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Lignite Pricing Strategies in Turkey

ABSTRACT

Turkish Coal Enterprises (TKI) is a government company which was established in 1957. It is the biggest lignite producer in Turkey and the tenth in the world. 30% of lignite reserves of Turkey and nearly 55% of production capacity of Turkey is owned by Turkish Coal Enterprises, while 45% of the lignite production is done by Electricity Generation Co. Inc. which is other government company and by private firms. Seen from this aspect it can be understood that the lignite prices in Turkey is controlled by the government. This condition creates an uncertainty both in mining and thermal power plant industries. 75% percent of the Turkey's lignite is used as a fuel source for electric power production and lignite prices are primary indicator for thermal power plants. In accordance with privatization policies in mining and thermal power plant industries, it is important for potential investors to be aware of lignite pricing strategies in Turkey. In this study, the lignite pricing strategies in Turkey is examined in detail for the period of 1997-2006 in the frame of cost and market approaches. Results suggest that (1) the lignite prices sold to the industry increase (decrease) depending on decrease (increase) in the industrial production and (2) the total electricity production and the electricity price are the most important factors that potential investors and related persons have to take into consideration for the pricing of lignite in the thermal power plant market.

Keywords: *Lignite Pricing, Pricing Strategies, Turkish Lignite Industry*

1. Introduction

Turkish Coal Enterprises (TKI) is a government company which was established in 1957. It is the biggest coal producer in Turkey and the tenth in the world. Turkish Coal Enterprises which is the most important lignite producer of Turkey has increased its production capacity by accelerating its investments since 1970s and in the first years of 1990s it reached the production capacity of 60 million tones. Turkey has approximately 8.3 billion tones of lignite reserves. 2.5 billion tones of these reserves are in responsibility of Turkish Coal Enterprises'. In the year 2006, while approximately 55% of the lignite production capacity of Turkey belongs to Turkish Coal Enterprises, 45% belongs to the private sector and Electricity Generation Co. Inc. (EUAS) which is another government company. In other words, lignite industry of Turkey is in the control of the government.

Turkish Coal Enterprises actualizes its production depending on the thermal power plants, heating and industrial demands. Almost half of Turkey's total primary energy production is represented by coal (43 percent lignite) and is likely to be predominant in the next decades. Since the quality of lignite is low, most of it has been used in thermal power plants (WEC, nd).

In the first years of 1980s the usage share of lignite in the total electricity production reached into 40%. Turkey had continued its electricity production in lignite based until 2000. After Turkey had started to import natural gas with important amounts, it tended to use natural gas in the electricity production. In 2003 Turkey actualized 45.2% of its total electricity production from natural gas. The share of lignite in the total electricity production of Turkey decreased 16% (TURKSTAT, 2003). However with its current lignite reserves, Turkey has a potential of decreasing its foreign country dependence (in the ratio of 50%) which occurs as a result of natural gas imports used mostly in the electricity production (Yilmaz and Uslu, 2007). In this respect, since 2005 in order to decrease the dependence of Turkey on natural gas in the production of electricity, it has started new attempts to find new lignite reserves. Also, in order to provide the usage of lignite reserves in the electricity production, Turkey has accelerated the practices of privatization. In 17 March 2004, the transfer of the thermal power plants and lignite fields in Turkey to the private sector was started with 'Official Document of Electricity Energy Sector Reform and Privatization' that was accepted by High Planning

Committee in the coordination of Energy and Natural Resources Ministry of Turkey. This document provided the transfer of lignite fields belonged to Turkish Coal Enterprises and Electricity Generation Co. Inc. to potential investors in order to construct thermal power plants. In this respect, it is thought that the investment of thermal power plant needed for the lignite based electricity production can be provided by the private sector. As a result of this practice, the share of the lignite-fired thermal power plants reached to the level of 19.93% in the total electricity production (TURKSTAT, 2006). But, currently the share of the natural gas based electricity production can not be decreased. As a result of the import agreements made with Russia, Turkey has much more natural gas compared with its needs. So, Turkey uses excessive natural gas that can not be stored in the electricity production. Projects prepared in order to give the natural gas, which can not be used, to various countries, for example Israel, by laid down tubes has a critic importance for increasing the lignite based electricity production (Aksiyon, 2004). The lignite based electricity energy production potential in Turkey in 2006 was approximately 120 billion kWh per year, currently its shares 45 billion kWh per year (37%) is used (MENR, 2006). The lignite production in Turkey and the lignite based electricity production have an important increasing tendency and it becomes a vital market for the private sector.

Soma, Afsin-Elbistan, Mugla, Tuncbilek, Seyitomer, Beypazarı, and Sivas are the regions that have Turkey's richest lignite reserves (Balat and Ayar, 2004). Major lignite fields in Turkey can be seen in Figure 1.

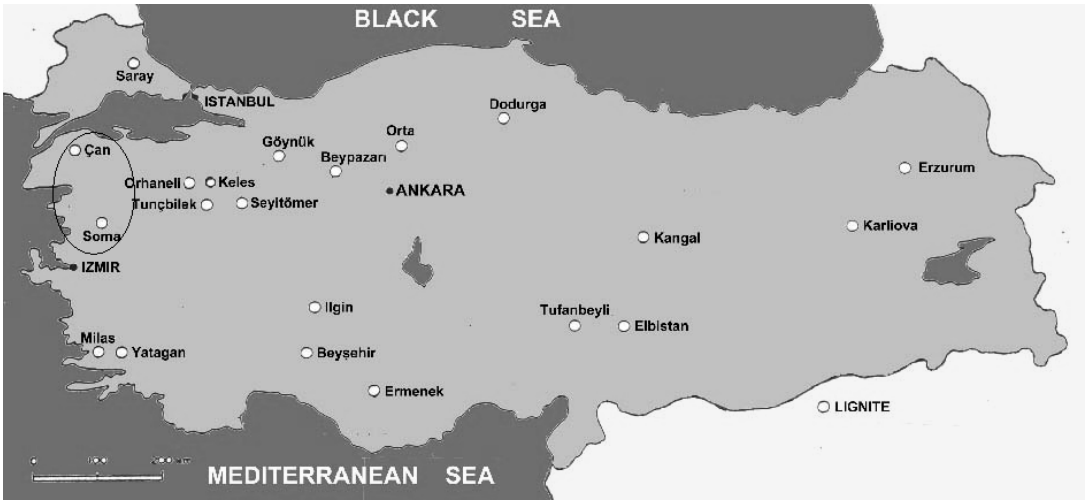

Fig. 1. Major Lignite Fields in Turkey.

Soma and Can with their 710.5 million tones lignite reserves are 28% of total lignite reserves of Turkish Coal Enterprises (ORTKI, 2006). As seen in Figure 2, Soma and Can lignites are produced and sold by Aegean Lignite Enterprise (ELI) which is one of the 4 establishments of Turkish Coal Enterprises. Aegean Lignite Enterprise is the biggest establishment of Turkish Coal Enterprises and approximately 31% of the total sales of Turkish Coal Enterprises are actualized by Aegean Lignite Enterprise. In this sense, Aegean Lignite Enterprise is a lignite producer that can make macro evaluations about Turkish lignite industry.

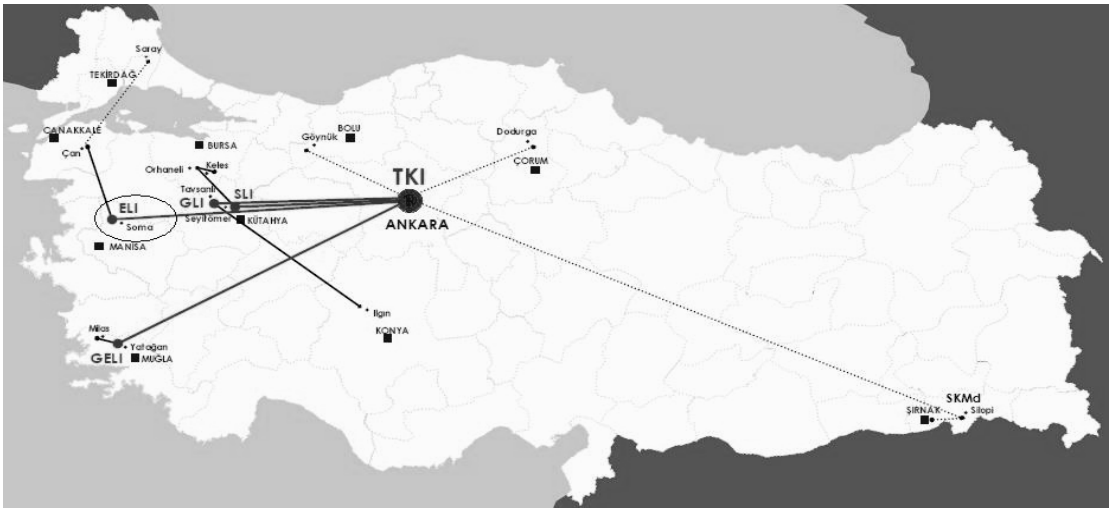

Fig. 2. Establishments (ELI, GLI, SLI and GELI) of Turkish Coal Enterprises (TKI).

In Aegean Lignite Enterprise according to their physical properties 7 types of lignites are produced (See Table 1). Each lignite type according to their properties is demanded by different markets. These are thermal power plant market, industry market, and heating market.

Table 1: Lignites produced in ELI.

	Lignite Type	Related market(s)	Calorie*
L1	0-200mm, unsorted	Thermal power plant	2,274.20
L2	0-1000mm, unsorted	Thermal power plant	1,627.98
L3	0-20mm, dust	Thermal power plant and industry	3,546.98
L4	0-10mm, dust	Thermal power plant, industry and heating	4,378.76
L5	10-18mm, hazelnut	Industry and heating	4,494.29
L6	+18mm, bit	Industry and heating	4,255.65
L7	+20mm, bit	Industry and heating	4,641.95

* average value as Kcal/kg, in respect of 2006. (source: LR, 2006)

As seen from the Table 1; L1, L2, L3, and L4 are lignites that are sold to thermal power plant. Because L1 and L2's calorific values are less than others, they are sold only to thermal power plant. The thermal power plant sales of Aegean Lignite Enterprise are made to Soma Thermal Power Plant that is one of the biggest thermal power plants in Turkey. Soma Thermal Power Plant is a lignite-fired production plant situated in Soma District of Manisa Province. Soma Thermal Power Plant is bounded to central electricity distribution system and the produced electricity is distributed to different places in Turkey by Electricity Generation Co. Inc. (EUAS). Soma Thermal Power Plant meets approximately 13% of Turkey's lignite based electricity production (OREUAS, 2006). In this sense, increases or decreases in the electricity production of Soma Thermal Power Plant directly reflect the lignite based electricity production of Turkey. We can make macro evaluations about lignite based electricity production in Turkey by analyzing the electricity production of Soma Thermal Power Plant. Soma Thermal Power Plant that has a power of 1034 NW possesses 8 units. Units of a, b, c, and d use L1, e and f use L2, g and h use L3 and L4. In Figure 3 the electricity production (kWh) of Soma Thermal Power Plant is shown within years, units, and the lignite types used.

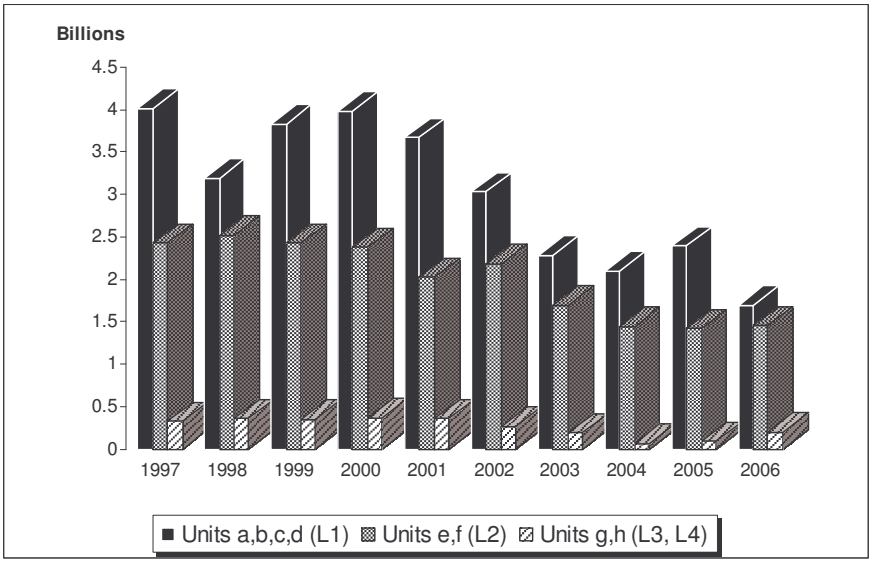

Fig.3. The electricity production of Soma Thermal Power Plant within years, units, and the lignite types used. (Source: Energy and Natural Resource Ministry of Turkey)

The electricity production of Soma Thermal Power Plant has decreased rapidly especially since 2000. As Turkey started to use the natural gas that is imported more than its needs in the electricity production as a substitute to lignite is the most important reason that forms this result.

The construction decisions of lignite-fired thermal power plants are taken in the frame of strategic plans and long term sales agreements made between the lignite producer and the thermal power plant. The main reason of this is that each of them wants to minimize risks depending on the fluctuations in the spot market (Joskow, 1987, 1988, 1990; Williamson, 2000). But, this kind of agreements directed to minimize risks are generally meaningful for the private sector and agreements are subject to sanction. As Soma Thermal Power Plant and Aegean Lignite Enterprise are goverment companies, transections between them are not subject to sanction. Because Aegean Lignite Enterprise sells more than 60% of its total sales to Soma Thermal Power Plant, decreases in the electricity production of it had an important impact on Aegean Lignite Enterprise. In fact, thermal power plant sales in all lignite enterprises of Turkish Coal Enterprises are at least two times of total sales made towards industrial and heating markets (ORTKI, 2006). The main reason of this is that calorie value of lignites produced in Turkey is low (Elevli and Demirci, 2006). Especially heating market sales are very few. With new environmental regulations forbidden of the coal usage for heating in most of the regions and reaching the usage of natural gas in heating into the level of 95% are the most important reasons of this (TURKSTAT, 2005).

The sale shares (%) of related markets and lignite types in total sales of Aegean Lignite Enterprise within years are illustrated in Figures 4 and 5.

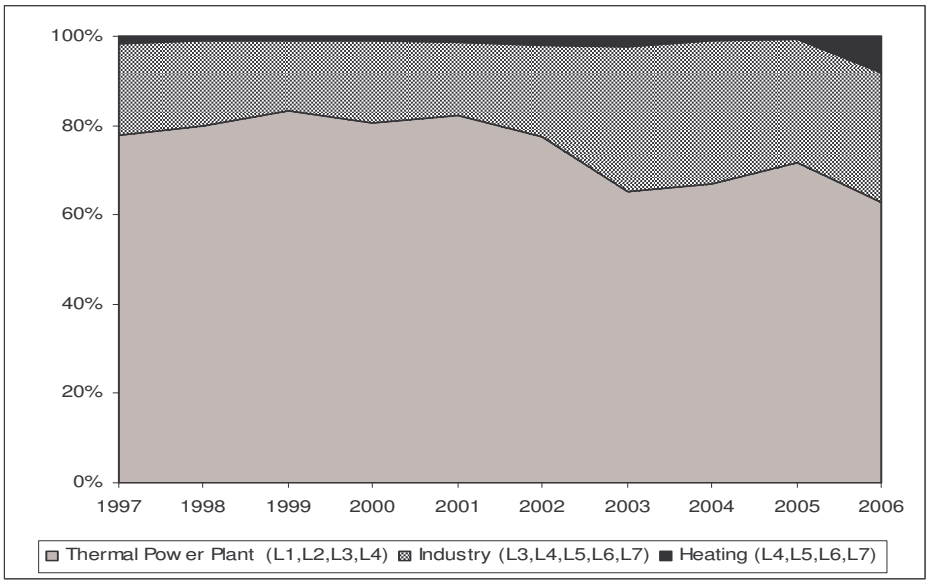

Fig.4. The sale shares (%) of related markets in total sales of Aegean Lignite Enterprise within years.
(Source: ORELI, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006)

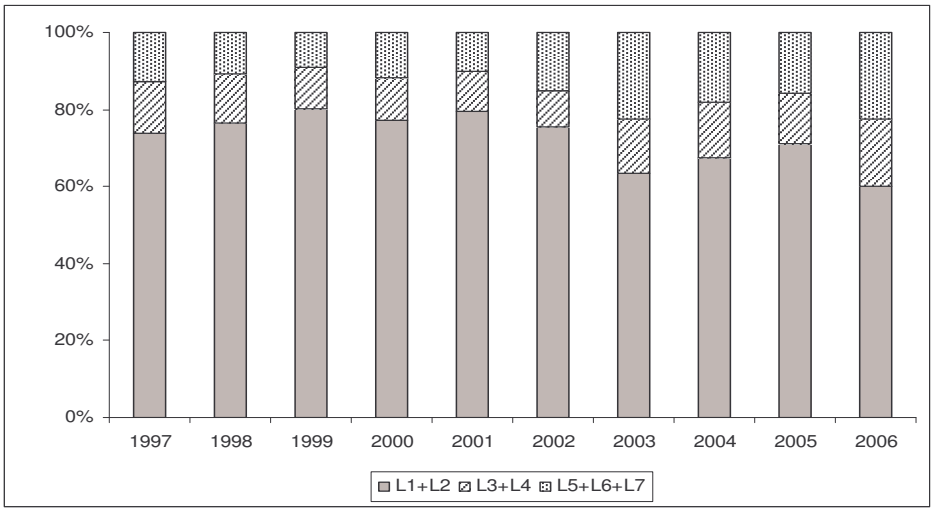

Fig.5. The sale shares (%) of lignite types in total sales of Aegean Lignite Enterprise within years..
(Source: ORELI, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006)

As seen, L1 and L2 lignites, which are sold to only thermal power plant, have big shares in the total sales of Aegean Lignite Enterprise. Figure 6 graphically illustrates the relationship between total lignite sales of Aegean Lignite Enterprise and the total electricity production of Soma Thermal Power Plant within years.

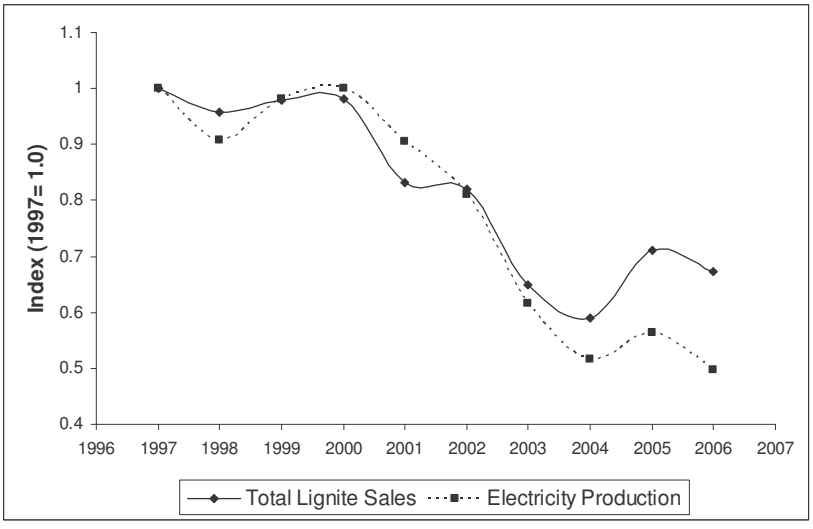

Fig.6. The relationship between total lignite sales and electricity production.

As the shares of L1 and L2 lignites inside the total sales are in the average level of 70%, this situation causes changes in the sales volume of Aegean Lignite Enterprise depending on the electricity production of Soma Thermal Power Plant. As illustrated from Figure 6, the highly usage of natural gas in the electricity production in 2000 decreased the total sales of Aegean Lignite Enterprise depending on the decrease in the lignite demand of Soma Thermal Power

Plant. As a result of the impact of the tendency of government towards the policy of supporting the lignite based electricity production since 2004, the lignite sales increased in 2005. But, because of not decreasing the share of excess natural gas in the total electricity production, lignite sales showed a decrease. We can say that Aegean Lignite Enterprise and Soma Thermal Power Plant reflect the macro situation of Turkey clearly. In this sense, examinations actualized by using data of Aegean Lignite Enterprise make possible of doing macro evaluations.

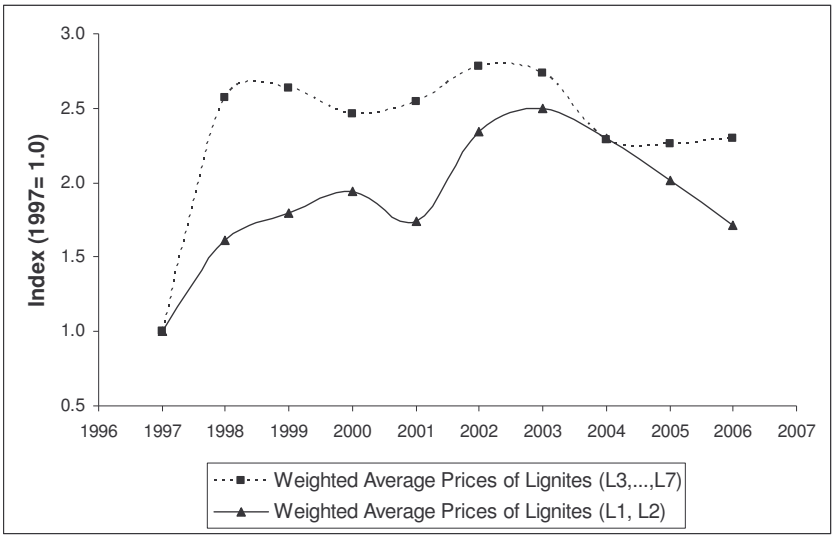

Fig.7. Weighted average prices of lignites.

Weighted average prices of lignites produced in Aegean Lignite Enterprise are graphed in Figure 7 in two groups. While L3 can be sold to the thermal power plant and industry, L4 can be sold to each of three markets. L5, L6, and L7 are sold to industry and heating markets. The share of the heating market inside the total sales is negligible. In this sense, the heating market will not have an important impact on the prices of lignite. Also, the shares of L3 and L4 lignites inside the total thermal power plant are negligible. For this reason, it will be suitable to think of L1 and L2 as lignite types whose sales can be done to thermal power plant market (group 1), others can be thought as the ones whose sales are done to the industry (group 2). In this respect, while weighted average prices of L1 and L2 express the sale prices of lignites that are sold to Soma Thermal Power Plant, weighted average prices of other lignites express the sale prices of lignites that are sold to the industry.

Industrial lignite sale price showed an important increase in 1998. Decreasing by 6% in increase speed of industrial production in 1998 is the main reason of this (SPO, 1998).

Industrial lignite sale prices, which showed little decreases and increases until 2003, had a sharp decrease in 2004 and in the next two years it showed no change. Turkey's increase speed of industrial production showed an increase by 10% in 2004 (SPO, 2004). In this sense, we can say that industrial lignite sale prices are formed by depending on the industrial demand. As the industrial market sales of Aegean Lignite Enterprise express the transactions between the government and the private sector, the market economy rules are acceptable in the industrial sales. Also, imported lignite prices have an impact on industrial lignite prices within the competition conditions.

Thermal power plant lignite sale prices, which showed an increase until 2003, have begun to decrease from this year on. In fact, the thermal power plant sales have been decreased continuously since 2000 depending on the electricity production. Because both of the Soma Thermal Power Plant and Aegean Lignite Enterprise are government companies, in contrast to the industrial market, market economy rules are not acceptable in the thermal power plant market. While Aegean Lignite Enterprise gained high profits until 2003, it has made loss since 2004 (ORELI, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006). Aegean Lignite Enterprise made profits until 2003 because of high sales volume and high lignite sale prices. After high losts in 2004 and 2005, the enterprise decreased its losts in 2006 depending on the increase in the industrial sales in the last two years. This situation is an important sign to show that politics applied by the government play an important role when compared with the market mechanism in pricing of lignite given to the thermal power plant.

As a result of the acceleration in privatization practices in Turkey and politics towards increasing the lignite based electricity production, lignite and thermal power plant industries increase their attraction for potential investors. The fixed costs of these types of investments are extremely high when compared with the others. So, the operating leverages of lignite enterprises and thermal power plants are high. Potential investors, who show interest in these industries, have to primarily take into consideration the lignite prices when taking decision. Because, it provides taking potential investment decisions effectively in order to know in which degree the lignite prices reflect the demand and supply of the market, from which factors they are affected and in which degree they are consistent. In this sense, it is extremely important to understand the lignite pricing strategies in Turkey by potential investors.

In this study, it is aimed to examine the factors that may have an effect on the lignite price in the frame of simultaneous equations econometric model depending on the yearly data for the periods of 1997-2006 for Aegean Lignite Enterprise. The data, which belong to Aegean Lignite Enterprise that produces and sells the lignite of Soma and Can, reflect the general situation in Turkey. So, it is possible to make macro evaluations about lignite pricing strategies in Turkey by examining the Soma and Can lignites. For this reason, we collected data that are vital for our study by visiting Manisa-Soma in order to examine Aegean Lignite Enterprise and Soma Thermal Power Plant in their own region. Other data were obtained from the official Web Sites of Turkish Coal Enterprises, Energy and Natural Resources Ministry of Turkey, Central Bank of Turkey and Turkey Statistical Institute. As data of some variables are not available in the previous years, the study was actualized by using the data for the periods of 1997-2006. In Turkey for this type of a study it is very difficult to collect the data needed. As a result of concentrated efforts, this study differentiates when compared with other studies done about the lignite pricing in Turkey. Because the data gained directly from its source were used and also, while other studies in the literature generally analyze the relationship between the lignite price and the chemical properties of lignite, in this study all variables except calorie value arise from economical and financial variables. The findings of the study are important for the establishment of the proper politics by the people related with the energy sector and throwing light on the decision process to the potential investors who are interested in lignite and thermal power plant market in Turkey.

2. Model Description and Data

In the theoretic framework of Mellish's (1998) study, a simultaneous equations econometric model is described for Aegean Lignite Enterprise. The simultaneous econometric equations model is specified as below:

Demand Side;

$$Q_{it}^{D} = \mu_i \times P_{it}^{\gamma_1} \times ELEC_{it}^{\gamma_2} \times IPI_{it}^{\gamma_3} \times CAL_{it}^{\gamma_4} \times PF_t^{\gamma_5} \times NG_t^{\gamma_6} \times MP^{\gamma_7 t} \times u_{1it}$$

Supply Side;

$$P_{it} = \alpha_i \times Q_{it}^{\beta_1} \times S_t^{\beta_2} \times LC_t^{\beta_3} \times PC_t^{\beta_4} \times SC_t^{\beta_5} \times MC_t^{\beta_6} \times AC_t^{\beta_7} \times PF_t^{\beta_8} \times PE_{it}^{\beta_9} \times u_{2it}$$

Equilibrium condition;

$$Q_{it}^{D} = Q_{it}^{S}$$

Where ‘t’ is the time subscript, ‘i’ identifies each of the lignite type that is accepted as L1…, L7 and ‘u_t’ is the random error term which is independent from explanatory variables. ‘Q^D’ denotes the total sales amount (tone) for ‘i’ type lignite at time ‘t’, while ‘Q^S’ denotes the total production amount (tone) for ‘i’ type lignite at time ‘t’. Data related to production and sales amounts were obtained from operating reports of Aegean Lignite Enterprise. ‘P’ denotes the annual average inflation adjusted sale price of ‘i’ type lignite at time ‘t’ (TL/tone). Data were obtained from coal income tables of Aegean Lignite Enterprise. Inflation adjustment was done by Mining Sector Producer Price Index whose values were obtained from Central Bank of Turkey’s electronic delivery system.

‘ELEC’ denotes the total electricity production (kWh) of Soma Thermal Power Plant for ‘i’ type lignite at time ‘t’. Soma Thermal Power Plant has 8 units. Units of a, b, c, and d use L1, e and f use L2, g and h use L3 and L4. For this reason ‘ELEC’ variable is described as total electricity production of a, b, c, d units for lignite type L1, total electricity production of e, f units for lignite type L2, total electricity production of g, h units for lignite type L3 and L4, and zero value for other lignite types. Data were obtained from Energy and Natural Resources Ministry of Turkey.

‘IPI’ denotes the Industrial Production Index for ‘i’ type lignite at time ‘t’ (1997=100). As lignite types L1 and L2 are only sold to the thermal power plant, ‘IPI’ variable is described as zero value for these lignites and index values for others. Index values were obtained from Central Bank of Turkey’s electronic delivery system.

‘CAL’ denotes the annual average lower heating value for ‘i’ type lignite at time ‘t’ (Kcal/KG). Data were obtained from laboratory reports of Aegean Lignite Enterprise. ‘PF’ is the annual average inflation adjusted sale price of fuel oil (TL/liter). ‘NG’ is the annual average inflation adjusted sale price of natural gas (TL/m^3). Inflation adjustments were done by Consumer Price Index whose values were obtained from Central Bank of Turkey’s electronic delivery system. ‘MP’ is the Mining Sector Import Unit Index (2003=100). Index values were obtained from Central Bank of Turkey’s electronic delivery system.

‘S’ is the annual stripping ratio (m^3/ton). Data were obtained from operating reports of Aegean Lignite Enterprise. ‘LC’, ‘PC’, ‘SC’, ‘MC’ and ‘AC’ denote direct labor unit cost,

manufacturing overhead unit cost, auxiliary service-manufacturing unit cost, marketing unit cost and administrative unit cost respectively (TL/tone). Data related to these variables were obtained from financial tables of Aegean Lignite Enterprise and data were adjusted for inflation by Mining Sector Produce Price Index. 'PE' denotes the annual average inflation adjusted price of electricity (TL/kWh). Data were obtained from the official web site of Energy and Natural Resources Ministry of Turkey and inflation adjustment was done by Consumer Price Index. This variable is described as electricity price for lignite types L1, L2, L3, and L4 which are used in thermal power plant and zero value for other lignite types.

Variables described above included in the model, depending on the two approaches which are taken up seriously in pricing by enterprises. These are market approach and cost approach.

Market approach is a methodology used in pricing products. According to this approach, pricing is done by adjusting the sale price of the subject product after making comparison between the subject product and its peers. In the competitive market, buyers and sellers has already set prices of products according to their expectations and value judgments. So, it is appropriate to set a price in respect of peers' prices.

'Going-Rate Pricing' is a method that is based on market approach and takes part in administrative science. According to this method, pricing is done by following competitors' prices instead of enterprise's cost or demand characteristics. Especially, prices show similarity in the oligopoly sectors where there is heavy competition. Consequently, small firms prefer to follow leader firms of the sector when doing pricing. In other words, changes in prices of the leader firms are more important reason for small firms to make a new pricing rather than changes in their costs or demands. In respect of the market approach price occurs in demand based within the competitive conditions. On this account all the factors that affect the demand should be taken into consideration by enterprises. 'ELEC', 'IPI', 'CAL', PF', 'NG', 'MP', and 'PE' variables were included in the model in order to display the market effect on lignite prices.

Cost approach is generally preferred in pricing of products which don't enable to make an effective projection in order to determine future cash flows. According to cost approach product's price is set by adding the profit margin to unit cost. In administrative science

‘Markup Pricing’ and ‘Target Return Pricing’ are two methods that are based on cost approach.

In ‘Markup Pricing’ method, a fixed profit margin is added to the average unit cost of the subject product. But, it is not always appropriate to use a fixed profit margin. Demand, competition and the perceived value of products should be taken into account in order to make an objective pricing. Otherwise, subject product’s price is set in a subjective way. Nevermore, ‘Markup Pricing’ is frequently used by operators by reason of its advantages. The first advantage of this pricing method is that enterprises can calculate costs more easily in comparison with demand estimation. In this wise, prices are associated with costs and so pricing can be done in an easier way. Secondly, if all firms apply ‘Markup Pricing’ method in market, all prices become similar. Thence, price-based competition actualizes in minimum level. Thirdly and lastly, it is thought that cost-based prices are righteous for both sellers and buyers because violent effects based on demand are not reflected to prices (Schwert, 1996; Considine, 2001).

In ‘Target-Return Pricing’ method, enterprises set prices in order to their target returns. In this method, expected sales volume plays an important role. Because, adding variable costs to the total costs makes target return dependent to sales volume. In other words, in contrary to the decreases in sales volume, which cause an increase in the total unit cost, increases in sales volume cause a decrease in the total unit cost. Especially, enterprises with high fixed costs are very sensitive to the changes in sales volume. As the changes in the sales volume cause sharp changes on the return, enterprises with high fixed costs have high operating leverage. Consequently, enterprises with high fixed costs take into account both market approach and cost approach in pricing. In this context, pricing is done by considering both the possible demand in market and the total unit costs of the subject product and in order to increase the sales volume, discount policy can be applied by enterprises (Lau, Lau and Wang, 2007; Tang and Yin, 2007; Zhou, 2007). Because of the operating leverages of Soma Thermal Power Plant and Aegean Lignite Enterprise are high; included variables reflecting only market effect in the model isn’t enough. So, ‘S’, ‘LC’, ‘PC’, ‘SC’, ‘MC’, ‘AC’, ‘PF’, and ‘PE’ variables were included in the model in order to display the unit cost effect on lignite prices.

As seen above ‘PF’ and ‘PE’ variables reflect both market effect and cost effect. Fuel oil is a substitute energy source for lignite in the electricity production. Therefore, fuel oil price can

affect lignite price. In addition, electricity price is an important factor for operators of thermal power plants in production planning and profitability analysis. In this sense, changes in electricity prices can indirectly affect lignite demand. Also, fuel oil and electricity are very important inputs for lignite enterprises. Increases in prices of fuel oil and electricity cause increases in unit costs.

The direct labor cost is connected with directly productive workers and includes their wages. Increases in wages or number of directly productive workers are important facts that increases the direct labor cost.

Auxiliary service-manufacturing cost includes social service expenses such as maintenance, shipment, food and beverage of workers, and sheltering. Finishing the economic lives of construction equipments and heavy trucks and a continuous maintenance needs are important factors that increase the auxiliary service-manufacturing cost. All production expenses except direct labor cost and auxiliary service-manufacturing cost are recorded in manufacturing overhead costs. In order to see the impact of the stripping found inside of the manufacturing overhead costs on the lignite price, 'S' variable was also added into the model. Marketing and administrative costs which are not related with manufacturing are extremely important for big enterprises. The share of marketing and administrative costs of Aegean Lignite Enterprise is in the level of 22% in the total costs. Consequently, these costs have to taken into account in the frame of the cost approach.

3. Empirical Results

Panel data set is formed by joining cross-section with time series data and it includes cross-section values depending on time and is related with different individuals. In other words, panel data sets are two-dimensional. In this study, data related with lignite types exists at cross-section.

Joined estimations are implemented by using panel data and 'Fixed Effect Model'. According to 'Fixed Effect Model' it is assumed that fixed term is different for each lignite type. 'μ_i' and 'α_i' denote fixed terms in demand equation and price equation respectively. 'i' subscript points out that the fixed term is differentiated for each lignite type. 'Fixed Effect Model'

expresses that average sales amount and price are differentiated between individuals (Greene, 1993).

Panel data set that consists of seventy data which are formed from annual observations including seven lignite types at cross-section and ten periods at time dimension (1997-2006) was used in the estimation of parameters of the econometric model. 'Pooled Two Stage Least Squares Method' was used for the estimation. Results of the model are reported in Table 2 for demand equation and in Table 3 for price equation.

Table 2: Demand Equation Results

Dependent Variable: Ln(Q_{it}^{D})				
Estimation Method: Pooled Two Stage Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	p-value
Fixed Term	12.2112*	4.8054	2.5411	0.0150
Ln(P_{it})	-0.0073	0.2616	-0.0280	0.9778
Ln($ELEC_{it}$)	0.4035*	0.1202	3.3559	0.0017
Ln(IPI_{it})	1.5049*	0.4424	3.4016	0.0015
Ln(CAL_{it})	-0.9219	0.5580	-1.6521	0.1063
Ln(PF_t)	-0.4589	0.5140	-0.8928	0.3773
Ln(NG_t)	0.3665	0.2339	1.5665	0.1251
Ln(MP_t)	0.0135	0.2687	0.0505	0.9599
Fixed Effects (Cross)				
L1	2.3237	L5	1.3187	
L2	1.8667	L6	2.8471	
L3	-5.5307	L7	2.7457	
L4	-4.6778			
Weighted Statistics				
R^2	0.9994	Durbin-Watson		1.6751
Unweighted Statistics				
R^2	0.9527	Durbin-Watson		1.4682

* indicates statistical significance at 5% level.

The estimated demand equation has an adjusted R^2 of 0.9994, indicating a very good fit. In other words, the explanatory variables collectively explain approximately 99 percent of the variation in the dependent variable. Total electricity production of Soma Thermal Power Plant and Industrial Production Index are highly significant. On the contrary lignite price, calorific value, fuel oil price, natural gas price and Mining Sector Import Unit Index are statistically insignificant.

Total electricity production for Soma Thermal Power Plant has a positive impact on the thermal power plant lignite demand for lignite types (L1, L2, L3, and L4). The coefficient of Soma Thermal Power Plant electricity production variable (ELEC), which was identified in order to distinguish the thermal power plant demand, is statistically significant at 5% level. The coefficient of "ELEC" is estimated as 0.4035. This condition shows that a 1% increase in electricity production increases the sales of lignite given to the thermal power plant by 40%. This result, which is consistent with our expectations, is a proof of Aegean Lignite Enterprise is highly affected from the changes in the electricity production of Soma Thermal Power Plant. The most important reason of this is that Aegean Lignite Enterprise does averagely 70% of its total sales to the thermal power plant.

The increase in the industrial production is an important factor that affects the lignite sales quantity positively. The coefficient of industrial production index is estimated as 1.5049 and it is statistically significant at 5% level. This situation shows that an increase by 1% in the Industrial Production Index will increase the lignite demand approximately 1.5%. This result, which is coherent with our expectations, signs that income elasticity of lignite demand is more than 1 and income has an elastic structure in the lignite sales. In other words, as Aegean Lignite Enterprise, which has a high operating leverage, increases the sales done to the industry, it decreases its total unit cost and increases its income. Aegean Lignite Enterprise, depending on the decrease in the industrial sales, increases the lignite prices. The most important reason of this is that income has an elastic structure. As the lignite types of L1 and L2 are used only in the thermal power plant, the increases in the industrial production will have an important positive impact on the lignite demand for the other lignites except these.

The relationship between the industrial lignite demand and the industrial production index is illustrated in Figure 8.

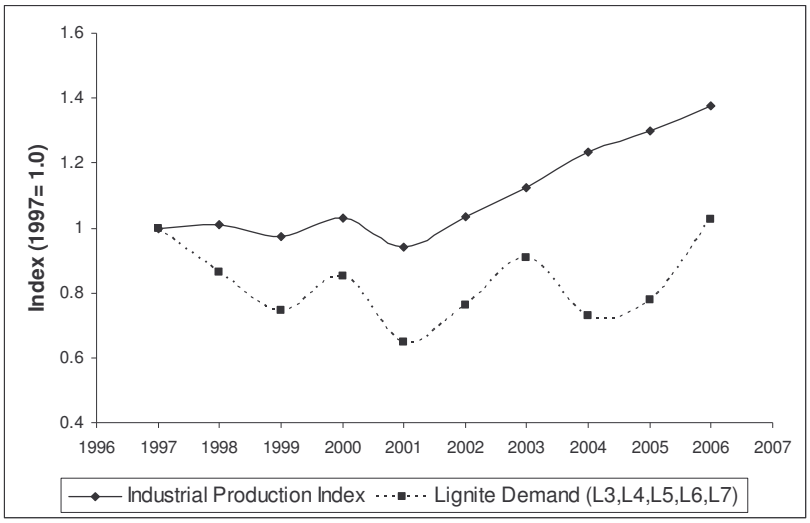

Fig.8. Relationship between IPI and lignite demand (L3,...,L7)

The fuel oil and natural gas are energy sources that are substituted to lignite in the electricity production. Being in the government control of the industry of the thermal power plant in Turkey and determining which energy source in which rate will be used in the electricity production by the government, remove the impact of fuel oil and natural gas prices on the lignite demand.

The calorific values of lignite do not show differences within years. As Soma Thermal Power Plant is established according to the calorific values of Soma and Can lignites, calorific values have no impact on the demand.

However market rules are valid in the industrial market, it is found that the lignite prices do not affect the lignite demand in the demand equation. Because, Aegean Lignite Enterprise actualizes most of its sales to Soma Thermal Power Plant and the parts of the thermal power plant market are government companies, this situation is consistent with our priori expectations. In this sense, as the lignite prices are not determined in the thermal power plant market within the demand and supply, lignite sales price is statistically insignificant.

Table 3: Price Equation Results

Dependent Variable: Ln(P_{it})				
Estimation Method: Pooled Two Stage Least Squares				
Variable	Coefficient	Std. Error	t-Statistic	p-value
Fixed Term	23.6088*	6.7831	3.4805	0.0013
Ln(Q_{it}^{D})	-1.0528*	0.3399	-3.0966	0.0037
Ln(S_t)	-1.3335*	0.6328	-2.1070	0.0418
Ln(LC_t)	-0.1273	0.1702	-0.7482	0.4589
Ln(PC_t)	1.8624**	1.0101	1.8437	0.0730
Ln(SC_t)	1.1041*	0.4200	2.6286	0.0123
Ln(MC_t)	0.0145	0.1843	0.0787	0.9377
Ln(AC_t)	-0.4471	0.5833	-0.7664	0.4481
Ln(PF_t)	-1.0824**	0.5348	-2.0237	0.0501
Ln(PE_{it})	1.3674*	0.4545	3.0087	0.0046
Fixed Effects (Cross)				
L1	1.8559	L5	-2.9601	
L2	1.3093	L6	-1.2648	
L3	-0.2020	L7	-1.3516	
L4	0.6377			
Weighted Statistics				
R^2	0.9855	Durbin-Watson stat		1.3040
Unweighted Statistics				
R^2	0.7398	Durbin-Watson stat		1.2256

* and ** indicate statistical significance at 5% and 10% levels, respectively.

The estimated price equation has an adjusted R^2 of 0.9855, indicating a very good fit. This result points out that the price equation is totally significant. Explanatory variables except the direct labor unit cost, marketing unit cost, and manufacturing overhead unit cost, are significant.

The coefficients related with the variables of the manufacturing overhead unit cost (PC) and auxiliary service-manufacture unit cost (SC) are estimated respectively as 1.8624 and 1.1041. While the coefficient of the variable 'PC' is significant in the level of 10%, the coefficient of

the variable 'SC' is significant in the level of 5%. This result points out that an increase by 1% in the manufacturing overhead unit cost increases the lignite price 1.86% and an increase by 1% in the auxiliary service-manufacture unit cost increases the lignite price 1.1%. The estimation of the coefficient of the demand (Q^D), which is represented by the sales quantity in the equation, as in the level of -1.0528 negatively, is consistent with our priori expectations. This coefficient that is statistically significant in the level of 5% means that an increase by 1% in the sales quantity of lignite will decrease the lignite price by 1.05%.

As the fixed cost and operating leverage of Aegean Lignite Enterprise are high, this situation increases the sensitivity depending on the sales volume. It can be understood that these findings are true, when the empirical results related with the variables of 'PC', 'SC', and 'Q^D' are examined all together. While pricing, Aegean Lignite Enterprise takes into consideration of manufacturing overhead and auxiliary service-manufacture unit costs. Also, when the unit fixed cost decreases, it decreases the lignite prices by observing the sales quantity. As Aegean Lignite Enterprise is a government company, in the pricing it takes into account the social aims rather then profit maximization. This is the most important reason of the decrease of the prices depending on the sales volume. The coefficient of stripping ratio is estimated as -1.3335 and it is statistically significant at 5% level. This result is consistent with our prior expectations. As an increase in the stripping ratio (S) decreases the unit cost, it has a negative impact on lignite price.

It is understood from the results of the price equation that while pricing, Aegean Lignite Enterprise does not take into consideration the direct labor unit cost, marketing unit cost, and administrative unit cost. Aegean Lignite Enterprise actualized taking lots of employees into the job until the year 2003 as a result of government's employment aim. In this sense, there was a big increase in the direct labor unit costs and administrative unit costs. Also since 2004 as a result of the acceleration in the privatization practices by the government, the production of lignite is actualized by subcontractors in some of the mines belonged to Aegean Lignite Enterprise. This practice decreased the efficiency too much by causing an increase in the number of the idle personnel. As a result of a sharp decrease in the sales of the thermal power plant, in order to increase the industrial sales, Aegean Lignite Enterprise gave importance to the marketing activities. By doing so, it can increase the industrial sales, but its marketing costs became too much. Because of not taking into consideration of pricing these cost

elements by Aegean Lignite Enterprise, the enterprise had a deficit depending on the decrease in the sales of the thermal power plant.

A similar situation is the matter in question for the fuel oil sales price variable (PF) in order to determine the impact of the energy cost used in the production process and distribution activity, on the price in the pricing equation. It is expected that an increase in the domestic fuel oil price will increase the sales price of the lignite. The coefficient of the 'PF' variable in the price equation is estimated negatively in the level of -1.0824. We can emphasize that this result is not suited with our priori expectations. Increases in the fuel oil prices, which is an important cost element in the production of lignite, it is unaccepted that these increases will have a negative impact on the lignite prices. This situation shows in the concrete that the fuel oil price, which is an energy cost element, is not taken into consideration for Soma Lignite Enterprise in the pricing lignite.

But, while evaluating the impact of the cost elements expressed above on the lignite prices, it will be suitable to make a distinction between the thermal power plant and the industry market. Figure 9 graphically illustrates the relationship between the weighted average prices and cost elements of lignites of L3, L4, L5, L6, and L7 that are sold to the industrial market. Figure 10 graphically illustrates the relationship between the weighted average prices and cost elements of lignites of L1 and L2 that are sold to the Soma Thermal Power Plant.

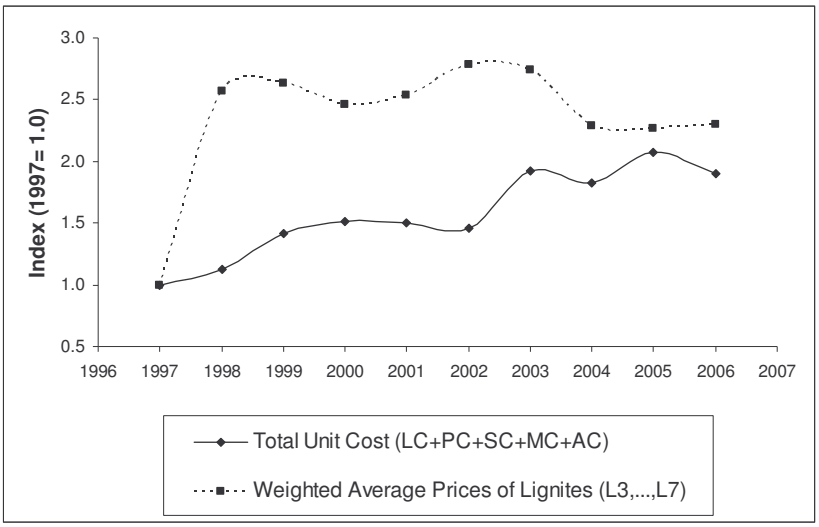

Fig.9. Relationship between cost elements and weighted average prices of lignites (L3,...,L7)

The relationship between the sale prices of lignites sold to the industrial market and the cost elements have a logical pattern. Until the year 2003 the sale prices of lignites sold to the industrial market in high profit margins will change depending on the total unit cost without changing profit margin. In this sense, it is understood that Aegean Lignite Enterprise set the lignite sale prices by applying the 'Markup Pricing' method until 2003.

In the year 2003 the new government took preventations in order to decrease the inflation in Turkey. So, in the year 2004 the inflation targeting is started to apply. As the increases in the demand and costs cause the inflation, the prices of inputs have been taken into control since 2004. In this sense, the lignite sales price of Aegean Lignite Enterprise bounded to Energy and Natural Resources Ministry of Turkey decreased in 2004. This practice both decreases the inflation and increases the industrial production speed. The total unit cost of Aegean Lignite Enterprise decreased depending on the increase in the industrial demand. 'Markup Pricing' method has been abandoned and 'Target Return Pricing' method has started to been applied since 2004. The target return is hold in minimum level in the frame of inflation policies. Not decreasing under the total unit cost of lignite prices and the effectiveness of the industrial production speed on the lignite demand proves that Aegean Lignite Enterprise takes up seriously both the cost approach and the market approach in pricing lignite all together.

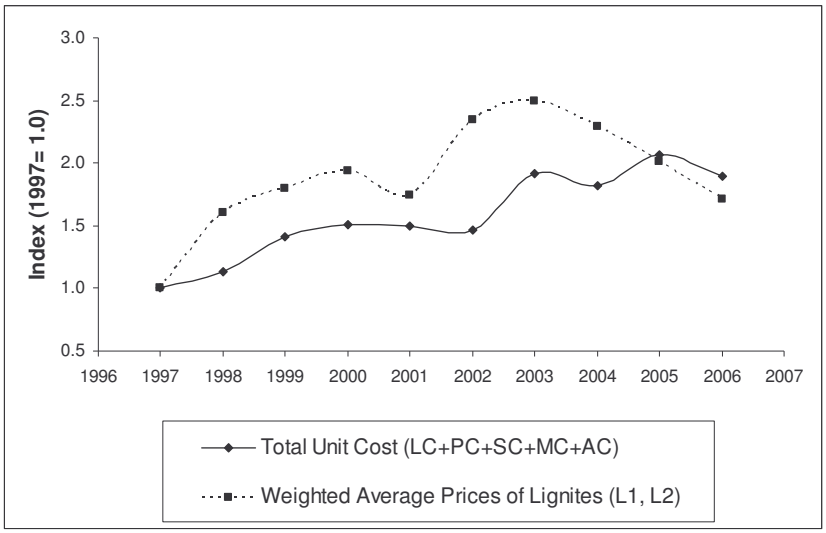

Fig.10. Relationship between cost elements and weighted average prices of lignites (L1, L2)

In contrary to the lignite sold to the industry, there was not a high profit margin in the lignite sold to Soma Thermal Power Plant. Until the year 2003 the sale prices of lignite sold to the Soma Thermal Power Plant showed a variety depending on the total unit cost. In contrary to

the increasing of total unit costs depending on the decrease in the sales of the thermal power plant, the lignite prices sold to the thermal power plant has showed a decrease tendency since 2003 and in 2006 L1 and L2 lignites was sold from the price which is less than the total unit cost. There had been a decrease in all of the lignite prices in 2001. The main reason of this is the economic crisis in Turkey. In that year an addition was not made to the lignite prices in the inflation rate and this situation caused a decrease in the real lignite prices.

The price of the electricity is the most important factor that directly affects the inflation. The government, which is directed to the policies aimed to decrease the inflation, has not made addition to the electricity prices since 2003. In other words, the real electricity prices have shown a sharp decrease since 2003. Figure 11 graphically illustrates the relationship between weighted average prices of lignite sold to Soma Thermal Power Plant and real electricity prices.

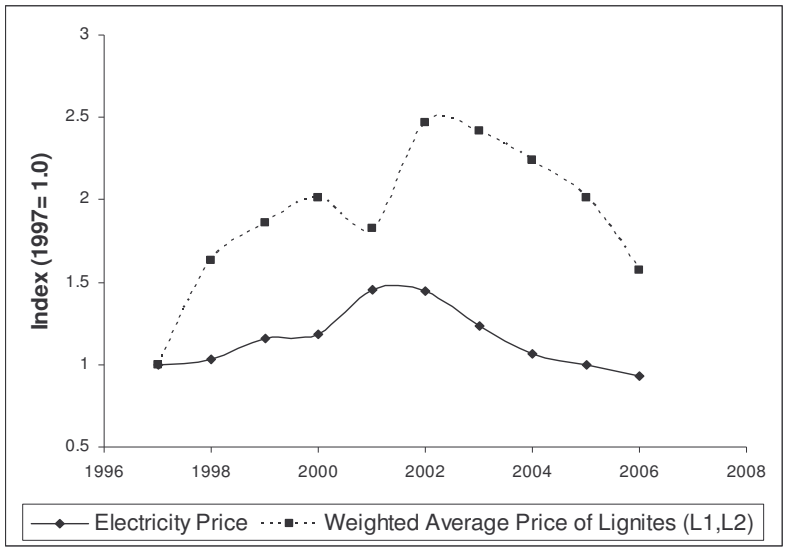

Fig.11. Relationship electricity price and weighted average prices of lignites (L1, L2)

The coefficient of real electricity price variable (PE) is statistically significant in the level of 5% and is estimated as 1.3674. This finding indicates that 1% increase in the real electricity price will increase the lignite price by 1.36% and this is consistent with our expectations. Since 2003 within the inflation politics, the government has decreased the lignite prices that are important inputs for the electricity production. In this respect, it is possible to say that Aegean Lignite Enterprise took into consideration of cost approach when setting the lignite

prices until 2003, but after the year 2003, the lignite prices have been set within the inflation policies depending on the electricity prices.
The privatization practices accelerate in the thermal power plant market where market rules are not valid. So, potential entrepreneurships, who will invest in the thermal power plant and lignite industries, have to closely follow the applied inflation policies and the electricity prices. The electricity prices are priori indicator for the thermal power plant and lignite enterprises.

4. Conclusion

Overall, the demand and price equations are found to be highly significant based on the data. Through empirical implementation of the theoretical model, several important determinants of supply and demand of the Aegean Lignite Enterprise are identified. On the demand side, total electricity production of Soma Thermal Power Plant and Industrial Production Index are significant. The demand equation fits the data well and can, therefore, reliably predict lignite demand for Aegean Lignite Enterprise. On the other hand, sales volume, stripping ratio, auxilary service-manufacturing unit cost, manufacturing overhead unit cost, fuel oil price and electricity price have significant effects on lignite price. The goodness-of-fit of the price equation is very high, which means that these determinants of supply side of the model can reliably predict lignite price.

In the pricing of lignites sold to the industry both the cost approach and market approach are taken up seriously. Especially, increase speed of industrial production has a great impact on lignite prices sold to the industry. In industrial market the 'Markup Pricing' method was applied until 2004, after this year in the frame of inflation policies 'Target Return Pricing' method has been applied. The lignite prices sold to the industry increase (decrease) depending on decrease (increase) in the industrial production.

As both the lignite industry and the thermal power plant are in the control of the government in Turkey, it is not possible to talk about the market approach in the thermal power plant market in contrary to the industrial market. Until 2003 cost approach was taken up seriously in the pricing of the lignites sold to the thermal power plant and it has leaved since this year. The government wanting to decrease the inflation has decreased the lignite prices in order to make the electricity prices stable since the year 2003. As the electricity price variable has a

high impact on the thermal power plant lignite sales price, this situation exhibits that the thermal power plant lignite prices are determined according to the electricity prices. Also, the decrease in the electricity production increases the profit margin belonging to the lignite prices. For this reason, the total electricity production and the electricity price are the most important factors that potential investors and related persons have to take into consideration for the pricing of lignite in the thermal power plant market.

Acknowledgement

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References

Aksiyon, 2004. Ofer's Ceyhan Project. Aksiyon. (Turkish News Magazine), 510, 13.09.2004

Balat, M., Ayar, G., 2004. Turkey's coal reserves, potential trends and pollution problems of Turkey. Energy Exploration & Exploitation 22 (1), 71–81.

Considine, T.J., 2001. Markup pricing in petroleum refining: A multiproduct framework. International Journal of Industrial Organization 19 (10), 1499-1526.

Elevli, S., Demirci, A., 2006. Developing of a pricing model for Turkish lignite used in thermal plants. Resources Policy, 31 (1), 50-55.

Greene, W.H. (1993) The Econometric Approach to Efficiency Analysis, in: H. Fried, C.A.K. Lovell, S. Schmidt (eds) The Measurement of Productive Efficiency: Techniques and Applications, Oxford, Oxford University Press, 68-119.

Joskow, P.L., 1987. Contract duration and relationship specific investments. American Economic Review 77 (1), 168–185.

Joskow, P.L., 1988. Price adjustment in long term contracts: the case of coal. Journal of Law and Economics 31 (1), 47–83.

Joskow, P.L., 1990. Price adjustment in long term contracts: further evidence from coal markets. Rand Journal of Economics 21 (2), 251–274.

Lau, A.H. L., Lau, H., Wang, J. 2007. Pricing and volume discounting for a dominant retailer with uncertain manufacturing cost information. European Journal of Operational Research 183 (2), 848-870.

LR 2006. Laborautary Report of Aagean Lignite Enterprises, Manisa-Soma, Turkey.

Mellish, M. (1998), "Coal pricing methodology for the Annual Energy Outlook 1998", U.S. Energy Information Administration, Issues in Midterm Analysis and Forescating.

MENR, 2006. Operating Report of Energy and Natural Resources Ministery of Turkey, Ankara. http://www.enerji.gov.tr

ORELI 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006. Operating Report of Aagean Lignite Enterprises, Manisa-Soma, Turkey.

OREUAS, 2006. Operating Report of Electricty Generation Co. Inc. Ankara, Turkey. http://www.euas.gov.tr

ORTKI, 2006. Operating Report of Turkish Coal Enterprises, Ankara ,Turkey.

Schwert, G.W., 1996. Markup pricing in mergers and acquisitions. Journal of Financial Economic 41 (2), 153-192.

SPO, 1998. Economic Developments. T.R. Prime Ministery State Planning Organization. Ankara, Turkey. http://www.dpt.gov.tr

SPO, 2004. Economic Developments. T.R. Prime Ministery State Planning Organization. Ankara, Turkey. http://www.dpt.gov.tr

Tang, C. S., Yin, R., 2007. Responsive pricing under supply uncertainty. European Journal of Operational Research 183 (1), 239-225.

TURKSTAT, 2003. State Institute of Statistics Statistic yearbook of Turkey in 2003 Prime Ministry, Republic of Turkey, Ankara.

TURKSTAT, 2005. Energy Consumption in The Households. Ankara, Turkey. http://www.turkstat.gov.tr

TURKSTAT, 2006. Press Release: Electricity Generation and Distrubition. Ankara, Turkey. http://www.turkstat.gov.tr

WEC, nd. Energy Related Environmental Policy of Turkey, World Energy Council, not dated, http://www.worldenergy.org/wecgeis/publications/default/tech_papers/17th_congress

Williamson, O., 2000. The new institutional economics: taking stock, looking ahead. Journal of Economic Literature 38 (3), 595–613.

Yilmaz, O., Uslu, T., 2007. The role of coal in energy production – Consumption and sustainable development of Turkey. Energy Policy 35 (1), 1117-1128.

Zhou,Y., 2007. A comparison of different quantity discount pricing policies in a two-echelon channel with stochastic and asymmetric demand information. European Journal of Operational Research 183 (2), 686-703.