*17th International Mining Congress and Exhibition of Turkey- IMCET 2001, ©2001, ISBN 975-395-417-4*

# Local Sustainable Development in Districts with Current Exploitation of Lignite Fields

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ABSTRACT: This paper deals with the expected impact of investing the recently established Compensation for Lignite Fields Exploitation (CLFE) on the development of counties in Greece where lignite mines are in operation, with emphasis on sustainability, in the sense of steady-state growth in the long term. Two models are considered, both with the regional Gross Domestic Product (GDP) $Y_t$ as a dependent variable. After proving that these models may reduce to a unique model in the form of a complete second order difference equation, we use numerical data available for the three counties where lignite is produced to obtain the time path of $Y_t$. Quantitative analysis of the results shows that the impact of investing the CLFE on $Y_t$ is almost negligible as a macroeconomic magnitude, and a multi-dimensional (economic, social, environmental, hydrological) integrated approach should be adopted in order to influence sustainable development.

## 1 INTRODUCTION

'Sustainable development* İs development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The term embodies two key concepts (World Commission on Environment and Development, 1987, often referred to as the 'Brundland Report*): (1) the concept of 'needs', to which overriding priority should be given, and (2) the idea of limitations imposed by the state of technology and social organization on the natural resources availability and the capacity of the environment to meet present and future needs. For large-scale projects and activities, like the exploitation of a lignite field for electricity production, it would be appropriate to consider the anticipated impacts in terms of their implications for sustainable development.

A necessary condition for sustainable development at local level is the continuation of operation of the main network of activities in the region under consideration after the cessation of operation of an industrial complex or a mine of major influence. In cases where the impact of such a cessation on the rest of local activities is decisive, leading to discontinuity of economic/social progress, a vicious circle may become established: increase in unemployment —* decrease in demand for goods and services —* decrease in new capital supply for investment —* • decrease in productivity —* • decrease in sales —* decrease İn production —> increase İn unemployment —*…; the same process can become established at a regional or national level, with several localities suffering the same problem.

Evidently, a breakdown of this vicious circle can be brought about only via exogenous action, mainly in the form of proper investment to activate local resources. For example, the German coal industry had been in decline since the second world war and when cheap foreign coal became available, many mmes closed down; since most of the industrial enterprises İn the Ruhr area were dependent on or connected with coal mining, the crisis extended to several industrial units which closed, leaving abandoned and derelict sites. In order to stop the catastrophic decline of the industrial sector in this region, the government decided in the early 1980s to stimulate the development of new industrial units, in part with public funding, on condition that they were established on derelict land left by the demise of the coal mines and associated industries. This example and some other similar cases have been analysed by Bell & Genske (2000) and Bell et al. (2000), who showed that the rehabilitation of abandoned sites may require significant investment, even though most of these sites have immediate access to pre-existing infrastructure.

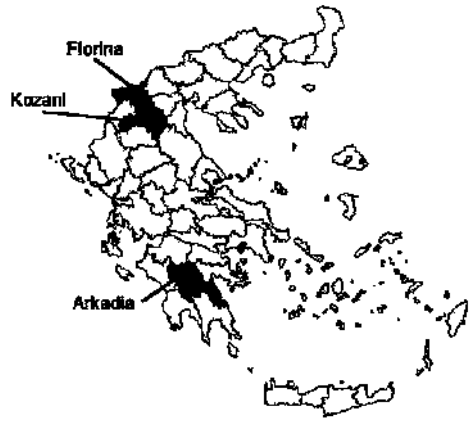


Figure 1. The three counties with lignite fields under exploitation

In Greece, there are lignite fields currently undergoing exploitation by the Public Power Corporation (PPC) in three counties; Arkadia, Florina and Kozanı (see map in Figure 1 ). The PPC contributes to sustainability at local level by providing (i) technical services and construction equipment for small works within nearby communities, (ii) thermal energy to the small cities of. Kozani and Ptolemais, and (iii) economic resources for archaeological excavation in the vicinity of mines so that ancient ruins or items may be unearthed and their loss prevented, (iv) advice to local authorities on methods of environmental protection. Moreover, the Greek Parliament issued Law 2446 in December 1996, which states in article 20 that the PPC is obliged to give 0.4% of its gross income annually (named herein, for convenience, Compensation for Lignite Fields Exploitation - CLFE) for the development and protection of the environment İn these three counties.

This fund is allocated in accordance with the proportion of electricity production based on lignite supplied by the thermal/electrical power stations of each county. A ministerial order issued on 22.07.97 gave guidelines for the choice of sectors where money coming from this fund should be invested: the development of each county according to its comparative advantages, creation of new jobs, vocational training of the unemployed, upgrading of human specialization by providing the means for development of new skills, increase in competitiveness of the primary, secondary, and tertiary production sector, development of local infrastructure, and conservation of the environment. The committee appointed by the Minister of Development to manage this fund consists of representatives of various chambers (economical, technical, industrial and commercial, geotechnical), ministries and local authorities. The characteristics of the members of this committee in combination with the guidelines of the above-mentioned order give the impression that emphasis is put on regional development rather than on environmental management. This impression led the Ecological Movement of Kozani to express the view that CLFE, which had been a demand initially for environmental concern of the people of Kozam for 10 years and was established finally by the state as a form of subsidy for investment, was intended to contribute to local development.

The aim of the present study is to examine the macroeconomic consequences of investment based on the CLFE fund, regardless of the kind or the purpose of the physical capital purchased with money from this fund. More specifically, we concentrate on the expected changes in regional Gross Domestic Product (GDP) to determine whether it is worthwhile investing through CLFE in order to increase this macroeconomic magnitude, or it is better to make another choice that will enhance sustainability in the long run.

## 2 A SIMPLE MODEL

To investigate the economic impact of investing CLFE in a region with lignite mmes in operation, we use the so-called *acceleration principle* (Samuelson, 1939), according to which the induced private investment I, in any period t is proportional to the increase in consumption Q of that period over the preceding $C_t$.i. In this relation, we introduce an amount of exogenous investment Hi equal to CLFE:

$$I_t = \beta [C_t - C_{t-1}] + H_t \quad (1)$$

The regional GDP Y, of the district where CLFE is applied is given by the following definition, which is widely accepted in macro-economic theory and practice:

$$Y_t = C_t + I_t + G_t \quad (2)$$

where the governmental expenditure G, is exogenously determined and the consumption expenditure Ct, in any period t, is proportional to the regional GDP of the preceding period:

$$C_t = \alpha Y_{t\,1} \quad (3)$$

The coefficient a of proportionality in Equation 3 is called the *marginal propensity to consume* and represents the proportion of a small increase in regional income which will be spent by the inhabitants to cover their needs. According to the "fundamental psychological law" of J.M. Keynes, the coefficient a falls when regional income rises, i.e.,

the richer the people in a region, the greater the proportion of increase in their income which would be saved.

By substituting Equations 3 and 2 in 1, we obtain:

$$Y_t = \alpha (1 + \beta) Y_{t-1} - \alpha \beta Y_{t-2} + G_t + H_t \quad (4)$$

Inasmuch as the increase in demand for electric power is negligible and no new power plants based on lignite are introduced into the national system of electricity production, there İs a constant rate of lignite mine exploitation. Consequently. H, is independent of time t. Under steady state conditions (implying also Gi-const.), the complete second order difference Equation 4 is rearranged to give:

$$Y^2 - a(1 + \beta)Y, -, + a\beta Y, = G + H \quad (5)$$

The form of the complete solution of this equation depends on the type of roots of its homogeneous part. For real and unequal roots:

$$Y_t = C_1 m_1^k + C_2 m_2^k + \frac{G+H}{(1-\alpha)}$$

For real but equal roots:

$$Y_t = (C_1 + C_2 k) m_{12}^k + \frac{G+H}{(1-\alpha)}$$

For complex conjugate roots:

$$Y_t = A r^k \cos(k\Theta + B) + \frac{G+H}{(1-\alpha)}$$

where mi,m.2 are the real roots of the auxiliary equation irf - ct (I + ß) m + a ß = 0, when its discriminant is positive; r,0 are given hy the complex conjugate roots of the auxiliary equation (when its discriminant is negative) with polar forms: r (cos© ± i-sin©); $mi._2$ is the double real root of the auxiliary equation when its discriminant is zero; C|, $C_2$, A, B are constants.

As the auxiliary equation is of the form m~ + aim + ci2 = 0, with ai = -a (1 + ß) and $a_2$ = aß, there is a necessary and sufficient condition for the solution of the homogeneous part of Equation 5 to converge to zero, independently of the initial values of the regional income $Y_0$ and Y|.This condition requires that both the roots of the auxiliary equation be less than I in absolute value. If the complete form of Equation 5 has a constant value as solution, then putting Yif=Y =const., we obtain,

$$Y^* = \frac{G+H}{(1+a_1+a_2)}$$

which is an equilibrium or stationary value of Y. A necessary and sufficient condition for this equilibrium value to be stable is p<1, where *p=max* { [mi I, Im? I} and mı, $m_2$ are the roots (either real or complex) of the auxiliary equation. The conditions for these restrictions to be valid are:

$$\left| \begin{array}{l} 1 + \alpha_1 + \alpha_2 > 0 \\ 1 - \alpha_1 + \alpha_2 > 0 \\ 1 - \alpha_2 > 0 \end{array} \right| \quad \text{or} \quad \left| \begin{array}{l} 1 - \alpha (1 + \beta) + \alpha\beta > 0 \\ 1 + \alpha (1 + \beta) + \alpha\beta > 0 \\ 1 - \alpha\beta > 0 \end{array} \right|$$

which usually hold as a, $\beta > 0$, $\alpha < 1$, $\alpha\beta < 1$, in most cases of economic reality.

The stable solution $Y^* = \frac{G+H}{(1+a_1+a_2)} = \frac{G+H}{(1-\alpha)}$ is identified as the economic 'multiplier' because of the property to increase the regional GDP Y by $\frac{G+H}{1-\alpha}$ times as a result of the investment G + H.

However, if conditions of full employment prevail in the local labour market, this multiplier is unlikely to increase the regional income to such an extent; in this case, the demand for services/goods related to investment will cause some rising of prices which will not permit real income to reach the level estimated by means of the multiplier action. The labour markets of the three districts under consideration (Kozani, Arkadia, Fiorina) where lignite mines are in operation do not give evidence of near-full employment; nevertheless, the difference of the levels of employment among them introduces an element of discrimination as regards the consequences of exogenous investment: the lower the level of employment, the more beneficial the multiplier action in regional GDP.

## 3 AN EXTENDED MODEL

The multiplier-accelerator model, which was used above to investigate the economic impact of investing CLFE in a region with lignite mines in operation, is a relatively simple one. Further analysis is required by means of more sophisticated modelling. This can be done by incorporating CLFE into a dynamic model where the income and capital stock of one period determine investment and consumption for the next period, and the changes İn these last economic magnitudes determine the former ones for the following period, and so on. As a basis for such interaction over time, we use Duesenberry's model (Duesenberry. 1958), where we introduce the governmental expenditure G, and the exogenous investment $H_1$ in the definition of $Y_t$, as follows:

$$Y_t = C_t + I_t + G_t + H_t, \quad I_t = I_{bt} + I_{ht}$$

where Ibt and IM stand for business and housing investment, respectively; the variables on the right-band side of these definitions are given by the following expressions:

$$C_t = f_1 (Y_{dt-i}, C_{t-1}) \quad (6)$$

$$I_{bt} = f_2 (Y_{t-1}, K_{bt-1}, E_{t-1}, P_{t-1}, D_{t-1}, R_{t-1}) \quad (7)$$

$$I_{ht} = f_3 (Y_{t\ 1}, K_{ht\ 1}) \quad (8)$$

$$P_t = f_4 (Y_t, K_{bt-1}) \quad (9)$$

$$d_t = f_5(P_{t-1}, d_{t-1}) \quad (10)$$

where R=capital consumption allowances;
Kb=business capital stock;
Kh=stock of houses;
P=profits (including those undistributed business and farms);
d=dividents and entrepreneurial withdrawals;
E=retained earnings of business;
D=business debt;
Yd=disposable regional income available to individuals, which is given by the following definitional relationship:

$$Y_{dt} = Y_t - P_t + d_t - R_{bt} - R_{ht}$$

Capital consumption allowances for business and housing are proportional to the stock of capital in the corresponding sectors:

$$R_{bt} = \alpha K_{bt}, \quad R_{ht} = \gamma K_{ht} \quad (12)$$

where the capital stock is given by the following isomorphic relations give, which are simple balance identities:

$$K_{bt} = K_{bt\ 1} + I_{bt} - R_{bt}, \quad K_{ht} = K_{ht-1} + I_{ht} - R_{ht} \quad (13)$$

By definition, we also have:

$$D_t = D_{t-1} + I_{bt} - R_t - E_t, \quad E_t = P_t - d_t \quad (14)$$

i.e., business debt is the algebraic sum of one-period-lagged debt, business investment, capital consumption allowances (depreciation), and retained earnings (profits minus dividends).

To be in agreement with Duesenbeny's modelling: (i) we disregard the housing equations so as to let the system of equations deal only with business investment, as this influence prevails; (İi) we eliminate lagged consumption from the consumption function (Eq. 6) and lagged dividends from the dividend Equation 10; and (iii). we make investment depend on profits and profits on capital stock at the end of any period rather man at the start, implying 1^= x KM only for the expressions that give It and Ki (i.e., Equations 7a and 13a, respectively) but not Ci. Under these simplifying assumptions, die corresponding equations are rewritten as follows:

$$C_t = f_1 (Y_{t-1} + d_t - P_{t-1} - R_{t\ 1}) \quad (6a)$$

$$I_t = f_2 (Y_{t-1}, K_{t-1}, P_{t-1}, R_t) \quad (7a)$$

$$P_t = f_4 (Y_t, K_t) \quad (9a)$$

$$d_t = f_5 (P_{t-1}) \quad (10a)$$

$$K_t = K_{t-1} + I_t - R_t \quad (13a)$$

By substitution, we obtain the following incomplete system of equations:

$$C_t = f_1 [(Y_{t-1} - f_4 (Y_{t-1}, K_{t-1}) - x K_{t\ 1}), f_5 (f_4 (Y_{t-1}, K_{t\ 1}))] \quad (6b)$$

$$I_t = f_2 [(Y_{t\ 1}, K_{t\ 1}, f_4 (Y_{t\ 1}, K_{t\ 1}), x K_{t\ 1}] \quad (7b)$$

$$K_t = K_{t-1} + I_t - x K_{t-1} \quad (13b)$$

By expressing diese equations in linear form and taking into account the basic definition of regional GDP Y,, we obtain die complete system:

$$Y_t = C_t + I_t + G_t + H_t \qquad C_t = \varepsilon Y_{t\ 1} + \zeta K_{t-1}$$
$$I_t = \gamma Y_{t\ 1} + \delta K_{t\ 1} \qquad K_t = (1 - x) K_{t-1} + I_t$$

By substitution, we obtain the relations for regional GDP Y, and capital K,, under constant H, G:

$$Y_t = (\gamma + \varepsilon) Y_{t-1} + (\delta + \zeta) K_{t-1} + H + G \quad (15)$$

$$K_t = \gamma Y_{t-1} + [\delta + (1 - x)] K_{t-1} \quad (16)$$

By eliiiiinating KM from these equations, we obtain:

$$(\delta + \zeta) K_t = (\delta + 1 - x) Y_t + [\gamma (\delta + \zeta) - (\gamma + \varepsilon) (\delta + 1 - x)] Y_{t\ 1} - [\delta + (1 - x)] (G + H) \quad (17)$$

In order to deduce a difference equation as regards tiie regional GDP, we combine Equations 15 and ! 7 to eliminate K,. The final result is:

$$Y_t - [(\gamma + \varepsilon) + (\delta + 1 - x)] Y_{t-1} - [\gamma (\delta + \zeta) - (\gamma + \varepsilon) (\delta + 1 - x)] Y_{t-2} = (x - \delta) (H + G) \quad (18)$$

This is a rather complete dynamic model of regional GDP, according to Duesenberry's reasoning, where we have incorporated I, and G, to account for exogenous investment coming from the PPC to offset lignite mines operation and from die state as a contribution to regional development. By adopting

the simplifying assumptions made by Kooros (1965), i.e., very low depreciation and negligible connection between consumption and capital stock (implying $\chi \cong 0$ and $\zeta \cong 0$, respectively) and $\delta = -1$, we obtain the deduced expression:

$$Y_t - (\gamma + \varepsilon) Y_{t-1} + \gamma Y_{t-2} = G + H \qquad (19)$$

which is similar in form to Equation 5 and identical to this equation in the special case that e = a and $y = a$ ß. Therefore, Equation 5 can be used to investigate the influence of the investment H, which equals tie share of the lignite tax given to each lignite-producing region. We should also bear in mind that we can extend mis model to include governmental expenditure G given for regional development as well as other macroeconomic magnitudes of local interest.

## 4 IMPLEMENTATION AND RESULTS

To investigate the expected impact of investing CLFE on regional GDP over time, we apply Equation 5 twice for the lignite-producing counties of Arkadia, Kozani, Fiorina: the first time by including CLFE, and the second time by excluding it Then, by subtracting, we obtain the difference $\Delta Y_t$ in monetary value, which represents the expected impact. The results are given in Figure 2. The initial values $Y_0$ and Yi are taken from the regional statistical tables for 1995 and 1996, respectively. Therefore, the first year for which GDP is estimated is 1997. All monetary values have been reduced to this year, which was also the latest year for which analytical statistical data at regional level were available by 31-12-2000.

It is worthwhile noting that $\Delta Y_t$ exhibits a sinusoidal form, as it is the difference of two complete second order difference equations with constant coefficients and the same auxiliary equation which has a negative discriminant. The necessary and sufficient conditions for stability are fulfilled, since a, $\beta > 0$, $a < 1$, $\alpha\beta < 1$. In practice, all investment, even for specific large works, is distributed within the corresponding year, while there is a tendency for the annually invested capital to increase; mis implies a smoothing effect on $Y_t$, and consequently on $\Delta Y_t$, over time, resulting in a corresponding curve with negligible oscillation and usually a positive slope. The smoothing effect may be further enhanced if empirical evidence suggests a time period shorter than one year, in which case equilibrium is achieved earlier. Figures 3-6 present 2D and 3D graphs of one-parameter and two-parameter sensitivity analysis, either over time or in cross-section, i.e., for the same year (here, 2005 is chosen as an example).

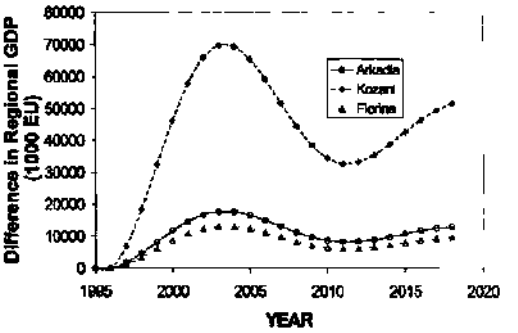


Figure 2 Expected impact of investing CLFE over a long time period (a=0.85, 0=1.00).

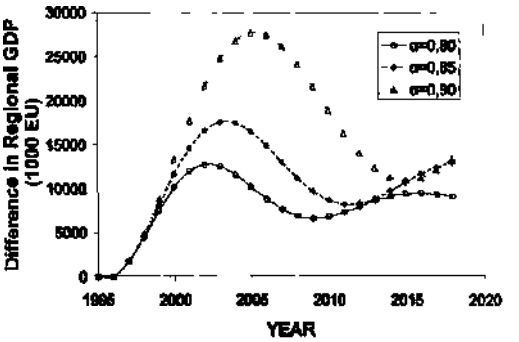


Figure 3. Dependence ofexpected impact of investing CLFE on the marginal propensity to consume a (ß=l 00)

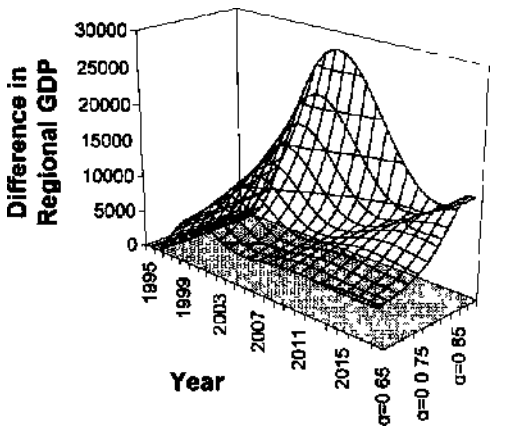


Figure 4. One-parameter sensitivity analysis of expected impact, with varying a-values over time

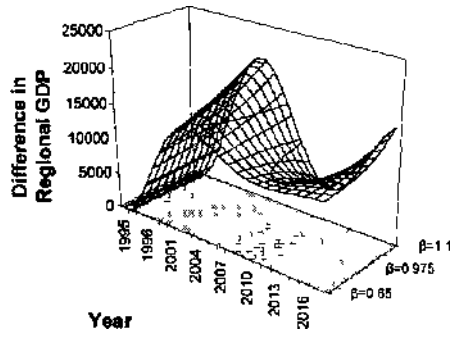


Figure 5. One-parameter sensitivity analysis of expected impact, with varying ß-values over lime

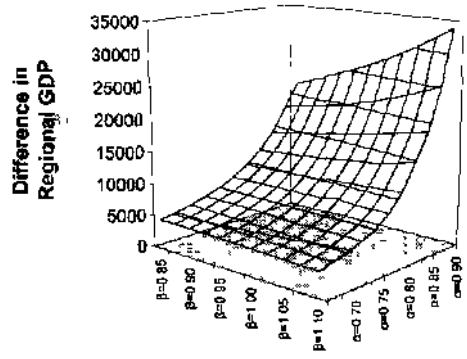


Figure 6 Two-parameter cross-sec non (year 2005) sensitivity analysis of expected impact, with varying values of both a & ß

## 5 DISCUSSION

The first point that should be discussed is the scope for establishing the CLFE. Is it a tax to finance regional development or an environmental policy? If both of these apply, is there a rule for sharing the fund? If the committee decides without a consistent rule, what are the criteria for such decision making? Finally, how are all these issues connected with sustainability at local level?

bHhe introduction section, we mentioned a doubt expressed by ecologists about the real purpose of the fund. There are two reasons that at least partially justify this doubt: (i) the financial support of social activities that have nothing to do with investment and (ii) the use of some part of the fund for land reclamation, although all restoration works should be included in the PPC's liability to return the mined land in a condition suitable for rehabilitation. The existence of this last reason is due to the fact that the PPC, when negotiating with the state's licensing authorities, does not submit a detailed long-term plan with a specific reclamation/recultivation schedule, in contrast to what happens in other lignite/coal-producing countries of the EU. For example, Rheinbraun, the sister company of RWE Energy, Germany's biggest power utility, spent a decade designing the Garzweiler II mine extension in cooperation with local authorities. According to this design, water, agricultural and forestry management plans were included for as far ahead as 2080, with detailed specifications aimed to balance the interests of agriculture and local recreation, while also ensuring that wildlife displaced by lignite mining could be re-established (Ballay 1996). It seems that this message has been received by PPC, as this corporation recently submitted a very detailed plan to obtain the license for the new mine at Mavropighi (which means "black spring") in the Lignite Centre of Prolemais-Amyndeon - LCPA.

Another point that deserves attention is the distribution of CLFE among the lignite-producing counties. The criterion of contribution to electricity production introduces a measure of participation in the product while the philosophy of CLFE should be to offset land loss and environmental deterioration, especially in the vicinity of lignite-fired power plants, due to fly ash in the atmosphere and polycyclic aromatic hydrocarbons together with heavy metals in the surface soils (Batzias & Roumpos, 2000a; Stalikas et al., 1997). If the offset criterion is adopted, CLFE can be distributed according to lignite production. In such a case, Arkadia will enjoy a better share as it has the poorest lignite (Table 1).

Table 1. Production data for the three counties under consideration (Source[1] PPC)

| | Electric Power Production from Lignite GWh | | | |
|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 |
| Florina | 4018 | 3480 | 3445 | 3911 |
| Kozani | 17606 | 18623 | 20930 | 20021 |
| Arkadia | 4629 | 4699 | 5315 | 5678 |
| total | 26253 | 26802 | 29690 | 29610 |

| | Lignite million tonnes | | | |
|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 |
| Florina | 7 .84 | 6 79 | 7 .2 | 8 28 |
| Kozani | 36 48 | 38 .08 | 39 45 | 39 .37 |
| Arkadia | 12 61 | 11 52 | 12 06 | 13 3 |
| total | 56 93 | 56 .39 | 58 .71 | 60 95 |

| | Electric Power Production / lignite GWh / million tonnes | | | |
|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 |
| Florina | 513 | 513 | 478 | 472 |
| Kozani | 483 | 489 | 531 | 509 |
| Arkadia | 367 | 408 | 441 | 427 |

As regards the impact of investing the CLFE, the results shown in Table 2 prove that the difference in regional GDP AY( due to this investment for the three counties under consideration is almost negligible. Actually, it ranges between 0.9% (valid for the optimistic scenario for Arkadia) and 2.20% (valid for the pessimistic scenario for Kozani) or 3.26% (valid for an estimation of regional GDP based on Equation 5, with ct=0.85 and ß=1.00, for Kozani).

Consequently, the amount given as CLFE must increase substantially if our intention is to significantly influence regional GDP, which seems to follow a time path closer to a rather pessimistic scenario (Fig. 7). Probably, such a favourable influence might be realised with an integrated multi-dimensional approach, rather than with a pure economic approach. Bellmann (2000) has shown the advantages of multi-dimensional modelling for integration of ecological, hydrological, economical and social components of regions disturbed due to extended surface coal mining. The same methodology can be followed when mining is still in progress, as modern techniques allow for some restoration works while mining is ongoing, often up to 150 feet from the edge of the mine (Phillips, 1993). It has been proved (Batzias & Roumpos, 2001) that under certain conditions parallel restoring is more beneficial than serial restoring (where all mining works must be finished before the restoration process begins).

These multi-dimensional integrated solutions enhance local sustainability, as they contribute to long-term steady-state development. In addition, it is worthwhile noting that by putting emphasis on the environmental dimension, we can go beyond the pure economic magnitudes as criteria for assessing the value of a lignite mine. As it has recently been shown (Batzias & Roumpos, 2000b), the environmental dimension can be used as a basic factor for choosing the optimal lignite field for exploitation, by means of multiple criteria analysis. This technique also allows other factors/criteria (like agricultural land loss, creation of new jobs, redistribution of national income for regional development, know-how and technology diffusion) to play a significant role in multi-dimensional decision making, thus contributing to local sustainable development.

Table 2. Regional GDP Y, and percentage increase AY, in ihe year 2015, under an optimistic, a moderate, and a pessimistic

| County: | Arka d i a | | Kozani | | Fiorina | |
|---|---|---|---|---|---|---|
| Parameter | Y, $10^6$EU | AY, % | Y, 10" EU | AY, % | Y, 10* EU | AY, % |
| a=0.85 | 1009.1 | 1.07 | 1308.9 | 3.26 | 551.78 | 1.45 |
| <o=2% | 897.3 | 1.20 | 1942.7 | 2.20 | 459 96 | 1.74 |
| (0=3% | 1038.7 | 1.04 | 2248.9 | 1.90 | 532.45 | 1.50 |
| o>=4% | 1200.7 | 0.90 | 2599.6 | 1.64 | 615.49 | 1.30 |
| Projection | 944.1 | 1.14 | - | - | - | - |

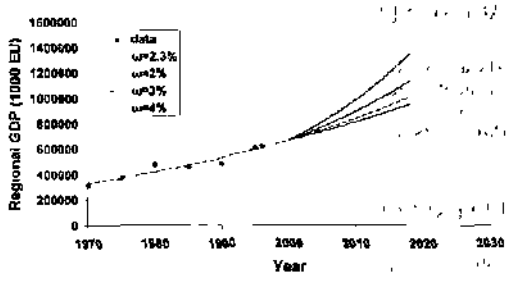


Figure 7. Forecasting the GDP for Arkadia, under ati optimistic, a moderate and a pessimistic scenario. The dashed line gives a • non-linear projection based on data for 1970-1996. •

## 6 CONCLUSIONS

To investigate the expected impact of investing.thç. recently established Compensation for Lignite Fields Exploitation (CLFE) on the development of the counties where lignite mines are in operation, we can apply a multiplier-accelerator model twice in the form of a complete second order difference equation. The results obtained show mat the impact, as a macroeconomic magnitude, is almost negligible. Consequently, the amount given as CLFE to the local management committee must be increased substantially, while any kind of financial support coming from the CLFE should be directed towards investment opportunities that enhance sustainability in each county. On the other hand, the Public Power Corporation (PPC) should undertake specific liability to return the mined land in a condition suitable for rehabilitation, according to an a priori determined schedule, regardless of the way the CLFE capital is invested in the time period.

This clarification will permit the local committee to orientate and coordinate its activities properly in the long run, without being obliged to invest in land restoration. The PPC's restoration plan will be considered given and will form the main corpus for sustainable development. These specifications seem to have been adopted by the PPC, as similar reasoning is contained in the detailed plan that this corporation submitted recently to obtain the licence for the new mine at Mavropighi in the Lignite Centre of Ptolemais - Amyndeon (LCPA).

It is also suggested that the distribution of CLFE among lignite-producing counties according to the criterion of contribution to electric-power generation İs not compatible with the target of sustainable development. Instead, the distribution in proportion to lignite production strengthens sustainability at local level. By extending this reasoning, we propose a multi-dimensional (economic, social, environmental, hydrological) integrated approach, in order to stabilize development in the long run.

## ACKNOWLEDGEMENTS

The authors kindly acknowledge die financial support provided by the Research Centre of the University of Piraeus. They also acknowledge valuable discussion with Mr C. P. Roumpos (MEng, MSc) at die Mines Development Dept,, PPC, Greece.

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