mineral statistic report). Over the past 10 years, Australia was the

largest source of imports of iron ore by Japan and accounted for 58.2 percent of total Japanese imports of iron ore in 2011

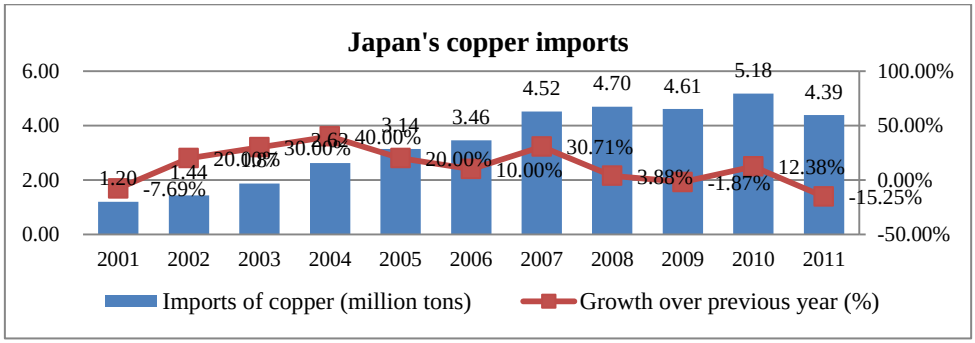
Figure 5.6: Japan's iron ore market



Source: Japan statistical year book

The copper is main products for building & construction sectors, engineering, electrical industry and transportation sector in Japan. In 2010/2011 the country imported 4.39 million ton. Japan's custom smelters, which process concentrates from foreign suppliers into refined metal, are stable importers of copper, purchasing roughly 50 percent of the world's marketable supply every year (Business recorder, 2002). Figure 5.7 is shown Japan's coal market. Regarding the source of import, 48.6 percent of its import came from Chile and 20.7 percent came from Indonesia in 2011.

Figure 5.7: Japan's copper market

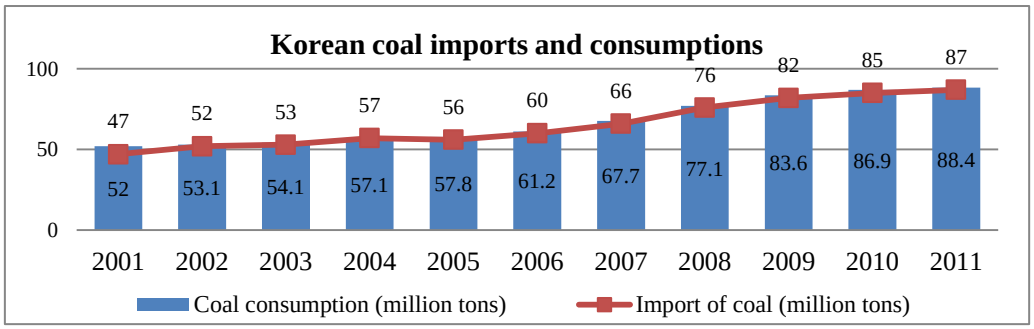


Source: World copper statistic report, 2011

5.3.3. Korea

Korea is fourth largest importer of coal in Asia. Also, Korea has national coal industry, which is owned by government. In 2010/2011 the country consumed 2.2 percent of the total world coal consumption and all of it were imported. Figure 5.8 is shown Korean coal market. Australia and China account for 70% of Korean market. The source of import, 43 percent of its import coal came from Australia and 26.1 percent came from China in 2011.

Figure 5.8: Korean coal market

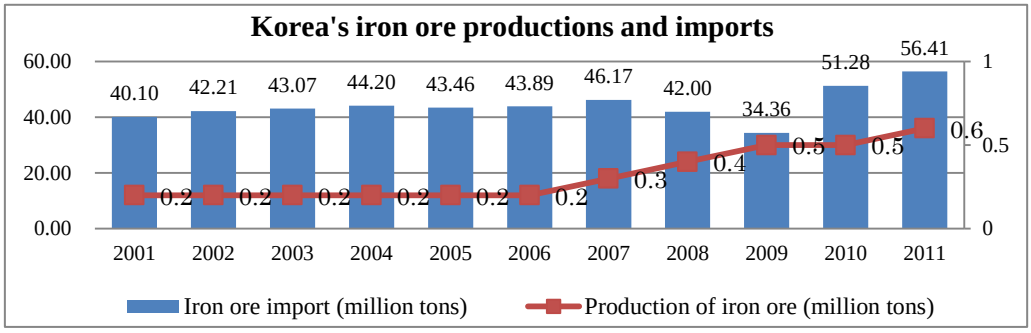


Source: Statistical review of world energy report, 2011; World coal statistics, 2011

Iron ore is one of important product for Korea. In 2010/2011 the country consumed 5 percent of the total world iron ore consumption and all of it were imported. Figure 5.9 is shown Korean iron ore market. In 2011 Korea The import of source, 10.6 percent of iron ore import came from Australia.

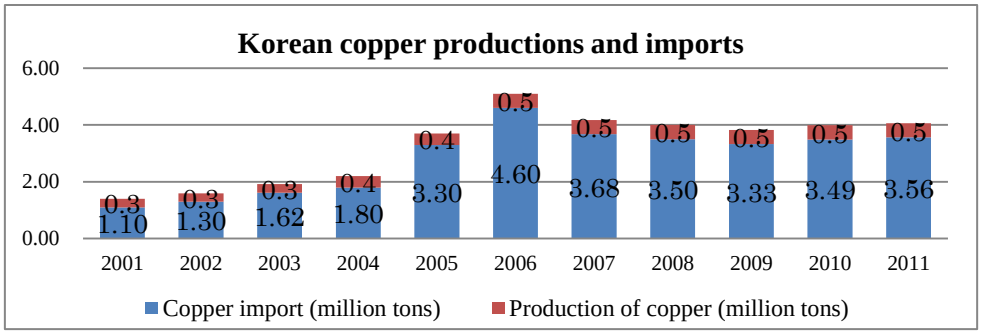
Today construction, telecommunication and electrical industry is developing significantly in Korea. For that reason, copper is their main products of their economic sectors. In 2010/2011, Korea imported 3.56 million tons of copper, which is 18.7 percent of total world copper consumption. Figure 5.10 is shown Korean copper market.

Figure 5.9: Korean iron ore market



Source: World mineral statistic, 2011

Figure 5.10: Korean copper market



Source: World mineral statistics, 2011 & World copper statistics report

5.4. Methodology

Dependent variables

Market share is the percentage of a mining company's export total revenue is given product category.

Independent variables

1. Market growth: The export and market trend of mining products in three selected countries.
2. Market competition: The global competitiveness estimation and score about market development and business maturity in selected three countries.

3. Price elasticity: The estimation of price impact on mining products to market demand and supply.
4. Market segments: Segmented the market by countries and mining products.

5.5. Empirical result

5.5.1. Source of data

The research is focused on market position analysis of Mongolian mining products. The research is based on statistical data of from 2000-2011. The Mongolian export and foreign trade data has taken from national annual statistical reports. Moreover, the world mining import and demands are taken from the world trade statistics and internet sources. The international prices are from International mineral trade report. The summary of variables is presented in table 5.1.

Table 5.1: Summary of import demand variables

Varialbes	Mean	Std.Dev	Min	Max
China				
Market share in China (%)	0.28	0.18	0.11	0.61
Price of coal ($/ton)	109	74.18	37	256
Price of copper ($/ton)	6415	2464.16	2500	9264
Price of iron ore ($/ton)	131	20.02	90	168
Total import of coal (million tons)	57	65.18	2	182
Total import of copper (million tons)	4.17	1.86	1.75	7.01
Total import of iron ore (million tons)	321	218.99	69	686
Japan				
Market share in Japan (%)	0.0065	0.006	0	0.02
Price of coal ($/ton)	98	48.89	45	168
Price of copper ($/ton)	6790	2514.97	2900	10000
Price of iron ore ($/ton)	142	20.30	110	180
Total import of coal (million tons)	169	11.78	150	187
Total import of copper (million tons)	3.20	1.48	1.20	5.18
Total import of iron ore (million tons)	130	12.77	115	156
Korea				
Market share in Korea (%)	0.05	0.06	0.01	0.21
Price of coal ($/ton)	74	23.21	51	125
Price of copper ($/ton)	6650	2459.15	2700	9750
Price of iron ore ($/ton)	137	19.94	98	170
Total import of coal (million tons)	63.75	15.15	44	87
Total import of copper (million tons)	2.69	1.23	0.99	4.60
Total import of iron ore (million tons)	43.60	5.95	34.36	56.41

5.5.2 Model of study

The basic model postulated that market share for a firm depends on structural and firm-related variables.

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

Where Y_i is dependent variable that *market share* in percentage, X_{ij} is the 4 used independent variable mentioned above that *Market growth* (x=1), *Market competition* (x=2), *Price elasticity* (x=3), *Market segments* (x=4).

5.5.3. Analysis of market share

The first stage, import demand is estimated for the three countries. The first step in the regression analysis is to test for the market share. The result indicate that

Table 5.2: Mongolian company's market share in China

Variables	Coefficients	Standard error	t-Ratio
Model specification			
Market growth	0.203	0.065	3.122
Market competition	0.701	0.405	1.730
Price elasticity			
Coal	0.017	0.011	1.545
Copper	-0.004	0.026	-0.159
Iron ore	0.001	0.000	2.456
Market segments			
Coal	-0.792	1.112	-0.712
Copper	0.122	7.085	0.017
Iron ore	65.793	11.09	5.933
Constant	-0.412		
F-statistic model	37.624		
R square	0.990		

For China, the price elasticity of copper and iron ore are less than one, meaning that price change will cause less of a change in quantity demanded. Although, the impact of coal price has the largest effect on demand of mining products compare to copper and iron ore.

Looking at market segments, iron ore coefficient is significantly positive and copper is positive, meaning that the Mongolian companies' export to the China is satisfied with the performance of iron ore and copper in the future they are willing to import iron ore and copper even more. However, the coal is negative and t-ratio is indicate also. It is indicate that the coal export to the China will decrease or the profit of coal is low than compared the other products. Moreover, price elasticity of coal is showing that the price is main factor for measuring the demand and export performance for the Mongolian companies.

Table 5.3: Mongolian company's market share in Japan

Variables	Coefficients	Standard error	t-Ratio
Model specification			
Market growth	0.005	0.003	1.507
Market competition	0.132	0.255	0.518
Price elasticity			
Coal	0.00006	0.000	0.365
Copper	-0.010	0.036	-0.287
Iron ore	0.00001	0.000	0.043
Market segments			
Coal	45.611	602.585	0.076
Copper	38.618	80.407	0.480
Iron ore	-28.125	395.679	-0.071
Constant	-0.124		
F-statistic model	3.127		
R square	0.893		

For Japan, the price elasticity of coal, copper and iron ore are less than one, meaning that price change will cause less of a change in quantity demanded. Although, the impact of coal and iron ore price have the effect on demand of mining products compare to copper.

Looking at market segments, coal and copper coefficients are significantly positive, meaning that the Mongolian companies' export to the Japan will satisfied with the performance of coal and copper in the future they are willing to import coal and copper highly. However, the iron ore is negative and t-ratio is indicate also. It is indicate that the iron ore export to the Japan will decrease or the profit of iron ore will low than compared the other products. Moreover, price elasticity of iron ore is showing that the price is main factor for measuring the demand and export performance for the Mongolian companies.

Table 5.4: Mongolian company's market share in Korea

Variables	Coefficients	Standard error	t-Ratio
Model specification			
Market growth	0.010	0.010	0.997
Market competition	-0.135	1.262	-0.107
Price elasticity			
Coal	0.001	0.002	0.452
Copper	0.218	0.146	1.490
Iron ore	0.000	0.001	0.140
Market segments			
Coal	-314.822	888.248	-0.354
Copper	10.280	233.369	0.044
Iron ore	809.528	1884.524	0.43
Constant	0.107		
F-statistic model	1.773		
R square	0.825		

For Korea, the price elasticity of coal, copper and iron ore are less than one, meaning that price change will cause less of a change in quantity demanded. The impact of copper price has the largest effect on demand of mining products compare to coal and iron ore.

Looking at market segments, iron ore coefficient is significantly positive and copper is positive, meaning that the Mongolian companies' export to the Korea is satisfied with the performance of iron ore and copper in the future they are willing to import iron ore and copper even more. However, the coal is negative and t-ratio is indicate also. It is indicate that the coal export to the Korea will decrease or the profit of coal is low than compared the other products.

5.6. Conclusion

The country's resource and business economic development are the major determinants of demand about mining products. The China's market is depend on economic sector development. Moreover, high industry development and business competition are main factors for increasing demand of mining products in Japan and Korea.

Mongolian mining product obtained the largest market share in China, meanwhile Japan and Korea countries have transportation problem with high cost. However, all the countries that China, Japan and Korea have less sensitive to price change. Currently China is main market for Mongolian mining products. On the other hand in Japan and Korea have high demand and one of main target countries of Mongolian mining sectors.

Different characteristics will generate different strategies for every country. China has high demand of coal, iron ore and copper products. However, iron ore and copper segments are more profitable in China. Meanwhile, Japan has less resource and high

demand for industries that steel, shipbuilding, automobile and electric industry. Therefore, coal and copper should be exported with competitive price and faster transportation than Australia, China and Chilean suppliers. In Korea where coal and iron is important and closest market of Mongolia, counting these issues will be important in maintaining market share in this country.

VI. Railway and logistics management of Mongolia

6.1 Introduction

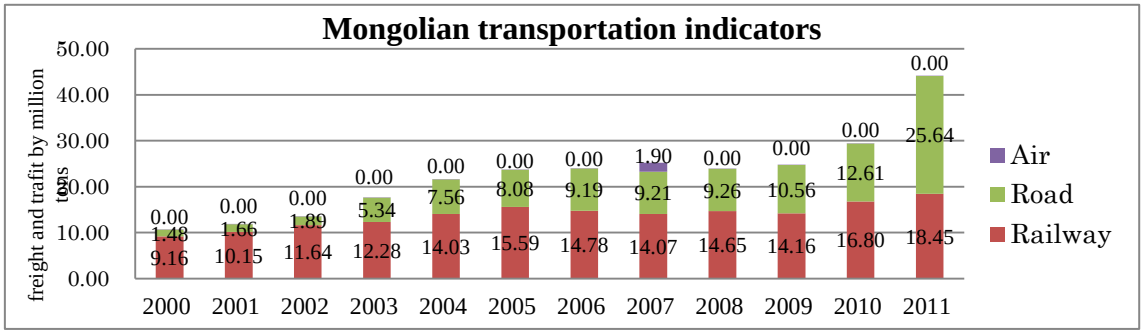
In 1949, Mongolian railway station was established a join with Mongolian-Russian shareholding company. The two shareholders of the company are the Mongolian Ministry of Transport and the Soviet Ministry of Roads and Communication. In 1952 the agreement was extended to cover construction of the line from Ulaanbaatar to the Chinese border and the Choibalsan lines in the east of the country were also transferred to the company in 1956. The Management Board is based in Ulaanbaatar. The Russian contributed 51% of the capital and the Mongolian 49% (Southern Mongolia Infrastructure, 2008).

The Mongolian rail network consists of two connections, which are north-south line connecting Russia and China & Ulaanbaatar, all have seven short branches mostly serving mines and a line in the extreme north-east serving Choibalsan and connecting with Chita in Russia. The total length of the network, all of which is single track, is about 1815 kilometres. The capacity of the mainline is 20 million tonnes of freight.

6.2 The railway sector of Mongolia

The total length of the railway line in Mongolia is currently more than 1815 km, including 1110 km of main line linking northern and southern borders of the country. In 2011, volumes of freight and traffic were 18.4 million tons. Table 6.1 is shown the railway freight and traffic of Mongolia.

Figure 6.1: Main freight and traffic by transportation type (million tons)



Source: Mongolian national statistical report, 2011

The railway equipment

The railway has 122 locomotives, 2690 wagons and 322 passenger coaches. However Mongolian Transportation Station's locomotives' condition is deteriorating, on average about 20 years old. Therefore railway technology is presently needed to modernize with high capacity suitable for Mongolia's sharp continental climate.

Difficulties in railway sector

The difficulty of railway sector is arisen from four main factors. First, it is increased transit rail charges in neighbouring countries. Second, barriers for transit cargo to Mongolia at sea ports: (1) High shifting cost at Xingang port, increasing operational charge and shortage of cargo. (2) Process of transit delayed for 14-30 days during high season from May until August. (3) The lack of wagon supply in China, delays in 7-14 days at sea port terminal. Third, Zamyn Uud has not enough transhipment facility and capacity at Mongolian border in due over loaded. Fourth, Trans-Siberian has outdated wagons and facilities in Russian railway (Enkhrimaa, 2012).

Mongolian logistic solutions

Private sector involving in International logistic solution: (1) Mongolian companies initiated an express block train service for container transportation between Europe and Asia since 2002. (2) They initiated to use Russian private wagons with cooperation of Mongolian and Russian Railways, to solve the problem of supply container railcars, covered wagons for import, export and transit since 4 years.

Major transport routes in the region

Trans-Siberian Railway is connected the Russian Federation to PRC. This railway consists of three tributary routes. The main routes run from Moscow to Vladivostok via southern Siberia and were built between 1891 and 1916. The second route is the Trans-Manchurian route, which branches off in Tarskaya (about 1000 km east of Lake Baikal) to head southeast into the PRC and its capital, Beijing. The third is the Trans-Mongolian route, which branches off the main line in Ulan Ude on Lake Baikal's eastern shore (Trade facilitation and logistic development strategy report, 2009).

Mongolia has four main ports in China, which are Xingang port, Dong Jian port, Lianyungang port and Qingdao port. (1) Xingang port is the nearest port for Mongolian transit cargo since 1990 (Sea/Rail/Rail, Sea/Rail/Road). (2) Dong Jian port since May 2012, new terminal in North East is fixed to be the port for transit cargo to Mongolia (Sea/Rail/Rail, Sea/Rail/Road). (3) Lianyungang port is main port Central Asia including Mongolia, total transit time 12 days (Sea/Rail, Rail/Rail). (4) Qingdao port opens for Mongolian transit cargo Inchon-Qigdao. Total transit time 25 days (Enkhrimaa, 2012).

New railway construction

In Mongolia approximately 5683.5 km railway lines will be built in 3 stages: (1) first stage and second stage will cover the construction of 1933 km new railway lines from the Gobi region to East region. (2) the third stage over 3600 km railway lines will be constructed and connected the Western region and Gobi region. New rail link from Ukhaa Hudag to Choibalsan to link with existing connection (to Trans-Siberian from Nauskhi to Erlian 1113 km) estimated cost of $2.5 million per kilometres. Table 6.1 shows the new railway line of Mongolia.

Figure 6.2: New railway line in Mongolia

Source: New railway infrastructure project, 2011

The justification for railway construction rests on the needs of the coal and mineral trade for different routes for export. Mongolia has Chinese and Russian port. Each of these points is a potential destination for rail freight from Southern Mongolia.

Regulation of private railways

The government has decided that private mining companies should finance, develop and operate the proposed railway serving Narin Sukhait and Tavan Tolgoi. Private financing will resolve much of the uncertainty associated with synchronizing mine and railway development. Private railway may also be developed more quickly and operated more effectively than if they were operated by government.

There are, however, some risks associated with the development of these private railways. In particular, there is a need to ensure that the private mining companies which own these railways do not use their control of the railways to inhibit competition from other coal mines. There are international examples where private mining companies have been unwilling to allow competitors to have access to those railways at reasonable prices.

Today Mongolian government concerned to ensure that the regulatory framework permits competing mining companies to use the private railways. International approaches to regulation of mining railways to ensure open access rely in the first instance on commercial negotiation between companies. Where price regulation is exercised, care needs to be taken to ensure that the regulated price is high enough to provide proper incentives to the owner to maintain and explained the facility as required.

6.3 Literature review

The transportation sector is considered a variety of characteristics of the alternative modes, such as price, speed, reliability, loss and damage experience and flexibility of service. The decision also affected by special attributes of the shipment (unusual

perishability, fragility or size) and by characteristics of the shipper, which is location, past transport behaviour, other socioeconomic variables, or simply random variables in tastes (Richard, 1978). McFadden (1973) has shown that by imposing several reasonably plausible assumptions on the utility maximizing problem, it is possible to derive the multinomial logit model, a functional form describing the probability distribution of individual choice which has convenient and attractive empirical properties (Richard, 1978).

The logit model, in both its binary and multinomial form, has been recently applied to a variety of discrete choice problems, ranging from urban travel demand (Domencich and McFadden, 1975) to fossil fuel turbine generator plants (Joskow and Mishkin, 1977) to freeway route selection by a state highway department (McFadden, 1975, 1976). The model has several properties which make it attractive for analysing the allocation of surface freight transportation. (1) The model is consistent with individual utility –maximizing behaviour. (2) The response of model market shares to a given change in the value of an independent variable is greater when the market is evenly divided among alternative than when one mode predominates. This specification seems more reasonable a priori than a linear relationship. (3) Unlike the linear probability model, predicted model market shares are constrained to the 0, 1 interval. (4) Unlike the comparative cost approach, the logit model permits the value of the service differentials among the various modes to be estimated rather than assumed.

In econometric applications, logit model have used individual decisions as the unit of observation. The observation consist of the model market shares within “markets” defined by commodity type, mileage block, and shipment weight block. The empirical problem at hand is to estimate the effect of observed attributes of modes, shipments, and

shippers on the market shares of truck, boxcar, and piggyback transport over a sample of manufactured commodities. The model can written:

$$log\frac{P_1}{P_2} = a_u + \sum_{h=1}^{k} b_{UK}X_{UK} \qquad (1)$$

The P_1 and P_2 represent market shares of the ith and jth mode. The each X_{UK} measures the difference between modes I and j in the value of the kth attribute (e.g., differences in price, speed, reliability, etc).

In demand for travel studies, difference in average transit typically enters directly as a determinant of modal choice. In explanation the demand for freight transport, economic theory suggests that time performance should enter interactively with the value of the commodity in transit. Since the inventory cost of goods in transit is the product of time in transit, the value of the goods, and the rate of time discount, it is possible, by using the product of intermodal differences in transit time and commodity value as an explanatory variable, to obtain a shadow discount rate from the estimated parameters of the model.

6.4 Methodology

The modal choice model specified in using the method proposed by Berkson (1953) and elaborated by Thei (1970). The logit model in (2) contains no error term, although it is derived from assumptions about the distribution of random taste variations. Market share observations are obtained by sampling from a population of shipments. An observed market share, f_i, is actually an estimate of P_i, the true probability of choosing the ith mode. In fact, it can be shown that

$$log\frac{f_2}{f_1} = log\frac{P_2}{P_1} + u_1 \quad (2)$$

Where u_1 is close approximately to a normally distributed random variable with zero mean. By substituting the right-hand side of (1) into (2), the model can be written

$$log\frac{P_2}{P_1} = a_1 + b_1(R_1 - R_2) + b_2(T_1 - T_2) + b_3(D_1 - D_2) + b_4(S_1 - S_2) + b_5(W_1 - W_2) \quad (2)$$

Where: P_1 and P_2 is market share; R_1= rate charge by transport mode, T_1= mean transit time for mode I (in days); D_1= distance of market; S_1= speed of train; and W_1= weight of product

The error terms in this model are heteroskedastic, since the market share estimates, f_i, have smaller variance when they are based on a larger number of underlying transport records. Moreover, u_i is correlated within each cell (or market), since market shares must sum to one. Consequently, efficiency estimation requires a generalized least squares procedure, where the appropriate weights involve knowledge of the number of shipment records upon which each triad of market share estimates is based (Richard, 1978).

6.5 Empirical result

Source of data

The research is focused on transportation cost analysis and it's impact on market share of Mongolian mining products. The research is based on statistical data of from 2000-2011. The export and trade data has taken from national annual statistical reports.

6.5.1. The cost analysis in transportation (railway)

The railway sector is required high investment and important for mining industry for serving freight volume to final destination. The railway will be justified for most of Southern region's mining industry whose major purpose is the transport final products of copper, gold, coal, steel and other metals.

A simple model can be used to compare the costs of different direction and railway options:

$$C = \frac{K \times r \times (1+r)^T}{(1+r)^T - 1} \times \frac{1}{x} \times d + v \times d$$

Where: *C* is the total cost per ton; *K* is the capital cost of route construction per kilometre ($1.8 million for railway); *T* is amortization period (20 years); *r* is the discount rate (15% or 0.15); *x* is the freight volume per year; *v* is the operating cost per tonne per kilometres ($0.02 for rail); *d* is the distance of the route in kilometres.

Using the simple model, table 6.2- 6.4 illustrates transportation cost of coal, copper and iron ore through Chinese and Russian port. The justification for railway construction rests on the needs of minerals for different routes for export. Each of these points is a potential destination for rail freight from Southern Mongolia. China port is negotiated on cost of transportation for coal product with $23.50. Russian port is useful for Mongolia to have an alternative export route. Russian applies discriminatory freight charges for foreign minerals as opposed to domestic minerals. Rail freight for foreign mineral from Naushki to Vostochnaya (4047 km) would cost about $85/tonne. Russian mineral producers in Siberia typically pay about $25/tonne, for hauls of about 4000 km.

From the cost analysis of transportation, the Chinese port has averagely $26-50 on coal; $3300-3500 on copper; and $84-126 on iron ore respectively. However, Russian port has averagely $83-126 on coal; $3500-$3700 on copper; and $170-200 on iron ore. Therefore, Russian port is presently uneconomic on coal and iron ore exports.

6.5.2. Transportation impact on market share

The regression analysis is estimated the transportation factors on market share. From analysis, Speed is more important determinant of modal choice than rate charge of rail line, because the t-Ratio is highly negative than other variables. Looking at market share, the rate charge is significantly positive on China, although it is negative on Japan. The possible explanation could be that distance and high rate charge is influenced to increase the cost and delivery to the final market. The next important factor is distance and coefficient is revealed negative on Japan and Korean market.

Table 6.1: Regression result dependent variable: market share

	China		Japan		Korea	
	Coefficients	t-Raio	Coefficients	t-Raio	Coefficients	t-Raio
Coefficients						
a1	-0.023		-0.021		-0.023	
b1 (Rate charge)	0.024	1.496	-0.031	-0.851	0.024	1.548
b2 (Transit days)	-0.03	-0.79	0.042	0.693	-0.028	-0.756
b3 (Distance)	0	0	-0.005	-0.498	0	-0.884
b4 (Speed)	-0.17	-2.379	-0.001	-0.058	-0.17	-2.435
b5 (Weight)	0.00008	0.894	0.001	0.373	0.00008	0.892
R2	0.081		0.078		0.079	
Number of observation	12	12	12	12	12	12
Maximum impact on market share of $1 per ton change in rates	0.024		-0.031		0.024	

Maximum impact on market share of one day improvement in transit time.	0	-0.005	0
r	0.15	0.15	0.15

6.6 Conclusion

The transportation strategy and logistics management is most important factor for representing competitiveness of Mongolian mining industry in world market. Mongolia has main two port through China and Russia. Today China is main market of Mongolia and cheapest rate charge on coal and iron ore product through their rail line. Although Russian port has high capacity, the rate charge is estimated the between $85 and $120, which is indicated the uneconomically to delivery raw mining products to world market.

The railroad sector presently the rate charge and speed are main important factor for considering economic value of mining export to the final market. Therefore the value created final products are main solutions to delivery to the outside markets and increase the competitiveness in world market.

Moreover, the new railroad is main instruments to reach on outside markets. In 2012, Mongolia was started the new railroad project on Tavan Tolgoi in South Gobi. After the completion of new railroad in 2015, Mongolia can be supply more cheaply and quickly to the large markets in Japan and South Korea. It takes a bulk carrier up to 17 days to haul coal from Newcastle to a South Korean port. Once a proposed new Mongolian rail line is built it will take just three days to transport mining products to ports in Siberia and just a few days sailing across the Sea of Japan.

Table 6.2: Indicate cost per tonne for coal exported from Mongolia (US $)

	A Tavan Tolgoi-Gashuun Sukhait-Baotou	B Tavan Tolgoi-Gashuun Sukhait-Baotou-Huanghua	C Tavan Tolgoi-Sainshand-Zamiin Uud-Datong-Qinhuangdao	D Tavan Tolgoi- Tsagaan Suvraga- Sainshand-Choibalsan- Vladivostok	E Tavan Tolgoi-Airag- Choibalsan-Vladivostok	F Tavan Tolgoi- Airag-Ulaanbaatar- Ulan Ude- Vladivostok	G Tavan Tolgoi-Ulaanbaatar-Ulan Ude- Vladivostok
1. Cost production	$12	$12	$12	$12	$12	$12	$12
2. New railway	410 km	410 km	385 km	870 km	860 km	390 km	490 km
10 million tonnes	19.99	19.99	18.77	42.42	41.93	19.02	23.89
20 million tonnes	14.10	14.10	13.24	29.91	29.57	13.41	16.85
30 million tonnes	12.13	12.13	11.39	25.74	25.44	11.54	14.50
3. Existing Mongolian railway			240	350	360	760	410
10 million tonnes			8.63	40.78	9.35	19.74	10.65
20 million tonnes			6.72	22.14	6.48	13.67	7.38
30 million tonnes			6.08	15.93	5.52	11.65	6.28
4. Existing railway	Chinese	$23.50	$18.00				
5. Existing railway	Russia			3172 km	3172 km	3634 km	3634 km
				31.72	31.72	36.34	36.34
TOTAL							
10 million tonnes	31.99	55.49	57.41	126.92	95.00	87.10	82.88
20 million tonnes	26.10	49.60	49.95	95.77	79.76	75.42	72.56
30 million tonnes	24.13	47.63	47.47	85.39	74.68	71.53	69.12

(1) The $12 cost of coal production is indicated. Estimated cost of coal production range from $10-$28 per tonne.
(2) It assumed a new railway has capital cost of $1.8 million per kilometre, amortized over 20 years at a 15% discount rate, operating costs of $0.02 per tonne per kilometre, and a distance of 1.05 times the indicated straight line distance.
(3) It is assumed that the existing Mongolian network can handle volumes of up to 10 million tonnes per year at an operating cost of $0.02 per tonne per kilometre. For greater freight volumes, a second track would need to be constructed, with same assumption for note (2)
(4) The estimated cost for the existing Chinese network reflects current Shenhua and China Railways tariffs. Actual prices will be commercially negotiated.
(5) The estimated cost for the Russian network is based on operating cost of $0.01 per tonne per kilometre. This is likely to be an under-estimate of the true cost and can be compared with current Russian freight rates of around $85 per tonne for foreign coal from Naushki to Vladivostok.

Table 6.3: Indicate cost per tonne for copper exported from Mongolia (US $)

	A Tavan Tolgoi-Gashuun Sukhait-Baotou	B Tavan Tolgoi-Gashuun Sukhait-Baotou-Huanghua	C Tavan Tolgoi-Sainshand-Zamiin Uud-Datong-Qinhuangdao	D Tavan Tolgoi- Tsagaan Suvraga- Sainshand-Choibalsan- Vladivostok	E Tavan Tolgoi-Airag- Choibalsan-Vladivostok	F Tavan Tolgoi- Airag-Ulaanbaatar- Ulan Ude- Vladivostok	G Tavan Tolgoi-Ulaanbaatar-Ulan Ude- Vladivostok
1. Cost production	$2,900	$2,900	$2,900	$2,900	$2,900	$2,900	$2,900
2. New railway	410 km	410 km	385 km	870 km	860 km	390 km	490 km
350 thousand tonnes	345.07	345.07	324.03	732.22	723.80	328.24	412.40
450 thousand tonnes	270.21	270.21	253.73	573.37	566.78	257.03	322.93
550 thousand tonnes	222.57	222.57	209.00	472.28	466.86	211.71	266.00
3. Existing Mongolian railway			240	350	360	760	410
350 thousand tonnes			201.99	291.07	299.39	632.04	340.97
450 thousand tonnes			158.17	227.17	233.66	493.27	266.11
550 thousand tonnes			130.29	186.50	191.83	404.97	218.47
4. Existing railway	2846	3698	3200.00				
Chinese	56.92	73.96	64.00				
5. Existing railway				3172 km	3172 km	3634 km	3634 km
Russia				31.72	31.72	36.34	36.34
TOTAL							
350 thousand tonnes	3301.99	3319.03	3490.02	3955.01	3954.91	3896.61	3689.71
450 thousand tonnes	3227.13	3244.17	3375.90	3732.26	3732.16	3686.64	3525.38
550 thousand tonnes	3179.49	3196.53	3303.28	3590.50	3590.40	3553.02	3420.81

(1) The $2900 cost of coal production is indicated. Estimated cost of coal production range from $2900-$3200 per tonne.
(2) The estimated cost for the Chinese network is based on operating cost of $0.02 per tonne per kilometre.
(5) The estimated cost for the Russian network is based on operating cost of $0.01 per tonne per kilometre. This is likely to be an under-estimate of the true cost and can be compared with current Russian freight rates of around $85 per tonne for foreign coal from Naushki to Vladivostok.

Table 6.4: Indicate cost per tonne for iron ore exported from Mongolia (US $)

	A Tavan Tolgoi-Gashuun Sukhait-Baotou	B Tavan Tolgoi-Gashuun Sukhait-Baotou-Huanghua	C Tavan Tolgoi-Sainshand-Zamiin Uud-Datong-Qinhuangdao	D Tavan Tolgoi- Tsagaan Suvraga- Sainshand-Choibalsan- Vladivostok	E Tavan Tolgoi-Airag- Choibalsan-Vladivostok	F Tavan Tolgoi- Airag-Ulaanbaatar- Ulan Ude- Vladivostok	G Tavan Tolgoi-Ulaanbaatar-Ulan Ude- Vladivostok
1. Cost production	$36	$36	$36	$36	$36	$36	$36
2. New railway	410 km	410 km	385 km	870 km	860 km	390 km	490 km
1500 thousand tonnes	86.80	86.80	81.51	184.19	182.07	82.57	103.74
3000 thousand tonnes	47.50	47.50	44.60	100.80	99.64	45.18	56.77
5000 thousand tonnes	31.78	31.78	29.84	67.44	66.66	30.23	37.98
3. Existing Mongolian railway			240	350	360	760	410
1500 thousand tonnes			50.81	70.60	72.62	153.30	82.70
3000 thousand tonnes			27.81	37.05	38.11	80.45	43.40
5000 thousand tonnes			18.60	23.63	24.31	51.31	27.68
4. Existing railway	Chinese	$23.50	$18.00				
5. Existing railway	Russia			3172 km	3172 km	3634 km	3634 km
				31.72	31.72	36.34	36.34
TOTAL							
1500 thousand tonnes	122.80	146.30	186.32	322.51	322.41	308.21	258.78
3000 thousand tonnes	83.50	107.00	126.41	205.57	205.47	197.98	172.51
5000 thousand tonnes	67.78	91.28	102.45	158.79	158.69	153.88	138.00

(1) The $36 cost of coal production is indicated. Estimated cost of coal production range from $32-$38 per tonne.
(2) The estimated cost for the Chinese network is based on operating cost of $0.02 per tonne per kilometre.
(5) The estimated cost for the Russian network is based on operating cost of $0.01 per tonne per kilometre. This is likely to be an under-estimate of the true cost and can be compared with current Russian freight rates of around $85 per tonne for foreign coal from Naushki to Vladivostok.

VII. Conclusion and Policy Recommendation

7.1. Conclusion

Mining industry is one of contributor of economy and developed since 1911 in Mongolia. Since 2000, Mongolian mining industry has grown fast and contributed significantly in Mongolian economy. Mongolian main mining products are considered copper, coal, iron ore and gold. Today Mongolian mining industry has arrived on the next stage of industry development and need to improve the competitiveness in world market.

Furthermore, mining sector is an important contributor to the country's GDP. Between 2000 and 2011, mining industry added, on average, approximately $525 million annually to Mongolia's real GDP. The mining industry represents approximately 15% of country's GDP.

The most of mining products explored in Mongolia such as coal, copper, iron ore, zinc and gold were exported mainly to China (90%), Russia (2%), Japan (1%) and Korea (1%). The main contributor to the change in export value is appeared in 2000-2004 by impacted from world market price. However, Mongolian competitiveness effect is considered low and market share is still small in China. Today Mongolia needs to penetrate the Japan and Korean markets. However, Mongolia is not yet in a position to compete in the global market. Mongolia has a competitive advantage in copper, gold and zinc in China market. However, coal and iron ore have competitive disadvantage in this market. Therefore, the restructuring is required for coal and iron ore and need to relocate the other markets.

Regarding the determinants of Mongolian mining industry competitiveness, modern technology, employee education and experience, and R&D sector is main contributor in mining industry. For that reason, government support, foreign direct investment and financial second market development (bond and stock) are important for allowing capital and improving capacity in Mongolian mining industry. On the other hand, legal right determinants and government industry policy is main route for developing Mongolian mining industry and improving competitiveness in world market. Moreover, today Mongolian railway strategy and logistics management is main competitiveness of Mongolian mining industry.

Every country has own characteristics and strategies. For that reason, China has high demand of coal, iron ore and copper products. However, iron ore and copper segments are more profitable in China. Meanwhile, Japan has less resource and high demand for industries that are steel, shipbuilding, automobile and electric industry. Therefore, coal and copper should be exported with competitive price and faster transportation than Australia, China and Chilean suppliers. In Korea where coal and iron are important and closest market of Mongolia, counting these issues will be important in maintaining market share in this country.

The Mongolian new railroad is main instruments to reach on outside markets. In 2012, Mongolia was started the new railroad project on Tavan Tolgoi in South Gobi. After the completion of new railroad in 2015, Mongolia can be supply more cheaply and quickly to the large markets in Japan and South Korea. It takes a bulk carrier up to 17 days to haul coal from Newcastle to a South Korean port. Once a proposed new Mongolian rail line is built it will take just three days to transport coal to ports in Siberia and just a few days sailing across the Sea of Japan.

7.2 Policy recommendation

Today Mongolian mining industry should consider in three factors for improving competitiveness in world market: (1) Improve the industry level on processing stage, (2) Diversify the Mongolian mining products to the world markets and (3) Improving the capability of mining companies.

7.2.1. The recommendation for mining industry development

The processing industry is important for value creation by producing final products in mining industry. Therefore, today Industry Park is important for developing processing manufacture in Mongolia. For that reason, Mongolian government should promote the policy of new technology imports and increase the tax on raw mining export from Mongolia. Moreover, processing industry is required high investment. Therefore, financial source establishes possibility by collecting from private companies and state budget. Specially, the foreign direct investment is important for contribution on mining industry. On the other hand, financial second market is useful for establishing fund and financing long-term investment for the mining companies. Therefore, the domestic stock and bond market development is important for mining industry. Specially today bond market is developing and reliable firms have an opportunity to share the bond in the market. Therefore, Mongolian government should motivate the mining companies for sharing stock and openness the company in the society, which is useful for growing until world level.

The Sainshand city has experienced the industry region in Mongolia. Also, the rich mineral resource has reserved in South Gobi. Therefore, Mongolia has high capacity to explore the mining ores in this region and process the raw minerals in Sainshand city,

based on industry park complex. Therefore, Mongolia should develop the infrastructure and transportation channels between these two cities and should connected the transportation channels with main railway lines to transfer the outside market through Russia and Chinese port. Figure 1 is shown the relationship between industry structure and transportation channels.

7.2.2. Recommendation for transportation and logistics management of Mongolia

The export diversify is strong associated with economic growth. Therefore today Mongolian government should highly consider on the railway strategy and logistics management. The Mongolia has two main gates on railway, which are trans-Siberian railway in Russia and Baotou port in China. For Mongolia, Japan and Korea are closest and largest markets. However, the rate charge of rail line is presently $24-50 on Chinese port and $85-120 on Russia's port. The Trans-Siberian port has high capacity to connect with Asian Pacific regions and North European countries. Therefore Mongolian government should negotiate with Russian government on rate charge. Also, inside the country government should take subsidy on railway sector for reducing transportation cost of mining companies. After, it is allowed the mining companies to transport products economically to the world market. Moreover, the railway lines need to extend on inside the country. For this goal, Mongolia was started new railroad with 1100 kilometers from Tavantolgoi (Umnogobi)- Sainshand (Dornogobi)- Suhbaatar to Trans Siberian railroad. The project will complete in 2015 when it allow to supply more cheaply and quickly to the large markets in Japan and South Korea.

Moreover, today Mongolia has high opportunity to develop a transit way between Russia and China. According to the analysis the train speed factor is appeared important than rate charge line. Therefore, entire new railway line system and new equipment is important for improving profit of railway sector from transit transport and freight. The main financing source is possibility to establish by creating IPO on international stock exchange.

7.2.3. Recommendation for Mongolian mining companies

The maturation of Mongolian mining companies is important for improving the competitiveness in world market and specialization in mining sector. For competitiveness of company: (1) modern technology, (2) employee education, (3) employee experience, (4) innovation and (5) business development sector are main contributor in mining industry. Therefore, mining companies should improve their learning capacity and improve the communication with University and research organizations. Today Mongolian mining companies have positive result on technology efficiency, although companies should improve their investment in fixed asset. On the other hand, employee skills and experience are useful through motivation of goals, increases of management and using a new technology. Moreover, Mongolian mining companies should consider their innovation and improve the investment in research and development sector.

REFERENCES

1. Aigner, D.J., Lovell, C.A.K and Schmidt, P. (1977). Formulation and estimation of stochastic frontier production function models. Journal of Econometrics. Vol. 6. No 1, 21-37

2. Lloyd & Zhang. (2001). Models of Chinese economy. UK: Edward Elgar Publishing Limited

3. Huynh, V.K & Mitsuyasu, Y. (2010). Technical efficiency analysis of rice production in Vietnam, Volume 17, No 1, 135-146.

4. Coelli, T. D & George, E.B. (2005). An introduction to efficiency and productivity analysis. Springer Science, New York

5. Farrell, M.J. (1957). The measurement of productivity efficiency. Journal of Royal statistical society. Series A (general). Vol. 120, No. 3, 253-290.

6. Jondrow, J,, Knox Lovell, C.A., Materov, I.S and Schmidt, P. (1982). On the estimation of technical inefficiency in the stochastic frontier production function model. Journal of econometrics. Vol. 19, No. 2-3, 233-238.

7. Meeusen, W. & Broeck, J. v. D. (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. International economic review. Vol. 18, No. 2, 435-444

8. Shapiro, K.H (1977). Sources of technical efficiency: the roles of modernization and information. Economic development and cultural change. Vol. 25, No. 2, 293-310

9. Selangor, S.A (2007). The study on export competitiveness of Malaysian electrical and electronic product. (600-IRDC/SSP 5/3/1377).

10. Amir M., (2000). Export specialization and competitiveness of the Malaysian manufacturing; trends, challenges and prospects; conference on international trade education and research, Melbourne.

11. Mohamad H. A., Habibah S., (1993); Constant market share analysis: An application to NR Export of major producing countries; journal of NR research, Vol. 8(1); pp 68-78.

12. The World Bank. (2010). Analyzing trade competitiveness. International trade department

13. Alcala, F & Ciccone, A. (2004). Trade and Productivity. Quarterly journal of economics. 119, 613-646

14. Bernard, A. B., Branford, J. J., Redding, S.J., & Schott, P.K. (2007). Firms in International trade. Journal of economic perspectives, 21(3), 105-30

15. Boltho, A. (1996). The assessment: International competitiveness. Oxford review of economic policy, 12(3), 1-16

16. Brenton,P., & Newfarmer, R. (2009). Watching more than the discovery channel to diversify exports. In R. Newfarmer, Shaw. W & Walkenhorst.P, Breaking into new markets: Emerging lesson for export diversification (pp. 111-126). Washington, DC: World Bank

17. Cadot, O., Carrere, C., & Strauss-Kahn, V. (2007). Export diversification: what's behind the hump? London: CEPR.

18. Haddad,M., Lim, J.J,. & Saborowki, C. (2010). Managing openness and volatility: the role of export diversification. Economic premise, Number 6, March 2010, PREM, The World Bank.

19. Husmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. Journal of economic growth, 12, 1-25.

20. Haddad, M., Lim, J.J., & Saborowski, C. (2010). Managing openness and volatility: The role of export diversification. Economic premise, Number 6, March 2010, PREM, The World Bank.

21. Klinger, B. (2010). Export competitiveness. Mimeo. Center for International Development, Harvard University, February, 2010.

22. Krugman, P. (1996). Making sense of the competitiveness debate. Oxford review of economic policy, 12, 17-25.

23. Kunst, R., & Marin, D. (1989). On exports and productivity: A casual analysis. Review of economic and statistics, 71(4), 699-703

24. Lall, S. (2000). The technological structure and performance of developing country manufactured exports: 1995-1998. Oxford development studies, 28(3), 337-369.

25. Lall, S., & Wignaraja, G. (1998). Mauritius: Dynamising export competitiveness. London: Commonwealth Secretariat.

26. Ki-Heung, K., (2008). Analysis of industrial competitiveness and trade effects between South Korea and India

27. Lee, H.S & Wang, Y.J., (2004). "Impact analysis on economic growth of trade structure resulting from concluding FTA among China, Korea, Japan" international economic research.

28. Balassa, B. (1978). Export and economic growth, Journal of development economic, North-Holland publishing company, No.5.

29. Balassa, B. & Bauwens, L. (1987). Intra- industry specialization in a multi-country and multi-industry framework, The economic journal, (97), pp. 923-939

30. Buckley, P.J., Pass, C.L., Prescott, K. (1988). Measures of international competitiveness: a critical survey. Journal of marketing management, vol. 4. No. 2, pp. 175-200.

31. Hertel, T.W. (1997). Global trade analysis: modelling and application. Cambridge University Press, Cambridge.

32. Mongolian National Statistical Commission. Handbook of statistics, 2000-2011

33. Australian Government. Australian mineral statistics, 2007-2011

34. World Economic Forum. The global competitiveness report, 2007-2011

35. Aaker, David A. (1992), “The Value of Brand Equity”, Jouranl of Business strategy, 13 (July/August), 27-32

36. Aaker, David A, and George S. Day (1986). “ The Perils of High-Growth Markets”, Strategic Management Journal, 7 (September- October), 409-21.

37. Amemiya, Takeshi (1985), Advanced Econometrics, Cambridge, MA: Harvard University Press.

38. Anderson, Erin and Barton Weitz (1989), “Determinants of Continuity in Conventional Industrial Channel Dyads”, Marketing Science, 8 (Fall), 310-23.

39. Frederick Wiersema (1981a), “Modelling changes in market share: A cross-sectional analysis”, Strategic management journal, 2 (January-March), 27-42.

40. Frederick Wiersema (1981b), “Successful share-building strategies”, Harvard Business Review, 59 (January-February), 135-44

41. Dodds, William B., Kent B. Monroe, and Dhruv Grewal (1991), “Effects of price, brand and store information on buyers’ product evaluations”, Journal of marketing research, 28 (November), 307-19.

42. Maddala, George S. (1977), Econometrics. New York: McGraw-Hill.

43. Ramaswamy, Venkatram, Eugene W. Anderson, and Wayne S.DeSardo (1994), “A disaggregate negative binomial regression procedure for count data analysis”, Management Science, forthcoming.

44. Rosen, Sherwin (1974), “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition”, Journal of political economy, 82 (January /February), 34-55.

45. Cook, Victor J., Jr. (1985), “The Net Present Value of Market Share”, Journal of marketing, 49 (Summer), 49-63.

46. Gale, Bradley T. and Ben Branch (1982), “Concentration Versus Market Share: What Determines Performance and Why Does It Matter?” Antitrust Bulleting, 27 (Spring), 83-106.

47. Monroe, Kent B. and R. Krishnan (1984) , “Effects of Price on Subjective Product Evaluations” in Perceived Quality: How Consumers View Merchandise in Stores, Jacob Jacoby and Jerry Olson, eds. Lexington, MA: Lexington Books.

48. Neter, John, William Wasserman and Michael H. Kutner (1990), Applied Liner Regression Models. Homewood, IL: Richaard D. Irwin, Inc.

49. Staten, Micheal, John Umbeck, and William Dunkelberg (1988), “Market Share/ Market Power Revisited” Journal of Health Economics, 7 (March), 73-83

50. Varadarajan, P. Rajan and William R. Dillon (1982), “Intensive Growth Strategies: A Closer Examination”, Journal of Business Research, 9 (December), 49-64.

51. Wind, Yoram and Vijay Mahajan (1981), “Market Share: Concepts, Findings and Directions for Future Research” in Annual Review of Marketing, B.M. Ennis and K.J. Roering, eds. Chicago: American Marketing Association, 31-42

52. Timothy W. McGuire, et al., “Estimation and Inference for Linear Models in Which Subsets of the Dependent Variables and Constrained” Carnegie-Mellon University, Working Paper No.3, Pittsburgh, Pennsylvania.

53. Daniel B.Suits, “Interpreting Regressions Containing Dummy Variables” Speech to Research Seminar in Quantitative Economics, University of Michigan, May 1962

54. Buzzell, Robert D. & F.D. Wiersema. 1981. Successful share-building strategies. Harvard Business Review, 59 January- February: 135-44.

55. Scherer, F.M. 1971. Industrial market structure and economic performance. Chicago: Rand McNally and Co.

56. Frank M.B, Philippe C & Dick R.W (1978). Firm Effects and Industrial effects in the analysis of market structure and profitability, Journal of Marketing research, 15, 3-10

57. Bernard C & Michel C (1974). Market Share Strategy and the Product life Cycle, Journal of Marketing, 4 (October), 29-34

58. Wagner A.K & Gary J.R (1989). A Probabilistic Choice Model for Market Segmentation and Elasticity Structure. Journal of Marketing Research. 4(November), 379-390.

59. Gerard J.T (1988). The Price Elasticity of Selective Demand: A Meta- Analysis of Econometric Models of Sales. Journal of Marketing Research, 4 (November), 331-341

APPENDICES

Table 1: Mongolian mining industry indicators (2000-2011)

	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coal (export)	thousand tons	5,185	5,141	5,544	5,666	6,865	7,517	8,074	9,238	10,072	14,442	25,162	30,940
Copper concentration	thousand tons	358	405	489	511	517	516	538	543	525	533	522	514
Iron ore export (export)	thousand tons	0	0	0	0	33.5	167.7	180	265.1	1387.4	1379	3076.6	5193
Molybdenum concentration	thousand tons	2.8	3	3.4	3.8	2.4	2.5	3	4.2	4	5.1	4.7	4.2
Spar (export)	thousand tons	734	585	514	488	468	508	522	638	546	629	727	659
Zinc (export)	thousand tons	0	0	0	0	0	23	110	155	144	142	113	105
Mining export	thousand dollars	401,858	447,150	393,000	461,550	651,825	797,925	1,156,500	1,460,625	1,900,850	1,414,039	2,181,377	3,585,263
Change	percentage		11%	-12%	17%	41%	22%	45%	26%	30%	-26%	54%	64%
GDP	million dollars	1137	1268	1396	1595	1992	2523	3396	4234	5623	4583	6200	8558
GDP growt rate	percentage	1.1	3.0	4.7	7.0	10.6	7.3	8.6	10.2	8.9	-1.3	6.4	17.3
GDP per capita	dollars	1950	2040	2150	2310	2600	2800	3120	3450	3750	3630	3660	4360
Employment	thousand employee	18.6	19.9	23.8	31.9	33.5	39.8	41.9	44.1	46.5	34.8	34.1	45.1
Change	percentage		7%	20%	34%	5%	19%	5%	5%	5%	-25%	-2%	32%
Domestic capital investment	million dollars	54	37	55	83	134	124	161	300	367	325	541	757
Foreing capital investment	million dollars	72	86	90	117	103	169	390	203	358	558	1047	1965

Source: Mongolian national statistical report

2.4. Empirical result

2.4.1. Analysis of technical efficiency

Stochastic frontier vairables	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Mining production	coal, thousand tons	5,185	5,141	5,544	5,666	6,865	7,517	8,074	9,238	10,072	14,442	25,162	30,940
Hired labor	thousand employees	19	20	24	32	34	40	42	44	47	35	34	45
Fixed assets	thousand dollars	298,050	365,626	390,623	530,308	571,101	819,705	1,453,288	2,198,000	3,822,500	5,054,000	6,868,000	6,771,600
Working capital	thousand dollars	532,400	545,100	712,800	697,950	653,400	876,550	1,296,050	1,601,400	1,807,000	1,985,500	2,262,400	1,539,000
Inventory	thousand dollars	260,400	317,020	319,950	386,100	371,250	447,600	687,700	843,404	863,190	824,524	888,800	533,520
Electricity cost	thousand kilobits	2,946,000	3,017,000	3,111,700	3,137,700	3,303,400	3,418,900	3,544,200	3,700,700	4,000,600	4,038,800	4,312,800	4,536,400
Heating cost	thousand Gkal	6,885	6,597	6,868	7,133	7,747	7,806	7,850	7,724	7,760	8,321	8,363	8,683
Small tools	thousand dollars	89,415	109,688	117,187	159,093	171,330	245,911	435,986	659,400	1,146,750	1,516,200	2,060,400	2,031,480
Labor cost	thousand dollars	65,100	75,020	75,840	100,980	103,950	132,415	193,085	232,360	278,000	303,240	363,600	256,500
Other mining expenditures	thousand dollars	29,805	36,563	39,062	53,031	57,110	81,970	145,329	219,800	382,250	505,400	686,800	677,160
Mining-specific variables													
Education of employee													
Primary school	thousand employees	4	4	5	6	7	8	8	9	9	7	7	9
Secondary school	thousand employees	6	6	7	10	10	12	13	13	14	10	10	14
High school	thousand employees	9	10	12	16	17	20	21	22	23	17	17	23
Experience	years	10	15	17	19	21	25	26	27	25	24	24	23
Age	years	35	35	37	37	38	38	42	42	45	45	43	43
Total value of mining activies	thousand dollars	106,016	106,016	106,016	106,016	110,165	145,321	184,558	264,433	368,999	295,591	397,786	604,283

2.4.2. Analysis of capital allocation

Dependent variable	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Manufacturing value added (MVA)	million dollars	76	105	89	106	110	145	185	264	369	296	398	604
Primary independent variables													
Business sophistication/Total score (Factor 1)	score (1-7)								0.43	0.44	0.44	0.44	0.45
Governance disclosure/ Total rank (Factor 2)	rank (1-139)								0.10	0.10	0.11	0.15	0.16
Independent variables													
Domestic loan (Bank)	million dollars	1,156	2,363	4,020	3,564	4,831	7,016	8,380	8,753	11,840	19,903	27,333	37,729
Domestic investment (DInvestment)	million dollars	14	10	14	22	35	32	42	78	95	84	140	196
Foreign investment (FInivestment)	million dollars	91	108	114	148	130	213	251	256	451	704	1,319	2,475
Fund raising (Stock)	million dollars	1	1	1	2	1	2	5	26	18	22	49	77
Initial wealth (GDP)	million dollars	1,137	1,268	1,396	1,595	1,992	2,523	3,396	4,223	5,623	4,583	6,200	8,558
Special variables													
Financial development (FD)	score (1-7)								0.52	0.51	0.49	0.47	0.46
Government procurment of advanced tech products (GPT)	rank 139								0.46	0.48	0.45	0.46	0.39
Legal rights (LR)	score (1-7)								0.63	0.61	0.09	0.43	0.37
Innovation (I)	score (1-7)								0.42	0.40	0.40	0.40	0.40
Technological readiness/Total score (Tech)	score (1-7)								0.37	0.39	0.40	0.43	0.59
Firm level technological absorption (TA)	score (1-7)								0.37	0.36	0.29	0.09	0.64

2.4.3 Financial ratio analysis

Liquidity ratios

1. Current ratio

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		0.33	0.44	0.71	5.43	0.71
Sharin Gol Co., Ltd	1.63	1.43	1.03	2.00	0.70	1.21
Baganuur Co., Ltd	1.28	1.56	2.13	2.25	3.21	1.77
Shivee Ovoo Co., Ltd	2.58	2.16	2.84	2.94	3.20	2.15
Average	1.83	1.37	1.61	1.98	3.13	1.46

2. Quick ratio

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		0.33	0.44	0.53	5.37	0.61
Sharin Gol Ltd	1.19	1.14	0.77	1.35	0.59	1.13
Baganuur Co., Ltd	0.97	1.35	0.95	1.10	1.25	0.49
Shivee Ovoo Co., Ltd	1.57	1.97	1.75	1.86	2.15	0.92
Average	1.24	1.20	0.98	1.21	2.34	0.79

3. Cash ratio

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		0.33	0.20	0.06	5.13	0.41
Sharin Gol Ltd	0.00	0.02	0.09	0.11	0.15	1.06
Baganuur Co., Ltd	0.13	0.08	0.22	0.19	0.13	0.21
Shivee Ovoo Co., Ltd	0.23	0.38	0.29	0.35	0.46	0.08
Average	0.12	0.20	0.20	0.18	1.47	0.44

Asset management efficiency ratios

1. Inventory turnover

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	8.74	35.23	9.40
Sharin Gol Ltd	3.71	3.98	5.10	4.47	6.04	6.28
Baganuur Co., Ltd	2.85	3.08	3.58	2.75	3.12	2.58
Shivee Ovoo Co., Ltd	2.36	2.17	1.85	1.98	2.54	2.20
Mogoin Gol Co., Ltd	1.45	1.52	1.32	1.15	1.08	0.90
Average	2.07	2.15	2.37	3.82	9.60	4.27

2. Receivable turnover

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	3.34	8.58	4.96
Sharin Gol Ltd	1.40	1.12	2.18	5.56	8.54	11.31
Tavan Tolgoi Corporation	4.38	4.48	5.12	5.54	9.64	2.79
Baganuur Co., Ltd	5.54	5.12	5.87	6.75	5.05	9.98
Shivee Ovoo Co., Ltd	3.12	3.58	4.12	4.32	1.04	4.47
Mogoin Gol Co., Ltd	3.85	4.12	4.05	3.95	3.93	4.11
Average	3.05	3.07	3.56	4.91	6.13	6.27

3. Net working capital turnover

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.23	0.19	0.19
Sharin Gol Ltd	(0.30)	0.15	0.05	0.60	(0.02)	0.04
Tavan Tolgoi Corporation	1.78	1.80	1.75	1.85	1.83	1.88
Baganuur Co., Ltd	2.68	2.65	2.45	2.52	2.76	2.85
Shivee Ovoo Co., Ltd	1.95	2.05	2.10	2.12	0.31	2.35
Mogoin Gol Co., Ltd	0.50	0.38	0.43	0.45	0.66	0.54
Average	1.10	1.17	1.13	1.30	0.96	1.31

4. Fixed asset turnover

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.81	0.82	0.44
Sharin Gol Ltd	2.19	2.51	3.19	3.00	1.21	1.25
Baganuur Co., Ltd	1.08	1.12	1.25	1.35	1.29	1.37
Shivee Ovoo Co., Ltd	0.12	0.08	0.25	0.42	0.11	0.35
Mogoin Gol Co., Ltd	0.35	0.28	0.32	0.43	0.45	0.34
Average	0.75	0.80	1.00	1.20	0.78	0.75

5. Total asset turnover

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.59	0.26	0.33
Sharin Gol Ltd	0.69	0.65	0.98	1.04	0.44	0.29
Tavan Tolgoi Corporation	1.48	1.55	1.52	1.43	1.44	1.68
Baganuur Co., Ltd	0.78	0.72	0.75	0.85	0.77	0.79
Shivee Ovoo Co., Ltd	1.15	1.12	1.05	0.32	0.07	0.27
Mogoin Gol Co., Ltd	1.98	1.52	1.12	0.58	0.26	0.20
Average	1.01	0.93	0.90	0.80	0.54	0.59

Fixed assets Unit: thousand dollars

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0	1,014	27,579	83,162	338,137	1,233,194
Sharin Gol Ltd	2,747	2,800	2,744	2,232	10,878	12,748
Tavan Tolgoi Corporation	2,300	2,542	2,850	3,254	3,540	4,794
Baganuur Co., Ltd	23,542	25,487	28,756	31,854	32,250	34,338
Shivee Ovoo Co., Ltd	32,547	35,156	43,254	45,625	48,850	49,136
Mogoin Gol Co., Ltd	854	954	985	1,150	1,200	1,348
Average	10,332	11,325	17,695	27,880	72,476	222,593

Total asset Unit: thousand dollars

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		1,985	35,926	113,230	1,053,270	1,628,015
Sharin Gol Ltd	8,708	10,761	8,514	6,384	17,338	28,137
Tavan Tolgoi Corporation	70,658	73,542	75,456	78,850	84,687	82,499
Baganuur Co., Ltd	48,652	52,854	53,456	55,487	58,117	59,673
Shivee Ovoo Co., Ltd	55,421	58,758	63,546	65,487	66,459	62,862
Mogoin Gol Co., Ltd	1,852	1,985	2,055	2,145	2,209	2,251
Average	37,058	33,314	39,826	53,597	213,680	310,573

	2006	2007	2008	2009	2010	2011
Average collection period	120	119	103	74	60	58
Inventory conversion period	176	170	154	96	38	85

Sales Unit: thousand dollars

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0	0	0	66,983	277,502	542,568
Sharin Gol Ltd	5,989	7,008	8,305	6,637	7,638	8,110
Tavan Tolgoi Corporation	108,542	115,435	118,542	122,587	121,763	138,575
Baganuur Co., Ltd	40,542	42,854	45,652	43,215	44,676	47,172
Shivee Ovoo Co., Ltd	4,125	3,851	4,325	4,512	4,824	17,240
Mogoin Gol Co., Ltd	421	462	550	652	578	454
Average	26,603	28,268	29,562	40,764	76,164	125,686

Debt management ratios

1. Total debt ratio

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		1.50	0.59	0.61	0.31	0.53
Sharin Gol Ltd	0.91	0.91	0.89	0.64	0.64	0.79
Tavan Tolgoi	0.09	0.06	0.08	0.12	0.16	0.00
Shivee Ovoo Co., Ltd	0.75	0.78	0.87	0.83	0.95	0.78
Mogoin Gol Co., Ltd	0.24	0.27	0.23	0.25	0.28	0.29
Average	0.50	0.70	0.53	0.49	0.47	0.48

2. Debt-equity ratios

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		(3.02)	1.43	1.58	0.45	1.12
Sharin Gol Ltd	9.66	10.14	7.89	1.75	1.79	3.29
Tavan Tolgoi	0.11	0.08	0.12	0.15	0.19	0.05
Shivee Ovoo Co., Ltd	3.16	5.47	8.13	12.54	17.67	3.48
Mogoin Gol Co., Ltd	0.28	0.33	0.32	0.35	0.38	0.40
Average	3.30	2.60	3.58	3.28	4.10	1.67

3. Equity multiplier ratios

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		(2.02)	2.43	2.58	1.45	2.12
Sharin Gol Ltd	10.66	11.14	8.89	2.75	2.79	4.67
Tavan Tolgoi	1.01	1.31	1.87	1.35	1.19	1.05
Shivee Ovoo Co., Ltd	10.57	8.26	12.57	15.43	18.99	4.48
Mogoin Gol Co., Ltd	1.33	1.37	1.42	1.35	1.38	1.40
Average	5.89	4.01	5.44	4.69	5.16	2.75

4. Long-term debt ratio

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		0.00	0.13	0.38	0.21	0.28
Sharin Gol Ltd	0.72	0.68	0.00	0.45	0.24	0.00
Tavan Tolgoi	0	0	0	0	0.00	0.00
Shivee Ovoo Co., Ltd	0.74	0.72	0.76	0.85	0.94	0.75
Mogoin Gol Co., Ltd	0.23	0.28	0.24	0.25	0.27	0.27
Average	0.42	0.34	0.23	0.39	0.33	0.26

5. Debt Unit: thousand dollars

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		2,968	21,136	69,389	325,989	859,151
Sharin Gol Ltd	7,891	9,796	7,555	4,067	11,121	19,852
Tavan Tolgoi	2,154	3,154	4,125	8,500	13,500	4,159
Shivee Ovoo Co., Ltd	50,690	45,127	52,148	53,427	62,960	48,844
Mogoin Gol Co., Ltd	542	574	584	608	613	648
Average	15,319	12,324	17,110	27,198	82,837	186,531

6. Equity Unit: thousand dollars

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation		(983)	14,791	43,841	727,281	768,864
Sharin Gol Ltd	817	966	958	2,317	6,217	6,026
Tavan Tolgoi	72,154	76,218	73,214	75,421	71,187	78,340
Shivee Ovoo Co., Ltd	5,321	5,642	5,872	5,478	3,499	14,018
Mogoin Gol Co., Ltd	1,678	1,524	1,314	1,300	1,596	1,603
Average	19,993	16,673	19,230	25,672	161,956	173,770

Profitability ratios

1. Profit margin

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.15	0.49	0.27
Sharin Gol Ltd	(0.04)	0.02	0.01	0.21	(0.02)	0.03
Tavan Tolgoi	0.40	0.41	0.43	0.42	0.45	0.41
Baganuur Co., Ltd	0.14	0.15	0.11	0.12	0.13	-0.07
Shivee Ovoo Co., Ltd	0.08	0.05	0.03	-0.05	(0.09)	(0.10)
Mogoin Gol Co., Ltd	0.03	0.04	0.05	0.03	0.04	0.02
Average	0.10	0.11	0.10	0.15	0.17	0.09

2. ROA

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.09	0.13	0.09
Sharin Gol Ltd	(0.03)	0.01	0.01	0.22	(0.01)	0.01
Tavan Tolgoi	0.67	0.68	0.67	0.66	0.65	0.69
Baganuur Co., Ltd	0.12	0.10	0.15	0.11	0.10	0.06
Shivee Ovoo Co., Ltd	0.07	0.06	0.08	0.05	0.02	(0.01)
Mogoin Gol Co., Ltd	0.04	0.02	0.03	0.02	0.01	0.00
Average	0.15	0.15	0.16	0.19	0.15	0.14

3. ROE

	2006	2007	2008	2009	2010	2011
Mongolian Mining Corporation	0.00	0.00	0.00	0.23	0.19	0.19
Sharin Gol Ltd	(0.30)	0.15	0.05	0.60	(0.02)	0.04
Tavan Tolgoi	0.79	0.85	0.82	0.78	0.77	0.73
Baganuur Co., Ltd	2.25	2.35	2.15	2.20	2.19	2.96
Shivee Ovoo Co., Ltd	0.04	0.05	0.03	-0.01	(0.08)	(0.13)
Mogoin Gol Co., Ltd	0.03	0.04	0.02	0.03	0.02	0.01
Average	0.47	0.57	0.51	0.64	0.51	0.63

3.4. Empirical result

3.4.2. The Constant Market Share analysis

	Mongolian copper export (thousand dollars)	Copper concentration to Chinese market (thousand dollars)	World market of copper (by million tons)	Mongolian total export of commodity (thousand dollars)	Mongolian commodity export to the Chinese market (thousand dollars)	World market total export (million dollars)	China raw copper import (million dollars)
1995	126,489	56,920	105,000	473,271	283,963	114,803	109
1996	137,488	82,493	108,500	424,267	212,134	114,803	158
1997	146,264	80,445	112,000	568,513	397,959	114,803	154
1998	152,358	83,797	119,000	462,314	323,619	62,412	1,006
1999	157,070	86,389	126,000	454,211	363,369	62,412	1,037
2000	160,276	88,152	136,500	535,831	401,874	44,850	1,058
2001	147,902	81,346	126,000	596,243	447,182	303,039	976
2002	140,232	77,128	126,000	523,963	366,774	6,093,308	926
2003	163,695	90,032	122,500	615,379	369,228	7,201,618	1,080
2004	284,322	156,377	112,000	869,084	608,359	48,967	1,877
2005	326,217	179,419	117,600	1,063,883	851,107	10,243,220	2,153
2006	635,420	349,481	121,100	1,541,964	1,233,572	11,970,949	4,194
2007	811,503	446,327	123,200	1,947,472	1,752,725	13,798,445	5,356
2008	835,666	459,616	126,00	2,534,466	2,281,020	12,736,900	5,515
2009	501,924	276,058	119,000	1,885,385	1,696,847	15,817,500	3,313
2010	770,594	423,827	133,000	2,908,502	2,617,652	14,841,057	5,086
2011	963,596	529,978	140,000	2,908,502	2,617,652	14,841,057	6,360

Source: Mongolian national statistical report 2011

3.4.3. Analysing the export competitiveness

Regression analysis

Independent variables	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Mining export	trillion dollars	402	447	393	462	652	798	1,157	1,461	1,901	1,414	2,181	3,585
GDP per capita	dollar	1950	2040	2150	2310	2600	2800	3120	3450	3750	3640	3650	4290
Population	million	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.7	2.7	2.7	2.8	2.8
Rail lines	total route-km	4293	5287	6452	6452	8857	8857	9218.5	8361	8261	7852	10287	11000
Railways, goods transported	million ton-km	1810	1810	1810	1810	1810	1810	1810	1810	1810	1814	1814	1814
Ease of doing business	score 1-7	2.9	2.9	2.9	2.9	3	3	3.1	3.1	3.1	3.1	3.2	3.2
Foreign market size	score 1-7	2	2.1	2.1	2.2	2.2	2.2	2.3	2.3	2.3	2.3	2.4	2.4
Trade tariff restrictiveness index	score 1-7	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6
Total factor productivity	score 1-7	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Innovation	score 1-7	2.6	2.6	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.8	2.8	2.8

Source: World bank database & Global competitiveness reports

Independent variables	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Log of GDP per capita	7.58	7.62	7.67	7.75	7.86	7.94	8.05	8.15	8.23	8.20	8.20	8.36
Log of population	14.70	14.71	14.72	14.73	14.74	14.75	14.76	14.78	14.80	14.81	14.83	14.85
Log of rail lines	8.36	8.57	8.77	8.77	9.09	9.09	9.13	9.03	9.02	8.97	9.24	9.31
Log of railways, goods transported	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Ease of doing business	2.90	2.90	2.90	2.90	3.00	3.00	3.10	3.10	3.10	3.10	3.20	3.20
Foreign market size	2.00	2.10	2.10	2.20	2.20	2.20	2.30	2.30	2.30	2.30	2.40	2.40
Trade tariff restrictiveness index	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.60	4.60	4.60	4.60	4.60
Total factor productivity	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Innovation	2.60	2.60	2.60	2.60	2.70	2.70	2.70	2.80	2.80	2.80	2.80	2.80

4. Export competitiveness of Mongolian mining products

4.4. Analysis and result

RCA

Table 1: RCA index of coal product in Mongolian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (coal)	Export i (world)	Total export (Mongolia)	Total Export (World)	RCA
2007	116,226	163,772,360	1,947,472	11,783,000,000	4.29
2008	184,666	318,765,856	2,534,466	13,619,000,000	3.11
2009	306,301	283,113,724	1,885,385	15,717,000,000	9.02
2010	881,998	284,271,650	2,908,502	12,178,000,000	12.99
2011	2,250,046	284,271,650	4,817,496	12,178,000,000	20.01

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 2: RCA index of coal product in Australian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (Australia)	Export i (world)	Total export (Australia)	Total Export (World)	RCA
2007	15,039,000	163,772,360	216,795,000	11,783,000,000	4.99
2008	15,794,000	318,765,856	233,813,000	13,619,000,000	2.89
2009	36,813,000	283,113,724	284,571,000	15,717,000,000	7.18
2010	24,526,000	284,271,650	253,762,000	12,178,000,000	4.14
2011	21,672,000	284,271,650	297,545,000	12,178,000,000	3.12

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 3: RCA index of copper product in Mongolian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (copper)	Export i (world)	Total export (Mongolia)	Total Export (World)	RCA
2007	811,503	910,000,000	1,947,472	11,783,000,000	5.40
2008	835,666	2,107,000,000	2,534,466	13,619,000,000	2.13
2009	501,924	1,057,000,000	1,885,385	15,717,000,000	3.96
2010	770,594	959,000,000	2,908,502	12,178,000,000	3.36
2011	963,596	1,540,000,000	4,817,496	12,178,000,000	1.58

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 4: RCA index of copper product in Australian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (Australia)	Export i (world)	Total export (Australia)	Total Export (World)	RCA
2007	6,528,000	910,000,000	216,795,000	11,783,000,000	0.39
2008	6,698,000	2,107,000,000	233,813,000	13,619,000,000	0.19
2009	4,052,000	1,057,000,000	284,571,000	15,717,000,000	0.21
2010	6,491,000	959,000,000	253,762,000	12,178,000,000	0.32
2011	7,728,000	1,540,000,000	297,545,000	12,178,000,000	0.21

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 5: RCA index of iron ore product in Mongolian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (iron ore)	Export i (world)	Total export (Mongolia)	Total Export (World)	RCA
2007	43,272	287,700,000	1,947,472	11,783,000,000	0.91
2008	182,358	354,080,000	2,534,466	13,619,000,000	2.77
2009	287,658	364,320,000	1,885,385	15,717,000,000	6.58
2010	641,466	417,760,000	2,908,502	12,178,000,000	6.43
2011	1,035,558	630,000,000	4,817,496	12,178,000,000	4.16

Table 6: RCA index of iron ore product in Australian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (Iron ore)	Export i (world)	Total export (Australia)	Total Export (World)	RCA
2007	21,835,000	287,700,000	216,795,000	11,783,000,000	4.12
2008	35,602,000	354,080,000	233,813,000	13,619,000,000	5.86
2009	35,588,000	364,320,000	284,571,000	15,717,000,000	5.40
2010	34,515,000	417,760,000	253,762,000	12,178,000,000	3.96
2011	39,879,000	630,000,000	297,545,000	12,178,000,000	2.59

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 7: RCA index of gold product in Mongolian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (gold)	Export i (world)	Total export (Mongolia)	Total Export (World)	RCA
2007	234,874	129,877,450	1,947,472	11,783,000,000	10.94
2008	599,883	126,561,430	2,534,466	13,619,000,000	25.47
2009	308,473	136,177,888	1,885,385	15,717,000,000	18.88
2010	178,339	140,378,180	2,908,502	12,178,000,000	5.32
2011	113,047	149,220,900	4,817,496	12,178,000,000	1.92

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 8: RCA index of gold product in Australian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (gold)	Export i (world)	Total export (Australia)	Total Export (World)	RCA
2007	10,320,000	129,877,450	216,795,000	11,783,000,000	4.32
2008	10,902,000	126,561,430	233,813,000	13,619,000,000	5.02
2009	16,146,000	136,177,888	284,571,000	15,717,000,000	6.55
2010	12,996,000	140,378,180	253,762,000	12,178,000,000	4.44
2011	9,880,000	149,220,900	297,545,000	12,178,000,000	2.71

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 9: RCA index of zinc product in Mongolian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (zinc)	Export i (world)	Total export (Mongolia)	Total Export (World)	RCA
2007	265,996	48,390,738	1,947,472	11,783,000,000	33.26
2008	275,825	50,581,290	2,534,466	13,619,000,000	29.30
2009	283,849	48,681,608	1,885,385	15,717,000,000	48.61
2010	240,319	53,343,552	2,908,502	12,178,000,000	18.86
2011	242,124	58,677,907	4,817,496	12,178,000,000	10.43

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 10: RCA index of zinc product in Australian mining industry, period 2007-2011 (thousands dollars)

Year	Export i (zinc)	Export i (world)	Total export (Australia)	Total Export (World)	RCA
2007	4,298,000	48,390,738	216,795,000	11,783,000,000	4.83
2008	3,366,000	50,581,290	233,813,000	13,619,000,000	3.88
2009	1,858,000	48,681,608	284,571,000	15,717,000,000	2.11
2010	2,214,000	53,343,552	253,762,000	12,178,000,000	1.99
2011	1,716,000	58,677,907	297,545,000	12,178,000,000	1.20

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

MCA

Table 11: Mongolian copper export to China's market (thousands dollars)

	Mongolian Export amount (copper) to China	Export amount to market (copper) in China	Mongolian global export amount (copper)	Total global export amount of Mongolia	MCA
2007	405,751	5,355,920	811,503	1,947,472	0.182
2008	417,833	5,515,396	835,666	2,534,466	0.230
2009	250,962	3,312,698	501,924	1,885,385	0.285
2010	385,297	5,085,920	770,594	2,908,502	0.286
2011	481,798	6,359,734	963,596	4,817,496	0.379

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 12: Australian copper export to China's market (thousands dollars)

	Australian Export amount (coal) to China	Export amount to market (coal) in China	Australian global export amount (coal)	Total global export amount of Australia	MCA
2007	1,567,500	157,200,000	15,039,000	216,795,000	0.144
2008	1,164,000	167,025,000	15,794,000	233,813,000	0.103
2009	1,870,500	180,780,000	36,813,000	284,571,000	0.080
2010	2,851,500	186,675,000	24,526,000	253,762,000	0.158
2011	1,756,500	196,500,000	21,672,000	297,545,000	0.123

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 13: Mongolian coal export to China's market (thousands dollars)

	Mongolian Export amount (coal) to China	Export amount to market (coal) in China	Mongolian global export amount (coal)	Total global export amount of Mongolia	MCA
2007	81,358	157,200,000	116,226	1,947,472	0.009
2008	147,733	167,025,000	184,666	2,534,466	0.012
2009	245,040	180,780,000	306,301	1,885,385	0.008
2010	793,798	186,675,000	881,998	2,908,502	0.014
2011	2,025,042	196,500,000	2,250,046	4,817,496	0.022

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 14: Australian coal export to China's market (thousands dollars)

	Australian Export amount (coal) to China	Export amount to market (coal) in China	Australian global export amount (coal)	Total global export amount of Australia	MCA
2007	1,567,500	157,200,000	15,039,000	216,795,000	0.144
2008	1,164,000	167,025,000	15,794,000	233,813,000	0.103
2009	1,870,500	180,780,000	36,813,000	284,571,000	0.080
2010	2,851,500	186,675,000	24,526,000	253,762,000	0.158
2011	1,756,500	196,500,000	21,672,000	297,545,000	0.123

Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 15: Mongolian iron ore export to China's market (thousands dollars)

	Mongolian Export amount (iron ore) to China	Export amount to market (iron ore) in China	Mongolian global export amount (iron ore)	Total global export amount of iron ore	MCA
2007	30,290	103,723,200	43,272	1,947,472	0.013
2008	145,886	107,427,600	182,358	2,534,466	0.019
2009	230,126	104,958,000	287,658	1,885,385	0.014
2010	577,319	110,020,680	641,466	2,908,502	0.024
2011	932,002	123,480,000	1,035,558	4,817,496	0.035

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 16: Australian iron ore export to China's market (thousands dollars)

	Australian Export amount (iron ore) to China	Export amount to market (iron ore) in China	Australian global export amount (iron ore)	Total global export amount of Australia	MCA
2007	26,119,620	103,723,200	15,039,000	216,795,000	3.630
2008	31,957,920	107,427,600	15,794,000	233,813,000	4.404
2009	41,561,100	104,958,000	36,813,000	284,571,000	3.061
2010	49,735,800	110,020,680	24,526,000	253,762,000	4.677
2011	38,721,240	123,480,000	21,672,000	297,545,000	4.305

Source: Source: Own estimates, data based on Australian mineral statistic report 2007-2011

Table 17: Mongolian zinc product export to China's market (thousands dollars)

	Mongolian Export amount (zinc) to China	Export amount to market (zinc) in China	Mongolian global export amount (zinc)	Total global export amount of Mongolia	MCA
2007	186,197	3,409,077	265,996	1,947,472	0.400
2008	220,660	3,936,253	275,825	2,534,466	0.515
2009	227,079	3,619,947	283,849	1,885,385	0.417
2010	216,287	3,338,786	240,319	2,908,502	0.784
2011	217,912	3,514,512	242,124	4,817,496	1.234

Source: Own estimates, data based on Mongolian national statistical report 2007-2011

Table 18: Australian zinc export to China's market (thousands dollars)

	Australian Export amount (zinc) to China	Export amount to market (zinc) in China	Australian global export amount (zinc)	Total global export amount of Australia	MCA
2007	1,896	3,409,077	15,039,000	216,795,000	0.008
2008	2,299	3,936,253	15,794,000	233,813,000	0.009
2009	1,611	3,619,947	36,813,000	284,571,000	0.003
2010	855	3,338,786	24,526,000	253,762,000	0.003
2011	1,649	3,514,512	21,672,000	297,545,000	0.006

Source: Source: Own estimates, data based on Australian mineral statistic report 2007-2011

TSI index

Table 19: Mongolia's export MCA to China (thousands dollars)

		Mongolia's export MCA to China				
	Year	2007	2008	2009	2010	2011
	Copper	811,503	835,666	501,924	770,594	963,596
	Coal	116,226	184,666	306,301	881,998	2,250,046
	Iron ore	43,272	182,358	287,658	641,466	1,035,558
Export	Zinc	265,996	275,825	283,849	240,319	242,124
Total export		1,947,472	2,534,466	1,885,385	2,908,502	4,817,496
Import of mining		602976	964180	569722	754903	1274427
	Copper	9.34	-19.72	-27.81	185.36	-15.50
	Coal	-4.00	-3.25	-7.16	22.88	4.94
	Iron ore	-3.48	-3.24	-6.68	-25.64	-20.17
TSI	Zinc	-5.78	-3.68	-6.60	-5.65	-4.67

5.5. Empirical result

5.5.3. Analysis of market share

Table 1: Total change of Mongolian coal export market shares

Year	China				Japan				Korea			
	Import (million tons)	Mongolian export (million tons)	Price ($/ton)	GDP per capita ($)	Import (million tons)	Mongolian export (million ton)	Price ($/ton)	GDP per capita ($)	Import (million tons)	Mongolian export (million ton)	Price ($//ton)	GDP per capita ($)
2000	2	0.00	37	2340	150	0.000	45	26350	44	0.000	58	17110
2001	3	0.01	39	2560	155	0.000	50	27040	47	0.000	51	18110
2002	11	0.01	39	2840	161	0.000	48	27680	52	0.000	53	19670
2003	11	0.22	39	3180	166	0.000	45	28420	53	0.001	58	20200
2004	19	0.82	72	3590	181	0.002	67	29880	57	0.003	58	21690
2005	26	1.11	100	4090	177	0.002	81	31150	56	0.004	67	22760
2006	38	1.90	92	4750	179	0.002	87	32700	60	0.004	61	24280
2007	51	2.62	101	5580	187	0.003	98	34490	66	0.006	75	26150
2008	40	3.13	256	6230	184	0.004	168	34700	76	0.007	125	26890
2009	137	5.33	200	6820	164	0.007	152	32970	82	0.012	94	27050
2010	164	15.05	200	7530	165	0.017	155	34810	85	0.028	95	28830
2011	182	19.00	135	8450	167	0.021	157	35530	87	0.036	97	30340

Data source: International energy agency, coal information 2011

World bank database

Table 2: The total change of Mongolian copper export market shares

Year	China			Japan			Korea		
	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)
2000	2.20	0.045	2500	1.30	0.000	2900	0.99	0.001	2700
2001	2.20	0.043	3500	1.20	0.001	3800	1.10	0.001	3750
2002	1.75	0.055	3800	1.44	0.001	4200	1.30	0.001	4120
2003	2.63	0.068	4200	1.87	0.001	4750	1.62	0.001	4650
2004	3.41	0.073	5400	2.62	0.001	5500	1.80	0.001	5430
2005	4.01	0.088	5960	3.14	0.001	6800	3.30	0.001	6750
2006	3.61	0.090	8042	3.46	0.001	7200	4.60	0.001	7300
2007	6.40	0.103	8080	4.52	0.001	8132	3.68	0.001	8000
2008	5.90	0.099	8435	4.70	0.001	9000	3.50	0.001	8550
2009	6.37	0.088	9000	4.61	0.001	9500	3.33	0.001	9300
2010	7.01	0.114	9264	5.18	0.001	9700	3.49	0.001	9500
2011	4.60	0.114	8800	4.39	0.001	10000	3.56	0.001	9750

Data source: http://www.japanmetalbulletin.com/?p=19611, 2012.12.22
http://www.accessmylibrary.com/article-1G1-85549370/japanese-copper-concentrate-imports.html, 2012.12.22
http://www.northernminer.com/news/china-to-consume-more-copper-concentrate-in-1997/1000161241/, 2012.12.22
http://www.mining-journal.com/production-and-markets/chinese-copper-hit-by-concentrate-shortage, 2012.12.22
ASEAN Korea trade analysis

Table 3: The total change of Mongolian iron ore export market shares

Year	China			Japan			Korea		
	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)	Import (mln tons)	Mongolian export (mln ton)	Price ($/ton)
2000	69.00	0.000	90	117.87	0.000	110	36.09	0.000	98
2001	92.00	0.000	108	120.28	0.000	112	40.10	0.000	112
2002	123.00	0.000	115	117.92	0.000	125	42.21	0.000	120
2003	148.00	0.000	131	128.17	0.000	140	43.07	0.000	135
2004	208.76	0.020	128	134.92	0.000	132	44.20	0.000	130
2005	250.00	0.089	132	127.44	0.000	138	43.46	0.000	138
2006	260.00	0.250	137	135.29	0.000	142	43.89	0.001	142
2007	410.00	0.192	135	115.20	0.000	150	46.17	0.000	147
2008	370.00	0.810	138	156.00	0.001	157	42.00	0.002	152
2009	627.00	1.278	141	150.00	0.002	154	34.36	0.003	148
2010	610.59	2.851	150	122.96	0.004	160	51.28	0.006	155
2011	686.06	5.178	168	128.48	0.006	180	56.41	0.009	170

Data source: http://english.caijing.com.cn/2010-12-20/110597459.html, 2012.12.22
http://www.bulkforum.com/publish_files/Report_31-2010.pdf, 2012.12.22
http://www.mbendi.com/indy/ming/iron/as/cj/p0005.htm, 2012.12.22
http://www.bloomberg.com/news/2012-01-10/china-s-2011-iron-ore-imports-gain-11-as-steel-output-rises-1-.html, 2012.12.22
http://www.scrapmonster.com/news/japan-iron-ore-imports-down-4.3-in-2011/1/4675, 2012.12.22
http://www.texreport.co.jp/xenglish/eng-genryou/200804/200804091142Wed-2.html, 2012.12.22

Table 4: Trade performance by million dollars

	Mongolian mining exports			Total mining imports		
Year	**China**	**Japan**	**Korea**	**China**	**Japan**	**Korea**
2000	274	8	12	211,564	128,373	51,354
2001	238	16	36	195,231	131,076	17,213
2002	221	6	22	185,106	135,130	17,396
2003	287	9	7	216,077	141,958	57,225
2004	413	33	10	375,305	157,494	71,828
2005	513	6	65	215,303	182,237	83,596
2006	1,049	7	21	335,502	215,501	99,003
2007	1,411	15	42	428,474	234,035	114,191
2008	1,636	28	30	441,232	252,656	139,288
2009	1,394	5	15	496,905	164,797	103,387
2010	2,466	3	31	406,874	194,448	113,726
2011	2,713	3	34	445,181	217,955	125,099

Table 5: The main variance of market share in global market

	Units	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Dependent variable													
Market share in China	Total Export /Total import	0.130%	0.122%	0.119%	0.133%	0.110%	0.238%	0.313%	0.329%	0.371%	0.281%	0.606%	0.609%
Market share in Japan	Total Export /Total import	0.006%	0.012%	0.005%	0.006%	0.021%	0.003%	0.003%	0.006%	0.011%	0.003%	0.001%	0.001%
Market share in Korea	Total Export /Total import	0.024%	0.210%	0.129%	0.013%	0.013%	0.078%	0.022%	0.036%	0.021%	0.015%	0.027%	0.027%
Independent variables													
Model speicification													
Market growth													
China		0.32	-0.13	-0.07	0.30	0.44	0.24	1.04	0.34	0.16	-0.15	0.77	0.10
Japan		-0.26	0.94	-0.60	0.35	2.93	-0.83	0.23	1.12	0.83	-0.83	-1.89	0.00
Korea		0.00	1.95	-0.38	-0.67	0.29	5.74	-0.67	0.94	-0.28	-0.48	0.97	0.10
Product life cycel													
Market competition													
China	Weight (1-Rank/Total)	0.72	0.74	0.78	0.73	0.75	0.82	0.79	0.84	0.86	0.90	0.86	0.85
Japan	Weight (1-Rank/Total)	0.88	0.89	0.90	0.91	0.91	0.91	0.92	0.92	0.93	0.94	0.95	0.97
Korea	Weight (1-Rank/Total)	0.50	0.51	0.53	0.52	0.55	0.59	0.60	0.63	0.63	0.71	0.90	0.89
Price elasticity													
China (Coal)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P1)]		32.99	0.00	0.00	1.95	0.93	-6.33	3.37	0.21	-2.12	0.00	-0.60
China (Copper)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P2)]		-0.09	2.87	2.18	0.28	1.88	0.07	0.00	-0.97	-1.82	0.00	-0.12
China (Iron ore)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P3)]		0.00	0.00	0.00	-86.33	41.03	25.57	17.73	56.10	24.96	11.64	5.23
Japan (Coal)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P4)]		19.00	-34.57	-29.47	2.95	1.60	0.99	2.65	0.46	-5.22	41.26	18.06
Japan (Copper)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P5)]		0.32	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42
Japan (Iron ore)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P6)]		0.00	0.00	0.00	-34.00	30.73	19.23	-4.76	27.04	-23.22	19.93	3.99
Korea (Coal)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P7)]		-8.10	36.68	21.11	0.00	2.10	-0.75	1.53	0.48	-1.84	76.21	11.11
Korea (Copper)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P8)]		0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Korea (Iron ore)	[(Q2-Q1)/(Q2+Q1)] / [(P2-P1)/(P2+P9)]		0.00	0.00	0.00	-53.00	22.88	19.23	-7.54	36.86	-16.80	16.48	5.09
Market segments													
Coal product	Mongolian coal export/ The country total coal import												
China		0	0	0	0.02	0.04	0.04	0.05	0.05	0.08	0.04	0.09	0.10
Japan		0	0	0	0.00	0.00001	0.00001	0.00001	0.00002	0.00002	0.00004	0.00010	0.00013
Korea		0	0	0	0.00001	0.00005	0.00007	0.00007	0.00008	0.00009	0.00015	0.00033	0.00041
Copper product	Mongolian copper export/ The country total copper import												
China		0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02
Japan		0.0004	0.0005	0.0004	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Korea		0.0008	0.0009	0.0008	0.0006	0.0006	0.0003	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003
Iron ore	Mongolian iron ore export/ The country total iron ore import												
China		0	0	0	0	0	0	0.001	0.000	0.002	0.002	0.005	0.008
Japan		0	0	0	0	0	0	0	0	0.00001	0.00001	0.00011	0.00004
Korea		0	0	0	0	0.00000	0.00001	0.00001	0.00001	0.00004	0.00008	0.00011	0.00017