J. Appl. Environ. Biol. Sci., 4(6)117-123, 2014

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

The Estimation of the Elasticity of the Production Factors of the Mining Sector of Iran

[1]Farshad Sameni-Keivani, [2]Sara Makouei and [3]Zeinab Khalili-Sourkouhi

[1]Department of Accounting, Roudsar and Amlash Branch, Islamic Azad University, Roudsar, Iran
[2]Department of Accounting, Islamic Azad University, Zanjan Branch, Zanjan, Iran
[3]Young Researchers and Elite club, Roudsar and Amlash Branch, Islamic Azad University, Roudsar, Iran

Received: January 21, 2014
Accepted: May 11, 2014

ABSTRACT

One of the most important mineral producers in the world is Iran. In order to do the research, first, the annual time series data is collected from the website of Central Bank and Statistics Center of Iran. This paper determines the elasticity of the production factors of labor and capital for mining sector in Iran covering data 1988 to 2010. The Cobb-Douglas function is used to estimate mining sector production function which it involves OLS method using EVIEWS8 and SPSS software. According to the results of this study during the years of the study the coefficients of the natural logarithm of the real capital and the natural logarithm of the labor in Iran are 1.621488 and 2.962340, respectively and these coefficients are statistically significant at the 5% confidence level. Indeed, these coefficients show the amount of elasticity of production factors for the mining sector in Iran. Hence, if the capital in the mining sector increases one percentage then the production in this sector increases 1.621488 and while the labor in this sector increases one percentage, then the production in this sector increases 2.962340 percent.

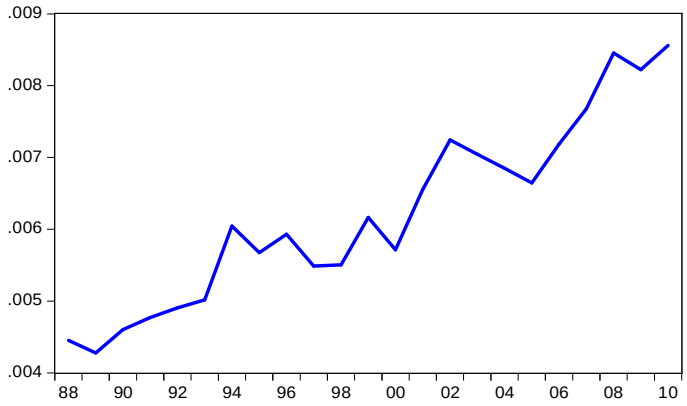
KEY WORDS: Cobb-Douglas Function, Value Added, Mining Sector, Production Function, Elasticity and Iran.

INTRODUCTION

Mineral resources and sources under the earth is one of the most important economics bases in each country. The importance of mining and sources in the economic growth of countries is undeniable. One of the most important mineral producers in the world is Iran. But unfortunately, its production is underdevelopment. More than 7% of the world's total mineral is located in Iran whereas its population is roughly 1% of the world's population. There are 68 types of minerals in Iran. Its actual and potential reserves of this country are about 37 and 57 billion tones, respectively. The most important mines in Iran are sand, metallic minerals, coal, and gravel, chemical minerals and salt. The most operating mines in Iran concerns Khorasan province, [8, 29, 30 and 31, 43, 49 and 50].

In the following figure is shown the proportion of the mining value add to the GDP in Iran at the period of this research, [49 and 50].

Figure.1:the Proportion of the Mining Value add respect to the GDP

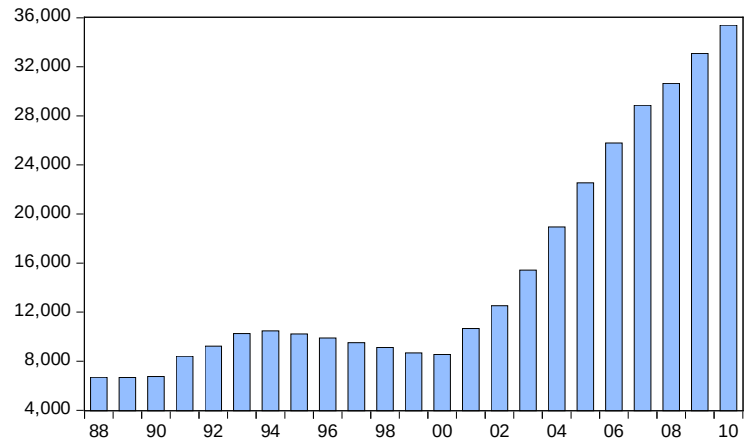


As we can see, the proportion of the mining value added has increased the period of the study in Iran. And this represents that importance of mining sector in the Iran economic. This ratio has been less than 0.5 percent in 1988

Corresponding Author: Farshad Sameni Keivani, Department of Accounting, Roudsar and Amlash Branch, Islamic Azad University, Roudsar, Iran, E-mail: farshadsameni@yahoo.com

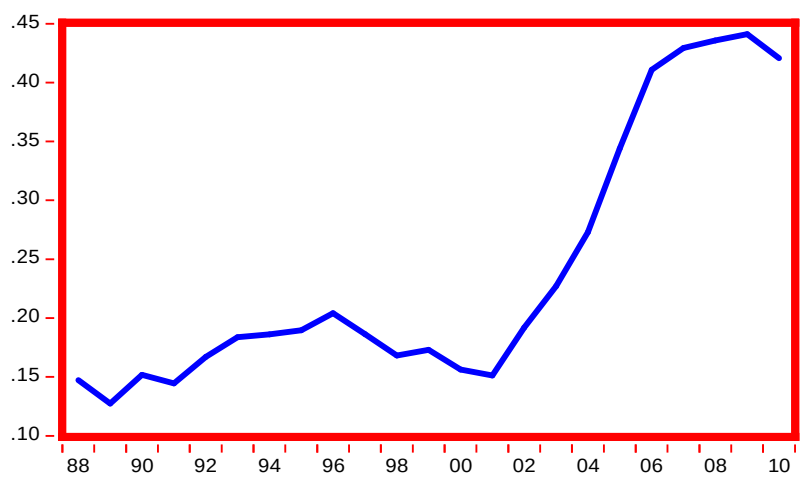
and it has gone up next to one percent in 2010. The capital stocks of the mining sector show at the following graph in the times series of the research, other papers on this subject include [32- 41].

Figure.2: the Capital Stocks of the Mining Sector in Iran during 1988-2010



As we can see in the figure.2, the capital stocks of the mining sector in Iran have increased period of the study years. One of the most important things in production function is the ratio of capital stock respect to labor. The paper has been calculated this ratio for the mining sector of Iran. And it has shown graphically as follows, [49 and 50]:

Figure.3: The ratio of the Capital due to the Labor in the Mining Sector in Iran



The above figure shows, gradually, the production technology of the Iranian mining sector has changed towards using of more than capital from using labor.

As we know, elasticity is one of the most important and empirical concepts. In fact, elasticity is the ratio of percentage changing of two variables. On the other hand, the elasticity indicates for each one percent changing in the independent variable, the changing percentage of dependent variable will be. For example, if the elasticity x and y, exy, is 2 when a one percent increase in x causes a 2 percent increase in y. If Y = f(x), then the elasticity, e_{xy}, can be showen by following equation:

$$e = \frac{\%\Delta Y}{\%\Delta x} \quad \text{Or} \quad e = \frac{\Delta y}{\Delta x}\frac{x}{y}$$

Many papers in economic to analyze companies behaviors assumes that production functions of companies are in form of the Cobb-Douglas production function which first introduced by Charles Cobb and Paul Douglas [3,5,6 and 9]. It is written as follow:

$$Q = F(L, K) = AL^{\alpha 1}K^{\alpha 2}$$

Where, A, α_1 and α_2 are parameters. In this function, α_1 and α_2 show the production elasticity of labor and capital, respectively. In this form, the marginal product of labor can be estimated as the following equation [1, 2 and 4]:

$$MP_L = \propto_1 A\mathrm{L}^{\alpha_1 - 1} K^{\alpha 2}$$

And the marginal product of capital is obtained as follow:

$$MP_L = \propto_2 A\mathrm{L}^{\alpha_1} K^{\alpha_2 - 1}$$

Hence, the marginal rate of technical substitution between labor and capital, $\mathrm{MRTS_{LK}}$, is:

$$\mathrm{MRTS_{LK}} = \left(\frac{\alpha_1}{\alpha_2}\right)\left(\frac{K}{L}\right)$$

The main objective of this paper is to estimate the production function in the Iran mining sector. Determination of this function will help the Iran mining decision makers to take a good decision to reduce extra costs and increase productivity in this sector.

The main hypotheses in the study are as follow:

1. The labor elasticity in mining sector of Iran is statistically significant and positive during period 1988 to 2009.
2. The capital elasticity in mining sector of Iran is statistically significant and positive during period 1988 to 2009.

MATERIALS AND METHODS

The paper applies the descriptive and analytical methods. Achieving the aim theoretical discussions and empirical studies was conducted using library methods. The required data, the related background information on empirical studiers and literature was collected by internet and library ways. The statistical data are taken from statistical data of Central Bank and the Statistical Center of Iran. After collecting the secondary data, it is necessary to determine to be or not to be the stationary for the data. Unit root test of Augmented Dickey-Fuller (ADF) is applied for it. Then is used the Cobb- Douglas function representing the relationship between the mining sector value add of Iran as a dependent variable and its factors of production, labor and capital, as the independents variables, other papers on this subject include [12- 28 and 44-48].

To representing the model is used the Cobb Douglas function as the following:

$$Q = F(L, K) = AK_{-1}{}^{\alpha 1}\mathrm{L}^{\alpha 2}$$

Now, the paper takes the natural logarithm from two sides of above equation, so we can easily the following liner function:

$$\mathrm{Ln(Q)} = \ln(A) + \alpha_1 \ln(K_{-1}) + \alpha_2 \ln(L)$$

Where

A = as a constant amount

ln(Q) = the natural logarithm of the mining sector value added of Iran

$\ln(K_{-1})$ = the natural logarithm of the capital stock in the mining sector in Iran with one lag period.

ln(L) = the natural logarithm of the number of employees in the mining sector in Iran.

Hence, the linear regression model can be used to estimate the production function in this research. The statistical population limits to Iran economy. The studied variables in this study are annual time series data mainly from 1988 to 2010. The study applies EIEWS8 and SPSS Software. Then significant of the model and coefficients investigates using appropriate statistical analyzes.

RESULTS AND DISCUSSION

Due to the results of the ADF test, at 5% confidence level, all of the data are not stationary at the level but only the natural logarithm of the mining sector value added of is stationary at the first difference level and the other variables in the natural logarithm of the variables are stationary at the second difference. In other words, however the variables have unit root test at the level but have not unit root test at the first difference for the Q and the L and second difference for the K_{-1}, while the natural logarithm of the variables are used in the Cobb Douglas function [7 and 10].

The ADF test results are as come at the following table:

Table1. The results of ADF test

The names of variables	ADF statistics	The Critical Value at 5%	The Stationary at	Prob.
Ln(Q)	-5.523267	-3.644963	1st difference	0.0012
$\ln(K_{-1})$	-5.147565	-3.658446	2st difference	0.0028
Ln(L)	-8.588226	-3.673616	2st difference	0.0000

In order to estimate the relationship among the mining sector value added of Iran and the effective's variables, the L and K, are applied the linear regression model. The function coefficients can be found from the below table [42 and 43]:

Table2. Coefficients of Model

Dependent Variable: LNQ				
Method: Least Squares				
Sample (adjusted): 1990 2010				
Included observations: 21 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-24.84971	4.918796	-5.051991	0.0001
LN K_{-1}	1.621488	0.590941	2.743910	0.0129
LNL	2.962340	0.450918	6.569568	0.0000
R-squared	0.755483	Mean dependent var		7.626202
Adjusted R-squared	0.729745	S.D. dependent var		0.493012
S.E. of regression	0.256298	Akaike info criterion		0.241170
Sum squared resid	1.248083	Schwarz criterion		0.389949
Log likelihood	0.347127	Hannan-Quinn criter.		0.276218
F-statistic	29.35214	Durbin-Watson stat		1.204337
Prob(F-statistic)	0.000002			

And for this model we can write as follow:
Substituted Coefficients:
==========

$$LNQ = -24.84971 + 1.621488 * LN\ K_{-1} + 2.962340 * LNL$$

The results of the study show, in the model, the coefficients of the natural logarithm of the capital stock in the mining sector with one lag period and the natural logarithm of the number of employees in the mining sector in Iran are 1.621488 and 2.962340, respectively. Due to the information of above table, all of coefficients are significant at %5 confidence level. In fact, these coefficients show the amount of elasticity of production factors for the mining sector in Iran. Hence, if the capital in the mining sector increases one percentage then the production in this sector increases 1.621488 and while the labor in this sector increases one percentage, then the production in this sector increases 2.962340 percent.

The coefficients of the variables are also statistically significant due to ANOVA test (see the ANOVA table as the follow):

Table 3. ANOVA[a]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	3.856	2	1.928	29.352	.000[b]
	Residual	1.248	19	.066		
	Total	5.104	21			

a. Dependent Variable: lnQ
b. Predictors: (Constant), ln(L), ln(K)

Due to the ANOVA data in table 3, the Sig is near to zero so the correlations are significant among the mining sector value added and the independent variables also the t-test statistic confirms it and also the value of R-Square is enough big which indicates the contribution of ln(L) and ln(K_{-1}) on the natural logarithm of the mining sector value added of Iran is 0.755483%. The closeness of R2 and Adj-R2, 0.729745%, shows the Goodness of fit of data. Generally, the hypotheses are accepted means that:

1. During period 1988 to 2010, the labor elasticity in the mining sector of Iran is statistically significant and it is positive.
2. During period 1988 to 2010, the capital elasticity in the mining sector of Iran is statistically significant and it is positive.

The results of the paper show that one percent change in capital causes to change 1.621488 percent in the production of the mining sector and one percent change in the labor causes to change 2.962340 percent in the production. In

other words, the elasticity of capital and labor are 1.621488 and 2.962340, respectively. Hence, it is important to invest in the mining sector in Iran.

Conclusions

This study estimates the factors elasticity of production in the mining sector of Iran using the Cobb Douglas function in Iran during 1988 to 2110. This survey examines the changes in the production factors how much affect on the change in the mining sector value added in Iran. The results of the study show that increasing capital or labor in the mining sector causes to increase the mining sector value added.

REFERENCES

[1] Balakrishnan P and Pushpangadan K (1994), "Total Factor Productivity Growth in Manufacturing Industry: A Fresh Look", Economic and Political Weekly, Vol. 29, pp. 2028-2035.

[2] Banerji A (1971), "Productivity Growth and Factor Substitution in Indian Manufacturing", Indian Economic Review, Vol. 6, No. 1, pp. 1-23.

[3] Burness HS, Quirk JP (1999) Appropriative water rights and the efficient allocation of resources. Am Econ Rev 69:25–37

[4] Berndt E R and Christensen L R (1973), "The Translog Function and the Substitution of Equipment, Structures, and Labor in US Manufacturing 1929-68", Journal of Econometrics, Vol. 1, pp. 81-114.

[5] Berndt Ernst R and Wood David O (1975), "Technology, Prices, and the Derived Demand for Energy", The Review of Economics and Statistics, Vol. 57, No. 3, pp. 259-268, MIT Press.

[6] Connor, M. (1994). Northern America as a Precursor of Changes in Western European Food Purchasing Patterns, European Review of Agricultural Economics, 21:155-73.

[7] Cox, D., and H. Miller (1965), the Theory of Stochastic Processes, John Wiley, NY.

[8] Caswell M, Lichtenberg E, Zilberman D (1990) the effect of policies on water conservation and drainage. Am J Agric Econ 72: 883–890

[9] Chakravorty U, Hochman E, Zilberman D (1995) A spatial model of optimal water conveyance. J Environ Econ Manag 29:25–41

[10] Dickey D A and Fuller W A (1981), "Likelihood Ratio Statistics for Auto-Regressive Time Series with a Unit Root", *Econometrica*, Vol. 107, No. 1, pp. 1057-1078

[11] Djitte N, Ekeland I (2006), an inverse problem in the economic theory of demand. Annales de l'Institut Henri Poincare´ (C) Nonlinear Anal 23(2):269–281

[12] Durlauf, S., and D. Quah (1999), the New Empirics of Economic Growth. In Taylor J., and Woodford, M. (eds.) Handbook of Macroeconomics. Elsevier Science

[13] Diewert W E (1971), "An Application of the Shephard Duality Theorem: A Generalized Leontief Production Function", Journal of Political Economy, Vol. 79, May-June, pp. 481-507.

[14] Engle R F and Granger C W J (1987), "Cointegration and Error Correction: Representation, Estimation and Testing", Econometrica, Vol. 55. No. 2, pp. 251-276

[15] Hoch, Irving, Simultaneous Equation Bias in the Context of the Cobb-Douglas Production Function, Econometrica, 26 (October, 1958), 566-578

[16] Goldar B N (1986), Productivity Growth in Indian Industry, Allied Publishers Private Limited, New Delhi.

[17] Greene W H (1980), "Maximum Likelihood Estimation of Econometric Frontier Functions", Journal of Econometrics, Vol. 13, No. 1.

[18] Gupta Deepak (1985), "Productivity Trends and Factor Substitutability in Manufacturing Sector in Maharashtra", Margin, July, pp. 62-69.

[19] Garrido R (2005) Price setting for water use charges in Brazil. Water Resour Dev 21(1):99–117

[20] Greene WH (2002) LIMDEP version 8.0 econometric modeling guide. Econometric Software Inc., New York

[21] Jorgenson and Griliches (1967), "The Explanation of Productivity Change", Review of Economic Studies, July.

[22] Little I M D, Mazumdar D and Page Jr. J M (1987), Small Manufacturing Enterprises: A Comparative Analysis of Indian and Other Economies, Published for the World Bank by Oxford University Press, Washington.

[23] Lynk L Edward (1982), "Factor Demand Substitution and Biased Technical Change in Indian Industry", The Manchester School of Economic & Social Studies , Vol. 50, No. 2, pp. 126-138.

[24] Matsuno Y, Hatcho N, Shindo S (2007b) Water transfer from agriculture to urban domestic users: a case study of the Tone river basin, Japan. Paddy Water Environ 2007(5):239–246

[25] Miller KA (1996) Water banking to manage supply variability. In: Hall DC (ed) Marginal cost rate design and wholesale water markets: advances in the economics of environmental resources, vol 1. JAI Press Inc., Greenwich, pp 185–210

[26] Scott CA, Flores-Loped F, Gastelum JR (2007) Appropriation of Rio San Juan water by Monterrey city, Mexico: implications for agriculture and basin water sharing. Paddy Water Environ 2007(5):253–262

[27] Mundlak, Yair, Estimation of Production and Behavioral Functions from a Combination of Cross-Section and Time-Series Data, in Christ, C. F., et al., Measurenmentin Economics, Stanford: Stanford University Press, 1963

[28] Mundlak, Y., And I. Hoch, Consequence of Alternative Specifications in Estimation of Cobb-Douglas Production Functions, Econometrica, 33 (October, 1965), 814-828

[29] Sameni Keivani. Farshad et al, 2013, The Estimation Of The Potential Capacity Of Zakah -A Case Study Of Iran, Journal of Basic and Applied Scientific Research, text road**,** ISSN 2090-4304

[30] Sameni Keivani. Farshad et al, 2013, The Creation Of bankruptcy prediction model with using Ohlson and Shirata models, Journal of Basic and Applied Scientific Research, text road**,** ISSN 2090-4304

[31] Sameni Keivani. Farshad et al, 2013, The Estimation of the Underdevelopment Degree of Different Regions- A Case Study of the Cities of Guilan Province in Iran, World Applied Sciences Journal, 22 (10): 1395-1400, 2013, ISSN 1818-4952

[32] Sameni Keivani. Farshad et al, The Historical Lack of Capital Accumulation in Iran's Agricultural Part, 11(5) IOSR Journals of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 10, Issue 4 (May. - Jun. 2013), PP 88-90

[33] Sameni Keivani. Farshad et al, (2013), Advantages and Barriers of E-Banking in Iran, Nature and Science Journal; 11(5)

[34] Jalali, L. and Sameni Keivani. Farshad, (2013), an Investigation of Historical Geography, 11(5) IOSR Journals of Humanities and Social Science (IOSR-JHSS) e-ISSN: 2279-0837, p-ISSN: 2279-0845. Volume 17, Issue 2 (Nov. - Dec.), PP 26-30

[35] Sameni Keivani. Farshad et al, An Investigation of the Internet Effects on Business, IOSR Journals of Business and Management (IOSR-JBM), e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 13, Issue 6 (Sep. - Oct. 2013), PP 96-99

[36] Sameni Keivani. Farshad et al, The Relationship between the Government Expenditures and Revenues in the Long Run, a Case Study of Iran, IOSR Journals of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 14, Issue 6 (Nov. - Dec. 2013), PP 83-87

[37] Sameni Keivani. Farshad et al, Strategic management; concepts, benefits and process, IOSR Journals of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668

[38] Sameni Keivani. Farshad et al, 2013, The role of Knowledge and confidence in reducing cost of electronic banking customers - a case study of Iran, The 5th International Conference on Financial Criminology (ICFC), Global Trends in Financial Crimes in the New Economies,

[39] Sameni Keivani, F., (2011), Synchronization of Economic Growth and Income Distribution, In 2011 International Conference on Sociality and Economics Development. IPEDR, vol. 10, pp. 7-11.

[40] Sameni Keivani. Farshad et al, 2011, Conceptual Approach to E-government, Targets and Barriers Facing its, International Conference on Construction and Project Management (ICCPM), September, 16-18, Singapore.

[41] Sameni Keivani. Farshad et al, 2011, Conceptual Evaluation E-commerce, Objectives and the Necessary Infrastructure, International Conference on Construction and Project Management (ICCPM), September, 16-18, Singapore

[42] Sameni Keivani. Farshad et al, 2012, A General View on the E-banking, International Conference on Adoption Certificate profile and ISI, International Economic Development and Research Center (IEDRC), Singapore, July 23-24

[43] Sharifvaqheei, Ali and Farhad Sameni Keivani, (2003), Geological and geotechnical studies and behavioral parameters, Iranian Tunneling Conference, Iran

[44] Sameni Keivani, Farshad et al, (2013), The Sanctions of Riba and Alternatives of Interest in Islamic Economics, , Journal of Applied Environment and Biological Sciences, text road, ISSN 2090-4274, J. Appl. Environ. Biol. Sci., 3(12)107-111.

[45] Sameni Keivani, Farshad et al, (2014), the Comparative Evaluation of the Underdevelopment Degree- A Case Study of The Villages of Roudsar City, Journal of Applied Environment and Biological Sciences, text road, ISSN 2090-4274, J. Appl. Environ. Biol. Sci., 4(2)252-258

[46] Jalali, L. and Sameni Keivani. F., (2013), an Investigation of Historical Geography of Shahindezh Region, Journal of Applied Environment and Biological Sciences, text road, ISSN 2090-4274, J. Appl. Environ. Biol. Sci.,3(12) 34-38

[47] Sameni Keivani, Farshad et al, (2014), The Description of Zakah and Its Applying and Computing Models, Journal of Applied Environment and Biological Sciences, text road, ISSN 2090-4274, J. Appl. Environ. Biol. Sci., 4(2)241-244

[48] Sameni Keivani, Farshad et al, (2014), The Evaluation of the Impact of the Government Revenues on the Government Current Expenditures A Case Study of Iran, Journal of Applied Environment and Biological Sciences, text road, ISSN 2090-4274, J. Appl. Environ. Biol. Sci., 4(2)259-263

[49] www.cbi.ir

[50] www.amar.org.ir