

ARCHIVES OF ECONOMIC HISTORY

Volume XVI

No 1

January - June 2004

ΑΡΧΕΙΟΝ ΟΙΚΟΝΟΜΙΚΗΣ ΙΣΤΟΡΙΑΣ

Τόμος XVI

Τεύχος 1

Ιανουάριος - Ιούνιος 2004

CONTENTS - ΠΕΡΙΕΧΟΜΕΝΑ

L. TH. HOUMANIDIS: A Spanish mercantilist in the transitory period from voluntarism to naturalism Conde Pedro Rodriguez Campomanes	5
A. SAITI - G. KATELANOS - TH. THEPHANOUS: Inflation and inflation uncertainty. Evidence for the case of Belgium from a garch approach	13
P. EVANGELOPOULOS: The proportionality controversy	33
G. ZAFEIROPOULOS: A study of the relationship between stock index futures and stock index. Empirical case of Taiwan stock exchange capitalization weighted stock index <TAIEX>	49
D. MYLONOPOULOS - P. MOIRA: The Coastal environment as conflict field of economic activities	73
A. P. KAKOURIS: Business process reengineering used as a creative option to implement strategy effectively	85
M. A. ALEXANDRIDIS: Comparative analysis of labour market parameters in european union	119
S. MELISIDOU - ST. VARVARESSOS: Sustainable tourism development: notional framework, perspective and implications	131
G. KOLOVOS: The Rio - Antirio bridge. Hope for the development of Western Greece	155

A SPANISH MERCANTILIST IN THE TRANSITORY PERIOD FROM VOLUNTARISM TO NATURALISM CONDE PEDRO RODRIGUEZ CAMPOMANES

LAZAROS TH. HOUMANIDIS

University of Piraeus

Abstract

A Spanish mercantilist in the transitory period from voluntarism to naturalism is Conde Pedro Rodrigues Campomanes. The author of the article presents the environment in which Campomanes proposed a new economic policy for the economic development of Spain. Campomanes sustains an economic policy of free trade with some measures to protect the industry which began to grow especially in Catalúnia. Campomanes argued that the guilds hindered the function of market mechanism due to their intervention. The spanish economist maintained also that the high inflation resulted in higher wages, which in their turn resulted in higher cost per unit. He also proposed some measures of taxation so as to enrich the spanish treasury.

JEL classification: N00, H2, O10.

Keywords: economic development, free trade, taxation.

1. Since the late 16th century and the beginning of 17th century Spain enters a period of monetary instability that can be attributed to a number of factors among which the import of substantial quantities of precious metals from the New World seems to be the most important one. Although some reservations have been expressed regarding the validity of this argument (Houmanidis, 2002, p. 82) it can be ignored the fact that the revolution of prices is caused by a rise in the inventory of gold and silver.

In the period between 16th and 17th century Spain and especially the areas of Andalousia and Castille were hit by the plague. During the reign of Phillip III (1598-1621) and Phillip IV (1617-1665) the currency was continuously depreciated, while during the period 1631-1665 uprisings against big landowners took place, since big landowners were enjoying particular

privileges at the expense of smaller farmers. The Spanish society was shaken by riots that broke out in Barcelona (1631) and in Aragon (1652). Due to the plague imported in Spain from Naples, riots broke out in 1647. Under those conditions Spanish mercantilists and politicians attempted to propose and introduce measures aiming to reconstruct the State and the commerce, the latter facing intense competition by English and French. Among the mercantilists was Campomanes who proposed a number of economic reforms aiming in the development of Spanish economy. It should be pointed out that Campomanes was a mercantilist, similarly to Uztariz, Ulloa and Ward, belonging to the transitional period from voluntarism to naturalism.

2. During the 18th century, after the big economic upheavals, Spain, already being under the influence of English liberalism, undertaken a program of economic reforms. The implementation of the new economic policy was undertaken by Cardinal Alberoni (1715-1752) minister of the king Phillip V (1665-1746) (Bonfante 1946, Parte Seconda, p. 122). During the Alberoni's tenure the Agricultural Bank of Spain was founded and the roads' network was upgraded. A solution was found in the old dispute between the main harbors of Spain, Seville and Kadix. The Casa de Contratacion¹ moved from Seville to Kadix which was the largest center of the overseas trade of Spain (G. Luzzatto, 1960, pp. 14-65, R. Herr., 1958, p. 121). However, only during the reign of Charles III (1759-1788) the balance has permanently changed in favor of Kadix. Due the favorable position of the king towards Kadix and the reaction of the merchants facing the threat of bankruptcy, Kadix lost its monopoly in commerce only for a short period of time.

In general, during the reign of Charles III the financial condition changed for better Charles under the advice of his ministers Squillaci and Grimaldi supported the free trade between Spain and the colonies and between the colonies themselves. In addition he founded the Consejo de Castilla better known as Contradaria General de propitios y arbitios (R. Herr, op. cit., p. 113).

3. The economic thought of Campomanes was converge with that of Uztariz (*Theoretica y Practica de Comercio y de Marina* Madrid, 1742, Vol. I-II) and that of Ulloa (*Restabilicemento de los fabricas y comercio espannol*, Madrid 1740, Vol. I) and influenced Charles III during whose reign the commerce and the industry of Catalonia were developed (E. Liuch

1973). Furthermore, Charles III after the advise of Campomanes abolished certain privileges of the Court and the State bureaucracy, while other measures, proposed by Campomanes, were taken in order to reduce the State expenses. It should be added that during his reign Charles, again under the influence of Campomanes, facilitated the internal immigration, especially to Sierra Morena and to the area between Cordova and Seville (G. Luzzatto, 1960, Parte Prima, p. 66). However, Charles did not adopt all the proposals of Campomanes while he retained many privileges of the nobility and the Church. Under these circumstances the social separation of the nobility and the Church from the agricultural proletariat (immos muertas) in favor of the former continued to exist (A.D. Ortiz. 1955).

In spite of the above-mentioned measures and the implementation new liberal economic policy, Spain's economy during the second part of the 18th century continued to be under the control of the certain groups with particular economic interests. Within this context, it may not be a matter of chance the dismissal of the two ministers of Charles Squillaci and Grimaldi and the dismissal of Campomanes who was Secretary of State Treasury, President of the Royal Council and Secretary of the Royal Post.

4. Among the measures proposed by Campomanes for the recovery and the progress of the Spanish economy was the restriction of the power of the guilds and the imposition of taxation on the basis of three types of taxes: a) progressive income taxes in order to enhance State revenues, b) tax on the product but not on the property, c) tax on luxury goods.

In his work "Discurso sobre la educacion popular de los artesanos y su fomento" (Madrid, 1775-1777) Campomanes develops his ideas regarding manufacturing and the role of the guilds, which he believes hinder the economic development of Spain. With respect to the price formation in the market, Campomanes argued in favor of the free formation of prices so that the law of supply and demand to function unhindered. Campomanes maintained that under conditions of free formation of prices the level of prices would be fairer and lower. Campomanes argued that the guilds hindered the function of the market mechanism due to their intervention through the regulation of prices. In his other work (Memorial ajustato del ... honrado consejo de la Mesta², Madrid 1783) Campomanes opposed to the activities of the guild of Mesta due its power, its privileges and the barriers that it posed to the development of agriculture.

5. In their research the economic historians regarding the quantitative theory of money and especially in its origin refer to Jean Bodin (*Reponses aux Paradox de M.Malestroit touchant les faits des monnais et l'encherissement des toutes choses 1568*) who developed a quantitative theory of money, which has been supported by John Holes (E.F. Hecksher, 1955 Vol. III, pp. 157-165; Marion Bowly, 1973 pp. 9-10; Marjory Grice Huntchinson, 1978 p. 108). It should be pointed out that the quantitative theory of money has been developed by the School of Salamanca. More specifically I refer to Martin di Agpioneta or Navvarus (1556) and Francisco Lopez Gomara (1558). (R. Trevor, 1970, 9.283, L.Houmanidis, 1975, p.84, Houmanidis,1999, p. 79 sq., L. Baeck, Num, XVII-XVIII, 1985-1986, p. 713).

Campomanes followed the same line of thinking regarding the phenomenon of the value of money and the rise of prices after the influx of silver and gold from the new world. Campomanes supported the notion that the quantity of money influenced the level of prices. Even in the days of Campomanes a rise in the level of prices was observed. In the period 1703 – 1766 and in particular in the winter 1765-1766, a rise in the level of prices was observed, which continued after the seven years war (1778-1786). It should be pointed out that the price of crop in the New Castille in the period 1763-1765 was almost doubled (R. Herr 1969, p.20, E. Hammilton, 1934, p. 158).

According to Campomanes the quantity of circulating money affects the prices as they are also affected by the ratio of the total annual expense of national community to the average quantity of the circulating money. This second perception of Campomanes regarding the circulation of money reinforced the exploration concerning the value of money.

It is true that during the reign of Charles III Spain was plagued by high inflation. Campomanes observed that the value of money and the rise of prices were due to the fact that the agricultural production could not meet the demand, mainly due to the separation of the big and small property. Consequently Campomanes proposed redistribution of land property. The result of that proposal was his dismissal from his office. The high inflation resulted in higher wages, which in their turn resulted in higher production cost per unit. As a consequence a fall in exports was observed. While the prices rise, the devaluation of money aggravated and the circulation of money accelerated (*Historia del Pensiamiento Economico en Espania siglo XVIII*, Ch. Los Economistas del siglo XVIII, Information Generale Spaniola, Madrid 1976).

Campomanes argued in favor of the free commerce. However, during his days commerce was not totally liberalized. After the death of Charles III the measures for the reformation of Spanish economy were completely abandoned, and economic recession followed. In 1773 more than 932 cities were desolated and no city in the areas of two Castille and Leon had a population of more than 25.000 inhabitants (Herr, 1925, p. 87).

Campomanes, in spite of the resistance he faced, he achieved during the reign of Charles III the suspension of some protectionist taxes, aiming to shield the local cotton industry (Heers, 1970, p.164). The wool industry along with the silk industry prospered during the same period, while the wage labor prevailed as a consequence of the gradual abandonment of the guild system (Liuch. 1973).

During the reign of Charles IV (1788-1819) and the napoleonic wars Spain was occupied. Charles IV followed a conservative policy in favor of the Nobility and the Clergy and prohibited the circulation of any publication relating to Francia Revuelta. However, the liberal ideas have already influenced Spanish economists. Under those circumstances the naturalism succeeded voluntarism and the ideas of economic liberalism emerged in Spain with Melchor de Jovellanos (1714-1811) (Houmanidis, 1999, pp. 193-197).

NOTES

- 1.The Casa de Contratación was the Chamber of commerce of Seville (1503).The first Chamber was founded in Castille (15th century) and subsequently was expanded in the Spanish colonies in America (Verlinden 1965, pp.21-22). The Chamber of commerce of Seville regulated issues relating to private businesses, to commerce in general, the routes of ships, the safe transport of gold and silver from New World. For those reasons, the Chamber of Seville administrated a Naval School which had a chair in Cosmography, while there was also a Naval Court (Houmanidis, 1991, p. 280).

2. Concerning Mesta in L.Th. Houmanidis: Economic History and the evolution of economic theories (in Greek), ed. Papazissis, Athens 1980, Vol. I p. 550.

REFERENCES

- Atkinson, WC. (1965): A history of Spain and Portugal, Ed. Penguin, London
- Baeck, L. (1985 - 1986): "L'Ecole de Salamanque et la réponse arbitrista", *"Anuario Juridies Escuriadense"*, Num. XVII-XVII.
- Bowley, Marion, (1973): Studies in the History of Economic Theory.
- Carrere Claude, (1967): Barcelone, centre économique (1382-1462), Vol. I-II.
- Dezert, G (1897), "Les Lettres politiques et économiques de Campomanes", *Revue Historique*, Vol. IV, p.140, p.265.
- Hamilton, E (1934), American Treasurers and the Prices Revolution in Spain, Ed. Harvard University Press, Cambridge Mass.
- Hamilton, E (1947): War and Prices in Spain 1651- 1800 Cambridge University Press, Cambridge Mass.
- Hombleton, H. G., (1964): The Economic Decline of Spain in the 17th century (thesis), ed. London School of Economics.
- Hecksher, E. F., (1931, 1955): Mercantilism (αγγλ. μτφρ. A. Sapiro), ed. George Allen and Unwin, London.
- Harsin, P (1928), Les Doctrines Monetaires et Financières en France Du XVI au XVIII siècle, Paris.
- Heers, J (1970), L' Occident au XIV et XV siècles, aspects économiques et sociaux, Paris.
- Herr, R (1958), The Eighteenth Century Revolution in Spain, Princeton University Press, Princeton, 1969.
- Hegeland, V (1951), The Quantity Theory of Money, University Press, Göteberg.
- Historia Del Pensamiento Economico en España, Siglos XVIII, XIV, XX, Ministro di Commercio, Madrid 1976, Num. 512-517.
- Houmanidis, L. (1975), I mercantilisti e lo Stato, Il Ruollo dello Stato nel pensiero di egli economisti (Ed. R. Finzi), ed. il Mulino, Vol.

- I, II, Bologna.
- Houmanidis, L (1991), *Economic History of Europe*, (in Greek), Ed. Papazisis, Athens.
- Houmanidis, L. (1999): *History of Economic Theories* (in Greek), Synchroni Ekdotiki, Athens.
- Houmanidis, L. (2002), *The Evolution of Financial Foundations and Institutions*, Synchroni Ekdotiki, Athens.
- Houmanidis, L. (2003): *Uztáriz Economic Thought, Essays in Honor of Prof. Apostolos Lazaris*, University of Piraeus.
- Hutchinson, Grice (1952), *The School of Salamanca (1544-1605)*, Oxford.
- Hutchinson, Grice (1978), *Early Economic Thought in Spain, 1177-1740*, ed. George Allen and Unwin, London.
- Iracci, L (1967): *Momenti del pensiero Economico*, Roma.
- Luzzatto, G. (1960), *Storia Economica (Parte Seconda)*, ed. Milani, Padova.
- Liuch, (1973), *El Pensamiento Economico a Cattalunia, 1760-1840*, in Ongem, *Ideologies de Proteccionisimo I la Presa de Comsciencia de la Borgetia Catalana*.
- Mauro, F, (1970), *Le XVI siècle Européen, Aspects Économique*, Presses Universitaires France.
- Ortiz, A.D. (1955), *La Societat Española en el siglo XVIII*, Madrid.
- Petregel y Canedol, M (1881): “Pedro Rodriguez Campomanes”, *Revista de España* Vol. LXXVIII, Madrid.
- Popescu , O. (1997): *Studies in the History of Latin American Economic Thought* ed., London New York.
- Schumpeter, J (1963), *The History of Economic Analysis*, ed. George Allen and Unwin L^{td}, London.
- Tevor Davis, R (1970), *The Golden Century in Spain (1501-1621)*, ed. Mac Millan Saint Martin Press, London.

INFLATION AND INFLATION UNCERTAINTLY. EVIDENCE FOR THE CASE OF BELGIUM FROM A GARCH APPROACH

A. SAITI G. KATELANOS TH. THEOPHANOUS

Horokopio University University of York University of York

Abstract

This study aims at investigating the relationship between inflation and inflation uncertainty by making use of GARCH models. We specifically test the hypothesis that higher inflation rates lead to higher levels of inflation uncertainty. For this purpose, we use data of the monthly inflation of Belgium to examine the exact nature of this relationship. Our empirical results demonstrate that asymmetric EGARCH models are the best performing in explaining the inflation process of Belgium. Moreover, our evidence supports the view of a positive impact of inflation on inflation uncertainty which is consistent with the economic theory.

JEL: C32, E31.

Keywords: inflation rate, uncertainty, Garch.

1. Introduction

The relation between inflation and inflation uncertainty and the manner they interact with each other captured the interest of economists for the first time thirty years ago. The dominant view is that higher inflation rate has a positive influence on inflation uncertainty and was principally developed by Friedman (1977). Using this relation in a more general context, Friedman concluded that low and less volatile inflation rates should be sought. At present, the volume of literature on the particular matter is quite extensive and Friedman's hypothesis has acquired formal foundations. In particular, Ball (1992) focuses on uncertainty about the monetary policy regime. In Ball's model, if there is currently low inflation, agents believe that the monetary authorities will seek to maintain the low inflation, so inflation

uncertainty will be low. Holland (1993) provided an alternative explanation for a positive relationship between inflation and inflation uncertainty. Whereas Ball considered the effect of regime uncertainty, Holland considered a case in which agents are unsure about the price-level effects of a given change in the quantity of money. The opposite type of causation has also been analyzed in the macroeconomics literature. Cukierman and Meltzer (1986) show that an increase in inflation uncertainty will raise the optimal inflation rate. Their main result is that the policymaker does not necessarily choose the most efficient control procedure available. Instead, he may choose to increase ambiguity to a politically optimal level. However, a different outcome is derived under the stabilization motive suggested by Holland (1995). Under this scenario, if higher inflation raises inflation uncertainty, the policy maker responds by disinflating the economy in order to reduce the associated costs. In such a case, the effect of inflation uncertainty on the rate of inflation is negative.

Nevertheless, the findings of the empirical research are not unambiguous. This study aims to shed further light on this topic and mainly is motivated by two concerns: to examine the time series on the inflation rate by utilising GARCH models in order to investigate the validity of Friedman's hypothesis and, in general, to examine the precise nature of the relationship between inflation and inflation uncertainty by using monthly Belgian data. This paper is organised as follows: Section 2 provides us with a review of the empirical literature on this topic. Section 3 provides us with the methodology developed in this article. Section 4 presents the interpretation of the empirical results. Finally, section 5 provides the concluding remarks

2. Empirical review

Research on inflation uncertainty goes back thirty years. In the first study on the issue, Okun (1971) found that countries with high inflation also had more variable inflation. His analysis made use of the unconditional standard deviation and the mean of the inflation process from a cross-section of seventeen OECD countries over the period 1951-68 to show an empirical relationship between the two variables. He interpreted the greater variability as an indication of greater uncertainty. Since Okun's

initial work, several empirical studies have been published on inflation uncertainty. The vast majority of the research has concluded that high inflation leads to more inflation uncertainty.

In recent research, two different strategies have been used to estimate inflation uncertainty. The first strategy uses surveys and the second uses econometric models. Researchers using survey estimates of uncertainty consistently find a positive relationship between inflation and inflation uncertainty. Researchers using econometric models do not find this relationship as consistent because different models yield different results. The first strategy for estimating uncertainty about inflation use surveys of economists and consumers. Analysts estimate inflation uncertainty from the surveys using two different approaches. One approach estimates uncertainty by asking respondents to provide a range of values which inflation might fall. The wider the range of possible outcomes, the more uncertainty is presumed to exist about future inflation. The second approach to estimating inflation uncertainty from surveys is based on the variability, or dispersion, of inflation expectations across survey participants. Unlike the first approach where uncertainty can be estimated for an individual, the variability estimate of uncertainty requires several survey participants. When survey participants have similar expectations of future inflation, uncertainty is presumed to be low. But if they disagree about the inflation outlook, uncertainty is presumed to be high. As we mentioned above, the results from these survey studies appear to support a link between inflation and inflation uncertainty. Wachtel (1977), Carlson (1977), and Cukierman and Wachtel (1979) all find a positive correlation between the rate of inflation and the dispersion of inflation forecasts gathered from the Michigan and Livingston surveys that proxy for inflation uncertainty. An obvious criticism of this survey-based approach is that an increase in the variability of inflation does not imply a corresponding rise in inflation uncertainty. If individuals have very little information, they may view the future with a large amount of uncertainty even though the econometrician observes little volatility in actual inflation *ex post*. Conversely, there may be very little uncertainty accompanying a large change in actual inflation observed by an econometrician because individuals have a good deal of advanced information about a change in monetary policy, for instance. Thus, estimates of inflation uncertainty based on the variability or on simple variance of actual inflation may be unreliable or even misleading.

To the contrary, in the second, econometric strategy which was introduced by Engle (1982) and then supported by Hwang (2001), it is underlined that it is the conditional variance in inflation and not the unconditional variance that matters. Through the development of the AutoRegressive Conditional Heteroscedasticity (ARCH) model and subsequently the derivatives based on GARCH (Generalized AutoRegressive Conditional Heteroscedasticity), Engle was able to reopen the debate on the relationship between inflation and the uncertainty of inflation. His original model used a conventional inflation equation with fixed parameters but allowed the conditional forecast-error variance to vary over time. Therefore, by taking this variance as a proxy for inflation uncertainty, the ARCH technique models inflation uncertainty as a time-varying process. Engle (1983) found little evidence of a link between the relatively high rates of inflation experienced by the United States in the 1970s and uncertainty measured by the conditional variance of inflation. However, Engle did not perform a statistical test on the hypothesis that a rise in inflation increases inflation uncertainty, but only compared the estimated conditional variance series with the US average inflation rate over various time periods. Other researchers that found no significant positive effect of inflation on inflation uncertainty are Cosimano and Jansen (1988) and Jansen (1989).

On the other hand, there are a number of papers that provide evidence that there exist a relation between inflation and inflation uncertainty. Among them are the studies of Grier and Perry (1998), and Brunner and Hess (1993). Grier and Perry estimate simultaneously the relationship between inflation and inflation uncertainty. They find that inflation has a positive effect on inflation uncertainty, but uncertainty has no significant impact on inflation. In particular, they examine the case of the G7 countries, and for three of them find that an increase in inflation uncertainty lowers inflation. Brunner and Hess (1993) perform Granger-causality tests simultaneously in a single model. Using US data, they provide support of the positive influence of inflation on inflation uncertainty.

3. The ARCH-based models

In this section we provide a brief description of the family of ARCH

(AutoRegressive Conditional Heteroscedasticity) models used in this study. The ARCH models are designed to model and forecast conditional variances. They are used especially in financial time series analysis, but have applications to other various branches of econometrics and were initially developed for measuring inflation uncertainty. In conventional econometric models, the variance of the disturbance term is assumed to be constant. Nevertheless, many economic time series exhibit periods of unusually large volatility followed by periods of relative tranquility. In such circumstances, the assumption of a constant variance (homoscedasticity) is inappropriate. Engel (1982) shows that it is possible to simultaneously model the mean and conditional variance of a series. The conditional variance can be considered the one-period ahead forecast variance based on past information, and may depend on random variables in the conditioning set such as the past disturbances, while the unconditional variance is considered constant as usual. So, in developing an ARCH model, we have to consider two distinct specifications—one for the conditional mean and one for the conditional variance, which are jointly estimated. The original ARCH model defines the conditional variance of the disturbance term as a function of past squared realizations of the errors. Here, we will start our description of the ARCH family with the GARCH (Generalized AutoRegressive Conditional Heteroscedasticity) model. It was introduced by Bollerslev (1986). It extends the specification of the conditional variance, since it allows to depend not only on past squared forecast errors but on lagged values of the conditional variance as well. These lags can be regarded as news about volatility from the previous periods. More specifically, the standard GARCH (1, 1) specification is:

$$y_t = x_t' z + \varepsilon_t$$
$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2$$

The mean equation given above is written as a function of exogenous variables which can be either lags of the dependent variable for simple univariate models or lags of the dependent variable plus lags of exogenous explanatory variables for structural models. These exogenous variables are represented by the vector term x_t' . There is also an error term. The conditional variance is a function of three terms: the mean, the lag of the squared residual from the mean equation (the ARCH term), and last

period's forecast variance (the GARCH term). In order to ensure that the conditional variance is strictly positive the following inequality restrictions are imposed. The constant must be strictly positive and the α and β coefficients must be nonnegative. Here, we have to say that the ordinary ARCH model is a special case of a GARCH specification in which there are no lagged forecast variances in the conditional variance equation.

Engle, Lilien, and Robins (1987) extend the basic ARCH framework to allow the mean of a sequence to depend on its own conditional variance. By introducing the conditional variance in the mean equation we get the GARCH-M (in-Mean) model. This model allows the econometric testing of the effect of a change in the variance of the series on the series itself. The conditional variance equation remains the same. In the case of the GARCH (1, 1)-M (0) model the mean equation is modified as follows:

$$y_t = x_t' z + \gamma \sigma_t^2 + \varepsilon_t$$

The second term in the right-hand side above represents the GARCH-M (0) term.

We will also allow for a variation of the GARCH model in the conditional variance equation. In order to investigate whether the level of the dependent variable positively affects the conditional variance in the next period, the dependent variable lagged by one period is added to the variance equation, transforming the GARCH(1,1) model in a GARCH(1,1)-Level(1). The specification of the variance equation is given below:

$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \delta y_{t-1}$$

The third term in the right-hand side above represents the GARCH-L (1) term.

Fountas, Karanasos, Karanasou (2000) combine the GARCH (1, 1)-M (0) and the GARCH (1, 1)-L (1) models and derive the GARCH (1, 1)-M (0)-L (1) model. The conditional variance is added as a regressor in the mean function and the mean is added in the variance function. This allows for simultaneous feedback between the conditional mean and the conditional variance. The model is specified as follows:

$$y_t = x_t' z + \gamma \sigma_t^2 + \varepsilon_t$$

$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \delta y_{t-1}$$

Nelson's (1991) seminal paper on conditional heteroskedasticity introduced an alternative to GARCH model, the exponential ARCH (EGARCH) model. This model class is even more flexible than the traditional GARCH approach as it allows disturbances of either sign to have a differential impact on volatility. Since in the EGARCH model the logarithm of the conditional variance is modeled, there are no restrictions of nonnegativity on the parameters, in order to achieve positive variance figures. The specification for the conditional variance in the EGARCH (1, 1) model is:

$$\log(\sigma_t^2) = w + \beta \log(\sigma_{t-1}^2) + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}}$$

The presence of leverage effects can be tested by the hypothesis that $\gamma < 0$. The impact is asymmetric if $\gamma \neq 0$. Because on the left-hand side there is the log of the conditional variance, it is implied that the leverage effect is exponential, rather than quadratic.

An alternative way that allows for asymmetric shocks to volatility is the TARCH or Threshold ARCH model, which was introduced independently by Zakoian (1990), and Glosten, Jaganathan, and Runkle (1993). In this model, positive disturbances (bad news), and negative disturbances (good news), have differential effects on the conditional variance. The conditional variance for the TGARCH (1, 1) model is specified as follows:

$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 d_{t-1} + \beta \sigma_{t-1}^2$$

where $d_t = 1$ if $\varepsilon_t < 0$, and $d_t = 0$ otherwise. Good news has an impact of α , while bad news has an impact of $\alpha + \gamma$. If $\gamma < 0$, then the leverage effect exists. If $\gamma \neq 0$, the news impact is asymmetric. In this study, we use a particular variant of the EGARCH (1, 1) and the TGARCH (1, 1) model which best fits our data. Particularly, we construct the EGARCH (1, 1)-L (1) and the TGARCH (1, 1)-L (1) variations of the above defined models. This specification alters the conditional variance equation of the original models by adding the term δy_{t-1} , which expresses the level effect.

4. Empirical evidence for the case of Belgium

4.1. Description of the data

We obtained the data that is used in this empirical work from the OECD Main Economic Indicators Database. In particular, we retrieved a time series on the Consumer's Price Index (CPI) of Belgium. Our sample includes 469 monthly observations covering a period from 1962:1M through 2001:1M. The inflation rate series was calculated by taking the log difference of the CPI of Belgium. In Table 1 (see Appendix) the descriptive statistics of the Belgian inflation rate are represented. The Jarque-Bera statistic is also included, which tests whether the series is normally distributed. The reported probability is the probability that the Jarque-Bera statistic exceeds (in absolute value) the observed value under the null. The zero probability value here, leads to the rejection of the null hypothesis of a normal distribution. The positive skewness means that the distribution has a long right tail, while the value of the kurtosis shows that the distribution is peaked (leptokurtic) relative to the normal.

In Table 2 (see Appendix), we represent the autocorrelations and the partial autocorrelations of the deviations and squared deviations respectively of the monthly inflation rate from its sample mean. The autocorrelation and partial autocorrelation functions characterize the pattern of temporal dependence in the series.

The last two columns report the Q-statistics and their p-values. The Q-statistic at lag k is a test statistic for the null hypothesis that there is no autocorrelation up to order k . We notice, that the significant Q-statistics of the squared deviations of the inflation rate from its sample mean indicate the presence of ARCH effects.

Before we start constructing our econometric model we have to check whether the series is stationary. A series is stationary if the mean and autocovariances of the series do not depend on time. For this purpose, we apply standard unit root tests, such as the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test, the results of which are presented in Table 3 (see Appendix). The null hypothesis of a unit root is rejected against the one-sided alternative if the t-statistic is less than (lies to the left of) the critical value. Here, the null hypothesis is rejected at any conventional significant level in both tests, indicating that the monthly

inflation of Belgium is a stationary process.

4.2. Specification of the model

We now proceed to the specification of the econometric model. This choice is particularly important for the estimation of the uncertainty of the future inflation rate. The selected forecasting model for inflation is assumed to be representative of the implicit model that is used by economic agents to forecast inflation. Our econometric model for inflation is a univariate autoregressive model, in which the current inflation rate depends on a certain number of past inflation lags which best approximate the process. Considering the serial correlation and the ARCH effects observed in the time series inflation data, we used Box-Jenkins techniques to select the best fitting GARCH (1, 1) model for the monthly inflation rate of Belgium. To make our inference robust to possible non normality, the two equations of the model were jointly estimated under quasi maximum likelihood using the consistent variance covariance estimator of Bollerslev and Wooldridge (1992). First, we estimated four models from the GARCH family to investigate which one captures better the link between inflation and inflation uncertainty. We developed the models GARCH (1,1), GARCH(1,1)-M(0), GARCH(1,1)-L(1), and GARCH(1,1)-M(0)-L(1).

4.3. Empirical results

The results from the GARCH (1, 1), GARCH (1, 1)-M (0) models are shown in Table 4a (see Appendix).

We see that both the ARCH and the GARCH parameters for the GARCH (1, 1) are statistically significant, indicating that the conditional variance of the inflation rate of Belgium is far from being constant and that the particular model can well approximate the process. The values of a number of test statistics are mentioned.

The ARCH LM test is a test for autoregressive conditional heteroskedasticity (ARCH) in the residuals and carries out Lagrange multiplier tests to check whether the standardized residuals exhibit additional ARCH effects. If the variance equation is correctly specified, there should be no ARCH left in the standardized residuals. Here, the LM ARCH test at four lags cannot reject the null of no ARCH effects.

The Ljung-Box test statistic for standardized residuals is used to test for remaining serial correlation in the mean equation and to check the specification of the mean equation. If the mean equation is correctly specified, Q-statistics should not be significant. Here, the 6th order (Q (6)), and the 12th order (Q (12)) of the statistic are mentioned and the 6th order value shows no ARCH effects. The Ljung-Box test statistic for standardized squared residuals is used to test for remaining ARCH in the variance equation and to check the specification of the variance equation. If the variance equation is correctly specified, Q-statistics should not be significant. In the Table, the 6th order (Q² (6)), and the 12th order (Q² (12)) of the statistic are noted. Both of them indicate that we cannot proceed to the rejection of the null hypothesis of no ARCH effects.

The Jarque-Bera Normality test is also referred. It tests whether the standardized residuals are normally distributed by measuring the difference of the skewness and kurtosis of the series with those from the normal distribution. If the standardized residuals are normally distributed, the Jarque-Bera statistic should not be significant. Here, the residuals fail to pass the Jarque-Bera test, since the small probability value leads to the rejection of the null hypothesis of a normal distribution.

Finally, the Akaike Information Criterion (AIC) and the Schwartz Criterion (SC) are included, which assist us in selecting the best fitting model to the data. The AIC and SC are fit measures which especially penalize the loss of degrees of freedom that occurs when a model is expanded by adding new variables. The AIC and the SC degrade as the model size increases, and place a premium on achieving a given fit with a smaller number of parameters per observation. Both criteria have their virtues and neither has an obvious advantage over the other, but the SC with its heavier penalty for degrees of freedom lost, will lean toward a simpler model.

The analysis of the GARCH (1, 1) model does not directly test the hypothesis of a positive relationship between inflation and inflation uncertainty. In this context, first we specify the GARCH (1, 1)-M (0) model, the results of which are demonstrated in Table 4a (see Appendix), in order to examine whether the conditional variance, that is, the inflation uncertainty, has a positive effect on inflation. We see that the in-mean coefficient is statistically significant at the 5% and the 10% levels, but the AIC and the SC provide evidence that the GARCH (1, 1)-M (0) model is worse than the GARCH (1, 1).

However, in order to test the hypothesis developed by Friedman (1977) and Ball (1992) which specifically states that the current inflation rate positively affects inflation uncertainty in the next period, we must add a one-period lagged level of inflation to the conditional variance equation, specifying a GARCH(1,1)-L(1) model. The results in Table 4b (see Appendix) show that the level coefficient is significant at any conventional level which indicates that a higher inflation rate has a positive impact on next period inflation uncertainty. The addition of the level effect clearly improves the performance of the model compared to the GARCH (1, 1) according to the AIC and SC. The Jarque-Bera normality test statistic still rejects the null hypothesis of normally distributed errors.

The fourth model of the GARCH (1, 1) family that we developed, is the GARCH (1, 1)-M (0)-L (1) the results of which are depicted in Table 4b (see Appendix). This model may capture the possible simultaneous feedback between inflation and inflation uncertainty. To construct it, we add the conditional variance as a regressor in the mean equation in the previous GARCH (1, 1)-L (1) model. The level coefficient is positive as previously, and it is statistically significant at 5% and 10% levels. The in-mean coefficient is significant at 5% and 10% levels, as well. Overall, however, the AIC and the SC demonstrate that the inclusion of the in-mean effect deteriorates the performance of the model, while the Jarque-Bera test illustrates that the standardized residuals are not normally distributed.

From the GARCH (1, 1) family we conclude that the best adapting model to the data is the GARCH (1, 1)-L (1), as the fit measures reveal, which is consistent with the hypothesis of a positive impact of the inflation rate on inflation uncertainty.

We now examine whether allowing for asymmetric effects of past forecasting errors improve the ability of the model to fit the inflation data. We proceed to the estimation of asymmetric GARCH models with the level effect included, specifically the TGARCH (1, 1)-L (1) and the EGARCH (1, 1)-L (1) models. Their results are illustrated in Table 5 (see Appendix). In the TGARCH (1, 1)-L (1) model, the level coefficient is again positive and statistically significant at 10% significance level but the asymmetric parameter is not, which implies that inflation uncertainty does not necessarily respond differently to positive and negative inflation shocks. On the whole, the TGARCH (1, 1)-L (1) model does not fit the data better

than the GARCH (1, 1)-L (1), as the AIC and SC demonstrate.

The EGARCH (1, 1)-L (1) model reveals that there are differential effects on the conditional variance from good news (negative lagged errors) or bad news (positive lagged errors). Since the asymmetric parameter is positive and statistically significant at 5% and 10% significance level, bad news will increase the slope coefficient, while good news will decrease it. This is equivalent to stating that bad news increases future uncertainty whereas good news reduces it. The particular model exhibits an apparent better performance compared to the GARCH (1, 1)-L (1) model according to the AIC and SC, which is an indication of the importance of the asymmetric responses to past disturbances. What is more, the Jarque-Bera test statistic is close to non-rejection values of the null hypothesis of normality. Hence, we may undoubtedly deduce that the EGARCH (1, 1)-L (1) model best fits the inflation series by incorporating the asymmetric effects and provides support to the hypothesis developed by Friedman (1977) and Ball (1992) that higher inflation rates lead to higher inflation uncertainty.

5. Conclusion

In brief, we examined the relationship between inflation and inflation uncertainty by making use of various GARCH models. We provided a concise summary of the theoretical literature on the topic of the relation between inflation and inflation uncertainty and we focused on the hypothesis originally proposed by Friedman (1971) that a rise in inflation leads to an increase in inflation uncertainty. In addition, we referred to the subsequent empirical work that has been conducted by researchers up to the present on the particular issue and the conclusions they reached. Our next step was to inspect whether the inflation data of Belgium provided verification of any of the suggested theories by making use of GARCH models. Our results evidently illustrate that the Friedman-Ball hypothesis is confirmed for the case of Belgium. This is best demonstrated by the EGARCH (1, 1)-L (1) model which reaches the best values of the fit criteria. The selection of the particular model is also indicative of the importance of the asymmetric effects of bad or good news on inflation uncertainty.

APPENDIX

Table 1: Monthly Inflation of Belgium, 1962(1) - 2001(1), 469 obs. Descriptive Statistics

Mean	0.001528	
Median	0.001327	
Maximum	0.006992	
Minimum	-0.005488	
Std. Dev.	0.00163	
Skewness	0.450159	
Kurtosis	4.154956	
Jarque-Bera	41.907	[0.000]

Notes: Probability is given in brackets.

Table 2: Monthly Inflation of Belgium, 1962(1)-2001(1), 469 obs. Correlograms.

M	Correlations of $(y_t - \bar{y})$				Correlations of $(y_t - \bar{y})^2$			
	ACm	PACm	Q-Statistic		ACm	PACm	Q-Statistic	
1	0.453	0.453	96.83	[0.00]	0.282	0.282	37.49	[0.00]
2	0.266	0.077	130.3	[0.00]	0.248	0.183	66.55	[0.00]
3	0.264	0.149	163.3	[0.00]	0.292	0.206	106.9	[0.00]
4	0.353	0.226	222.6	[0.00]	0.224	0.089	130.6	[0.00]
5	0.388	0.185	294.2	[0.00]	0.148	0.002	141.1	[0.00]
6	0.395	0.179	368.7	[0.00]	0.249	0.14	170.6	[0.00]
7	0.284	0.007	407.3	[0.00]	0.099	-0.062	175.3	[0.00]
8	0.282	0.077	445.4	[0.00]	0.104	0.001	180.5	[0.00]
9	0.392	0.19	519.2	[0.00]	0.17	0.075	194.4	[0.00]
10	0.326	-0.014	570.2	[0.00]	0.064	-0.049	196.3	[0.00]
11	0.305	0.059	615	[0.00]	0.052	-0.012	197.6	[0.00]
12	0.413	0.222	697.5	[0.00]	0.122	0.046	204.8	[0.00]

Notes: Probabilities are given in brackets.

Table 3: Monthly Inflation of Belgium, 1962(1) - 2001(1), 469 obs.
Unit Root tests.

ADF Test Statistic (4)	-4.697132
PP Test Statistic (5)	-13.71278

Notes: The tests include a constant

Order of augmentation and lag truncation in parentheses.

Critical values: -3.45(1%), -2.87(5%), -2.57(10%).

Table 4a: Symmetric GARCH Models of the Monthly Inflation of Belgium.

(1) GARCH (1,1) results							
$y_t = 0.000 + 0.259y_{t-1} + 0.177y_{t-6} + 0.235y_{t-12} + 0.142y_{t-18}$ <p style="text-align: center;">[0.00] [0.00] [0.00] [0.00] [0.00]</p> $\sigma_t^2 = 3.01E - 07 + 0.150e_{t-1}^2 + 0.600\sigma_{t-1}^2$ <p style="text-align: center;">[0.07] [0.00] [0.00]</p>							
LM	6.131	[0.190]	JB	22.439	[0.000]	AI C	-10.528
Q(6)	10.850	[0.093]	Q ² (6)	7.0587	[0.315]	SC	-10.455
Q(12)	29.826	[0.003]	Q ² (12)	16.723	[0.160]		
(2) GARCH(1,1)-M(0) results							
$y_t = 0.000 + 0.250y_{t-1} + 0.172y_{t-6} + 0.235y_{t-12} + 0.139y_{t-18} + 251674\sigma_t^2$ <p style="text-align: center;">[0.79] [0.00] [0.00] [0.00] [0.00] [0.04]</p> $\sigma_t^2 = 3.20E - 07 + 0.150e_{t-1}^2 + 0.600\sigma_{t-1}^2$ <p style="text-align: center;">[1.00] [0.11] [0.00]</p>							
LM	5.435	[0.246]	JB	23.917	[0.000]	AIC	-10.526
Q(6)	9.702	[0.138]	Q ² (6)	19.891	[0.003]	SC	-10.444
Q(12)	28.736	[0.004]	Q ² (12)	27.472	[0.007]		

Notes: LM is the LM ARCH test statistic(4 lags).

JB is the Jarque-Bera test statistic.

Q(6) is the 6th order Ljung-Box test statistic for standardized residuals.

Q(12) is the 12th order Ljung-Box test statistic for standardized residuals.

Q²(6) is the 6th order Ljung-Box test statistic for standardized squared residuals.

Q²(12) is the 12th order Ljung-Box test statistic for standardized squared residuals.

The numbers in the brackets are the p-values

Table 4b: Symmetric GARCH Models of the Monthly Inflation of Belgium (contd).

(1) GARCH (1,1) results							
$y_t = 0.000 + 0.259y_{t-1} + 0.177y_{t-6} + 0.235y_{t-12} + 0.142y_{t-18}$							
$\sigma_t^2 = 1.44E - 07 + 0.150\varepsilon_{t-1}^2 + 0.600\sigma_{t-1}^2 + 0.000162y_{t-1}$							
$[0.00] \quad [0.00] \quad [0.00] \quad [0.00] \quad [0.00]$							
$[0.13] \quad [0.01] \quad [0.00] \quad [0.00]$							
LM	7.060	[0.133]	JB	27.170	[0.000]	AI	
			C				-10.574
Q(6)	8.313	[0.216]	Q ² (6)	8.900	[0.179]	SC	-10.492
Q(12)	27.140	[0.007]	Q ² (12)	20.109	[0.065]		
(2) GARCH(1,1)-M(0) results							
$y_t = -2.12E - 05 + 0.249y_{t-1} + 0.172y_{t-6} + 0.235y_{t-12} + 0.139y_{t-18} + 251.674\sigma_t^2$							
$\sigma_t^2 = 1.96E - 07 + 0.150\varepsilon_{t-1}^2 + 0.600\sigma_{t-1}^2 + 0.000120y_{t-1}$							
$[0.88] \quad [0.00] \quad [0.00] \quad [0.00] \quad [0.00] \quad [0.03]$							
$[1.00] \quad [0.03] \quad [0.00] \quad [0.04]$							
LM	5.779	[0.216]	JB	27.023	[0.000]	AIC	-10.553
Q(6)	8.044	[0.235]	Q ² (6)	7.6788	[0.263]	SC	-10.462
Q(12)	27.061	[0.008]	Q ² (12)	19.004	[0.088]		

Notes: LM is the LM ARCH test statistic(4 lags).

JB is the Jarque-Bera test statistic.

Q(6) is the 6th order Ljung-Box test statistic for standardized residuals.

Q(12) is the 12th order Ljung-Box test statistic for standardized residuals.

Q²(6) is the 6th order Ljung-Box test statistic for standardized squared residuals.

Q²(12) is the 12th order Ljung-Box test statistic for standardized squared residuals.

The numbers in the brackets are the p-values.

Table 5: Asymmetric GARCH Models of the Monthly Inflation of Belgium. Symmetric.

(1) EGARCH (1,1) - L(1) results							
$y_t = 0.000 + 0.197y_{t-1} + 0.166y_{t-6} + 0.259y_{t-12} + 0.134y_{t-18}$ $\log(\sigma_t^2) = -1.093 + 0.927\log(\sigma_{t-1}^2) + 0.103 \left \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right + 0.103 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + 0.113y_{t-1}$							
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]		
	[0.26]	[0.00]	[0.06]	[0.02]	[0.00]		
LM	3.487	[0.480]	JB	7.306	[0.026]	AI	-10.600
Q(6)	13.049	[0.042]	Q ² (6)	4.3782	[0.626]	SC	-10.509
Q(12)	34.466	[0.001]	Q ² (12)	11.998	[0.446]		
(2) GARCH(1,1)-M(0) results							
$y_t = 0.000 + 0.259y_{t-1} + 0.177y_{t-6} + 0.235y_{t-12} + 0.142y_{t-18} + 251674\sigma_t^2$ $\sigma_t^2 = 1.12E - 07 + 0.150\varepsilon_{t-1}^2 + 0.600\sigma_{t-1}^2 + 0.000169y_{t-1} + 0.050\varepsilon_{t-1}^2 d_{t-1}$							
	[0.79]	[0.00]	[0.00]	[0.00]	[0.00]	[0.04]	
	[0.18]	[0.05]	[0.00]	[0.05]	[0.69]		
LM	7.782	[0.100]	JB	34.030	[0.000]	AIC	-10.565
Q(6)	7.346	[0.290]	Q ² (6)	9.878	[0.130]	SC	-10.474
Q(12)	25.593	[0.012]	Q ² (12)	21.198	[0.048]		

Notes: LM is the LM ARCH test statistic(4 lags)

JB is the Jarque-Bera test statistic

Q(6) is the 6th order Ljung-Box test statistic for standardized residuals

Q(12) is the 12th order Ljung-Box test statistic for standardized residuals

Q²(6) is the 6th order Ljung-Box test statistic for standardized squared residuals

Q²(12) is the 12th order Ljung-Box test statistic for standardized squared residuals

The numbers in the brackets are the p-values.

REFERENCES

- Ball P. (1992) Why Does High Inflation Raise Inflation Uncertainty? *Journal of Monetary Economics*, 371-388.
- Bollerslev T. (1986) Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics* 31:307–327.
- Bollerslev T. and J. M. Wooldridge (1992) Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariances. *Econometric Reviews* 11:143–172.
- Bollerslev T. and J. M. Wooldridge (1992) Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariances. *Econometric Reviews* 11:143–172.
- Brunner A. D. and G. D. Hess. (1993) Are higher Levels of Inflation less Predictable? A State-Dependent Conditional Heteroscedasticity Approach. *Journal of Business and Economic Statistics* 11:187-197.
- Carlson J. A. (1977) A study of Price Forecasts. *Annals of Economic and social Measurement* 6:27-56.
- Cosimano T. and Jansen D. (1988) Estimates of the Variance of US Inflation based upon the ARCH Model. *Journal of Money, Credit, and Banking* 20:409-421.
- Cukierman A., and Meltzer A. (1986) A Theory of Ambiguity, Credibility, and Inflation under Discretion and asymmetric Information. *Econometrica* 54:1099-1128.
- Cukierman A. and Wachtel P. (1979) Differential Inflationary Expectations and the Variability of the Rate of Inflation. *American Economic Review* 69:595-609.
- Engle R. F., Lilien D. M., and Robins R. P. (1987) Estimating Time Varying Risk Premia in the Term Structure: The ARCH-M

- Model. *Econometrica* 55:391–407.
- Engle R. F. (1983) Estimates of the Variance of U.S. Inflation Based upon the ARCH Model. *Journal of Money, Credit, and Banking* 15:286-301.
- Engle R. F. (1982) Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of U.K. Inflation. *Econometrica* 50:987–1008.
- Fountas, S., Karanasos, M., Karanasou, M., (2000) A GARCH Model of Inflation and Inflation Uncertainty with Simultaneous Feedback. Working Paper, University of York.
- Friedman M. (1977) Nobel Lecture: Inflation and Unemployment. *Journal of Political Economy* 85:451-72.
- Glosten, L.R., R. Jagannathan, and D. Runkle (1993) On the Relation between the Expected Value and the Volatility of the Normal Excess Return on Stocks. *Journal of Finance* 48:1779–1801.
- Golob J. (1994) Does Inflation Uncertainty Increase with Inflation? *Federal Reserve Bank of Kansas City Economic Review* 27-38.
- Grier K. and Perry M. (1998) On Inflation and Inflation Uncertainty in the G7 countries. *Journal of International Money and Finance* 17:671-689.
- Holland A. S. (1995) Inflation and Uncertainty: Tests for Temporal Ordering. *Journal of Money, Credit, and Banking* 27:827-37.
- Holland S. (1993) Uncertain Effects of Money and the Link Between the Inflation Rate and Inflation Uncertainty. *Economic Inquiry* January:39-51.
- Hwang Y. (2001) Relationship between inflation rate and inflation uncertainty. *Economics letters* 73:179-186.
- Jansen D. (1989) Does Inflation Uncertainty Affects Output Growth? Further Evidence. *Federal Reserve Bank of St. Louis Economic Review* 43-54.
- Nelson Daniel B. (1991) Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica* 59:347–370.
- Okun A. (1971) The Mirage of Steady Inflation. *Brookings Papers on*

Economic Activity 2:485-98.

Wachtel P. (1977) Survey Measures of Expected Inflation and their Potential Usefulness. In Joel Popkin (Eds) Analysis of Inflation 1965-74, Cambridge, Mass.: Ballinger.

Zakoian J.M. (1990) Threshold Heteroskedastic Models. manuscript, CREST, INSEE, Paris.

Wachtel, P. (1977) Survey Measures of Expected Inflation and their Potential Usefulness. In Joel Popkin (Eds) Analysis of Inflation 1965-74. Cambridge, Mass.: Ballinger.

THE PROPORTIONALITY CONTROVERSY

PANAGIOTIS EVANGELOPOULOS

University of Thessaly

Abstract

The Proportionality Controversy has played a remarkable role of the determination of cause of the economies of scale in the history of economic theory. On the one pole of the controversy the neoclassical position claims that full divisibility of the factors of production causes constant returns of scale and on the other pole the Chamberlin's critique against the linear homogenous production function. Chamberlin argues that despite of both the proportionality principle and full divisibility the average cost will make the curve turn up shaping a U form. Although Leibenstein offers an alternative support of Chamberlin's critique late in '50s, the neoclassical position remains unassailable as long as economies of scale can occur only if at least one of the factors is either fixed or indivisible.

JEL classification: B13, B21.

Keywords: proportionality, divisibility, economies of scale.

1. Introduction

Economic Theory is characterized by a series of disputes and controversies around its very central issues. These disputes and controversies play a very important role in the evolution of economic science. The Proportionality Controversy dominated in the decades of '40s and '50s. From one side it is the neoclassical school with its mathematical austerity and its deductive approach and from the other side the realistic one with protagonist E. H. Chamberlin, founder of monopolistic competition (1), who substantially brought back again in front of the stage the controversy of the proportionality principle in which many eminent economists were involved in the period between first and second world war in the Economic Journal (2).

The Proportionality Controversy is very important because it approaches crucial issues as the analogy of change of output when the factors of production change proportionally, the range of divisibility of the factors of production and the kind of the economies of scale emerge. The principle of

proportionality and the nature of divisibility of the factors of the production are used by neoclassical economists to prove the robustness of constant returns of scale and the validity of linear homogenous production function. Chamberlin shows that even if divisibility (3) characterizes the nature of the factors of production and the principle of the proportionality the way of their change then neither constant returns of scale nor linear homogenous production function, necessarily follow (4). The argument of Chamberlin reopens the discussion of the mid war period, where in this time, it takes place in *Quarterly Journal of Economics* (5). One year later after the challenge of Chamberlin to neoclassical school, A. N. McLeod and F. H. Hahn will answer with two comments against Chamberlin's argumentation in the same journal in 1949.

A. N. McLeod heavily criticizes Chamberlin that he excludes from his model the influence that the indivisibilities of the factors of the production function exercise as a cause of emergence of diminishing returns of scale (6). F. H. Hahn argues that it is not possible with perfect divisibility and full proportionality of the change of the factors of the production function not to follow constant returns of scale (7). Both McLeod and Hahn will argue that Chamberlin is in a methodological mistake since he confuses the definition of perfect divisibility that if we accept it under the condition of proportional change of all the factors of production function, it implies constant returns of scale with full mathematical austerity. From the other side Chamberlin calls and accuses it as tautology, a usual mathematical technical device that is so used from the part of neoclassical economists (8).

Five years later T. M. Whitin and M. H. Peston (Nov., 1954, p. 612) will stress that given the full divisibility of the factors of production, random fluctuations of the production and the risk refute, a posteriori, the tautological relationship between perfect divisibility and constant returns of scale. Harvey Leibenstein (Nov., 1955, p.625) will close this phase of proportionality controversy arguing that perfect divisibility will not necessarily mean that constant returns of scale will prevail. Nevertheless Leibenstein in his short article tries to overstep Chamberlin's polemic against the position of the defenders of the proportionality principle building a new model of production which the basis is not the factors of production but the activity and the set of the cooperated activities that consist in an operation. Leibenstein uses his model exercising the same

polemic as this of Chamberlin's against the proportionality principle of neoclassical economists but Leibenstein is achieving this with a remarkable different approach than that of Chamberlin.

As I show in the beginning of the introduction of my article, the controversy of the proportionality is taking place in a pretty long time and is related with many crucial issues. One more characteristic of the proportionality controversy is the remarkable theoretical strength of the proportionality principle in the realm of economic theory. From the beginning of the mid war period it starts the dispute of the proportionality until in the decade of '50s when Leibenstein closes this phase of discussion (9). The economists who support the proportionality principle are in superior position against Chamberlin and actually they are who are making the content and the meaning of the main stream economics.

2. The position of Chamberlin

Chamberlin (1948, p. 231), developing his argument, clarifies the meaning of the average cost of the firm ("plant" average cost) (PAC). This is the curve of average cost given the size of the fix-constant factors of production in the short time. We could extract the curve of the average cost of the production of a good if we drew thousands of PACs of each firm in the economy.

In the general case PACs are innumerable that implies that average cost curve AC and marginal cost curve MC are becoming totally smooth and average cost curve AC forms the very well known envelope cost curve (10) (Chamberlin, 1948, p.234).

Chamberlin faces the whole issue from the other side of proportionality principle. He begins with the meaning of divisibility and he tries to clarify the consequences of divisibility on the kind of the returns of scale given the well known curves of marginal and average cost of the production of a good. A factor of production is distinguished by indivisibility that means that it needs a fixed analogy from the other factor to achieve the optimum point of production. Then this point, where it is achieved, it is in the area either of diseconomies or economies of the scale. This is the right explanation of the relative inefficiency of the small size production of the firm. It must be sufficient the employment of the indivisible factor of

production, “lumpy factor”, (Chamberlin, 1948, p. 236) to move toward in efficient area of the production. Therefore economies of scale are explained by imperfect divisibility. (Chamberlin, 1948, p. 236).

This explanation is based on the definition of divisibility that gives us two alternatives:

Indivisibility → economies or diseconomies

Perfect Divisibility → proportionality principle

Both of the cases, very substantially, are two aspects of the same one and only one tautological relationship that originates from the definition of the factor as itself. George Stigler strengthens this claim since he argues “It is tautological that economies of scale rest on indivisibilities, for an indivisible productive service is defined as one which is not equally efficient in all sizes” (11) George Stigler (1949, p.202). Nevertheless Chamberlin contrasts the definition of divisibility offered by neoclassical economists where efficiency is the same in all sizes of production and he gives a new dimension of how efficiency is affected by the change of the analogy of the use of factors of production along the economies of scale. Chamberlin’s main argument remains that the efficiency of the factor of production is not the same in all sizes of production even if this factor is characterized by perfect divisibility.

So the proportionality principle totally ignores the effect on the efficiency of perfectly divisible factors of production both on the areas of the small size firm and the big size firm. This effect is explained by the fact that the factors of production that are highly specialized with superior capabilities could be used only in a big scale of production. So if the size of production of the firm is pretty small then the superior capabilities of the factors of production do not spend all their utility although they are perfectly divisible.

The definition of divisibility that leaves room for efficiency to be affected by the size of production changes dramatically the notion of what kind economies of scale emerge. Chamberlin (1948, p.246) writes “efficiency remains nevertheless a function of size”. This has a very important consequence. It offers an alternative explanation for AC curve since this curve takes its U form not because is consisted in pieces of PACs for each of the firm but because the AC curve is an expression of its relative position between PACs. The analysis of this procedure makes clear that if we keep capital constant and labor as variable then the move on the AC

curve is very obvious. The qualitative change of the capital is moving the productive procedure to the next relatively first PAC. So AC curve makes its U form as an expression of its own necessity although its U figure is a composition of all the pieces of each PAC for each size of production.

On this very important point, Chamberlin attacks the tautological relationship:

Indivisibility → economies or diseconomies of scale

He writes “if a factor is indivisible, that is the end of the matter: there is no way of finding out how dividing it would affect its efficiency” (Chamberlin, 1948, p.245). This very important sentence shows that a factor of production that it could not be divided does not permit us to claim that if it was divided (12) we would imply that affects at the same degree the efficiency along all the line of the size of production.

Therefore there is no meaning to try to explain the figure of AC curve related with the indivisibility. This means nothing for the shape of AC curve that actually follows a completely different necessity. Chamberlin finishes his argument exactly on this point. The tautological relationship does not imply anything and the economies or diseconomies of scale are not related with the indivisibility but very contrary on the efficiency of each unit of the factor of production that is very different in each size of production. The difference in the terms of efficiency of the factor of the production in relation with the size of production plays a very important role and gives to the AC curve the down turn and the up turn part of it.

3. The comments of McLeod and Hahn

McLeod argues that if we really want to examine the proportionality principle we must do a very explicit distinction between how works the real world and what are our claims for the construction of a theoretical model. Also we must base our theoretical enterprise on a very clear definition of divisibility. Chamberlin very unfortunately confuses both of the two claims and his conclusions are not clear for the real world and completely incorrect in the realm of economic theory.

The wide definition of divisibility based on the principle of proportionality implies that efficiency is not affected by the factor of

production at every unit it is used. So it is not at all a mistake the claim that theoretical model does not permit the emergence of economies scale. Of course we must not use this kind of conclusion with no caution or wisdom in the real world. But if we use it carefully with the right methodological way then it is possible to understand how the real world works or to help us to understand it. Such an approach of the real world it is possible accepting the indivisibility of some of the factors, something that it is wide spread in the real world. So we reach in the conclusion that “this very indivisibility or lumpiness of factors is what makes economies of scale possible” (McLeod, 1949, p.130).

If it is so then what we are looking for is to find out, according to McLeod, the way of rectification of our theoretical conclusions on the application of the real world. But this adjustment of our theory to the reality does not mean that we must reject our theoretical model. So Chamberlin loses a great opportunity to bridge the gap between theory and reality and to move his theoretical enterprise on this right direction (13).

With similar way with that of McLeod, Hahn tries to give a more penetrating and a more extensive answer on Chamberlin’s vision of the proportionality controversy. Chamberlin argues that it is crucial and we need very strong support and proof that divisibility implies constant returns of scale. From the other side Hahn answers that this is obvious because as a tautology it does not need any kind of support or proof.

Hahn argues that Chamberlin makes a big mistake when he claims that the efficiency of a factor of production depends on the size of production and the extension of the degree of a factor is used in the production process. This happens because Chamberlin systematically avoids facing the difficulties that arise from the definition of the factor of production. The consequence of this approach of Chamberlin is that he cannot understand his mistake since the factor of production is not well defined and it comes in a clear contradiction with its basic properties. So Chamberlin drives himself in a trap enterprising to show that a tautology needs a proof while it is valid as a tautology itself. Hahn is in a great advantage that totally clarifies such a tricky theoretical situation. To define a factor means to make it distinctive among any other. The only basis for such a complete distinction is the marginal rate of substitution of every unit of the factor of production to be equal with unit in all sizes of production (14). This is the most appropriate

definition for the determination of the uniqueness of the kind of the factor. That it rejects a priori any enterprise undertaken by Chamberlin to combine the effectiveness of the factor with the level of production and the existence of economies of scale. I quote what Hahn writes just for underlining the above mentioned. “Professor Chamberlin difficulties seen to a large extent due to the fact that he does not realize that he must define a factor of production before he can say whether it is divisible or not” and “Unfortunately he never defines his general factor labor, so that we do not know what it is that he is dividing” (Hahn, 1949, p.133).

Along the above mentioned argumentation Hahn accuses Chamberlin that there is no sense to use non well defined terms like “machinery” and labor as factors with full and perfect divisibility and to insist that units of these factors are more efficient technologically since he has removed the homogeneity property of the nature of the factor of production. So the size of production does not play any role of the emergence of economies of scale if we restore the homogeneity property of the nature of the factor of production in the model just because we must keep our model theoretically consistent and reliable. The consequences of the property of homogeneity but also of that of divisibility of the factors of production make the proportionality principle dominant and valid. So the conclusion and the assertion of the neoclassical economists that doubling of inputs in a production procedure implies double of output are robust. On this point Hahn completes his comment and attack on Chamberlin’s critique on proportionality principle.

4. The Reply of Chamberlin

Although McLeod and Hahn make a very austere critique against Chamberlin, it is true that Chamberlin tried to show that it is possible to make an alternative theoretical model which mainly must respond to the reality that is fully characterized by both indivisibility and heterogeneity of the nature of the factors of production. The reply of Chamberlin to the comments both of McLeod and Hahn supports very much indeed this position but without to be enough convincing especially on the big issue of the definition of the factor of production. So Chamberlin asserts, that very

deliberately, left a wide sense of the definition of the factor of production firstly because there is no general agreement on this and secondly because with that way his theoretical enterprise takes a form of a generalized model of production. But both assertions by Chamberlin seem more as an excuse than as positions that make a new foundation of a general definition of the factor of the production in a new kind of production model. However Chamberlin accepts the challenge to adopt the definition made by Hahn. So he does not hesitate to begin his reply based on Hahn's definition and finally to show that economies of scale do not disappear even in this case. Economies of scale remain as Chamberlin has already argued from the very beginning of the proportionality controversy. The insistence of the economies of scale under Hahn's austere and mathematical definition of divisibility, it shows both the theoretical and real strength of Chamberlin's argumentation that explains better the economic reality.

Chamberlin will try in his reply to show pretty nice the relationship of his theoretical model with economic reality in a series of examples. Chamberlin will assert that the marginal rate of substitution of each orange, we consume, is equal with the unity but this does not prevent the emergence of the diminishing law of marginal utility. The substitution of Smith by Jones is substitution of skills but with different performance although both men can offer the same quantity of labor. It is the same with the division of money but also the example of ant-men where it is supposed that the efficiency of one man is equal with his subdivision in a big number of ant-men (15). The continuous subdivision of a unit of a factor of production is with no sense since it cannot determine the consequences on its efficiency. The above argumentation developed in the last reply of Chamberlin, implies that Hahn confuses the expansion of an industrial field with the addition of new same firms with the expansion of one and only one firm that represents the industrial field as a whole. If divisibility is in effect in both of the cases for the factors of the production then in the first case it is possible but only possible for the proportionality principle to be valid but in the second that is never possible to be. This happens because on its long big expansion of a firm, it presents complexities pretty much earlier that cause the emergence of remarkable diseconomies. Even in the case where the management is doubling or multiplying along the expansion of the size of the firm or management keeps perfect divisibility in its expansion,

diseconomies finally will emerge since the bigger size of the firm cannot support proportional doubling or multiplying of the output because mainly of the emergence of more and much more complexities that make unsuccessful any kind of effective coordination of the multiplied inputs whatever they are either divisible or homogenous.

5. The evaluation of controversy and the epilogue of Leibenstein

The point that someone concludes, examining in detail the proportionality controversy, is a methodological dilemma. Chamberlin wants his model to be close to the reality, to approach it as much close as it can, and to explain the phenomena of production in the real world as much as it is possible. His theoretical enterprise drives Chamberlin to collect numerous of remarks of the economic reality and with the help of a general definition of the factor of production is trying to form a concept that divisibility or indivisibility does not play any role on the U figure of AC curve. So Chamberlin challenges the rule of the proportionality principle very effectively. He clearly claims that this rule not only does not matter in the reality but also is not valid in the economic theory.

Hahn approaches the big issue of proportionality principle very differently (16). Hahn builds a theoretical model using concrete and very well delineated definitions that are transparent, consistent and coherent but far from the economic reality (17). Especially in the case of the need to apply the theory in the reality Hahn goes back to his theoretical model and with appropriate adjustments, is trying to apply it approaching the economic reality. For the neoclassical economists the PAC curve of each firm has the U figure because we remark many forms of indivisibility in the economic reality. The curve AC which is composed by a big number of PACs takes its U figure because of indivisibilities that are present for each firm, except of course the case of Viner (18). From the other side Chamberlin concludes in U shape of AC independently of indivisibility either it exists or not.

The methodological dilemma that emerges is that Chamberlin uses the inductive method in contrast with the proportionality principle that is based on and derived from an austere, mathematical, abstractive and deductive method. For this reason the examples of Hahn seem somewhat exaggerated like that of ant-men. From the other side Chamberlin is more realistic in his

examples like that of typewriters. However from the theoretical point of view the principle of proportionality presents a relative superiority and that excuses its very long and powerful historical dominance in economic theory.

The proportionality controversy finishes with the article of Leibenstein that seems to be a differential epilogue between the former two positions. Leibenstein finally closes the second phase of the controversy for the validity of the proportionality principle that took place after the Second World War. Nevertheless the real theoretical value of this controversy is in the first article of Chamberlin and the answer of Hahn. I firmly believe that these two poles of the controversy will be the battle of discussion not only from the side of its historical importance for the evolution of microeconomic theory but also for any further discussion in the future for this controversial issue.

I would like to close my paper with a short mention on Leibenstein. Although he discusses very extensively the above mentioned two poles of controversy, Leibenstein tries to overcome this dispute building a new model based on new argumentation. Although Leibenstein (19) is an adversary of the principle of proportionality, he does not agree both with the method and the content of Chamberlin's argumentation and model. For all the former discussions that have been developed in proportionality controversy Leibenstein writes "But in these discussions an important methodological point has been missed. In this note we shall explore this point and show how it can help to clarify some aspects of the problem" (1955, p.619)

Leibenstein is building a new model of production especially for facing the proportionality controversy. The basic components of this new model are the commodity, the activity that is the hard core concept of the new model, the set of activities that consists of the operation, the process that is a vector of specialised operations, the factor that it is possible to be used to one or more activities and the firm.

This new model of production connects strongly and directly the activity with the level of output. So it disconnects the factors with the produced level of output that it happens in the traditional neoclassical model. The derivation of the production function is generally not homogenous since it is not necessary for all the activities to contribute at a determined level of production. In contrast it is possible happening not continuous, interrupts or rapid changes of the level of production because of the involvement of an activity that does not perform normal contribution in a productive

operation. The distinction is clear and very explicit. The nature of the factors is different from the nature of the activities that are connected in a productive process and the sets of activities that consist of the operations contribute in non proportional way on the level of output. So in a productive process it does not need necessarily all the activities or operations to be functions of the level of production (20). Therefore the divisibility of the factors does not imply necessarily the principle of proportionality (21).

Leibenstein undertakes the enterprise to build a theoretical model to be close to the real world and to disconnect the factors and the divisibility or indivisibility that characterizes them with the level of production. Simultaneously his model is based on an abstractive and deductive method to achieve consistency and coherence. Nevertheless the specification of Leibenstein's model is structurally poor and his model turns to a theoretical stratagem. That is the transfer of the contribution of the factor in productive process to the activity. The activity undertakes the role of the factor that plays in the traditional neoclassical model but free of the restrictions imposed on the factor in the old model. However this theoretical stratagem does not respond better on the problems that production function arises and does not promise many for the outcome of the proportionality controversy against the neoclassical position. Therefore, the two poles that I have already analyzed pretty much, remain the main battlefield of the proportionality controversy in favor of neoclassical position on the terms of mathematical austerity, coherence and consistency of the model but in favor of Chamberlin's position for the better explanation of the economic reality.

NOTES

1. E.H. Chamberlin founded the monopolistic competition in his book "The Theory of Monopolistic Competition", Harvard University Press, Cambridge, Mass., 1933. In the same year Joan Robinson

published her book "The Economics of Imperfect Competition", Macmillan Co., London 1933.

2. J. H. Clapham "Of Empty Economic Boxes", Sept. 1922, pp. 305-14; A. C. Pigou "Empty Economic Boxes: A Reply" Dec. 1922, pp. 458-65; D. H. Robertson "Those Empty Boxes" Mar. 1924, pp. 16-30; P. Sraffa "The Laws of Returns under Competitive Conditions" Dec. 1926, pp. 535-50; A. C. Pigou "The Laws of Diminishing and Increasing Cost" June 1927, pp. 188-97; L. Robbins "The Representative Firm" Sept. 1928, pp. 387-404; A. A. Young "Increasing Returns and Economic Progress" Dec. 1928, pp. 527-42; D. H. Robertson, G. F. Shove, and P. Sraffa "Increasing Returns and the Representative Firm: A Symposium" Mar. 1930, pp. 79-116; G. F. Shove "The Imperfection of the Market. A Further Note", Mar. 1933, pp. 113-24; N. Kaldor "The Equilibrium of the Firm" Mar. 1934, pp. 60-76; E. A. G. Robinson "The Problem of Management and the Size of Firms" June 1934, pp. 242-57.
3. "Doubling all the factors of production, even there are no indivisibilities and the proportions between the factors remain constant, need not necessarily lead to the doubling output" F. H. Hahn "Comment" Quarterly Journal of Economics, Feb. 1949, p. 135.
4. "If such expedients as leaving out factors or holding some of them fixed are necessary in order to "make the curve turn up" I predict that the linear homogeneous production function, which we seem to agree should be abandoned, will have a long and healthy existence; for such a position constitutes a tacit admission that with all factors present and continuously variable (which seems to be the most "general" assumption) the function is homogeneous" E. H. Chamberlin "Reply" Quarterly Journal of Economics, Feb. 1949, p. 143.
5. E. H. Chamberlin "Proportionality, Divisibility and Economies of Scale", Feb. 1948, pp. 229-62; A. N. McLeod "Comment", Feb. 1949, pp. 128-131; F. H. Hahn "Comment", Feb. 1949, pp. 131-137; E. H. Chamberlin "Reply" Feb. 1949, pp. 137-143; T. M. Whitin and M. H. Peston "Random Variations, Risk, and Returns of Scale" Nov. 1954, pp. 603-12; H. Leibenstein "The Proportionality Controversy and the Theory of Production" Nov. 1955, pp. 619-625.

6. "Having defined his terms so as to exclude the influence of indivisibility in the sense used by others, he finds that indivisibility in this sense plays no part in his model. What could be more tautological than that?" A. N. McLeod *ibid* p. 129.
7. "The common sense proposition that the duplication of a given industrial process (together incidentally with a duplication of entrepreneurs or entrepreneurial function) will lead to a doubling of the output is unassailable." F. H. Hahn *ibid* p. 135.
8. "Both of my critics defend tautologies, and Mr. McLeod even finds that my own argument may also be dismissed as tautological." E. H. Chamberlin *ibid* p.142.
9. "What the outcome of the debate has been is not at all clear. If the writer can judge on the basis of conversations he has had with some economists on the problem, he must conclude that the "proportionalist position" is still held quite tenaciously in some quarters" H. Leibenstein p. 619.
10. The number of plant possibilities has been multiplied to the point where they may be considered as continuous, so that AC and also MC have become smooth curves" E. H. Chamberlin *ibid* p. 234
11. "It was argued that all economies of scale could be viewed as arising from indivisibilities" George J. Stigler "The Theory of Price" The Macmillan Company, New York, 1946, p.202
12. "In the same way, if horses cannot fly, there is no way of finding out how high they could fly, if they could." Chamberlin, 1948, p. 245
13. "Professor Chamberlin has missed an excellent opportunity of bridging the gap between theory and practice in this field". McLeod, 1949, p. 131
14. "If we are to talk of demand and supply curves of factors of production to the firm, we must define a factor in a manner such that the marginal rate of substitution between its individual units is equal to unity for all levels of output" Hahn, 1949, p. 132
15. "By definition a hundred ant-men in any one use are equi-efficient with one man in the same use, and similarly with machines". Hahn, 1949, p.134

16. The way that Frank Hahn defends the wide use of abstractive and deductive method in economic theory as long as his contribution of the extension of the prototype neoclassical model of general equilibrium is deeply analyzed in Anastasios Karayiannis book "General Economic Equilibrium" Stamoulis, 1988, Chapter 3 & 4
17. Tjalling C. Koopmans in his monograph "Three Essays on the State of Economic Science" McGraw-Hill, 1957 completes the orthodox neoclassical methodology bringing together the assumptions and the definitions that we have to create for the construction of a model under the deductive method with the use of mathematical terms and techniques. An excellent analysis of the contribution of T.C. Koopmans is in A.K.Karayiannis book "Economic Methodology-An Historical Analysis" Kritiki, 2001, p.276
18. It is the case of the so called Vinerian Error that it is valid only when the curve of the long run average cost is horizontal and adjoins to the curves of short run average cost that are called by Chamberlin plant average cost curves PACs. "Cost Curves and Supply Curves" στο "Reading in Price Theory" Eds. G. Stigler and K. E. Boulding, Homewod Ill., Irwin, 1952. Analysis of the Vinerian Error in Greek bibliography is in P.G.Pavlopoulos book "Economic Theory" Sakkoulas, 1980, Volume 3, p.238 and p.246
19. Harvey Leibenstein in his book "Beyond Economic Man: A New Foundation for Microeconomics" Harvard University Pree, 1976, Chapter 4, enterprises to include assumptions of economic behaviour on non individualistic basis in the corpus of the orthodox economic analysis. Anastasios D. Karayiannis analyses it in his book "Economic Methodology-An Historical Analysis", Kritiki, 2001, p.311
20. "Now clearly in any conceivable productive process not all activities or operations need be functions of output". Leibenstein, 1955, p. 622
21. "Perfect divisibility of factors (provided we accept the distinctions between factors, activities, and operations) is not a sufficient condition for long-run constant costs... The relationship need not be a proportional one" Leibenstein, 1955, p. 622

REFERENCES

- Chamberlin H. E. (1933), *The Theory of Monopolistic Competition*, Harvard University Press, Cambridge, Mass.
- Chamberlin H. E. (Feb.1948), Proportionality, Divisibility and Economies of Scale, *Quarterly Journal of Economics*.
- Chamberlin H. E. (Feb.1949), Reply, *Quarterly Journal of Economics*.
- Hahn H. F. (Feb.1949), Comment, *Quarterly Journal of Economics*.
- Karayiannis D. A. (1988), *General Economic Equilibrium*, Stamoulis, Athens.
- Karayiannis D. A. (2001), *Economic Methodology-An Historical Analysis*, Kritiki, Athens.
- Koopmans T. (1957), *Three Essays on the State of Economic Science*, McGraw Hill.
- Leibenstein H. (Nov. 1955), The Proportionality Controversy and the Theory of Production, *Quarterly Journal of Economics*.
- Leibenstein H. (1976) *Beyond Economic Man: A New Foundation for Microeconomics*, Harvard University Press.
- McLeod N. A. Comment (Feb.1949), Comment, *Quarterly Journal of Economics*.
- Pavlopoulou G. P. (1980), *Economic Theory*, Sakkoula, Athens
- Stigler J. G. (1946) *The Theory of Price*, The Macmillan Company, New York.
- Viner J. (1952) Cost Curves and Supply Curves, στο “Reading in Price Theory” Eds. G. Stigler and K. E. Boulding, Homewod Ill., Irwin.
- Whitin M.T. and Peston, H. M. (Nov.1954) Random Variations, Risk, and Returns of Scale, *Quarterly Journal of Economics*.

A STUDY OF THE RELATIONSHIP BETWEEN STOCK INDEX FUTURES AND STOCK INDEX. EMPIRICAL CASE OF TAIWAN STOCK EXCHANGE CAPITALIZATION WEIGHTED STOCK INDEX <TAIEX>

GEORGIOS ZAFEIROPOULOS

ATEI of Patras

Abstract

In recent years, futures have become indispensable instruments in the international financial market. From theories or previous empirical studies, it exists the fact that futures market is more sensitive than spot market and the futures market may promote the spot market as well. In other words, it implies the existent and significant lead-lag relationship. Therefore, the topic of study takes the (TAIEX) Taiwan Stock Exchange Capitalization Weighted Stock Index and its' future contracts TAIFEX; Mini Taiwan stock Index Future <Mini-TAIFEX> as the objectives. The major purpose is focusing on examining the lead-lag relation between the Taiwan index FUTURE market and SPOT market return rate of the price. By using the intraday five-minutes interval return data from 10/05/2002 to 22/08/2002, with total 4050 sets of market price data. Through descriptive statistics, we examine the lead-lag relationship between Taiwan Stock Index Futures and Spot Market. The first step in the empirical analysis is to examine the stationary of three series (five minutes transaction price data of TAIEX spot and futures TAIFEX; MINI-TAIFEX markets). The non-stationary is tested with use the augmented Dickey-Fuller (1979, ADF) test. Which is capable of predicting the other one?

The study can find following empirical result:

1. The per five minutes data sets of the TAIEX, TAIFEX and MINI-TAIFEX price return all were stationary.
2. In the aspect of Taiwan Stock Exchange Capitalization Weighted Stock Index: The price return rates of futures lead with the spot by 5 minutes. What's more, the future market may act as a better conduit of information than the spot market, which has price discovery function.

The findings TAIFEX and MINI-TAIFEX futures prices lead the TAIEX spot index and suggest that futures markets can provide investors with important information, And hope the investors to get great benefit from the study.

JEL classification: G14.

Keywords: Futures stock-index market, Spot stock-index market, lead-lay relationship, regression analysis.

1. Related literature

Much research has investigated the relationship of cash market and the stock index futures market with use of the transaction data. The earlier studies that examine lead-lag relationship between stock index and index futures prices used Granger's (1969) notion of causality which rests on an incremental predictability criterion. A variable, X causes another variable, Y, if the past history of X can be used to predict Y more accurately than simply using the past history of Y alone. At the same time, the past history of Y cannot help predict X more accurately, once the history of X and other relevant information are accounted for. Several test procedures have been employed to investigate the lead-lag relation. The most popular are: a one-sided distributed-lag model (Granger 1969)¹, a two-sided distributed-lag model (Sims 1972)², and a cross-correlation technique. Zeckhauser and Niederhoffer (1983) looked at the early experience with market index futures and found indications that futures prices appear to have some ability to anticipate movements in the spot index, particularly in the near term. Their analysis consisted of computing the basis (difference between the prices of the futures contracts and the prices of the spot index) at closing, a variable they call the premium. This variable was examined with three different movements in the spot prices—to the next day open, to the next day close, and to the close three days later. Looking at the period of study as a whole, they found that the larger the premium, the greater is the tendency for the spot to rise. Ng (1987) uses intraday data to investigate the price behavior of S&P index futures prices and its ability to predict the S&P500 index level. Finnerty and Park (1987). Kawaller, Koch and Koch (1987), Harris (1989), Stoll and Whaley (1990), Chan (1992) report that price movements in the futures markets consistently lead the stock index movements, while there is weak evidence that stock index movements lead to futures price changes. This lead-lag relationship between the futures and cash index markets can be attributed to lower transaction costs and less restrictive short selling in the future markets. The following are the previous, related studies:

1.1. The futures index market lead the stock index market

Kawaller, Koch and Koch (1987) the paper exams the intraday price

relationship between S&P500 futures and the S&P 500 index using minute-to-minute data in 1984 and 1985. Three-stage least-squares regression's results suggest that future price movements consistently lead index movements by twenty to forty-five minutes while movements in the index rarely affect futures beyond one minute. The lead from futures to the index on expiration days is at least as long as other days prior to expiration, suggesting that expiration days do not demonstrate a temporal character substantially different from earlier days

Stoll and Whaley (1990) This study investigate the time series properties of 5-minute, intraday returns of S&P stock index and index future contracts, the result finds that S&P and MM index futures returns tend to lead stock market returns by around 5 minute. Although futures returns tend to lead stock returns, the effect is not completely unidirectional. The lagged stock index returns have a mild positive predictive impact on future returns. The evidence supporting the future market has the function of the price discovery hypothesis.

Chan (1992) used the MMI component stocks, S& P 500 index futures, MMI 5 minute-interval transaction data, examined closely variations in the feedback relationship between the spot and futures markets according to 1. Whether the news arriving in the market is good or bad. 2. The relative intensity of trading activity in the two markets, and 3 the extent of market-wide movements. He found that the infrequent trading of component stocks cause a spurious lead-lag relation between the two market returns. However, when there are more stocks moving together (market-wide information), the feedback from the futures market to the cash market is stronger. Chan suggested that the futures market is the main source of market-wide information.

Y.K.TSE(1995) examined the lead-lag relationship between the spot index and futures prices of the NIKKEI Stock Average(NSA) and the futures traded in the Singapore International Monetary Exchange(SIMEX).Using the daily data to investigate the interaction between spot and futures series through the Error Correlation Models(ECM).The results show that the future lead the spot Index , supporting the price discovery function of the future contracts.

Kawaller (1987) finds that the S&P 500 futures lead the S&P 500 index returns by 20 to 45 minutes, while the lead from cash to the futures rarely

lasts beyond on minute. It was also indicated that the pattern of the lead-lag relationship remained unchanged throughout the different trading days and futures contracts examined in the research. Empirical results showed that the extent of the lead from the futures to the cash index on expiration day was similar to the days prior to expiration. The author concluded that the co-movement of the intraday price were largely contemporaneous in nature.

Ng (1987) used the cross-correlation function approach to test for causal relationships between spot and futures prices for the S&P 500, the Value Line Index (VLI), the five exchange rates. Employing daily data for about 5 years, Ng reported evidence that futures prices lead rather than lag spot prices by one day, although the lead coefficients were rather weak in magnitude. No lead was detected for the spot prices. Ng used Haugh's test³, but not the "modified» Haugh's test , that accounts for the possible serial correlation in the cross-correlation function.

1.2. The stock index market lead the future index market

Wahab & Lashgari(1993) use the cointegration analysis to examine the temporal causal relationship between the S&P500 and Financial Time-Stock Exchange 100(FTSE100) indexes. The advantage to use the cointegration analysis is the reaction to the new information in the two markets can be different in the short- run. However, if the two markets are efficient, there is a long-run equilibrium relationship between the two markets. The researchers use the daily data over the period from 1988 to 1992 and found out that the cash and futures index in the S&P500 and FTSE100 are cointegrated. The evidence is the important of price discovery served stronger in the cash market lead the futures markets.

Ghosh(1995) examines the S&P 500 index spot ;Commodity Research Bureau(CRB)index spot and its' futures. The S&P 500 collected prices the approximately every 15 minutes on every Wednesday during the whole year 1998 from New York Futures Exchange (NYSE). Daily closing prices of CRB during the whole year 1998 collected from Chicago Mercantile Exchange (CME), the author chooses the two price series to investigate the different information systems affect the lead-lag relation. The result indicates that both index spot and futures prices are integrated processes. The finding of cointegration between contemporary spot and futures prices in the S&P 500 and CRB markets provides evidence inconsistent with

market efficiency. The CRB the new information affect the spot first then to futures; S&P 500 affect the futures index first then the spot index. Therefore, the two indexes have different lead-lag relation.

1.3. The stock index market and the future index market are independent relationship or exist a co-integration

Abhyankar(1995) seeks to examine the FTSE100 stock index and index futures, and collects the data from 28/04/1986-24/10/1986,(is the period prior to the introduction of the major structural reforms in the International Stock Exchange, London, known as the Big Bang);27/10/1986- 30/09/1987 (post Big Bang to the crash of 1987) ;05/01/1988-23/03/1990 (the time following the 1987 crash) the three natural sub-periods hours data. The author uses the linear regression analysis and cross-correlation analysis. The result showed that there is a strong contemporaneous relationship between the FTSE 100 stock index and index futures. There is no significant lead-lag relationship between them by the all three periods. Although there is a weak effect of the spot index return having the predictive power for the index futures in the period after the Big Bang. Maybe it because the lower transaction , and entry costs on the index futures. The author finds that the futures lead the spot during times of “moderate” news. But during the “good” and “bad” news, there is no significant relation of lead-lag between the two time series. The relationship was also found to be bi-directional.

Kuo,Wei-Ling(1998) examine the lead-lag relationship between SIMEX MSCI Taiwan Stock index future and cash index ,using the GARCH model concluded that the cash and future indexes have the bi-directional feedback relationship.

The general conclusion of previous research is that the results are different. Some researchers examine the same market but have different result. For example the returns in the futures market seem to lead the cash market return. There is, however, some weak evidence of predictive ability from the cash to future. (For example Kawaller, Koch and Koch and Wahab & Lashgari all examine S&P 500, but the former results are future lead the cash market, the latter are cash market lead the futures). The reason may due to the different time frame. The Kawaller, Koch and Koch data was collected from 6/1984-12/1985;Wahab & Lashgari data was collected from 04/01/1988 –30/05/1992) or due to the different time interval Kawaller,

Koch and Koch use the minute-to minute prices; Wahab & Lashgari uses the daily prices. The summary of the above literature is presented in the **table 1**. A number of studies have examined the different markets, the reasons that cause of lead-lag relationship between the two time series are a lots, except the above reasons, because the different trading mechanisms, different trading systems, the regulation restricted, the attitude of the investors, the well-established financial systems or not all could result in the problems of calculating and reporting of the spot or futures prices. Taiwan stock market was already launched for a long time, but the future markets was launched only for 4 years. The purpose of this article is to investigate the lead-lag relationship between the Taiwan stock index and index futures.

Table 1: the summary of stock index and the future index markets literature.

Author	Market	Data	Methodology	Result
Kawaller, Koch and Koch (1987)	S&P 500	Minute-to minute	Granger Causality	Future lead spot
Stoll and Whaley (1990)	S&P 500(trade in CBOT MMI)	Every 5 minutes	GARCH mode	Future lead spot
Chan(1992)	S&P 500	Every 5 minutes	Granger Causality	Future lead spot
Wahab & Lashgari (1993)	S&P 500 FTSE 100	Daily Causality	Granger	Spot lead future
Ghosh (1995)	CRB	Daily	Granger Causality	Spot lead future
Y.K.TSE (1995)	Nikkei 225	Daily Causality	Granger	Future lead spot
Abhyankar (1995)	FTSE 100	Hourly	GARCHmode	bi-directional feedback relationship
Kuo,Wei-Ling(1998)	SIMEX	5 minutes	Granger Causality	bi-directional feedback relationship

2. Description of the data

The TAIFEX and MINI-TAIFEX index futures contract traded on the Taiwan

Futures Exchange, is based on the Taiwan Stock Exchange Capitalization Weighted Stock Index. The index futures contracts trades on the quarterly cycle maturing in March, June, September, and December annually. The near contract is the most heavily traded. The study here uses the data on the near contract shifting to the next near contract on the expiration day. The future and spot time series analyzed here used the every 5 minutes interval.

The TAIEX and MINI-TAIEX index futures trading time are from 08:45-13:45 daily while the TAIEX spot index is from 9:00 –13:30. The future market traded 15 minutes earlier than the spot then trade 15 minutes more than the spot market was closed. Since no price observations are available for the stock market was closed ; while the two time series are need to be used the same time frame. The entire data set consists of 5 -minute interval from 9:05 –13:35 during the period 10/05 2002 to 22/08 2002. In all, the procedure generated a total 4123 observations, which were transformed to total 4050 prices observations are used to compute 5-minute returns. The return series for the spot index and index futures are calculate as follow:

$$R_{i,t} = \text{Ln} \left(\frac{P_{i,t}}{P_{i,t-1}} \right) \quad (1)$$

Where the return for the interval t on day i . P is the last price for the cash index and future index in the 5 -minute interval. Further, we do not include the overnight return because it is calculated over a longer period and would induce a severe volatility problem, and omit the first opening 9:00 price in order to ensure synchronous prices.

3. Preliminary statistics

The autocorrelation structure of five minutes returns of spot index, TAIEX future and mini- TAIEX is presented in **table 2**. According to Box Jenkins (1976), who discussed the distribution of sample values of (r_s) under the null that y_t is stationary with normally distributed errors. Allow $\text{var}(r_s)$ to denote the sampling variances of (r_s) we obtain:

$$\text{VAR}(r_s) = T^{-1} \quad (2)$$

where T is the number of observations in our sample. Moreover, in large

samples (i.e., for large values of T), (r_s) will be normally distributed with a mean equal to zero.

An appropriate condition to use the sampling variance and test if the autocorrelations are different from zero is our series to be stationary. Initially, the first step is to check if the data is stationary. A stochastic process is said to be strictly stationary if its properties are unaffected by a change of time origin; in other words, the joint probability at any set of times is not affected by an arbitrary shift along the time axis. Hence the process S_t named stochastic process. The stationarity conditions require are:

$$E(S_t) = \mu \quad \text{Var}(S_t) = \sigma^2 \quad \text{Cov}(S_t, S_{t+1}) \quad \text{Cov}(S_{t-K}, S_{t-k+j})$$

If the data is not stationary, the data should be differenced. The analyst should repeat the process until a stationary data set has been found. The next procedure is to determine the form of the model that should be used. This can be achieved by analyzing the autocorrelations of the data. An autocorrelation is a value that represents the relationship between a variable, lagged one or more periods, and itself. In other words, it shows whether error values are independent of one another." Error terms that are correlated over time are said to be autocorrelated", (Statistics for Management and Economics Fourth Edition, Keller and Warrack, 1997). Although from the result, the three time series are the returns and logically should be stationary, we will employ the Augmented Dickey Fuller unit root test (ADF). The general strategy is that lagged difference, such as Δy_{t-1} , Δy_{t-2} , ... are included in the regression, such that its error term corresponds to white noise. This leads to the so called augmented Dickey-Fuller test (ADF test), A test for a single unit root in higher order AR processes can easily be obtained by extending the Dickey-Fuller test procedure.

According the Pagan& Wickens (1989) studies about the time series, the most common unit root tests are DF test, ADF test, and Phillips and Perron test (1988)⁴, the ADF test and PP tests, applicable for general ARMA models, sometimes referred to as a nonparametric test for a unit root. To use the ADF test is better than PP test (Schwart,1987), therefore, In this study was used the ADF to test if the time series data for the Spot index and futures are stationary or not.

Regression:

$$\Delta Y_t = \beta + \beta_1 Y_{t-1} + \sum_{k=1}^n \gamma_k \Delta T_{t-k} + \varepsilon_t \quad (3)$$

Above the e_t we will refer to the e_t process as a white noise process that is homoskedastic and exhibits no autocorrelation. According the (3), when Y_t is non stationary the $\beta_1 = 0$, and when Y_t is stationary the $\beta_1 \neq 0$, so the statistic hypothesis:

A null hypothesis, $H_0 : \beta_1 = 0$ (Y_t series has unit root, the time series is nonstationary).

An alternative hypothesis, $H_1 : \beta_1 \neq 0$ (Y_t series does not have unit root, the time series is stationary).

The critical region corresponding to every test must be found. If the sample value falls in the critical region, then H_0 is rejected, otherwise it is accepted. A test statistic is said to be significant if it falls in the critical region, otherwise it is non-significant.

If the t statistic is greater than the t- ADF we reject the null hypothesis that there is a unit root, in other words that our time series is not stationary.

(The two star show that are significant). The table below shows the results for the ADF test:

Augmented Dickey-Fuller tests.

Table 2: The ADF TEST of five minute Taiwan Spot index and futures price return change. Included observations:4050.

INDECES	T- VALUE (in absolute values)	CRITICAL VALUES (1%, 5%) in absolute values	RESULT(reject null if t-value>critical value)
Spot returns	48.76**	1.939 - 2.566	Reject null so: stationary
TAIFEX returns	45.92**	1.939 - 2.566	Reject null so: stationary
Mini returns	48.39**	1.939 - 2.566	Reject null so: stationary

At 0.01 and 0.05 level, the critical value of the t –statistic for the null hypothesis are 1.939; 2.566. Thus, only if the estimated value is more than 1.939 or 2.566 standard deviations from zero, is it possible to reject the null hypothesis. As can be seen from inspection of **table 2**, the spot ,TAIFEX and MINI-TAIFEX returns the estimated values that significantly different from zero. So we secured that our data is stationary. So we can use the sampling variance in order to test if our autocorrelation coefficients are

different from zero. Our sample contains 4050 observations so the sampling variance is:

$$\text{VAR}(r_s) = 4050^{-1}$$

We will use a 95% confidence interval(i.e two standard deviations) and if the calculated value of autocorrelation for spot, TAIFEX and MINI-TAIFEX returns exceeds the standard deviation of autocorrelation (Standard deviation (**square root of var** $2T^{-1/2}$) = $4050^{-1/2}$ and for 95 % confidence interval is $2 * 4050^{-1/2} = 0.031426968$), our autocorrelation is significant. In **table 3**, are presented the autocorrelations of five minutes spot index, TAIFEX index and MINI index for 6 lags duration:

Table 3: Autocorrelation of five minute Taiwan Spot index and futures price return change. Included observations:4050.

lags	Spot	TAIFEX	MINI
1	0.22660**	0.020782	-0.0050477
2	-0.14446**	-0.032158**	-0.071040**
3	-0.13771**	-0.025721	-0.050666**
4	-0.035954**	-0.00083774	0.0031613
5	0.021427	0.031662**	0.022784
6	0.027866	0.012139	0.022338

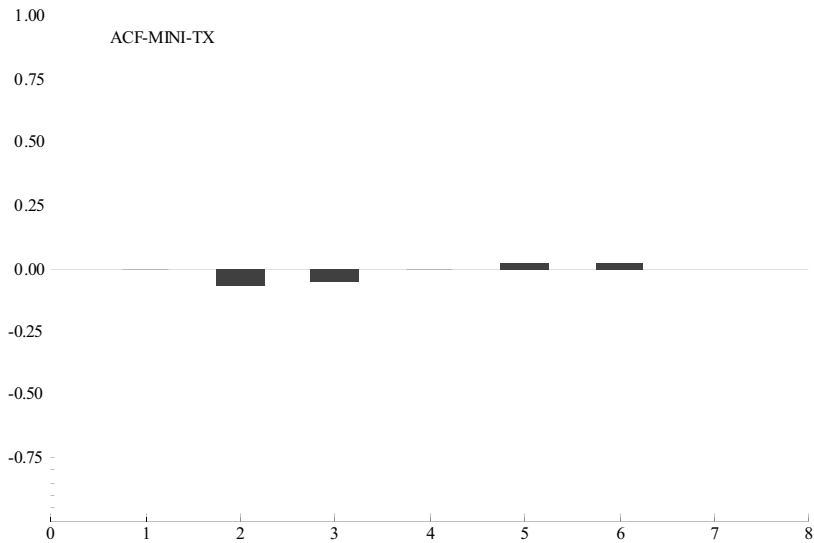
Notes: Autocorrelation coefficients for up to 6 lags are computed from the 5 minute intraday returns beginning with the 9:05 A.M price quote and ending with the 1:35 P.M price quote in both markets each day.

** significant at 0.05 level.

If we want to depict the autocorrelation structure and identify from the diagram which lags are significant (the thin green line indicate the sampling variance, in our case the number 0.031426968), we can see the correlogram, which shows the relationship of the current returns with its own lags: Autocorrelation function correlogram ACF, the ACF plays a major role in modeling the dependencies among observations. From the ACF we can infer the extent to which one value of the process is correlated with previous values and thus the length and strength of the memory of the process. The autocorrelation function (ACF) or correlogram- should convergence to zero geometrically if the series is stationary. It supports in

this study that the spot, and the futures time series are all stationary. The vertical axes we have are the autocorrelations coefficients and on the horizontal axes are the numbers of lags.

Figure 1:



and

on.

Figure 2:

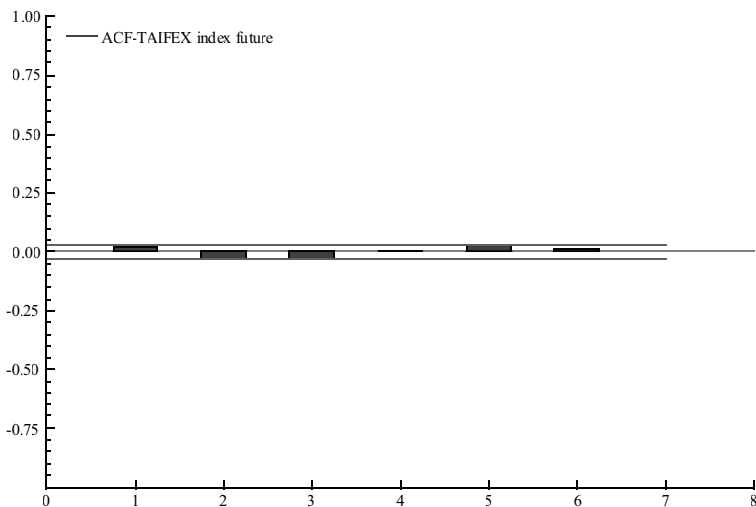
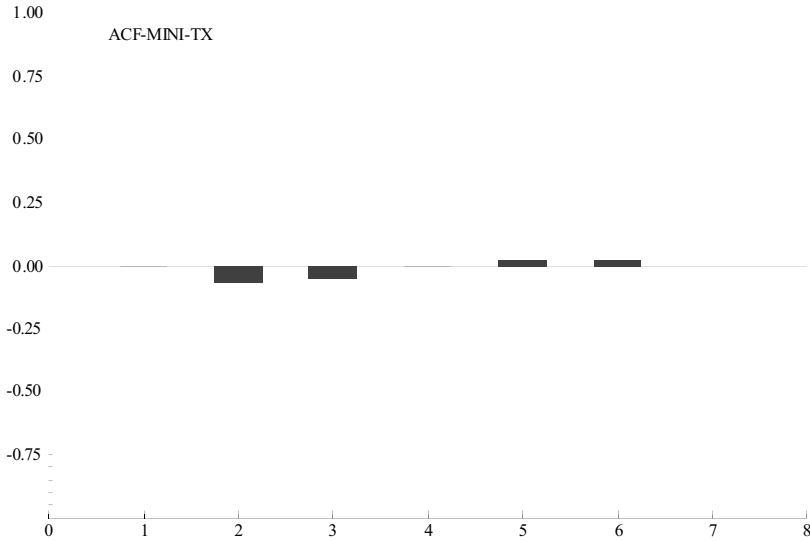


Figure 3:



The serial correlations of spot index returns-first column- for the first one lag is significant with 5% level which is reasonably large (0.22660). In contrast, the serial correlations of TAIFEX and MINI TX returns are relatively small and only significant for the second lags of TAIFEX, and for the second, third lags of MINI-TX as spot returns. In the first lag, the coefficient is 0.020782 for the TAIFEX returns and -0.0050477 for the MINI-TX. Another comment according to the autocorrelation structure of spot returns, is that spot returns diminish over time after three lags, finding consistent with the evidence in Froot and Perold (1990). The serial correlation in the spot index is 0.22660 for the first lag and then turn to negative at the second lag.

In order to see the lead lag relationship more closely and find the optimal numbers of lags and leads that are going to be used later to our regression analysis, we consider the cross correlation between returns of the spot index and the two index futures, the TAIFEX and the Mini (**Table 4**).

Table 4: Cross-correlation coefficients of five minute return of Taiwan Spot index and TAIFEX and MINI-TAIFEX futures.

Included observations: 4050

lag	$P(S_t, F_{t+k})$	$P(S_t, F_{\min i,t+k})$
-6	0.00779315	0.00974219
-5	-0.0250084	-0.0185903
-4	-0.0344391**	-0.0450746**
-3	-0.0586208**	-0.00943836
-2	0.0699399**	0.0533342**
-1	0.463074**	0.338446**
0	0.527832**	0.531304**
1	-0.0542921**	0.0604816**
2	-0.0368715**	-0.0263577
3	-0.0155593	-0.0228037
4	0.000550284	-0.000896870
5	-0.00746214	0.00529584
6	-0.00879422	-0.0103584

 (S_t) Taiwan Spot index (F_t) TAIFEX index future $(F_{\min i,t})$ MINI-TX index future

Notes: Cross-correlation coefficients are computed from the 5 minute intraday returns beginning with the 9:05 A.M price quote and ending with the 1:35 P.M price quote in both markets each day. Positive lags indicate cross-correlation between past futures returns and current spot returns. Negative lags or “lead” indicate cross-correlation between future futures returns and current spot returns.

** at 0.05 level

The first column shows the cross correlation between spot index returns and TAIFEX returns and the second the cross correlation among spot index returns and MINI returns. The contemporaneous correlations are **0.527832** and **0.531304** respectively, suggesting that the two time series are not perfectly correlated. Correlations between current returns of spot

and lagged returns of TAIFEX and MINI are significant positive for the first two lags (for lag 1: **0.463074** lag 2: **0.0699399** another lag 1 **0.338446** and lag 2 **0.0533342** respectively). In contrast correlation between current return of Taiwan Spot index and leading return of TAIFEX index future are only significant in the first lead (**-0.0542921**) for leads there are no positive coefficients. Taiwan Spot index and leading return of MINI-TAIFEX index future are positive significant in the first lead (**0.0604816**).

In general, from **table 4** we can conclude that cross correlation coefficient of longer leads and lags are small so we consider the regression model where the spot current returns are regressed against lead and lag values of order 2.

4. Methodology and Empirical Results

To examine the nature of the lead-lag relationship between return in the Spot index and the index futures, the study is also based on the following Stoll and Whaley(1990) Chan(1992), the following regression is estimated:

$$R_{s,t} = \alpha + \sum_{i=-2}^2 \beta_i R_{F,t+i} + \varepsilon_t$$

The $R_{s,t}$ the five minute Taiwan spot index return at time t (the dependent variable) and $R_{F,t}$ the five minute neither TAIFEX or MINI-TAIFEX index futures return at time t (the independent variable). The coefficient β_i represent the lead variable coefficients, when the positive subscript $i = 1, 2$, and lag variable coefficients, when the negative subscript $i = -1, -2$. We use the $i = 1, 2, -1, -2$, are the numbers of lead/lags used according to the previous result on **table 4** cross-correlation analysis. If the lead coefficients are significant, it means that the spot index lead futures index return. If the lag coefficients are significant, it means that spot index lag futures index. ε_t denoted the error term. The regressions are estimated using Hansen's (1982) variance-covariance estimator, resulting the t-ratios which are consistent in the presence of serial correlation and heteroscedasticity.

Under the assumption of perfect and frictionless capital market, the spot index itself can capture all relevant expectations with the regard to future price. In such a perfect market, if a futures contract based on the index was developed, arbitrage can assure that it traded at a fixed relationship to the

spot price. The price change in spot index and futures index should be contemporaneously correlated and not cross-correlated. If it was the case, the result of the regression analysis should show a contemporaneous coefficient, or β_0 is significant different from zero. If the regression analysis produces significant lead coefficient, it show that the spot index return lead the future index return. If the regression analysis produces significant lag coefficient, it show that the spot index return lag the future index return.

From **table 4** cross-correlation result, so we will regress spot returns (dependent variable) with future returns of lag-1 (VAR2_1), lag-2(VAR2_2) and leads of lag 1 (VAR2_-1) AND lag 2 (VAR2_-2)

From cross correlations we have a first impression, from the two positive significant lags, that spot lags future.

var 1 (Y variable The Taiwan spot index- dependent) and Var 2 (X variable: TAIFEX –independent) var2_1, var2_2, var2_-1, var2_-2.

EQ(1) Modelling Var1 by OLS

The estimation sample is: 3 to 4048

	Coefficient	Std.Error	t-value	t-prob	Part.R ₂ [^]
Constant	-3.03945e-006	1.924e-005	-0.158	0.874	0.0000
Var2	0.527873	0.01045	50.5	0.000	0.3869
Var2_1	0.466409	0.01045	44.6	0.000	0.3301
Var2_2	0.0675215	0.01045	6.46	0.000	0.0102
Var2_-1	-0.0535665	0.01046	-5.12	0.000	0.0064
Var2_-2	-0.0392741	0.01047	-3.75	0.000	0.0035
sigma	0.00122375	RSS		0.00605013502	
R ₂ [^]	0.540074	F(5,4040) =	948.8	[0.000]**	
log-likelihood	21393.8	DW	2.15		
no. of observations	4046	no. of parameters	6		
mean(Var1)	-1.29857e-005	var(Var1)	3.25126e-006		

The var2_-1 and var2_-2 are significant not positive coefficient. The t-value -5.12 and $-3.75 < -1.96$, we have evidence that spot lead future, var2_1 and var2_2 are significant, we have evidence that future lead the spot.

var 1 (Y variable: The Taiwan spot index- dependent variable) var 3(X variable: The MINI-TAIFEX_independent variable) var3_1, var3_2, var3_-1, var3_-2.

EQ(2) Modelling Var1 by OLS (Ordinary Least Squares)

The estimation sample is: 3 to 4048.

	Coefficient	Std.Error	t-value	t-prob	Part.R ₂ [^]
Constant	-5.68124e-007	2.052e-005	-0.0277	0.978	0.0000
Var3	0.532978	0.01051	50.7	0.000	0.3892
Var3_1	0.342052	0.01049	32.6	0.000	0.2082
Var3_2	0.0563043	0.01049	5.37	0.000	0.0071
Var3_-1	0.0614522	0.01050	.86	0.000	0.0084
Var3_-2	-0.0275298	0.01050	-2.62	0.009	0.0017
sigma	0.00130536	RSS		0.0068840669	
R ₂ [^]	0.476679	F(5,4040) =		736 [0.000]**	
log-likelihood	21132.6	DW		2.09	
no. of observations	4046	no. of parameters	6		
mean (Var1)	-1.29857e-005	var(Var1)		3.25126e-006	

Table 5: Regression of five-minute return of Taiwan Spot index and TAIFEX and MINI-TAIFEX futures. (summary of the EQ(1) and EQ(2))

Dependent variable: Taiwan spot index

Independent Variable: TAIFEX and MINI-TAIFEX

	TAIFEX	MINI-TAIFEX
b ₂	0.0675215** (6.46)	0.0563043** (5.37)
b ₋₁	0.466409** (44.6)	0.342052** (32.6)
b ₀	0.527873** (50.5)	0.532978** (50.7)
b ₁	-0.0535665** (-5.12)	0.0614522** (5.86)
b ₂	-0.0392741** (-3.75)	-0.0275298** (-2.62)

Notes: Sample period are 9:05 –13:35 5 minute interval during the period 10/05 2002 to 22/08 2002. Value in parentheses are t-statistic.

** significant at 0.05 level.

In order to see more precisely which correlation coefficients are significant and influence more the spot index returns we employ the OLS (Ordinary Least Squares) procedure by regressing the spot index returns (excluding overnight returns otherwise our results would be biased) against TAIFEX (Mini respectively) index returns, TAIFEX (Mini) index returns 5 minutes before (lag 1), TAIFEX (Mini) index returns 10 minutes before (lag 2), TAIFEX (Mini) index returns 5 minutes after the current time origin (lead 1) and finally TAIFEX (Mini) index returns 10 minutes after the current time origin (lead 2). The choice of the appropriate number of lags and leads was derived from the cross correlation coefficients result above. In order to see more precisely if these values are unbiased we can employ a multivariate regression and we will check statistically if these values are significant or not. From the results we observe that all correlation coefficients, for all lags and leads, are significant as the F statistic indicates and for TAIFEX and for MINI-TAIFEX return. The value of each correlation coefficient differs substantially. Among spot index returns and TAIFEX index returns and its lags and leads, the value of correlation coefficient for the current TAIFEX index return is large 0.52,

which means spot index returns and TAIFEX index returns are not perfectly correlated. In other words, if TAIFEX index return rise by 1% the spot index return will rise by a half. In addition there is substantially significant large value and for lag1 with a value of 0.46. That indicates that TAIFEX index returns 5 minutes before, have an effect on current spot index returns. So there is strong evidence that spot index returns lag futures returns. In practice that means the information that is already incorporated in futures returns is transferred to the spot market within 5 minutes. The correlation coefficient of spot index returns and TAIFEX futures returns for lag2 - the returns of the TAIFEX index 10 minutes before now- is significant but very low, only 0.06 which means that the returns of futures 10 minutes before don't have any explanatory power for the current spot return levels. So we can conclude, from our sample data and findings, that TAIFEX futures returns lead spot index returns within a horizon of 5 minutes. In other words, a trader can see futures returns 5 minutes before and determine what will be the current level of spot index returns or better the direction of current spot index returns. If we want now to see the effect of lead futures index returns up to 10 minutes from now, we can observe significant values but very low for both lead 1 and lead 2 (-0.053 and -0.039 respectively). So there is no strong evidence of lead relationship among spot index returns and lead futures returns up to lead 2 which can be derived from our sample data.

The findings and the conclusions are the same for the relationship between spot index returns and Mini futures returns. Again the lag one of Mini futures returns has significant, positive and high value of correlation coefficient (0.3420) with the spot index returns. But this is substantially lower than the correlation coefficient between spot index returns and TAIFEX futures returns (0.46). So TAIFEX futures returns have stronger explanatory power for spot index returns than Mini futures returns. Again lag 2 of Mini futures returns doesn't have an important influence on current spot index returns since the correlation coefficient is negligible, only 0.056. For leads Mini futures returns up to 10 minutes from the current levels, the findings are exactly the same with TAIFEX futures returns results. Significant correlation coefficients but with very low values and for the 2 leads (0.0614 and -0.0275 respectively) which cannot be used as tools to explain current spot index returns.

5. Conclusion

In this study the lead-lag relation between the intraday TAIEX spot index and TAIEX;MINI-TAIFEX future index prices return over the 5 minute from 10/05 2002 to 22/08 2002. is examined. The results from applying the regression analysis to the stock index and their corresponding stock index futures markets provide evidence that the TAIEX and MINI-TAIFEX futures clearly lead the spot index by 5 minutes, there is weak evidence that the spot index return have the predictive power to the futures. In particular, there appear to be significant bi-directional price spillover effects between the two markets. In general, the results of the study confirm the findings of earlier literature that futures markets lead spot markets. This is supported by most of the empirical literature, which finds that the futures market tends indeed to lead the spot market (Kawaller, Koch and Koch, 1987; and Antoniou and Garrett, 1993).

The main contribution of this study is to improve our understanding of the pricing relationship between spot and futures markets and futures markets in the light of Taiwan market. The findings of this investigation should be of great interest to investors, fund managers and regulators. Since the existence of spot market imperfections, such as transaction costs and short-sale restrictions, suggest that the futures market should act as a price discovery vehicle. Hence, changes in the futures prices would tend to lead changes in the cash market. Moreover, these results can not be explained with the previous literature to the microstructure arguments of Stoll and Whaley (1990), because the nonsynchronous trading and other such anomalies not be present in the data in this study. It may be worthy of further analysis.

NOTES

1. Granger's (1969) one-sided regression approach involves estimating the following bivariate autoregressive model (after appropriate pre-filtering), using empirically determined filters:

$$Y_t = \sum_{k=1}^n \alpha_k Y_{t-k} + \sum_{i=1}^m B_i X_{t-i} + \mu_t$$

$$X_t = \sum_{k=1}^n r_k Y_{t-k} + \sum_{i=1}^m \delta_i Y_{t-i} + \nu_t$$

unidirectional causality from X to Y requires that some of the B_i must be nonzero, while all δ_i must be equal to zero. Similarly, for Y to cause X , some of B_i must be nonzero while all δ_i must be jointly zero.

2. The two-sided regression approach of Sims (1972) involves estimating a two-sided regression model of the form:

$$X_t = \sum_{i=-m}^{+m} B_i Y_{t-i} + w_t$$

and test the hypothesis that all coefficients on future Y values are zero.

3. The Haugh (1976) approach to testing causality involves two steps. First, Box-Jenkins univariate ARIMA models are used to estimate appropriate filters for each series and to compute in-sample innovations. Second, estimated innovations are used to compute the sample cross-correlation function to make inferences about the population cross-correlation function which, in turn, permits inferences about causal relationships in the system.
4. Phillips and Perron have suggested an alternative to the augmented DF tests. Instead of adding additional lags in the regressions to obtain an error term that has no autocorrelation, they stick to the original Dickey-Fuller regression, but adjust the t -statistics to take into account the potential autocorrelation.

REFERENCES

- Abhyankar, A. H., "Return and Volatility Dynamics in the FT-SE 100 Stock Index and Stock Index Futures Markets," *Journal of Futures Markets*, 1995, Vol.15, No. 4.
- Alex Frino and Andrew West "The Lead-Lag Relationship Between Stock Indices and Stock Index Futures Contracts: further Australian Evidence" *ABACUS*,1999, Vol.35, No.3.
- Antoniou, A and I Garrett "To what extent did stock index futures contribute to the October 1987 stock market crash", *Economic Journal*, 1993 103 (421) 1444-1461.
- Chan, K. "An Analysis of the Lead-Lag Relationship between the Cash Market and Stock Index Futures Markets," *Review of Financial Studies*, 1992, Vol. 5, No. 1.
- Cornell,B.and French,K.R.(1983) The price of stock index futures, *Journal of Futures Markets*, 3,1-14.
- Dickey, D. A. and Fuller, W. A., "Likelihood Ratio Statistics for Autoregressive Time Series with Unit Root," *Econometrica*, 1981, Vol. 49.
- Engle, R. F. and Granger, C. W. J., "Cointegration and Error Correction Representation, Estimation and Testing," *Econometrica*, 1987, Vol. 55.
- Finnerty, J.E. and Park, H.Y. "Stock Index Futures: does the Tail Wag the Dog," *Financial Analysts Journal*, 1987, Vol. 43, No. 2.
- Fleming, J., Ostdiek, B. and Whaley, R. E. "Trading costs and the relative rate of price discovery in stock, futures and option markets" *Journal of Futures Markets*, 1996, 16, 353-87.
- Gang Shyy,Vasumathi.V and Brian Scott-Quinn "The Further Investigation of lead-lag relationship between the cash market and stock index

- futures market with the use of bid/ask quotes: the case of France”
The Journal of Futures Markets, 1996 Vol.16, No.4, 405-420.
- Ghosh, Asim, “Cointegration and Error Correction Models: Intertemporal Causality between Index and Futures Prices,” The Journal of Futures Markets, 1995, Vol. 13, No. 2.
- Granger, C. W. J., “Testing for Causality-A Personal Viewpoint,” Journal of Econometric Dynamics and Control, 1980, Vol. 2.
- Grossman, S. J. and Miller, M. H. “Liquidity and market structure”, Journal of Finance, 1988, 43, 617-33
- Grunbichler, A., Longstaff, F. A. and Schwartz, E. S. “Electronic screen trading and the transmission of information: an empirical examination” Journal of Financial Intermediation, 1994, 3, 166-87.
- Harris, L., “The October 1987 S&P 500 Stock-Futures Basis,” Journal of Finance, 1989 44:77-99
- Hansen, L.P. “Large Sample Properties of Generalized Method of Moments Estimators,” 1982, Econometrica, 50, 1029-1054.
- Kawaller, Ira G., Koch, Paul D. and Koch, Timothy W., “The Temporal Price Relationship between S&P 500 Futures and the S&P 500 Index,” The Journal of Finance, 1987, Vol. 42, No. 5.
- Kiohos Apost., Dimopoulos Ar. “Estimation portfolio var with three different methods: Financial institution Risk Management Approach”, Journal spoudai, 2004, vol. 54, No 2.
- Koutmos, G., and M. Tucker, "Temporal Relationships and Dynamic Interactions between Spot and Futures Stock Market," Journal of Futures Markets, 1996, Vol. 16.
- Kuo, Wei-Ling “The lead-lag relationship between SIMEX MSCI Taiwan Stock Index Futures and Cash Index”, 1997 Taiwan National library system numbers 86CCU00121008
- Lihara, Y., K. Kato and T. Tokunaga, “Intraday Return Dynamics between the Cash and the Futures Market in Japan,” Journal of Futures Markets, 1996, Vol. 16.

- Martikainen, T., and V. Puttonen, "International Price Discovery in Finnish Stock Index Futures and Cash Markets," *Journal of Banking and Finance*, 1994, Vol. 18.
- Ng, N., "Detecting Spot Prices Forecasts in Futures Prices Using Causality Tests", 1987 *Review of Futures Markets*, 6, 250-267.
- Owain Ap Gwilym and Mike Buckle "The lead-lag relationship between the FTSE100 stock index and its derivative contracts" *Applied Financial Economics*, 2001, 11, 385-393.

THE COASTAL ENVIRONMENT AS CONFLICT FIELD OF ECONOMIC ACTIVITIES

D. MYLONOPOULOS

T.E.I. of Epirus

P. MOIRA

T.E.I. of Epirus

Abstract

From the dawn of civilization, the economical, social and geostrategical importance of sea for human societies is well known to be interwoven with the history of humanity. Sea was always the shipping route facilitating not only commercial but also cultural communication.

Coastal environment, as part of natural environment, has an endogenous conflicting character owed to ruptures and confrontations that are connected with productive mechanism. A sequence of fundamental conflicts is involved in the relationship between productive mechanism rate and nature.

Economic activities in residential, industrial, tourist and fishing sector have negative impacts to biodiversity of coastal environment. Competition of land-use in coastal environments and particularly the need for tourist and residential growth, leads to the extension of structured environment against the natural one.

The interaction between anthropogenic and natural environment, in conditions of antagonism that are shaped by the requirement of economic growth, transforms the coastal environment.

The sustainable development of coastal environment requires integrated management that has to be based on the counterbalance of different factors. This factorial polymorphism has ecological, economical, social, cultural and administrative characteristics.

The sustainable development should maintain the coastal environment and the social-cultural identity of region, as this (the coastal environment) constitutes natural resource with multiple possibilities of economic exploitation. Political planning of this exploitation should aim to the satisfaction of social needs. Essential component of political planning is the participation of citizens, local government and state administration. It is very important the participative management of coastal environment, in order the more suitable policy to be applied and besides action in national, regional and local level to be undertaken.

JEL: R1.

Keywords: coastal environment, natural environment, competition.

1. The coastal environment as natural resource

According to anthropocentric classification of natural resources, the fundamental resources are water, soil and air. The so-called Hydrologic Cycle is an endless recycling of water from the surface of oceans to atmosphere and from atmosphere to the surface of the ground and once again to the oceans (Thompson, 1999: 5-9). Oceans maintain a biomass, which is estimated to be at least 10 times greater than that of land. Sea is more prosperous as biotope than land (Emberlin, 1996:287).

From the dawn of civilization, the economical, social and geostrategical importance of sea for human societies is well known to be interwoven with the history of humanity. Sea was always the shipping route facilitating not only commercial but also cultural communication (Mylonopoulos, 2003:120). Therefore, historically human population live in coastal regions. The most multitudinous cities in the world are located by coasts. According to 2001 United Nations Organisation documents, more than half of world population live within a 200-km radius of coastline. As coastal regions are the most productive and have the greater biodiversity of the planet (80% out of 13.200 species of fishes are coastal), coastal environment becomes a natural resource. The acquired profit by the utilisation of coastal environment for a specific activity is its direct use as natural resource.

However coastal environment, as part of natural environment, has an endogenous conflicting character owed to ruptures and confrontations that are connected with productive mechanism. A sequence of fundamental conflicts is involved in the relationship between productive mechanism rate and nature. It is trapped in the tendency of economic systems to simplify ecosystems against their stability.

The problem that is evolved, is the one of sovereign type, as its sovereignty imperils the existence of its living space. It is an everlasting confliction between the field of economic activities that is continuously expanded and the one of public goods that is shrunk.

Coastal environment as public good (Willis, 1991:38-48) and collective in particular, is not underlied to private appropriation but provides its services simultaneously and indiscriminately to everybody. These services do not follow the market rules but have communal character that is based on the commonweal. The possible concession of public goods exploitation

to individuals or groups of people involves the obedience of commonweal to private interest. This is an unconfessed substitution of human subgroup utility for the social utility interrelation (Passet, 1987:99).

The feature of public good which is assigned to coastal environment is not retracted by its individualisation as natural resource, because coastal environment can be the source of biological, aesthetics or entertaining satisfaction that each person enjoys (i.e. amateur fishing) and material wealth source (i.e. professional coastal fishery) as well.

Coastal environment is determined by the interactions of its living and non-living elements that compose complex autotrophic systems. It includes natural and human ecosystems of coastal area (coastal zone). This area is extended to the sea in a distance of 15 km from the coastline and to inland in a distance of 15 km (Goulielmos, 1997:24).

2. The conflictual character of economic growth

Environment, generally, in economic terms is considered as a complicated asset that offers services, which satisfy not only our aesthetic needs but our survival too. Thus, its depreciation should undoubtedly be an interesting area of study by economic science (Xenos, 2002:5).

Environment is subject to a permanent admission of human activities, the confrontation of which requires a socio-economic management, based on the interdependence of natural and living world.

As coastal regions assemble population ceaselessly, coastal environment experience strangleholds by the plethora of economic activities that developed not only in land but in water environment too. These pressures acquire threatening dimensions for the viability of coastal environment, and reach such point that exceed the threats which emanate from natural phenomena like typhoons, volcanic eruptions, tsunami etc. The results of these pressures are devastated natural landscapes, drained lagoons and usually covered with waste, ravaged estuaries and forests, transformed wetlands to cultivable lands, destroyed ecosystems and sea polluted by human activities.

Each coastal environment is affected by lots of factors that emanate from two components, its geographical position and residents' socio-economic

situation. However, independently of the particularities that each coastal environment presents, either it is continental or insular, it constitutes a field where economic activities conflict. These can be grouped in economic activities that are developed in overland of coastal environment and those that are developed in marine area of coastal environment.

2.1. Overland

Residential - Tourist Activity

The urbanisation of environment in coastal regions where citizens resort to, in order to achieve better living conditions and move to city only for business, the lack of a planned land-use, the lack of building regulations and the absence of inspectional mechanism, facilitate the residential activity in coastal regions, causing degradation of its ecosystems.

The near costs excessive residential activity and the extensive cover with asphalt can disturb the sea-overland balance and degrade the coastal ecosystems. The degradation becomes more intensive with the conversion of region into tourist. The construction of giant hotel units and cluster of houses, as well as dining and entertaining companies for mass tourism service, not only absorbs extent of grounds but also causes collateral waste of natural resources.

It is indicative that in Goa, India, a coastal tourist resort where many of the British Airlines package travellers are headed, drinking water supply is available all day long. However, the pipe which supplies the resorts with water, passes through the surrounding villages, to which the water supply was denied even for one or two hours a day. Hence, the locals have to move miles away, under aggravating circumstances of heat, in order to draw water from the small number of wells that exist in the region. It is characteristic that a five-star hotel consumes so much water every day as five villages together. The same occurs with the electricity. A hotel consumes 28 times more electricity than just one resident (Burns and Holden, 1995:162). Consequently, it is emerged that although local population lack basic resources, essential for its survival, at the same time tourism is proved to be an “extravagance” activity.

Globalisation, world trade growth and free traffic of goods inside European Union, require the construction of extended traffic ways and railways networks for the connection of ports and city centres, resulting

ground-absorption of coastal environments. It is remarkable the example of Igoumenitsa, where Egnatia connects the port of Igoumenitsa with Alexandroupoli and in combination with the new port construction, it affected determinately the coastal environment and differentiated radically its uses, causing new economic activities growth.

Furthermore, the construction of canals, bridges and other infrastructure works for transport facilitation, cause conflicts of land-use and alter the economic activities in coastal environments; characteristically the Rio-Antirio Bridge, in the Gulf of Patra, can be reported.

Moreover airports today do not illustrate only a convenient place for airplanes but widely around them, various activities are developed concerning passengers and their companions service i.e. hotel units, parking, passenger-railway stations etc (Wheeler, J. - Thrall, G. 1998:97). If airports lie near coastal or insular regions, affect the coastal environments in multiple ways.

Rural activity

The intensiveness of agricultural activity as European Union policy brings about changes to the environment generally and to the coastal agricultural environments specifically. The removal of fences, stonewalls and ditches as well as the drainage of wetlands contribute to the loss of natural biotopes for a big number of birds, plants and other natural species. In a lot of regions, this intensiveness leads to water consumption that decreases the available water resources, accelerating consequently the ground erosion. Agricultural intensiveness also, encourages the increase of fertilizers and pesticides use. This situation causes water and ground pollution, destroying some vital ecosystems.

Industrial activity (study of environmental impacts)

Generally industrial activity has negative impacts on the environment. The exploitation of non-renewable resources deprives the befalling generations of precious resources. On the other hand, these industry activities destroy environment (air, ground, water pollution, noise pollution, destruction or disorder of natural ecotopes, visual landscape pollution, impact on the groundwater level). Industrial wastes constitute a very serious problem.

Coastal environment due to its geographical advantages, which consist of easy raw material and goods move through ports, attracts industrial activities. Worldwide, industrial units concentration is observed in coastal area and especially those that are activated in oil sector. These units require great extents of ground and are intensively competitive, up to the point of exclusion of any other economic activity.

Furthermore, shipbuilding industry is coastal too. It requires extensive infrastructure works and facilities. It is extended not only seaward but to the land coastal zone as well. Careenage is a type of smaller shipbuilding yard, where small boats are repaired or manufactured. The shipbuilding yard is a unit of capital intensity and especially fixed capital as harbour works, tanks, buildings, machineries, cranes etc.

Port activity

There are multiple port operations that aim at the emergence of port as economic growth factor. Primary and fundamental port operation is cargos and passengers' traffic, an undoubtedly considerable service. According to Eurostat, 90% of European Union's trade with other countries and 30% of intra-EC trade is carried out through ports.

Port is important to have the suitable places as well as buildings and machines infrastructures in order to provide the appropriate means to ship, cargo and passengers. Of course the required infrastructure works, in order all these services to be provided, are widely dependent on the type of each port, consequently are not the same for all ports. However, generally there are some fundamental works and machinery that have to be present, with no exception, in each harbour. So port infrastructure works are required for the ship to sail safely into the port. Safe anchoring requirement can possibly presume port caution works from bad weather conditions, such as breakwaters etc. The operational service of the ship requires docks for ship's shore fact and mooring, long wharfs etc. Machinery is required for cargo to be loaded and unloaded of the ship as well as for cargo distribution in the port. Furthermore, building facilities are required for cargo storage. Usually in ports with heavy cargos movement, special stations (terminal) are established that require ad hoc facilities and specialised machinery (Pardali 2001:43). Such kind of terminals is container terminal, distribution cargo terminal and liquid cargo distribution terminal. It must be underlined

the necessary availability of passenger terminal with lounges, tourist shops, restaurants and coffee shops, banks, foreign exchange offices, duty free shops, tourist buses parking etc, concerning external shipping lines.

A suitable road network is indispensable, in order vehicles to be moved in the port. Furthermore, the access to the port should be easy. Many ports are equipped with railway network so that cargos to be distributed quickly inside and outside of the port.

For the best port operation, convenient buildings are required, intended to establish excellent working conditions among managerial and clerical staff.

2.2. Marine Area

Fishing activity

Since antiquity, fishery was the main human activity and basic food source for human beings. It is well known that earliest human societies were fishermen and hunters. The undoubted fact that 71% of earth surface is covered with water conducted considerably to this aspect (Mylonopoulos, Moira 1996:11).

Marine collective fishery aims to obtain aquatic fauna from sea. This normally happens with fishing vessels equipped with fishing tools.

Fishing products are particularly perishable, that's why their distribution requires quick processes, under the most excellent sanitary conditions, so that their quality and nutritional value to be ensured. Good organisational structure, modern storage, elaboration, standardisation and transformation facilities are also required, in order fishing products reach consumers in excellent condition.

In cases that fishing port is not effectible, then a special dock is established within the limits of commercial port to facilitate the fishing trade, the so-called fish-wharf. Fish-wharf requires special harbour facilities i.e. breakwater, buildings, refrigerators and mechanisms intended to serve the fishing movement of the port.

Today, individuals not only do practice fishing activity exclusively for livelihood but also for entertainment and exercising. Thus, apart from professional fishery, amateur-athletic one is as well in existence. In order ships of amateur fishery to be docked, some areas are required to be rearranged in a special way, intended for vehicles access and parking, catering business, shops with amateur fishery stuffs etc. All these requirements put the screw on the coastal environment.

During the last decades, aquacultures have presented significant growth. Aquaculture includes marine fishes feeding, marine shellfishes and freshwater fishes breeding. Water space is engaged in favour of aquaculture facilities, and due to the required conditions intended for its growth other economic marine activities should be excluded. Undoubtedly, a really intensive interaction is reported between aquaculture and natural environment (Fischler 1999).

Marine tourism

Marine tourism constitutes an enormous enterprise that is a part of the wider tourist industry. For many insular and coastal nations (Maldives, Caribbean islands, etc) marine tourism constitutes the “peak of spear” (Miller-Auyong 1991:75-99) of tourist industry. Even if generally marine tourism constitutes just an autonomous branch of a wider tourist industry, in some cases it constitutes the only type of tourism.

Countries are encouraged to invest in marine tourism due to certain economic benefits, especially these of foreign exchange flow, employment’s increase and infrastructure rate development. Of course, the cost benefit analysis of tourist growth is usually focused on these positive impacts, paying little attention to social, environmental and other consequences that are generally connected with tourist growth (Warren and Taylor, 1994) and specifically with marine tourism.

Worldwide a lot of important cases have been recorded, establishing beyond doubt the negative impacts, which are connected with the interaction between marine tourism and natural environment.

A lot of people express their concern for the negative impacts of marine tourism to marine ecosystems. Many cases, not only in Greece but internationally as well, have been occurred that endorsed all these concerns. Thus:

- i. Greece. In Zakynthos, the great and uncontrollable increase of coastal hotel units construction and the raise of demand for marine sports, brought about considerable destructions to regions where Careta-Careta and the green turtle *Chelonia Mydas* nest. The shrinkage of coastal region that is used for egg laying, due to uncontrollable tourist growth, the noise from hotels, the vehicles and amusement centres, the lights that disorientate the nestlings, the beach umbrellas etc, act as a check on egg laying and incubation.

- ii. Internationally. In Florida, U.S.A., the existence of a mammal tribe known as sea cow (*Trichechus manatus*) raised the tourist flow for dives and ship excursions in the region, in order visitors to enjoy this unique sea mammal. The period (from November up to March) that mammals are gathered in the region, the divers' density in water reserve can come up to $1/10\text{m}^2$. Despite the legislation in force for the non-disturbance of animals' peace, many try to caress, hit or even ride them.

Serious problems have also been observed in Galapagos Islands, 1000 km westwards of Equator. These islands are worldwide known for their exceptional beauty and big variety of flora and fauna. They are considered as "progress laboratory" in practice. The most important resource of islands is marine flora and fauna, which constitutes also the most powerful centre of tourists' attracting, that combine holidays with dives, fishing and marine activities.

U.N.E.S.C.O. classified the islands in the World Natural Heritage List and Equator's government voted, in 1998, a special law for the limitation of migration, the expansion of marine reserve limits round the islands, the transport restriction of imported animal and vegetable species and the growth rate of national revenue from tourism that disposed to the National Park. Despite these measures, population of islands has increased in relation to the past, while the number of visitors increased as well (Benchley, 2002:20-21). Despite the efforts to keep the natural environment unalterable, the impacts are unavoidable i.e. it was realised that although cruise ships are mooring far from islands so not to disturb island's balance, ships lights attracted thousands of insects that followed them when sailed. As a result, species of insects that constituted part of food chain were disappeared, as was other animal's species food.

In the coast of Mombasa, Indian Ocean, accommodations in coastal regions cause beaches depopulation and destruction of coral reefs due to wastes, pollution and tourists' behaviour as well (Burns and Holden, 1995:163). It is not unusual the coral breakage by tourists that wish to take some as souvenir, the corals, conches and other similar souvenirs sale from the locals, the reefs havoc by tourists that walk on them, the over-nourishment of sea flora and fauna by dregs and the incident increase of the seaweed extract that threaten swimmers etc.

The posed question is whether each marine tourism institution (public and private) can undergo a realistic management. The in question management

refers to the use and organisation of coastal and insular land, to the administration of marine tourism corporations, to the more advantageous exploitation, for local's good, of the cross-cultural communication, by adopting models that will be in place to preserve traditions, folkways and finally by carrying out plans, friendly to coastal environment, for marine tourism development.

The above economic activities cause conflicts and disagreements that are developed either in overland i.e. grounding for living quarters and hotel facilities, roads opening up, region port building, land-field of region, or in marine area i.e. professional fishery, amateur fishery, marine tourist activities etc.

However there are conflicts and disagreements in sectional level that penetrate marine and overland regions as the industrialisation of coastal environment i.e. shipyard facilities, transformation of coastal environment to touristic i.e. hotel business with hotel-tourist port, the urbanisation of coastal environment i.e. extension of city, transformation of coastal environment to transport center i.e. streets and airports opening up etc.

Fishing industries, sea transport and tourist industries compete for the vital space of coastal areas (E.C. 2002:5) that indicatively in European Union are extended to nearly 89.000 km long, and lodge some of the most sensitive and precious natural living quarters of Europe (European Committee 2001:3).

Conclusively, the impacts to coastal environment are several and often act multiplicative. These consequences can be grouped as follows:

- Loss of natural resources that local populations traditionally consider as given.
- Alteration of coastal environment by installations and infrastructures, usually unfamiliar with local and traditional rhythm.
- Natural environment alteration and aesthetic degradation.
- Excess of region's capability.
- Noise pollution, especially in the peak time, which affect not only the local overland but sea flora and fauna also, as well as residents' and tourists' way of living.
- Pollution of coastal and marine ecosystem.

3. The sustainable development

Economic activities in residential, industrial, tourist and fishing sector have negative impacts to biodiversity of coastal environment. Competition of land-use in coastal environments and particularly the need for tourist and residential growth, leads to the extension of structured environment against the natural one. Many times, land-use zoning is applied, in order ecological sensitive regions to be protected on the one hand, and the growth of activities which involve danger for the ecological balance of region to be warded off on the other (Vlahos 2001:88).

The interaction between anthropogenic and natural environment, in conditions of antagonism that are shaped by the requirement of economic growth, transforms the coastal environment.

The sustainable development of coastal environment requires integrated management that has to be based on the counterbalance of different factors. This factorial polymorphism has ecological, economical, social, cultural and administrative characteristics.

The sustainable development should maintain the coastal environment and the social-cultural identity of region, as this (the coastal environment) constitutes natural resource with multiple possibilities of economic exploitation. Political planning of this exploitation should aim to the satisfaction of social needs. Essential component of political planning is the participation of citizens, local government and state administration. It is very important the participative management of coastal environment, in order the more suitable policy to be applied and besides action in national, regional and local level to be undertaken. However, indispensable in this type of management should be the public education so as to understand the operation of ecosystems (UNEP 1998) that is essential condition for the perception of ecological, aesthetic and cultural importance of coastal environment. European Union, working within the above framework, calls all its country-members to work out national strategies of coastal areas integrated management (COM 547/27-9-2000). Besides, European Union tries to establish a coordinated policy of the Union's coastal regions, encouraging the -per regional sea- approach of Mediterranean and Baltic countries coastal policies.

REFERENCES

- Benchley, Peter (2002), "Galapagos. The heaven is in danger", National Geographic GREECE.
- Burns, P.M. - Holden Andrew (1995), *Tourism. A new Perspective*, Prentice Hall.
- COM (2000) 547/27-9-2000.
- Emberlin, J.C. (1996), *Introduction to Ecology*.
- European Commission (2002), *Choices for a greener future*, Luxemburg.
- Fischler, Franz (1999), *The future of aquaculture in Europe*, 3rd annual Conference PESCO, Santiago de Compostela - Spain, 5th November 1999.
- Miller, M.L. and Auyong, J. (1991), "Coastal zone tourism: a potent force affecting environment and society", in *Marine Policy*, March
- Passet, Rene (1987), *Economy and Environment*, Paratiritis, Thessalonica.
- Thompson, S.A. (1999), *Water Use. Management and Planning in the U.S.* Academic Press.
- UNEP (1998), *Guidelines for integrated management of coastal and marine areas*.
- Warren, J.A.N. and Taylor, C.N. (1994), *Developing Ecotourism in New Zealand*. New Zealand Institute for Social Research and Development, Wellington.
- Wheeler, J.-Thrall, G. (1998), *Economic Geography*, John Willey and sons, N.Y.
- Willis, K.G. (1991), *The priceless Countryside: The recreational Benefits of Environmental Gods*, Royal Bank of Scotland Review.
- Vlahos, A. (2001), *Environment and Natural Resources*, Kritiki
- Goulielmos A. (1997), *Coastal and marine industries management*, Stamoulis.
- European Committee (2001), *Coastal zone*, Luxembourg.
- Mylonopoulos, D. – Moira, P. (1996), *Maritime Economic Geography*.
- Mylonopoulos, D. (2003), "The Maritime heritage as civilized pylon of globalisation", International Conference "Mediterranean. Maritime Routes", Maritime Museum of Greece, Athens.
- Xenos, D. (2002), *Environmental and Natural Resources Economy*, Papazisis
- Pardali, A. (2001), *The Port Industry*, A. Stamoulis.

BUSINESS PROCESS REENGINEERING USED AS A CREATIVE OPTION TO IMPLEMENT STRATEGY EFFECTIVELY

ANDREAS P. KAKOURIS

T.E.I. of Athens

Abstract

Corporate management is looking for ways to exploit organisational competences, to regain competitiveness, to achieve long-term sustainability and to focus the processes closer to the customer. It recognises the need for change and it searches for widely accepted execution plans or methods available to support such change. Business Process Reengineering (BPR) seems to have captured the imagination of corporate management, as it is an important and powerful management technique for change and value creation, provided that the processes to be re-engineered have been carefully selected by establishing what will be the greatest impact on customer service, the company's strategic and marketing positions and its profitability. Information Technology (IT) through Enterprise Resources Planning (ERP) systems plays an important enabling role.

The scope of this paper is to help clarify and sort out the confusion surrounding BPR, through a literature survey. The approach used addresses the following topics: appearance of BPR, what it is and what it is not, definition of BPR, BPR tools and techniques, BPR and IT, current trend towards reengineering, identification of reengineering opportunities, how to develop, issue and evaluate reengineering and contract issues to avoid. Specific emphasis has been placed on the IT and BPR relationship, providing a summary of IT roles in initiating and sustaining BPR. The paper also addresses barriers to successful implementation of reengineering and identifies critical factors for both its success and its failure. Finally, it describes, through a case study, a successful implementation of SAP R/3 to re-engineer the business processes of a major manufacturer together with the lessons learned.

JEL classification: M19.

Keywords: Business Process Reengineering (BPR), Information Technology (IT), Enterprise Resource Planning (ERP), SAP, Change, Processes, Management.

1. Introduction

Increased competition, new and changing needs involving the successful

management of real economics, products flow, and customer interaction, have forced companies to reconsider the way they are organised and conduct business. Change is the only constant in a continuously changing environment. In fact, it happens not at a steady linear rate but is increasing exponentially and irreversibly. Under these circumstances, companies are searching for ways to gain better control of their business and mechanisms like BPR seems to move them in this direction.

BPR is the Western World's answer to the Japanese Kaizen or continuous incremental improvement (Imai, 1986), which calls for a great deal of continuous effort and commitment. In fact with continuous improvement, both actions and decision-making is "on the shop floor", and not only in the hands of the management. BPR, on the other hand, is: "starting all over..... starting from scratch..... abandoning long-established procedures and looking afresh....., it doesn't mean tinkering with what already exists or making incremental changes that leave basic structures intact". (Hammer and Champy, 1993). BPR is undeniably an important and powerful management technique, which has gathered such momentum that current literature is replete with reports highlighting its successes. However, many others believe that reengineering falls well short of its potential (Hall *et al*, 1993; Grover *et al*, 1995; Pegels, 1995; Johannessen *et al*, 1997; Jarvenpaa and Stoddart, 1998;) or is dead (Harari, 1996). Literature indicates that there are more organisations in the failure than the success category. Not surprisingly, since this has been the case with every "new" significant managerial and organisational initiative that has ever been developed (Robson and Ullah, 1996). Improvements brought about reengineering of 50-80%, some even over 100% are widely quoted in literature (Peppard and Rowland, 1995). They are often reported in terms of reduced costs, lower stocks, shorter lead times, and higher productivity. Failures in the area of 70 to 80 % are quoted (Bennis and Mische, 1995) with the two most prevalent reasons being that (a) reengineering must unite many divergent interests, needs, skills, and departments into highly effective, cross-functional, and integrated business units, and (b) the significant discrepancy in the influence of IT during reengineering, otherwise termed the "divergence gap" (Whitman, 1996). On the positive side, one thing is clear; the rapid pace of IT advancement is a further reason why BPR has proved to be so popular. ERP systems are some of the information technologies that support seamless

integrated key business activities and management functions and provide a view of the happenings in all company's functions. SAP and similar applications software have been broadly implemented (Caldwell, 1998; Al-Mashari and Zairi, 2000b, 2000c) to embrace the breadth and depth of the cross-functional requirements, due to the combination of new technology, change management and business reengineering offered by these systems.

BPR is not a new subject, at least, from the conceptual point of view. What it does is to skilfully and carefully consolidate the many features of the latest electronic commerce technologies and not just computer technology, together with the technologies of managing change and managing people, to more radical manners in the way businesses are run than was possible in the past.

Studies have showed that firms were either engaged in BPR projects, or are willing to take up BPR projects in the next few years.

The scope of this paper is to help clarify and sort out the confusion surrounding BPR, through a survey of various leading business journals, popular business magazines as well as books on this field. It is wise to better understand what BPR involves, to think and consider its potential carefully and how it can fit into the framework of a company's improvement process, and then to start to plan and implement it in a thorough and professional manner. The approach used addresses the following topics: appearance of BPR, what it is and what it is not, definition of BPR, BPR tools and techniques, BPR and IT, current trends in reengineering, identification of reengineering opportunities, how to develop, issue and evaluate reengineering and contract issues to avoid. Specific emphasis has been placed on the IT and BPR relationship, providing a summary of IT roles in initiating and sustaining BPR. Finally, it describes, through a case study, a successful implementation of SAP R/3 to reengineer the business processes of a major commercial company, together with the lessons learned. The reported case represents an ERP application which acted as a mechanism for reengineering.

2. Reengineering

Market turbulence and IT developments over the last few years has led to changes in the rules of competition and the ways companies are organized (Scott Morton, 1991). Companies are faced with a constantly

changing, uncertain economic environment that has forced them to reconsider the way they are organized and conduct business in general. They explore concepts, ideas and techniques like Activity Based Costing (ABC), Total Quality Management (TQM), Quick Responses (QR), Process Innovation (PI) and Business Process Reengineering (BPR) in an attempt to counterbalance the situation.

BPR first appeared in the 1990s and since then it has gained such momentum and been so widely accepted, that literally hundreds of articles have been written regarding the reengineering concept. Yet, as it picks up speed, it has also created much confusion as to: how it appeared, what reengineering is and what it is not, where it leads, what are the key ingredients of a successful reengineering project, when it should be used, and how the concept can be applied correctly.

2.1. How BPR appeared (History)

There is some debate on the origin of reengineering with some believing that is manufacturing breaded while some others believe that it is IT breaded.

a. Manufacturing breaded

According to Chase and Aquilano (1995):

“the concept of reengineering has been around for nearly two decades and was implemented in a piecemeal fashion in organizations. Production organizations have been in the vanguard without knowing it. They have undertaken reengineering by implementing concurrent engineering, lean production, cellular manufacturing, group technology, and pull-type production systems. These represent fundamental rethinking of the manufacturing process. Manufacturers generally made significant improvements in their internal operations during the 1980’s. But excellence in manufacturing has not always translated to superior sustainable results in the marketplace. More recently, the focus appears to have shifted out of the manufacturing process to other interfunctional and interorganizational and customer-based processes. The 1992 Manufacturing Futures Survey reports similar views held by manufacturing executives. Rapid advances in information technology and its applications have been a major enabler of business process reengineering in services”.

From a survey of top-level managers at 200 companies, only 40% of manufacturing executives recognize the need for change, with the corresponding figure from service executives being 80% (King, 1993). The rather high percentage need to change from service executives lies in the intangible character of service business itself, where for example, it is not possible to consider product innovation without considering the related reengineering process. In contrast, the perception of a low need for change in manufacturing can be attributed to the fact that the manufacturing industry has already reengineered some of their processes, during its long history, by using techniques or concepts which may be named differently, like lean production, Just-in-Time, zero defects, quality circles and TQM but meaning the same thing as that the recently introduced term “reengineering”, invented by the guru of reengineering, Hammer and Champy in the 1990s. It is worth mentioning that most of these managerial ideas and concepts originated in Japan as shop-floor techniques, before being introduced to the USA and transformed into organisational models such as: Statistical Quality Control vs. TQM and JIT vs. Lean Production. It is interesting to quote how the Economist (1994) describes the reengineering movement:

“Reengineering is a management mongrel. On the one side its ancestors are Japanese theories about lean, flexible, just-in-time production; on the other hand, American ones about redesigning companies from bottom up”.

Interestingly enough, though the Japanese are willing to develop the new process – and in fact they are doing it at a faster pace than their American and European counterparts – they do not usually use the term reengineering to describe radical process change (Anon, 1991).

The manufacturing roots of reengineering are also stressed by Lowenthal (1994), who claims that reengineering started in the 1980s when the US auto industry, battered by Japanese rivals, began to integrate car design with assembly-line automation.

b. IT bred

According to Attaran (2004) the term “reengineering” first appeared in the IT field and has evolved into a broader change process, as many US companies embraced it as an effective tool to speed up the process, reduce needed resources, improve productivity and efficiency, and improve competitiveness (Hammer and Stanton, 1995; Verespej, 1995; Wellins and Murphy, 1995).

One reason for BPR was the significant cost reduction of IT, in the 1990s, which led to massive IT investments in IT applications, through systems able to stimulate increasingly complex organisational processes. This, in turn, fuelled process reengineering, as people see it as an enabling tool.

Another reason relates to the increasing emphasis placed on integrating business web sites with backend legacy, enterprise systems, as well as organizational databases (Nissen, 1998; Broadbent *et al*, 1999; Kalakota and Robinson, 1999), which require considerable reengineering.

Working together, BPR and IT have the potential to create more flexible, team-oriented, coordinative, and communication-based work capability (Whitman, 1996). According to Grovera *et al* (1998), BPR and IT are natural partners in a relationship that has not been fully explored yet.

c. Other

There is a group of researchers who believe that the fundamental ideas behind the reengineering concept are, in many cases, simply well established management and marketing doctrines. Also, they believe that reengineering only borrows ideas that have been around for a while, and repackages them in an approach for managing changes which may lead to productivity and quality improvements (Ardhaldjian and Fahner, 1994).

While the genesis of reengineering is a debated subject, one thing that is clear is that it has become one of the most written terms and is popular in industry. For example, in 1994, over 800 articles had the term “reengineering” in their title. Its overwhelming acceptance in industry can be seen from its wide application in the industry. One study showed that about 87% of firms surveyed were either engaged in BPR projects, or indicating their intention to take up BPR projects in the next few years (Ranganathana and Dhaliwal, 2001). Another survey of over 500 senior executives revealed that 41 percent were reengineering their companies (Aurand *et al*, 1996). A separate study found as many as 88 percent of large corporations involved in reengineering (Bashein *et al*, 1994; Cavanaugh, 1994). Indeed, well-known and diverse companies such as General Electric, Harley Davidson, NEC Technologies, Owens Corning, Texaco USA, Texas Instruments and Xerox, have all undertaken reengineering efforts in the past.

The concept of the radical restructuring of business processes was first coined “reengineering” by Michael Hammer in 1990 (Hammer, 1990). He

later copyrighted the term, and since then it has become part of everyday corporate language when Hammer and Champy's best selling book, *Reengineering the Corporation: A Manifesto for Business Revolution*, was first published in 1993.

2.2 What BPR is and what is not - BPR: definitions and barriers

Therefore the roots of reengineering originate from industrial engineers, methods analysts and experts who are trying to fix something that is defective. Who then, from the managers, would not support the idea of taking something that is defective and then fixing it? This is exactly its evolution and simulation into today's organisation business. Reengineering is a pervasive and labelled term of efficiency for transforming organisations. Lack of understanding of the concept and inappropriate application will all contribute to organizations' failure to appreciate the promise of reengineering (Heusinkveld and Benders, 2001). Its recent promotion covers the adoption of radical means to corrective actions and as Hammer and Champy (1993), the two expert consultants who head the reengineering movement, state:

"Business reengineering means starting all over, starting from scratch."

"It means forgetting how work was done ...old titles and old organizational arrangements ...cease to matter. How people and companies did things yesterday doesn't matter to the business reengineer."

"Reengineering ...can't be carried out in small and cautious steps. It is an all-or-nothing proposition that produces dramatically impressive results."

"... the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed."

Other commonly used definitions appeared in the reengineering literature include:

"... radical or breakthrough change in a business process. Reengineered process designs seek dramatic orders of magnitude, as distinguished from incremental improvements in business value." (Dixon et al, 1994).

"... involves radically changing and reinventing the way work is done" (Greengard, 1993).

"... the fundamental rethinking and redesign of operating processes and

organizational structure, focused on the organization's core competencies, to achieve dramatic improvements in organizational performance.” (Lowenthal, 1994).

While there is an apparent variation in definitions, there are some keywords like: fundamental, radical, dramatic and process that appear in virtually all generally accepted definitions of reengineering and encompass the whole meaning of the message (Hammer and Chamy, 1993).

Fundamental: To ask the most basic questions about organisations and operation, such as: (a) *why* do we do *what* we do, and (b) ignore what is and concentrate on *what should be*.

Radical: To get to the roots of things by *reinventing* business and *not* enhancing, improving or modifying them

Dramatic: To promote quantum leaps in performance. Reengineering should be brought in “when a need exists for heavy blasting”, such as: (a) companies in deep trouble, (b) companies that see trouble coming, and (c) companies that are in peak condition.

Business

Process: To look at the entire process that cuts across organisational boundaries. To be process-oriented.

From the above four words, business process is the most important and the one that give managers trouble. But what is a business process? Process is a vague word that encompasses so many meanings that it is hard to define. In practice, almost anything that involves time can be called a process under some form or another. Because time is the essence in a process, it is very difficult to grasp intellectually. In fact, it can be captured through the events derived from the process that is witnessed. A comprehensive review of the existing literature reveals the difference of opinions as to what constitutes a business process:

“a set of logically related tasks performed to achieve a defined business outcome” (Davenport and Short, 1990)

“a collection of activities that takes one or more kinds of inputs and creates an output that is of value to a customer” (Davenport, 1993)

“an ordering of work activities with a beginning, end, and clearly identified inputs and outputs” (Davenport, 1993)

“simply a structured, measured set of activities designed to produce a specified output for a particular customer/market” (Davenport, 1993).

“a set of activities that, taken together, produces a result of value to a customer” (Hammer and Champy, 1993)

“any sequence of pre-defined activities executed to achieve a pre-specified type or range of outcomes” (Talwar, 1993)

“a sequence of dependent events” (Balle, 1995).

“term often used to describe the collection of techniques which are used to model existing and develop new business processes” (IBM, 1995);

It is evident that there is no clear and agreed definition of this term (Irani *et al*, 2000); on the contrary its definition is arbitrary and incomplete. How then can someone understand reengineering, when he has inherent difficulties in defining the term Business Process, itself?

The review of the literature (Al- Mashari and Zairi (1999, 2000a) showed that there is a lack of common and standardised terms and definitions for BPR, and other types of improvements related to it. This is illustrated well by a Gateway Management Consulting, Incorporated survey of 121 senior executives, who were asked to define reengineering. All readily did so, but common consensus was not reached. They defined reengineering as process redesign (46 percent of respondents), technology changes (17 percent), product improvements (16 percent), efficiency improvement (8 percent) and customer satisfaction (4 percent) (McPartlin, 1992; Manganelli and Klein, 1994). Then it is not surprising that although many business people claim their organizations are reengineering, few can define the term (Nickols, 1998), explain how it is used, or elaborate on what specific results have been achieved as a result of reengineering efforts (Whitman, 1994).

In a further effort to clarify a term that has been subjected to such controversy, a list of some of the more prevalent myths is presented next when trying to describe, “what reengineering is not”.

Myth 1: It is about Information Technology and automation.

Reengineering enables new process design. It does not provide new mechanisms for performing old processes.

Myth 2: It creates anxiety. As a changing process, it does create some anxiety which need not be detrimental but creative.

Myth 3: It means destroying your organization. Reengineering is not concerned with how an organisation is structured but rather how work is done.

Myth 4: It means downsizing. Reengineering eliminates work, not jobs or people. Companies embedding BPR and voluntarily forfeiting their talents, “downsizing” became synonymous to “committing suicide”.

Myth 5: It can be managed by anyone. The person who serves as the transformation leader requires to have, amongst others: strong leadership skills and business judgment, knowledge of the BPR process itself, commitment to change and credibility.

Myth 6: It “fixes” everything. BPR is a process that changes the organisational culture and creates new processes and new structures, not a solution that fixes every isolated problem.

Myth 7: It is a scientific process. Although certain scientific techniques may be used in a BPR project, it is not a scientific process itself. Reengineering at its best represents the fusion of information technology and management– *science* and *art*. The term “engineering” implies a body of scientific knowledge that can be taught, and whose results can be measured and quantified. The art of managed change rests not only on the ability to assess organizational readiness and capability to implement change from a cultural, human resource, financial or technological standpoint but also in determining which combination of business engineering approaches will yield the desired results in a given organization (Grotevant, 1998).

The non-scientific nature of BPR was also stressed by Davenport (1995), the guru of BPR, who treated the subject of BPR from the teaching point of view, dealing with questions such as: “Is reengineering a fad, and if so is there a time when we should stop teaching it”; “what to teach”; “how to teach it”; “where within the university should be the teaching take place” and “who should teach reengineering”?

He identifies information systems departments as a valid place to teach the topic, as he believes that legitimately they are the originators of reengineering. However, he admits that due to the high popularity of the subject, reengineering courses not only in Information Systems, but also in organizational behaviour (with a work design emphasis), operations management (with a manufacturing process emphasis), and even accounting (with a

financial systems emphasis) are now in existence. Finally, he believes that those teaching reengineering must be persons with “diverse experiences”.

Myth 8: It can be implemented effectively only in large companies.

Myth 9: It requires major investments in technology.

Therefore, it is evident, that there is a great need for more research into BPR definitions and terms from both academics and practitioners of BPR, in order to develop a more and common use of the term. BRP supports a radical change of both structure and processes in the organisation. The best tools to begin a reengineering project are to start from scratch or with a clean slate approach. In fact, Davenport (1994) identifies five combined primary concepts that make up Business Redesign:

1. A clean slate approach to organisational design and change.
2. An orientation to cross-functional business processes, or how work is done.
3. The need for, and possibility of, radical change in performance.
4. Information technology as an enabler of change in how work is done.
5. Changes in organisational and human arrangements that accompany change in technology.

2.3. Where BPR goes

Champy (2002) - the consultant who coined the expression business reengineering, together with Hammer - argues that BPR was the 1990's remedy for sluggish corporations that lacked customer focus and competitive ability. Today, he sees reengineering as only a beginning, as businesses will need to continue by using technology to add customers, suppliers, and other partners to the process redesign mix. The redesign of work will be between a company and its customers, suppliers and partners, naming this process X-engineering and citing examples of successful X-engineering implementations in companies such as Cisco, Dell, Intel and Solectronoundaries. IT has assumed control of the business to such extend that it has broken down all communication isolations and improved information access. Not only does it now support processes, but it actually creates new ones as well. Therefore, it should not be seen as a way to

automate existing business, but as a support tool to improve information access and coordination across organizational units. Gates (1999) advocates complete digitalisation of companies with new digital infrastructures similar to the human nervous system that will enable companies to run smoothly and efficiently, make them respond quickly to emergencies and opportunities, and provide a means for quickly getting valuable information to the people in the company who need it. Also, he argues that if the 1980s were about quality and the 1990s were about reengineering, then the 2000s will be about velocity.

2.4. Key Ingredients of a Successful BPR Project

Many projects come under criticism and fail to deliver results (Al-Mashari and Al-Mudimigh, 2003). They waste huge budgets that run amok and staff wastes their time in the process. BPR is no exception if companies do not carefully select the processes to be reengineered and do not establish what will have the greatest impact on: customer service, the company's strategic and marketing positions and its profitability. While some of the criticism may be deserved, most is based on misunderstanding. Applying a BPR methodology, which aims to assist customers to prosper in an environment that grows more competitive daily, demands the proper use of the BPR principle. A proper BPR implementation can achieve results that exceed a company's most ambitious targets. Over the year's businesses using BPR have been seen to:

1. Reduce operations management costs 35 per cent;
2. Improve customer service ratios 80 per cent;
3. Reduce advertising and marketing costs 40 per cent, while maintaining effectiveness;
4. Cut inventory levels 30 per cent.

The scope in undertaking a BPR project is to provide a method to improve processes in practice. Some times it can create unrealistic expectations, if the following parameters are not be fully considered carefully:

a. Lack of proper strategy

Wu (2002) identifies the major reason for the high failure rate of BPR projects is because the efforts are not connected to corporate goals.

Tomasko (1993) states: “Don’t fix stuff you shouldn’t be doing in the first place”. Reengineering is about operations, and only the strategy can show which operations matter. Reengineering programs should concentrate on understanding the existing process. Expectations must be set in crystal clear form and in quantitative terms.

b. Define the output

Many BPR projects lack focus with unclear objectives. This is why before embarking on the processes, it is important to have a clear knowledge of “where you want to go” both actual and desired, as it will be the yardstick on which to base:

1. The expected form of the output
2. The starting point of the process
3. The duration of the expected output.

c. Choose the Right People

To be successful, both managers and key users of the processes being reengineered should be committed and actively participate in it, not only before or during, but also after the reengineering is implemented. Only by working together they can improve their long-term opportunities. BPR is a team based technique that takes advantage of the collective experience of the practicalities of work to find the necessary conditions that will support the creation of new jobs, even if in the short run some of the existing jobs will have to cease to exist. In BPR projects, people study the “as-is” conditions and propose “to be” alternatives. Reengineering changes almost every employee’s job causing them to acquire new skills at all levels. Moreover, it combines many job categories, so it creates anxiety and fear. It is the job of the management to quell these fears and cope with the reaction of employees. Making employees feel they own the reengineering efforts can improve employees’ morale and soothe negative feeling (Thomas and Dunkerley, 1999). Any employee with an understanding of the business should participate; while external help is requested only if it does not already exist anywhere internally.

Undisrupted elements involve: an *executive sponsor* and reinvention steering committee from the highest levels of the organisation which establish strategies and policies, provide direction and funds and resolve issues; a *transformation leader* to guide the organisation through the

reengineering journey; a *process champion* to serve as a specific reengineering process; *technology* and *resource people* to provide a sounding board for determining the feasibility of ideas and suggesting new ways to go about things. They all have to follow a *well-orchestrated* reengineering process that will bring minimal damage and disruption.

d. Communicate

Two-fold communication is vital. Management should clearly communicate its commitment throughout the project, so that both project team and key users do believe that the company's intention to achieve fundamental change and management is behind its initiatives. People, on the other hand should also communicate.

e. Go After Quick Wins

Often projects are so prolonged that they lose sight of the ongoing success. They miss the opportunity to implement the important quick wins and this hampers people's enthusiasm, as they cannot see the results of their success. So the message is: "Go after quick wins and do not postpone the implementation of all changes until the end of the project".

f. Measure Progress Regularly

Measurement of the project progress should be done regularly with the implementation of the right key performance indicators, which must also be monitored and reviewed to reflect the changing needs and progress. Needless to say, that the information used must be representative and properly filtered to ensure data conformity.

g. Unrealistic Expectations

Either the unclear definition (or misunderstanding) of what BPR is, and/or its immoderate promotion as the "magic wand" that solves all problems, means that management frequently has unrealistic expectations of what a BPR project can accomplish. Examples of improvements in the order of 50-80% or even over 100% have been reported (Peppard and Rowland, 1995) and this has created an enthusiasm response from management, which rushes to implement BPR. But of course, no two companies are the same. Experience has shown that BPR projects always involve more resources than scheduled, take longer than expected and present more problems than

anticipated (Attaran, 2004). According to a survey by Arthur D. Little (Attaran and Wood, 1999), only 16% of senior executives were fully satisfied with their reengineering programs. About 68% were experiencing unanticipated problems. It was concluded that much of this came from setting unrealistic targets. It was also pointed out that nobody knew whether reengineering programs did increase revenues and profits.

h. Lack of sponsorship/leadership

Reengineering efforts have a great tendency towards failure if project-sponsors come either from the low-level management hierarchy or are technically oriented. In BPR projects, the sponsor should not only come from the highest level of the organisation, for example: Chief Executive Officer (CEO), Chief Operating Officer (COO) or Chief Financial Officer (CFO), but he should also embody the elements of: leadership, credibility and commitment. These elements, together with his prestigious status, are the essential ingredients to: set the pace and direction within the organization, instil motivation and assist in overcoming internal barriers and doctrines. According to Sutcliffe (1999) “BPR implementation requires a top-down, directive leadership style. Yet, it also requires the management of motivated, skilled, independent-thinking people doing non-programmable tasks for which a non-directive leadership style is most suited”.

i. Others

1. it has to be practical and not theoretically based.
2. it will happen live along with the day-to-day work (and processes).
3. it will be team based – relying on the accumulated know-how of existing employees.
4. it will be results oriented, as the customer, either internal or external, will be the one who will judge its output.

3. IT capabilities and reengineering

For years now companies have been searching for tools to gain better control of their business. The utilisation of the continuous changes in technology, in order to satisfy the continuous needs and demands of prospective business, has

been the greatest challenge for every company wishing to lead in the years ahead. ERP systems are some of the technologies that support moves in this direction (Muscatello *et al*, 2003). ERP aims to seamlessly integrate key business activities and management functions and to provide a view of the happenings in the company, in the areas of finance, human resources, manufacturing, supply chain, etc (Davenport, 1998; James and Wolf, 2000; Kumar and Van Hilleberg, 2000), in order to achieve a competitive advantage (Davenport, 2000; Al-Mudimigh *et al*, 2001). However, IT itself cannot provide an economic return. To be of any use, it has to be linked with process innovation, as a change in a process can yield productivity benefits and thus economic returns (Davenport, 1993). Consequently the role of IT is to make a new process design possible. The notion of an IT system as enabler is a clever approach to achieve dramatic improvement in business processes.

The evolution of ERP was the result of the shortcome of MRP & MRP-II functionalities and inability to incorporate Finance, Supply Chain, Human Resources and Project Management functionalities, thus impeding the flow of information throughout the organisation. Amongst the leaders in ERP systems, SAP's product R/3 has emerged as an extremely popular choice for medium to large companies that need an integrated software product and is now one of the most used tools for optimising and reengineering business processes (Cooke and Peterson, 1998; Keller and Teufel, 1998; Buck-Emden, 2000). SAP R/3 provides a set of business application software modules that are integrated, and span most functions required by a major corporation, including manufacturing, finance, sales, supply chain and human resources. (Hicks, 1997; Mullin, 1997; Rick, 1997; Supply Chain Council, 1997; Bancroft *et al*, 1998; Martin, 1998). The system provides true integrated real-time enterprise wide information system processing, which makes it a hot seller! (Bancroft *et al*, 1998). Numerous companies have successfully implemented SAP (Elliott, 1997; Bancroft *et al*, 1998). However, there are many cases, as the relevant literature reveals, when such software projects fail; and it is not always because the applications did not work (Bicknell, 1998; Boudette, 1999), but because the enterprise rejected them (Laughlin, 1999). Several studies on ERP implementation (Ross and Vitale, 2000; Scott and Vessey, 2000; Soh *et al*, 2000; Murray and Coffin, 2001) have revealed such issues as: top management support, organizational-wide commitment and change along key areas, culture change, effective implementation team

work and others as the critical factors for the success of an ERP project. And as Nah *et al*, (2001) declare: people, costs and technology must be simultaneously managed through changes to ensure success. The exclusive focus on either parameter at the cost of change management elements has proved to be a major source of failure.

3.1. What is the relation between BPR & Information Technology?

While IT is recognized as the key enabler of BPR (Naisbitt and Aburdene, 1985; Davenport and Short, 1990; Hammer, 1990; Harrington, 1991; Hammer and Champy, 1993; Macdonald, 1993; Tapscott and Caston, 1993; Venkatraman, 1993; Attaran, 2003) its impact as an enabler is not well understood. Davenport and Short (1990) argue that BPR stresses the need to take a broader view of both IT and business activity, and of the relationships between them. IT capabilities should support business processes, which in turn should be in terms of the capabilities IT can provide. Also, they believe that IT is the most powerful tool for reducing the costs of coordination. Teng *et al* (1994) argue that innovative uses of IT would inevitably lead many firms to develop new, coordination-intensive structures, enabling them to coordinate their activities in ways that were not possible before, which eventually may lead to strategic advantages, something that Hopper (1990) has seriously questioned. Working together, BPR and IT have the potential to create more flexible, team-oriented, coordinative, and communication-based work capability (Whitman, 1996). According to Grovera *et al* (1998), BPR and IT are natural partners in a relationship that has not been fully explored yet.

However, it is wrong to believe that BPR and IT are the two sides of the same coin. This misunderstanding has come about as a result of the misconceptions:

1. that the first group of people who scientifically (seriously) engaged in reengineering were the IT people, something evident from the literature, and
2. most of the “noise” about BRP tends to come from the computer companies that try to overstate every little success, attributing it to the advantages of IT and more specifically to the IT-software they offer.

It is interesting to quote Thurow’s (1993) observations in a major MIT study on the impact of IT on business:

“specific cases in which the new technologies have permitted huge increases in output or decreases in costs can be cited, but when it comes to

the bottom line there is no clear evidence that these new technologies have raised productivity (the ultimate determinant of our standard of living) or profitability. In fact, precisely the opposite is true. There is evidence, in the United States at least, that the investment in the new technologies has coincided with lowered overall productivity and profitability”.

Davenport (1998) argues that companies would not expect an IT investment itself to provide economic return; instead it has to be linked with process innovation. Only change in a process can bring productivity benefits and the role of IT is to make a new process design possible.

A considerable number of well-known and diverse companies such as American Express, Cisco Systems, Dell Computer, FedEx Corp, Ford Motor Corp, Hewlett-Packard Co., Pfizer Inc., R.J. Reynolds, Texas Instruments and Wal-Mart have reported IT enabled reengineering successes with a combination of breakthrough ideas and from modifying the ideas that have succeeded or failed in other companies.

4. Case Study

A case study design was elected for use in order to explore the role of IT in BPR. Case study design enables us to ‘investigate a contemporary phenomenon within its real life context’ (Yin, 1994). For a successful ERP implementation, an organisation should make the necessary adjustments and changes to its business processes to ‘fit’ the package (Koch *et al*, 1999; Sumner, 1999), or to reorganise its business (Schneider, 1999). Thus a comprehensive change program is necessary to remove all traditional cross-functional barriers such as contradictory objectives and performance measures that lead to inconsistent value and belief systems (Donovan, 1999). This is further supported by the fact that changing the ERP system to fit the current business processes will slow down the implementation process, introduce dangerous bugs into the system, and will make upgrading an extremely difficult and risky task (Koch *et al*, 1999).

Bingi, *et al* (1999) advises that the degree of match between the standard practices embedded in the software package and the ways the company is doing business be checked carefully, in order to avoid the painful consequences when most of its modules do not fit the business (Edwards, 1999; Koch *et al*, 1999).

Further, Bingi *et al* (1999) state that: “Research shows that even the best application package can meet only 70 percent of the organizational needs”. Experience has proved their point, so the question that immediately arises is:

1. What happens to the remaining 30%?
2. Does the organization have to change its processes to “fit” into the whole ERP package, to customize the software to suit all its needs, or to leave out and purposely ignore the remaining 30%?

Obviously an organisation cannot ignore such high percentage ERP inefficiency, in which case it has either to customise itself to the package or vice versa. If the package cannot adapt to the organization, then the organization has to adapt to the package and change its processes. However, when an organization customizes its software to match its needs, the total cost of customisation (or implementation) rises. In addition both the maintenance costs and the future cost of upgrading the system rises too. In fact, the more the customisation, the greater the cost. Essentially, ERP systems are regarded as ‘the missing link to reengineering’ (Lieber, 1995) as they enable BPR-efforts (Restivo, 1998; Champy, 1999) by integrating the various processes (Kalakota and Whinston, 1997). Tackling the issue of when reengineering should take place in ERP implementation (Schniederjans and Kim, 2003) Bancroft *et al* (1998) presents a model that classifies implementation modes based on two dimensions, namely scale of change (small vs. large) and magnitude of change (streamlining vs. reinventing). Moreover, for the specific case of reengineering through SAP R/3, Bancroft *et al* (1998) identify four strategies of implementation:

1. reengineering to the SAP business model,
2. reengineering all business processes even if they are not supported by SAP,
3. reengineering only processes supported by R/3, and
4. reengineering before SAP selection (Cooke and Peterson, 1998; Taylor, 1998).

4.1 Objectives

The following case study presents the reengineering approach followed by a local commercial company during the implementation of a new IT system whose aims were:

1. To reorganise (or reengineer) around business processes.
2. To integrate the information and software aided procedures in order to optimise performance and support decision-making.
3. To provide a common working platform within the group for on-line information.
4. To minimise the internal customer dissatisfaction.
5. To achieve: (a) inventory reductions
(b) quality improvements
(c) better control
(e) better management of the resources used, and
(f) better process execution.

In fact, the ultimate aim is to satisfy the external customer, realizing that he is not simply a person but also part of a process, and the above are the drives that motivates his actions.

4.2. The Company and its Environment

The company is a holding of a group of companies, and has been in operation for more than sixty years. During that period, it has been developed into a complex of companies providing commercial products and services. Its commercial side, along with the manufacturing one, employs more than 120 people. Its significant exports range from Balkan countries through to the Middle East and East Asia. The company is fully equipped to import/export, pack/re-pack, warehouse, physically distribute and administrate, or in short, manage its products on the request of its clients, using both make-to-stock and, made-to-order process.

During the last few years, the company has grown substantially. Recently, it created a strategic alliance with an overseas multinational. This was perceived as a challenge to the businesses and urged management to reinvent the way they did business. As a result, management stressed the need to reengineer business processes and procedures and to get key people involved in the revitalization effort. Thus a corporate reengineering group was formed to act as internal consultant, together with the expertise of an outside consultant, in order to verify how sound the BPR concepts are and to determine if the concepts were economically feasible.

The steps followed during the reengineering effort were the following:

1. Formation of inter-departmental teams
2. Identification of the customers of the business processes and services
3. Clarification of the customer's critical needs and expectations
4. Identification of the core business processes that link different functions and connect the company with customers
5. Streamlining work processes between departments and enhancing products and services delivered to the customers
6. Improving measures for monitoring core work processes
7. Create performance measures
8. Select the appropriate software to enable the reengineering process.

4.3. Discussion

Before the new ERP implementation the company had a tailor-made ERP solution, with some of its functions linked together. The system has been in existence for fifteen years. Over the years, it has been modified and customised to functions' needs facilitating the daily operation of the company. It has been supported by an IT department, responsible for: the technical support of the system, its maintenance, and the extension and development of the applications. The company was far away from the desired situation of "having the right product in the right time". Each function defined its data according to its own goals and priorities. The so called ERP system was a batch of software islands which had been linked through batch or EDI interfaces rolling data back and forth amongst the functions. The principal "one set of data" was far from reality. Sometimes even the meaning of data files with similar or same names had different meanings between the different functions. The batch interface created great problems and long delays. The current application had become obsolete (text environment) and difficult to maintain. Above all it was a pool of applications rather than integrated software, so when the company wanted to have a picture of its business as an entity, it had to rely on a series of undocumented interfaces.

The selected software belongs to SAP R/E. Although it is beyond the purpose of this article to describe the merits of the SAP solution, it is worthwhile to mention some essential benefits that the new system is expected to bring, see Table 1.

Table 1: Benefits of the new ERP system.

QUALITY	CONTROL
Elimination of multiple entries for the same operation entity	Through a common database, it assures that files-information are both accurate and up to date
Provide interface to MSOffice applications and other reporting tools	Produces statistics and performance measurements reports
Minimizes delays due to multiple manual entry and retrieving of files	Propagates accountability because it distinguishes the responsibility of each person for every act
It decreases risks associated with "forgotten" steps	Electronically establishes records for all documents and back up accounts
Minimises errors due to elimination of re-entry	Enforces procedures
It is widely parametric	Outputs audit trails
Provides quality reports	
One set of data	
SERVICE	
	Provides accurate and customised service requests
	Produces customised management reports
	Outputs customer reports readily and accurately

Figure 1 shows the organisational set-up before and after reengineering. It emphasises only the commercial part of the company structured around the warehouse, which receives, stores, packs and delivers the products when required by the customers. Five functions inside the organization are involved in the process cash-to-cash. The *Purchasing* department which places orders based on forecasts prepared by *Marketing*, which in turn takes advice from *Sales* which is processing customers. So when a customer does place an order, it is the Sales function responsibility to instruct (a) the *Warehouse* to prepare and deliver the order, and (b) the *Finance* function to invoice the customer sale. Purchasing is also responsible for materials planning and stock control. Figure 1a reflects this micro operation of the five functions which have organized the flow of material and information within the company. The possibility of errors and misconnections amongst the interfaces of the five functions is obvious. However, what is more apparent is the lack of total responsibility for looking after the customers' needs and wants, as three different functions, namely Warehouse

Operations, Finance and Sales come in contact with customers. On the other hand, two different functions, namely Warehouse Operations and Purchasing are in one way or another in contact with suppliers.

Figure 1: a. Commercial Company before Reengineering, b. Commercial Company after Reengineering.

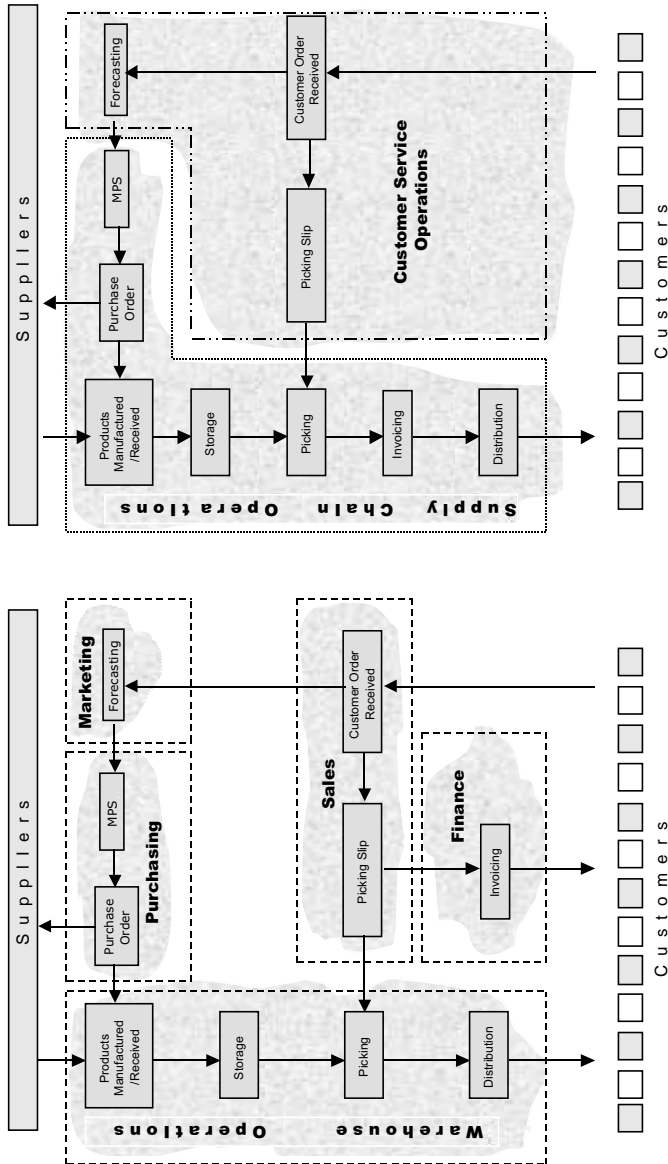


Figure 1b Commercial Company after Reengineering

Figure 1a Commercial Company before Reengineering

With the current set up, that is after reengineering, see figure 1b, the company reorganized under two essential business processes. The first one is called Supply Chain and deals with everything concerning relationships with suppliers. In addition, it has under its control warehousing, delivering, and automatic customer invoicing once the delivery notes are produced. The other business process, called Customer Service Operations has total responsibility for satisfying customers' needs. With this set up, the effort has been focused on speaking "with one voice" to the customer from figures and system entries which satisfy the "one set of data" rule.

A number of important lessons were learnt, the most of important of which are:

1. It is essential that in projects like these, the selection of the "right" people, who have both the knowledge and the attitude for change is of paramount importance. These people should be, if possible, the key-users, who, in turn, will be the liaison between the company and the consultant(s). They must possible have a detailed knowledge of their module together with an integrated perception of the business functions. Unfortunate efforts to include people with the wrong attitude in this project delayed it considerably, whereas some "sabotaged" it while some others pushed it in the wrong direction.
2. SAP proved to be a good driver, in the sense that as integrated software it requires the users to define things. Hence it paves the way for the project team to explain in detail how to organize and run the processes in an integrated manner, thus eliminating conflicting organisational structures and mixed processes.
3. Initially it was decided to leave the Finance function out of the reengineering project, assuming that it was not essential to the process. Unfortunately, once the project was over and SAP was there, it was realized that this omission was unwise, as neither the financial structure nor the processes fit well with SAP. Both had been tailored to fit the old legacy system and now they could not communicate efficiently with the new (SAP) system and the new company processes resulting from the reengineering project, due to the different structures and processes imposed by both of them. Now the company is to redesign the Finance function.
4. The experience gained by the people involved in the project was

substantial. In fact in some instances, they perceived aspects and improvements that they had never thought of. Some of them were used straightaway, while some others were kept as future developments. This also shows the powerful and creative character of the reengineering projects but also the great capabilities of the SAP software.

5. The experience of the external consultant and the help of SAP people were invaluable. They both dissuade the company from defining the new business environment too tightly before the implementation of SAP. The use of their knowledge and capabilities of SAP led to the avoidance of too much detail, since this would delay the project as many things had to be redone during the SAP implementation.
6. The end of the project found both management and employees not only relieved of a heavy project, but also stressing the advantages of the “new” and pleased with its capabilities. They realised that the extra working effort made for a long period of time, on top of daily operations was worthwhile.
7. It was realised from the beginning, by both management and people either participating or not in the project, that an effort of such magnitude should not be treated as just another company-project but as a functional and radical change in the way people are used to working. They both understood that things, attitudes, jobs and behaviours would eventually change at the end of the project, while their silo and functional attitude approach had to change into an integrated and process one.
8. The understanding of the people helped considerably during the migration process, which ran parallel to the run of the normal business.
9. It was wise to start data preparation early on and to identify some hidden workload in converting code numbers or data cleaning.
10. Sometimes the powerful role of SAP was questioned as to whether its installation may hamper future progress and innovation, which is difficult to answer, as this depends on whether SAP will engender flexibility and adaptability for future change within the organization.

5. Conclusions

The scope of this paper is to review the subject of BPR, through a survey of articles, reports, books and white papers. The review shows that

considerable misunderstanding exists as to exactly what constitutes BPR; how people understand it and how they translate both BPR and the many different outcomes, placing different emphasis on different things. The various topics examined include, amongst others, the relationship between BPR and IT. A true business case of a major commercial company was studied where IT implementation was run parallel to BPR efforts. The enabling role of IT in reengineering was proved, arguing that its utilization is essential for such projects. The study provides a successful IT application, through an SAP system, to BPR and enlists some of the lessons learnt, defending that necessary pre-requisites are creative thinking and visionary leadership, as well as active participation from the people, with a change in mindset regarding the role of IT and reengineering. It also showed that reengineering the business brings such a major change in business that no function or process should be excluded from the BPR effort (as for example the exclusion of Finance function in the above case study). Equally, reengineering of one function or sub-process cannot add so much value as reengineering the whole system.

Finally, it is apparent that the radical nature of BPR and the powerful character of SAP converge towards a common ascertainment that the inclusive advantages resulting from both cannot be appreciated unless a fully proportional and combined perspective is embraced in bonding together every key change aspect, in order to furnish a match among the reengineered business processes and their fundamental SAP modules.

REFERENCES

- Al-Mashari, M. and M. Zairi (1999) "BPR implementation process: an analysis of key success and failure factors". *Business Process Management Journal*, Vol. 5 No. 1, pp. 87-112.
- Al-Mashari, M. and M. Zairi (2000a) "Revisiting BPR: a holistic review of practice and Development". *Business Process Management Journal*, Vol. 6 No. 1, pp. 10-42.

- Al-Mashari, M. and M. Zairi (2000b) "Supply-chain re-engineering using enterprise resource planning (ERP) systems: an analysis of a SAP R/3 implementation case", *International Journal of Physical Distribution & Logistics Management*. Vol. 30 No. 3/4, pp. 296-313.
- Al-Mashari, M. and M. Zairi (2000c) "Information and Business Process Equality: The Case of SAP R/3 Implementation" *The Electronic Journal on Information Systems in Developing Countries*. Vol. 2 No. 4, pp. 1-15. Available at: <http://www.ejisdc.org>
- Al-Mudimigh, A., M. Zairi and M. Al-Mashari (2001) "ERP software implementation: an integrative framework". *European Journal of Information Systems*, Vol. 10 No. 4, pp. 216-26.
- Al-Mashari, M. and A. Al-Mudimigh (2003) "ERP implementation: lessons from a case study". *Information Technology & People*. Vol. 16 No. 1, pp. 21-33.
- Anon (1991) "Factories of the Future" Executive Summary of the 1990 International Manufacturing Futures Survey, Boston: Boston University [Taken from: Chase, R.B. and N. J. Aquilano (1995), *Production and Operations Management: Manufacturing and Services*. 7th ed., Irwin, Chicago, p. 737].
- Attaran M. (2003) "Information technology and business-process redesign". *Business Process Management Journal*, Vol. 9 No. 4, pp. 440-458.
- Attaran, M. (2004) "Exploring the relationship between information technology and business process reengineering". *Information & Management*, 41, 585–596.
- Attaran, M. and G. G. Wood (1999) "How to succeed at reengineering", *Journal of Management Decision*. Vol. 37 No. 10, pp. 752-757
- Ardhaldjian, R.P. and M. J. Fahner (1994) "Reengineering for simplicity and flexibility at Siement Solar Industries". *National Productivity Review*, Vol. 13 No. 3, pp. 341–50.
- Aurand, T. W., D. D. Schoenbachler and G. L. Gordon (1996) "Reengineering and the marketing function: integration of theory and practice", *Journal of Product & Brand Management*. Vol. 5 No. 3, pp. 6-23.

- Balle, M (1995) *The Business Process Re-engineering Action Kit: A five day plan to redesign your process*. Kogan Page, London.
- Bancroft N, H. Seip and A. Sprengel (1998) *Implementing SAP R/3: How to introduce a large system into a large organization*. Manning Publications Co: Greenwich, CT.
- Bashein, B.J., Markus, M.L. and Riley, P. (1994) "Preconditions for BPR success: and how to prevent failures". *Information Systems Management*, Vol. 11 No. 2, pp. 7-13.
- Bennis, W. and M. Mische (1995) *The 21st century organization: Reinventing Through Reengineering*. Jossey-Bass Publications, San Francisco.
- Bicknell, D. (1998) "SAP to fight drug firm's \$500M suit over R/3 collapse", *Computer Weekly*, September 3, p. 3. Available at: http://www.findarticles.com/cf_dls/m0COW/1998_Sept_3/53055430/p1/article.jhtml.
- Bingi P, M. Sharma and J. Godla (1999) "Critical issues affecting an ERP implementation". *Information Systems Management Summer*, pp. 7-14.
- Broadbent, M., P. Weill and D. St. Clair (1999) "The implications of Information Technology information infrastructure for business process redesign". *MIS Quarterly*, Vol. 23 No. 2, pp. 159-182.
- Boudette, N.E. (1999) "Europe's SAP scrambles to stem big glitches- software giant to tighten its watch after snafus at Whirlpool Hershey". *Wall Street Journal*, November 4, p. A25.
- Buck-Emden, R. (2000) *The SAP R/3 System: An Introduction to ERP and Business Software Technology*. Addison-Wesley, Reading, MA.
- Caldwell, B. (1998) "GTE goes Solo on SAP R/3". *Information Week*, No. 685, pp. 150-151.
- Cavanaugh, H.A. (1994) "Re-engineering: buzz word or powerful new business tool?" *Electrical World*, Vol. 208 No. 4, pp. 7-9.
- Champy J. (1999) *Reengineering dead? Don't believe it*. In *Harvard Management Update*. Harvard Business School: Boston, MA, March.
- Champy, J. (2002) *X-Engineering the Corporation: Reinventing Your Business in the Digital Age*. Warner Books, New York.

- Chase, R.B. and N. J. Aquilano (1995) *Production and Operations Management: Manufacturing and Services*. Irwin, Chicago.
- Cooke, D. and Peterson, W. (1998) *SAP Implementation: Strategies and Results*, Research Report 1217-98-RR, The Conference Board, New York, NY.
- Davenport, Th. H. and J. E. Short (1990) "The New Industrial Engineering: Information Technology and Business Process Redesign". *Sloan Management Review*, Vol. 31 No. 4, pp 11-27.
- Davenport Th. H. (1993) *Process Innovation: Reengineering Work through Information Technology*. Harvard Business School Press, Boston, Massachusetts.
- Davenport Th. H., and D. B. Stoddard (1994) "Reengineering: Business Change of Mythic Proportions". *MIS Quarterly*, Vol. 18 No. 2, pp. 121-127.
- Davenport Th. H. (1995) "Teaching About Reengineering". Available at: <http://hsb.baylor.edu/ramsower/acis/papers/davenport.htm>. and: http://66.102.9.104/search?q=cache:Ha4gtixix_kJ:www.aima-ind.org/assignments-2004/DBA%2520%26%2520Adv%2520Dip/DOM04.doc++%22Teaching+About+Reengineering%22&hl=en&lr=lang_en.
- Davenport, Th. H. (1998) "Putting the enterprise into the enterprise system". *Harvard Business Review*, Vol. 76 (July/August), pp. 121-131.
- Davenport, Th. H. (2000) *Mission Critical: Realizing the Promise of Enterprise Systems*. Harvard Business School Press, Boston.
- Dixon, J.R., P. Arnold, J. Heineke, J. S. Kim, J.S. and P. Mulligan (1994) "Business process reengineering: improving in new strategic directions". *California Management Review*, Vol. 36 No. 4, pp. 93-108.
- Donovan, M. (1999) "Successful ERP Implementation the First Time. Mid Range ERP", August. Available from: <http://www.rmdonovan.com/pdf/perfor8.pdf>
- Economist (1994) "Re-engineering Europe", February 26.
- Elliott, H. (1997) "Don't be late for those important dates". *Electronic Business Today*, Vol. 23 No. 7, pp. 34-6.
- Edwards H. (1999) "ERP: it's not rocket science". Available at: <http://www.PlanetIT.com/docs/PIT19991104S0036>

- Gates, B. (1999) *Business @ the Speed of Thought: Succeeding in the Digital Economy*. A Warner Books, New York.
- Greengard, S. (1993) "Reengineering: out of the rubble". *Personnel Journal*, Vol. 72 No. 12, pp. 48B-48O.
- Grotevant, S. M. (1998) "Business Engineering and Process Redesign in Higher Education: Art or Science," CAUSE 98 Seattle, Washington, December 8.
- Grover, V, S.R. Jeong, W.J. Kettinger and J.T.C. Teng (1995) "The implementation of business process reengineering". *Journal of Management Information Systems*, Vol. 12 No. 1, pp. 109-144.
- Grovera, V., T. James, A.H. Segarsb and K. Fiedlera, (1998) "The influence of information technology diffusion and business process change on perceived productivity: the IS executive's perspective". *Information & Management*, Vol. 34 No. 3, pp. 141-159.
- Hall, G., J. Rosenthal and J. Wade (1993) "How to Make Reengineering Really Work". *Harvard Business Review*, November-December 1993, pp. 119-131.
- Hammer M. (1990) "Reengineering Work: Don't Automate, Obliterate". *Harvard Business Review*, and July-August 1990, pp104-112.
- Hammer M. and J. Chamy (1993) *Reengineering the Corporation: A Manifesto Business Revolution*. Nicholas Brealey Publishing, London.
- Hammer, M. and S.A. Stanton (1995) *The Reengineering Revolution*. Hammer and Co.
- Harari, O. (1996) "Why did reengineering die?" *Management Review*. Vol. 85 No. 6, pp. 49-52.
- Harrington, H.J. (1991) *Business Process Improvement*. McGraw-Hill, New York, N.Y.
- Hicks, D. (1997) "The managers' guide to supply chain and logistics problem-solving tools and techniques". *IIE Solutions*, Vol. 29 No. 10, October, pp. 24-9.
- Heusinkveld S. and J. Benders (2001) "Surges and sediments: shaping the reception of reengineering". *Information & Management*, Vol. 38 No. 4, pp. 239-251.
- Hopper, M. (1990) "Rattling SABRE – New Ways to Compete on Information". *Harvard Business Review*, May-June, pp. 118-125.

- IBM (1995) Business Process Reengineering and beyond. International Technical Support Organization Redbooks, December, p. 4.
- Imai, M. (1986) Kaizen – The Key to Japan’s Competitive Success. McGraw-Hill.
- Irani, Z., V. Hlupic, L. P. Baldwin and P. E. D. Love (2000) “Re-engineering manufacturing processes through simulation modelling”. Journal of Logistics and Information Management, Vol. 13 No. 1, pp. 7-13.
- James, D. and M. L. Wolf (2000) “A second wind for ER”. McKinsey Quarterly 2: 100-107.
- Jarvenpaa, S. and D. Stoddart (1998) “Business process redesign: radical and evolutionary change”. Journal of Business Research, January, 1998.
- Johannessen, J., B. Olsen and J. Olaisen (1997) “Organizing for innovation”. Long-Range Planning Vol. 30 No. 1, pp. 97–109.
- Kalakota R. and A. Whinston (1997) Electronic Commerce. Addison-Wesley, Reading, MA.
- Kalakota, R. and M. Robinson (1999) e-Business, Roadmap for Success. Addison Wesley.
- Keller, G. and T. Teufel (1998) SAP R/3w Process Oriented Implementation: Iterative Process Prototyping. Addison-Wesley Publishing, Boston, MA.
- King, J (1993) “Reengineering Repercussions”. Computerworld, Vol. 27 No. 26 (June 28), p. 149.
- Koch C, D. Slater and E. Baatz (1999) “The ABCs of ERP”, CIO; London.
- Kumar, K. and J. Van Hillegersberg (2000) “ERP: Experiences and evolution”. Communications of the ACM 43 (April): 23-26. 39].
- Laughlin, S. P. (1999) “An ERP Game Plan”. Journal of Business Strategy, January-February 1999, pp. 32-37.
- Lieber R. (1995) “Here comes SAP”. Fortune 2, October, p. 1.
- Lowenthal, J.N. (1994) “Reengineering the organization: a step-by-step approach to corporate revitalization”. Quality Progress, Vol. 27 No. 2, pp. 61-3.
- Macdonald, K.H. (1993) Business strategy development, alignment and redesign: The Corporation of the 1990s. Oxford University Press, New York, N.Y.

- Manganelli, R. L. and M. M. Klein (1994) *The reengineering handbook: A step-by-step guide to business transformation*. Amacom, New York.
- McPartlin, J.P. (1992) "Seeing eye to eye on reengineering". *InformationWeek*, June 15, p. 74
- Martin, M. (1998) "Enterprise resource planning". *Fortune*, Vol. 137 No. 2, pp. 149-51.
- Mullin, R. (1997) "Putting the P in ERP". *Chemical Week*, Vol. 159 No. 49, pp. 19-20.
- Murray, M.G. and G.W. Coffin (2001) "A case study analysis of factors for success in ERP system implementations". *Proceedings of the Seventh Americas Conference on Information Systems*, pp. 1012-1018.
- Muscattello, J. R., M. H. Small and I. J. Chen (2003) "Implementing enterprise resource planning (ERP) systems in small and midsize manufacturing firms". *International Journal of Operations & Production Management*, Vol. 23 No. 8, pp. 850 – 871.
- Nah, F. F-H., J. L-S. Lau, and J. Kuang (2001) "Critical factors for successful implementation of enterprise systems". *Business Process Management Journal*, Vol. 7 No. 3, pp. 285–296.
- Naisbitt, J. and P. Aburdene (1985) *Re-inventing the Corporation*. Warner Books, New York, N.Y.
- Nickols, F. (1998) "The difficult process of identifying processes". *Knowledge and Process Management*, Vol. 5 No. 1, pp. 14-19.
- Nissen, M. (1998) "Redesigning reengineering through measurement driven inference". *MIS Quarterly*, Vol. 22 No. 4, pp. 509–534.
- Pegels, C. C. (1995) *Total Quality Management: A survey of Its Important Aspects*. Boyd & Fraser Publishing Company.
- Peppard, J. and P. Rowland. (1995) *The essence of business process re-engineering*. Prentice Hall, New York.
- Ranganathana, C. and J.S. Dhaliwal (2001) "A survey of business process reengineering practices in Singapore". *Information & Management*, Vol. 39 No. 2, pp. 125–134.
- Restivo K. (1998) "Guru lauds hi-tech visions". *Computer Dealer News*, Vol. 14 No. 27, p. 12.
- Rick, M. (1997) "IT integration programmed for global operation". *Chemical Week*, Vol. 159 No. 6, pp. 21-27.

- Robson, M. and P. Ullah (1996) A practical guide to business process re-engineering. Gower, Aldershot, England.
- Ross, J.W. and M.R. Vitale (2000) "The ERP revolution: Surviving vs. thriving". Information Systems Frontiers, Vol. 2 No, 2, pp. 233-241.
- Schneider P. (1999) "Wanted: ERPeople Skills". CIO, March.
- Schniederjans, M. J. and G. C. Kim (2003) "Implementing enterprise resource planning systems with total quality control and business process reengineering: Survey results". International Journal of Operations & Production Management, 23(4): 418 – 429.
- Scott, J.E. and I. Vessey (2000) "Implementing enterprise resource planning systems: The role of learning from failure". Information System Frontiers, Vol. 2 No, 2, pp. 213-232.
- Scott Morton, M. S. (1991) The Corporation of the 1990's: Information technology and organizational transformation. Sloan School of Management, Oxford University Press, New York.
- Soh, C., S.S. Kien, and J. Tay-Yap (2000) "Cultural fits and misfits: Is ERP a universal solution?" Communications of the ACM 43 (April), pp. 47-51.
- Sumner M. (1999) Critical success factors in enterprise wide information management systems projects. In Proceedings of AMCIS'99, pp. 232–234.
- Supply Chain Council (1997). Available at: <http://www.supply-chain.org/html/slide1.cfm>
- Sutcliffe, N. (1999) "Leadership behavior and business process reengineering (BPR) outcomes: an empirical analysis of 30 BPR projects". Information & Management, Vol. 36 No. 5, pp. 273–286.
- Talwar, R. (1993) "Business re-engineering - a strategy driven approach". Long Range Planning, Vol. 26 No. 6, pp. 22-40.
- Tapscott, D. and A. Caston (1993) Paradigm Shift: The New Promise of Information Technology. McGraw-Hill, New York, N.Y.
- Taylor J. (1998) "Participative design: linking BPR and SAP with an STS approach". Journal of Organizational Change Management, Vol. 11 No. 3, pp. 233–245.
- Teng, J. C., V. Grover and K.D. Fiedler (1994) "Business Process Reengineering: Charting a Strategic Path for the Information Age". California Management Review, Vol. 36 No. 3 (Spring), pp. 9-31.

- Thomas, R. and D. Dunkerley (1999) "Careeing downwards: middle managers' experiences in the downsized organization". *British Journal of Management*, Vol. 10 No. 2, pp. 157–181.
- Thurow, L. in Davenport T.H. (1993) *Process Innovation: Reengineering Work through Information Technology*. Boston: Harvard Business School Press.
- Tomasko, R. M. (1993) *Rethinking the Corporation: The Architecture of Change*. AMACOM, New York.
- Venkatraman, N. (1993) *IT-induced business reconfiguration, The Corporation of the 1990s*. Oxford University Press, New York, N.Y.
- Verespej, M. (1995) "Reengineering Isn't Going Away". *Industry Week*, 20 February, p. 42.
- Wellins, S. R. and J. S. Murphy (1995) "Reengineering: Plug Into the Human Factor". *Training & Development*, January, pp. 33–37.
- Whitman, A. R. (1994) "Virtual Reengineering". *Industrial Engineering*, Vol. 26 No. 3, pp 17-18.
- Whitman, M. E. (1996) "IT divergence in reengineering supports: performance expectations vs. perceptions". *Information & Management* 30 (5), pp. 239–250.
- Wu, I. L. (2002) "A model for implementing BPR based on strategic perspectives: an empirical study". *Information & Management* 39 (4), pp. 313–324.
- Yin, R. K. (1994) *Case study research: design and methods*. Thousand Oaks: Sage Publications.

COMPARATIVE ANALYSIS OF LABOUR MARKET PARAMETERS IN EUROPEAN UNION

MICHAEL A. ALEXANDRIDIS

T.E.I. of Piraeus

Abstract

The Labour Force Survey (L.F.S.), made every year in the frames of European Union, consists the main source of internationally comparable statistical data on the labour market, which are recorded in the Official Yearbook “Eurostat” of E.U.

With this article, a comparative analysis of the data on the employment- unemployment is attempted to be made in Greece, on the prevailing all the times as well as in comparison with the respective data presents by the other countries- members of E.U.

The Statistical Yearbook “Eurostat Yearbook 2001” containing statistical data for the countries- members of E.U. for the period 1989- 1999 is used as data source.

JEL classification: O15.

Keywords: Employment, unemployment, European Union.

1. Introduction

The Labour Force Survey takes every year place in the frames of European Union on the labour market.

It covers all the people residing in their own households and doesn't include persons residing in “collective” households (that is boarding houses, guests' houses, hospitals etc.).

The terms used in this research (and their meaning) are applied in all the Members-States of European Union and are in harmony with the recommendation of International Labour Office (I.L.O.).

Based on the fact that this research consists a main source of internationally comparable statistical data on labour market, its data are recorded in the Official Statistical Yearbook “Eurostat” of E.U.

In the terms, thus, of this piece of work (and taking under consideration the entries on the labour market of “Eurostat” 2001), a comparative analysis is

attempted to be made on the data of the employment-unemployment noticed in Greece, everlasting, as well as in the frames of European Union, so that any similarities or differences will emerge among the Members- States of E.U.

2. Parameters' Analysis of Labour Market

2.1. Economically Active Men and Women Rate (by age group)

It should be, first of all, made clear that under the data of the Community Labour Force Survey (being internationally acceptable), as “economically active individuals” are considered all the employed and unemployed people in a country. Then on basis of the data of Table 1, (ref. to the Appendix) we notice the following:

1. During the period 1989 - 1999, the rate of the economically active people aged 15-24 years in Greece presents a reduction as, on the other hand, in the most Members -States of E.U. of 12 (except Netherlands and Ireland). The reduction, however, noticed in Greece (1,6%) is lower, in comparison with the respective rates of the other countries of European Union during the above period.
2. During the period 1989-1999 the rate of the economically active people aged 25-49 years in Greece presents a rise (7,6%), as, on the other hand, in the most Members-States of E.U. of 12 (except Denmark).
We should also notice that our country is among the six first countries (together with Ireland, Spain, Netherlands, Germany and Luxembourg) of European Union, with the higher increased rate of the economically active people aged 25-49 during the above period.
3. During the period 1989- 1999, the rate of the economically active people aged 50-64 years in Greece, presents a reduction (2,1%) in comparison with a respective rise noticed in the most Members-States of E.U. of 12. It is noticeable that, during the above mentioned period, a reduced rate of the economically active people aged 50-64 years (apart from our country) is noticed only in Italy.
4. Finally, for the same period and for all the partial aged classes (that is, 15-64 years), Greece presents an increased (5,1%) rate of the economically active people, as, on the other hand, the most countries of E.U. of 12 (except

Denmark, Italy and United Kingdom). Especially, our country is included in the first five Members-States of European Union (together with Netherlands, Ireland, Belgium and Spain) with the higher rise of the economically active people's rate aged 15-64 years during the period 1989- 1999.

2.2. Employed Men and Women (per sector of production)

It is noticed that under the international practice as regards to the statistical data on the labour “all the individuals with even one hour of paid labour during the considered period are thought to be employed”.

Then, and on basis of the data of Table 2 (ref. to the Appendix), we notice the following:

1. During the period 1989- 1999 Greece presents a reduction (28,1%) related to the employed in the primary sector of production , as , on the other hand, the other Members-States of E.U. of 12.

We should notice, however, that our country is included among the five first countries (together with Germany, Netherlands, Ireland and Belgium) of European Union with the lower reduced rate of its employed people in the primary sector of production during the above mentioned period.

2. During the period 1989-1999 Greece presents a reduction related to the employed in the secondary sector of production (as in Belgium, France, Luxemburg and United Kingdom), compared with a rise noticed in the other Members-States of European Union.

We should also notice that our country presents the lower reduction (4,6%) of its employed people in the secondary sector of production, among the countries of E.U. of 12, during the above mentioned period.

3. During the period 1989-1999 Greece presents a rise (31,9%) of the employed in the tertiary sector of production, as, on the other hand, in the other Members- States of European Union.

We should also notice that our country presents the highest rise (after Ireland and Germany) of the employed people in the tertiary sector of production, among the countries of E.U. of 12, during the above period.

2.3. Number of Hours Usually Worked per Week (full-time/ part-time)

At first it should be made clear that according to the data of Eurostat, the distinction between full- and part-time employment has been made on basis of the answers given by the inquired persons.

It is almost impossible for a concrete distinction to be formed (related to the full- and part-time employment) because there are some declinations on the working hours among the Members-States of E.U. and among the various industrial sectors.

Then, based on the data of Table 3,(ref. to Appendix) we notice the following:

1. As regards with the full-time employment and for the period 1993-1999.
 - a) Greece presents a reduction of the full-time employment hours per week, as, on the other hand, the most countries of E.U.(except Germany, Italy, Austria, and Finland, presenting some slight rise).
 - b) Of course, our country has been included among the five first Members-States of European Union (together with Denmark, Spain, Sweden and United Kingdom) presenting the lowest reduction rates in the weekly hours of full-time employment.
 - c) Finally, Greece presents the same reduction rate (0,5%) as regards with the weekly full-time employment,to the respective one on average of the Members- States of E.U. during the considered period.

2.4. Unemployment Rate of Men and Women

It is noticed that under the data provided by the Labour Force Survey of E.U. (which have been internationally acceptable) , as “unemployed” are considered the persons who are not employed, as long as:

- a) They are actively seeking a job
- b) They are available to start work within two weeks.

Then, and on basis of the data in Table 4 (ref. to Appendix), we notice the following:

1. During the period 1989-1999 the unemployed people rate (men and women) in Greece presents a rise, as, on the other hand, the respective rate in eight out of fifteen countries of E.U.
2. During the same period Greece has been included among the first three countries (together with Sweden and Finland) of European Union with the highest increase (74,6%) of the unemployed people rate (men and women).
3. Finally, during the period 1989- 1999, the increase of the unemployed people rate (men and women) in Greece has been six times more than the respective increase (12,1%) on average of the Members-States of E.U.

2.5. Unemployment Rate (people aged less than 25 years)

It is noticed that, according to the data of the Labour Force Survey of EU related to the young persons unemployment, about a half of the unemployed people aged less than 25 years in European Union , seeks for employment for first time.

Then, and on basis of the data in Table 5 (ref. to Appendix), we notice the following:

1. During the period 1989- 1999, the unemployed people rate (aged less than 25 years) in Greece presents an increase, as, on the other hand, the respective rate in nine out of fifteen countries of E.U.
2. Greece is, of course, included among the first three countries (together with Italy and France) of European Union with the lower increased (40,4%) rate of unemployed people (aged less than 25 years).
3. Finally, it should be noticed that during the above period, the increase of the unemployed persons' rate(aged less than 25 years) in Greece has been fourfold of the respective increase (10,4%) on average of the Members-States of E.U.

3. Conclusions

From the, until now, comparative analysis of the data on the employment-unemployment noticed in Greece (everlasting, as well as in comparison with the respective data presented by the other Members-States of European Union) the following conclusions are drawn:

1. As positive results from the data of employment-unemployment in Greece, we may mention the following:

- a) The increase (by 31,9%) of the employed persons in the tertiary sector of production, during the period 1989-1999.

In particular, our country presents the highest increase (following Ireland and Germany) of the employed people in the tertiary sector of production, among the countries of E.U. during the above mentioned period.

- b) The reduced hours of full-time employment per week (by 0,5%), that is a rate equal to the respective one , on average, of the Members-States of E.U. for the period 1993-1999.

2. As negative results from the data of employment-unemployment in Greece, we may mention the following:

a) The reduction (by 4,6%) of the employed people in the secondary sector of production, during the period 1989-1999.

Of course, the above reduction is lower among the countries of E.U., during the above period.

b) The unemployed people (men and women) increased rate (by 74,6%) during the period 1989-1999.

In particular, this increase is sixfold of the respective increase (12,1%) on average of the Members-States of E.U. during the above period.

c) The unemployment people (aged below 25 years) increased (by 40,4%) rate during the period 1989- 1999.

We should also notice that this increase is fourfold of the respective one(10,4%),on average, noticed in the Members-States of E.U. during the above period.

3. Finally, it is noticeable that, filing the unemployment rates on average in the Members-States of European Union, as well as in Greece (period 1989-1999), in a “time series” order's form, we may estimate the long trend they present, making use of the “least squares method”.

So according to the above mentioned, we'll have:

a) The unemployment rate (men and women) on average in the Members- States of European Union, presents a slightly increasing trend ascribed as $(\Psi_i = 10,04 + 0,09 X_i)$ and it is anticipated that in 2004 it will be about 10,85%.

b) The unemployment rate (men and women) in Greece clearly presents a more intense trend ascribed as $(\Psi_i = 9,29 + 0,52 X_i)$ and it is anticipated that in 2004 it will be about 13,97%.

Of course, the above provisions have only an “indicative “ character (mainly as regards with the trend noticed by the considered variables and not by their concrete values) because they are carried out after the acceptance of the supposition that the prevailed conditions (in social, political and economic areas) in 1990's will remain almost invariable during 2000's, as well, which has not been considered to probably happen.

On the other hand, however, we must admit that the above provisions are useful enough for decisions making on this concrete sector.

APPENDIX

Table 1: Active Rate of Men and Women (by age group).

MEMBER – STATE	15-64			15-24			25-49			50-64		
	1989	1994	1999	1989	1994	1999	1989	1994	1999	1989	1994	1999
EUROPEAN UNION	-	-	68,6	-	-	47,3	-	-	83,6	-	-	52,6
BELGIUM	58,7	61,7	64,6	36,0	35,2	32,9	80,2	82,9	85,7	33,6	34,6	40,8
DENMARK	82,0	78,8	80,6	75,3	69,1	73,3	91,6	87,9	89,0	65,2	65,7	68,5
GERMANY	68,1	70,9	71,2	59,5	54,9	50,8	79,0	84,3	85,9	53,4	55,4	54,7
GREECE	59,8	59,5	62,9	39,9	36,9	39,3	74,5	75,5	80,2	49,5	47,4	48,5
SPAIN	58,2	59,6	62,1	47,6	43,0	41,4	71,1	75,7	78,4	45,7	44,3	47,7
FRANCE	67,3	67,4	68,8	45,2	36,7	36,1	84,9	86,9	87,4	47,7	46,6	51,4
IRELAND	60,3	61,8	66,4	50,8	46,4	50,8	70,0	74,3	79,3	47,9	49,3	53,8
ITALY	60,0	57,5	59,6	48,6	39,1	38,1	75,4	73,9	76,4	41,1	39,6	39,8
LUXEMBOURG	60,2	62,3	63,1	52,5	46,5	34,0	74,2	77,7	80,0	35,7	37,1	40,4
HOLLAND	64,8	68,7	73,6	57,5	60,6	67,7	76,7	81,0	85,1	41,5	43,5	51,4
AUSTRIA	-	-	71,6	-	-	58,4	-	-	86,4	-	-	46,9
PORTUGAL	68,8	67,6	70,9	59,5	45,2	47,6	82,2	84,8	85,9	53,5	55,6	60,6
FINLAND	-	-	76,4	-	-	63,0	-	-	88,7	-	-	61,5
SWEDEN	-	-	76,4	-	-	42,3	-	-	87,6	-	-	77,2
UNITED KINGDOM	76,2	75,0	75,2	72,6	64,6	63,2	84,3	84,2	84,8	61,8	61,7	62,9

Source : Eurostat 2001, P. 118.

Table 2: Employed Men and Women 1000s (Per sector of production)

MEMBER STATE	PRIMARY			SECONDARY			TERTIARY		
	1989	1994	1999	1989	1994	1999	1989	1994	1999
EUROPEAN UNION	-	-	6.898	-	-	45.400	-	-	102.690
BELGIUM	120	108	95	1.127	1.028	1.028	2.340	2.557	2.864
DENMARK	149	127	90	715	670	726	1.748	1.728	1.882
GERMANY	1.056	1.171	1.034	11.006	13.261	12.210	15.344	21.408	22.845
GREECE	930	788	669	945	894	902	1.795	2.104	2.369
SPAIN	1.605	1.164	1.020	3.985	3.530	4.215	6.605	7.034	8.538
FRANCE	1.503	1.128	968	6.552	5.830	5.991	13.574	14.750	15.789
IRELAND	169	151	136	314	335	451	609	716	996
ITALY	1.912	1.550	1.118	6.659	6.429	6.675	12.238	12.045	12.825
LUXEMBURG	6	5	3	45	44	39	103	114	133
HOLLAND	286	262	231	1.603	1.532	1.610	4.116	4.769	5.368
AUSTRIA	-	-	229	-	-	1.094	-	-	2.354
PORTUGAL	881	522	611	1.580	1.442	1.704	2.099	2.476	2.516
FINLAND	-	-	148	-	-	645	-	-	1.532
SWEDEN	-	-	121	-	-	1.013	-	-	2.917
UNITED KINGDOM	593	534	424	8.607	7.087	7.098	17.190	17.890	19.760

Source: Eurostat 2001, P. 122

Table 3: Number of Hours usually worked (per week).

MEMBER - STATE	FULL TIME			PART TIME		
	1993	1996	1999	1993	1996	1999
EUROPEAN UNION	-	42,1	41,9	-	19,7	19,5
BELGIUM	40,1	40,5	38,4	20,8	21,3	21,7
DENMARK	40,1	40,1	40,0	18,8	19,1	19,6
GERMANY	-	41,6	41,8	-	18,5	17,7
GREECE	44,9	44,6	44,7	24,1	24,8	21,3
SPAIN	42,3	42,2	42,2	18,8	18,2	18,2
FRANCE	41,4	41,2	40,9	22,4	22,7	22,9
IRELAND	44,0	43,9	42,1	18,7	18,9	18,6
ITALY	40,3	40,6	40,5	25,1	24,5	23,4
LUXEMBURG	41,6	40,6	40,6	21,0	20,9	21,1
HOLLAND	41,3	41,5	41,0	17,7	18,4	18,7
AUSTRIA	-	41,8	41,9	-	22,2	22,0
PORTUGAL	43,8	43,7	42,4	25,5	26,2	20,4
FINLAND	-	40,5	41,0	-	20,3	20,8
SWEDEN	-	41,4	41,3	-	23,4	23,5
UNITED KINGDOM	44,5	44,8	44,4	17,1	17,5	18,0

Source: Eurostat 2001, P 131.

Table 4: Unemployment Rate of Men and Women

MEMBER STATE	YEARS										
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EUROPEAN UNION	-	-	8,2	9,2	10,7	11,1	10,7	10,8	10,6	9,9	9,2
BELGIUM	7,5	6,7	6,6	7,2	8,8	10,0	9,9	9,7	9,4	9,5	9,1
DENMARK	7,3	7,7	8,4	9,2	10,2	8,2	7,2	6,8	5,6	5,2	5,2
GERMANY	-	-	5,6	6,6	7,8	8,4	8,2	8,9	9,9	9,4	8,8
GREECE	6,7	6,4	7,0	7,9	8,6	8,9	9,2	9,6	9,8	10,9	11,7
SPAIN	17,2	16,2	16,4	18,4	22,7	24,1	22,9	22,2	20,8	18,8	15,9
FRANCE	9,4	9,0	9,5	10,4	11,7	12,3	11,7	12,4	12,3	11,8	11,3
IRELAND	14,7	13,4	14,7	15,4	15,6	14,3	12,3	11,7	9,9	7,6	5,7
ITALY	9,8	9,0	8,6	8,8	10,2	11,1	11,6	11,7	11,7	11,8	11,3
LUXEMBURG	1,8	1,7	1,7	2,1	2,6	3,2	2,9	3,0	2,7	2,7	2,3
HOLLAND	6,9	6,2	5,8	5,6	6,5	7,1	6,9	6,3	5,2	4,0	3,3
AUSTRIA	-	-	-	-	4,0	3,8	3,9	4,3	4,4	4,5	3,8
PORTUGAL	5,2	4,8	4,2	4,3	5,7	6,9	7,3	7,3	6,8	5,2	4,5
FINLAND	3,1	3,2	6,6	11,7	16,3	16,6	15,4	14,6	12,7	11,4	10,2
SWEDEN	1,6	1,7	3,1	5,6	9,1	9,4	8,8	9,6	9,9	8,3	7,2
UNITED KINGDOM	7,3	7,0	8,8	10,0	10,5	9,6	8,7	8,2	7,0	6,3	6,1

Source: Eurostat 2001, P. 135.

Table 5: Unemployment Rate (people aged less than 25 years).

MEMBER - STATE	YEARS										
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EUROPEAN UNION	-	-	16,2	18,0	21,3	22,0	21,5	21,9	21,1	19,5	17,9
BELGIUM	16,3	15,3	14,9	16,1	21,7	24,2	23,9	23,2	23,1	23,2	24,9
DENMARK	11,1	11,4	11,6	12,7	13,9	11,1	10,6	10,6	8,4	8,0	9,8
GERMANY	-	-	5,9	6,4	8,0	8,8	8,8	10,0	10,8	9,9	9,2
GREECE	22,5	21,5	22,9	25,1	26,8	27,7	28,5	31,0	30,8	30,1	31,6
SPAIN	34,4	32,3	31,1	34,5	43,2	45,1	42,5	41,9	38,9	35,4	29,5
FRANCE	20,2	19,5	21,3	23,3	27,3	29,2	27,5	29,1	29,2	26,5	24,2
IRELAND	20,5	19,4	22,4	24,4	25,3	23,0	19,5	18,2	15,4	11,3	8,3
ITALY	29,2	27,2	25,9	27,0	30,5	32,3	33,7	34,0	33,8	33,8	32,7
LUXEMBURG	4,2	3,9	3,2	4,0	5,3	7,3	7,4	8,5	8,1	7,2	6,8
HOLLAND	9,9	8,6	8,3	8,5	11,0	11,5	12,1	11,7	9,5	8,0	7,2
AUSTRIA	-	-	-	-	6,3	5,7	5,5	6,2	6,7	6,4	5,1
PORTUGAL	11,9	10,8	9,5	10,4	12,8	15,0	16,6	16,8	15,1	10,6	9,0
FINLAND	8,6	9,3	16,3	26,4	33,6	34,0	29,7	28,0	25,2	23,5	21,4
SWEDEN	3,7	4,4	7,6	13,2	22,0	22,0	19,1	20,5	20,6	16,6	13,6
UNITED KINGDOM	10,4	10,8	14,4	16,7	18,1	17,0	15,9	15,5	14,2	13,6	13,0

Source: Eurostat 2001, P. 136.

REFERENCES

- Birkin Shaw and Hood Neil, "Multinational Corporate Evolution and Subsidiary Development", London and New York, St. Martin's Press Inc. 1998.
- Centre of Planning and Economic Research " Planning of Economic and Social Development 1983-1987", Athens, 1985.
- Commission of the European Communities, " The Regional Development and European Community", Edition " European Issues", Athens, Paper No 53/1983.
- Commission of the European Communities " Europe of Twelve: Diagrams of Enlarged Community", Edition " European Issues", Athens, Paper No 5-6/1986.
- Commission of the European Communities " Regional Policy of European Community", Edition "European Issues", Athens, Paper No.14/1987.
- Commission of the European Communities " The Great European Market: A Fundamental Support for Economy and Employment", Edition, "European Issues", Athens, Paper No 14/1988.
- International Bank for Reconstruction and Development/ The World Bank, "World Development Report 1988", New York, 1988.
- May Peter and Seroa da Motta Ronaldo, "Pricing the Planet: Economic Analysis for Sustainable Development", New York, Columbia University Press, 1996.
- Meier Gerald and Stiglitz Joseph, " Frontiers of Development Economics: The Future in Perspective ", New York, Oxford University Press, 2001.
- Negroponte- Delivani Maria "Regional Development in Greece in the Frames of E.C.C.", Edition "Observer", Thessaloniki, 1986.

- Office of Official Publications of the European Communities “ European Community and its Regions”, Edition “European Documentations”, Luxembourg, 1985.
- Office of Official Publications of the European Communities, “Europe Without Frontiers– Completing the Internal Market”, “European Documentations” Publications, Luxembourg, Issue No 4/1987.
- Office of Official Publications of the European Communities “Towards the European Union”, Luxembourg, 1991.
- Office of Official Publications of the European Communities “ The Greek Regions in European Union”, Luxembourg ,1999.
- Office of Official Publications of the European Communities “European Policy on Employment and Social Policy: A Policy for People”, Luxembourg, 2000.
- Office of Official Publications of the European Communities, “Regions: Statistical / Yearbook 2000”, Luxembourg, 2000.
- Office of Official Publications of the European Communities,” European Economy”, Luxembourg, 2001.
- Office of Official Publications of the European Communities, “Eurostat Yearbook 2001: The Statistical Guide of Europe”, Luxemburg, 2001.
- Porten Philip and Sheppard Eric, “A World of Difference: Society, Nature, Development”, London, The Guilford Press, New York, St. Martin's Press Inc., 1998.
- Reed David, “Structural Adjustment, the Environmental and Sustainable Development”, London, Earthscan Publications Ltd, 1997.

SUSTAINABLE TOURISM DEVELOPMENT: NOTIONAL FRAMEWORK, PERSPECTIVES AND IMPLICATIONS

S. MELISIDOU

T.E.I. of Lamia

ST. VARVARESSOS

T.E.I. of Lamia

Abstract

In this paper we discuss the growth of modern tourism, and its perspectives and implications in an overall frame. We focus on environmental implementations such as the paradigm of sustainable conservation of St. Phillip Island in Australia. Additionally some economic perspectives provide an overview of sustainable tourism development and its dynamics for the next few years. Notional aspects of mass tourism, sustainability, carrying capacity are provided for an integrated sustainable tourism assumption approach. Sustainability, for tourism as for other industries, has three interconnected aspects: environmental, socio-cultural, and economic. Sustainability implies permanence, so sustainable tourism includes optimum use of resources, minimization of ecological, cultural and social impacts; and maximization of benefits to conservation and local communities. In conclusion we summarize that potential dimension to make tourism a form of Sustainable Development, by practising Governmental Legislation and its applicable concepts, in a few years should be viewed as a part of larger policy framework designed, to be achieved a sustainable society.

JEL: L83, Q01, O10.

Keywords: mass tourism, aspects of sustainability, sustainable tourism development, Agenda 21, carrying capacity, sustainability principles, sustainability's indicators, economic perspectives, socio-cultural; economic and environmental implications, national strategies for sustainable development.

1. Introduction

The growing, even accelerating, concerns about the status of the world environment initially triggered by many publications, which were coalesced by the Brundtland Commission's report "*Our Common Future*", which argued that survival of human species depended on adoption of a new paradigm of

economic development termed 'sustainable development' (World Commission on Environment and Development, 1987). The Brundland Commission report served as a catalyst for discussing the future of human society and ways of ensuring that development is sustainable over the long term.

The last few decades, tourism phenomenon has developed rapidly. Nowadays tourism is one of the world's largest industries and one of its fastest growing economic sectors. It has a multitude of impacts, both positive and negative on socio-cultural issues, economic and environment as well. (McCool, Moisey, 2002) Clearly, tourism has become a global financial power, achieving a planetary presence unequalled by many other economic sectors. As it has grown, so have the criticism of its environmental, economic, socio-cultural and political consequences (Cater & Goodall, 1992; McLaren, 1997). Tourism is no longer the benign economic development tool that the boosterism of the past purported it to be.

Sustainable tourism development meets the needs of the present tourists and host regions while protecting and enhancing the opportunity for the future. It is envisaged as leading to a management of all resources in such a way that economic, social and aesthetic needs can be fulfilled, while maintaining cultural integrity, essential ecological processes, biological diversity and life support systems (McCool, Moisey, 2002; U.N.E.P., 2002).

In this paper, we analyze the notion of sustainability, and outline several of pathways, perspectives and implications confronting tourism as it seeks an appropriate role in the world. These conclude:

1. The meaning of sustainable tourism – there are several such meanings, which ones are used suggest not only world-views but also have implications for other issues.
2. Integration with larger economy and linkage with scale of consideration- academic reviews, planners, international organisations are increasingly concerned with how tourism development fits in with broader social and economic development goals.
3. The search for indicators- how do we know if sustainable tourism is indeed sustainable without a set of measurable variables that indicate progress?
4. Planning and implementation – sustainable tourism does not just happen, it occurs only with explicit decision making processes that consider what futures are plausible and desirable and the pathways to them.
5. Strategies, forms of knowledge and public participation – achieving

sustainable tourism will require a variety of individuals, agencies and programmes, each using different forms of knowledge and each involving those affected by decisions.

2. Defining the “new” Tourism

An intertwined overview of several definitions and notional approaches will provide clearly, the conception of sustainability and its aspects which will be analyzed furthermore, in this paper.

Mass Tourism is the model of tourism where the influence of the tourist flow has negative effects to the environment, the economy, the social and the cultural values of the society. Unfortunately nowadays the symptom of the Mass Tourism is very common because of the enormous rise in Tourist Packages sales which Travel Agents use to try to decrease the cost of the tourist package and to increase the beneficial aspects (Holden, 1996).

This phenomenon provides mass economical profits to the wholesalers and at the meantime the natural, cultural and social environment is “hurt” by the massive tourist attack. Where there is no concern for the physical implementations of the tourist flow (Cater, 1995).

A brief indication by Vincent (1991:112-118) of the problems of Mass Tourism follows, to show the extension of the catastrophe and the possible dangers which threaten the ecosystem:

- Environmental pollution effects (air, water, sites, noise).
- The destruction of flora and fauna (disappearance of several species plants and animals).
- Loss of Natural Landscape.
- Degradation of landscape and of historic sites and monuments (aesthetic degradation).
- Effects of congestion (traffic, time and space of tourists on holidays).
- Effects of conflict at the resident population.
- Effects of competition (is bound to occur to the detriment of traditional activities).

A few definitions are quoted to provide a balanced approach for the subject of the notion of sustainability.

Sustainable Tourism, “is the ideal model of Tourism which is able to

operate the system, by creating a profitable and 'healthy' environment from the Tourism industry, during the time" (Harrison L., 1996:35-41).

Sustainable Development, is the development which "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Eber, 1992:1). Thus some researchers suggest that there may be a symbiotic relation between Tourism and the environment (Mathieson and Wall, 1989:102).

Sustainable Tourism Development, is the complex of the above definitions means "that tourism development is both in volume and in direction of development evolving in such a way that the pressure on the natural environment remains below the level of the carrying capacity for both the present and the future generation" (Janssen, Kiers, & Nijkamp, 1995:65.). This also indicates the importance of creating and supporting the Sustainable Development of Tourism. The matter of fact is that Tourism relies on conserving the natural environment.

2.1. Tourism & Sustainable Development

The massive and rapid development of industry increased the concern of sustainability. "The strive for a concerted development of the economy and ecology based on a coherent and integrated viewpoint has stimulated many social scientists to adopt systemic notions and concepts for achieving a balance between natural and socio-economic systems. The functioning of such natural and socio-economic systems has, in their view, to be studied from the angle of material inputs of all production and consumption processes" (Nijkamp, 1995:67).

New disciplinary efforts such as human ecology and environmental economics have come to the fore, in where important attempts have been made to certify a merger between ecology and economics. These efforts have been especially intensive in the last two decades. The concern that a sustainable development is a matter of fact which shows in present and in future as well, its quantitative and qualitative implementations have been significantly increased (Butler, 1995:49). The stakeholders having been aware of the problems which can be caused because of the negative influence of the mass Tourism considerably took action by carrying out seminars, and publishing reports and documents in favour of the environmental conservation and indications for sustainable tourism.

At the meantime, despite the earth's natural resources and the environmental decay, the political awareness and intervention has increased rapidly.

“In spite of many efforts, local, national and international policy bodies have been unsuccessful in ensuring the viable economic development trajectory that was compatible with environmental quality (WTO, 1997). For instance, the UN Conference on human environment (Stockholm, 1972) has only very moderately achieved the high targets which were set for our planet.

The world Commission on Environment and Development, established by the general assembly of the United Nations in 1983 (U.N.E.P.), was assigned the task of providing concrete recommendations for action on the interrelated issues of environment and development, seen from a strategic long-term viewpoint. The Commission Report (1987), ‘Our Common Future’ (often named Brundtland Report after the president of the (Commission), is a remarkable document in that offers concrete hope for sustainable development” (Nijkamp, 1995:167).

The “Agenda 21” (Rio, 1997), is the latest interaction, in a global level, of the stakeholders which frames the scenario. Above that, is the most up to date indication of the actions should be taken for Sustainable tourism, towards profitable development and general perspective growth. An abbreviation of “Agenda 21” is listed below.

2.2. The interpretation of “Agenda 21” scenario

A number of tourism-related initiatives have been taken, both within and outside tourism sector, which encourage a redirection of tourism towards sustainable practises. The initiatives are diverse, including integration of sustainability in policies such as the national ecotourism policy in Australia (Commonwealth of Australia, 1994) and in planning, including the integration of tourism with local Agenda 21 initiatives (WTTC, WTO and EC, 1997).

Agenda 21 for the Travel and Tourism industry is a comprehensive program of action adopted by 182 governments at the United Nations conference on environment and development. It is also known as the earth summit on 14th of June 1997. It is the first document of its kind to achieve international consensus (WTO, 1997). Agenda 21 provides a blueprint for securing the sustainable future of the planet into the 21st century. It identifies the environment and development issues which threaten to bring

about economic and ecological catastrophe and present a strategy for transition to more sustainable development practices (WTTC, 1997).

The scenario of Agenda 21 highlights the indications for altering the existing tourism model to sustainable tourism. The Travel and tourism has a real potential to contribute to sustainable development with effective management and flexible regulation. The partnership between governments, private sector and local communities essentially needed to scope, shape and deliver tourism activities, where the voluntary action is preferable to regulation (WTO, 1993). Additionally, the controlled expansion of infrastructure is critical to the achievement of the sustainable tourism. The policy of setting environmental taxes, where applied, should be fair and non-discriminatory.

The intervention of the stakeholders should be in order to minimise the impact on consumer prices. As the International, local, and national funding bodies should include sustainable development as part of their criteria, so that in time, all funding would be dependent on sound environmental practice (Middleton 1998:250-257).

Environmental education and training should be increased, particularly in schools, for future members employed in the hospitality industry.

The agenda 21 for travel and tourism industry document should be regionalised for local implementation and the local organisations should be urged to adopt it as their core document (WTO/ Green Globe Board, 1997).

3. Economic Perspectives of growing Sustainable Tourism - An overview of today's tourism industry

Tourism can be considered as a tool for social and economic development, as a method to enhance economic opportunity, not as an end itself. Gale and Cordray's (1994) investigated the query "What should be sustained?" in a natural resource management context, to which they gave various answers, primarily focusing on various ecosystem characteristics. In this sense, tourism is integrated into broader economic and development programmes (Hunter, 1995; McCool, 2001) and can be viewed as a method – similar to many definitions of ecotourism- to protect the natural and social capital upon which the industry is built.

By this query, tourism can be viewed as a tool, which at times, may be important to a community and other times not so important. In this sense,

there is no any case of protecting cultures for their value to the tourism industry, but because of their value to their people (Robinson, 1999). It may be possible under this view that tourism is not sustained over a long period, but is used as a method to accumulate income and government revenue that can be used later for other development tools. Tourism would be viewed as a part of larger policy framework designed to achieve a sustainable society.

These alternative views of sustainable tourism carry significantly different implications for social economic policy, selection of indicators, public participation and the processes of planning should have encouraged the growth of tourism in private sector. They reflect different perspectives on the concept of sustainability. It seems that it more properly places tourism as a means and not an end to economic development. It allows tourism to be considered as one of the several alternatives that can help a community overcome its weaknesses and preserve its strengths. It views tourism as a tool and not as an end.

According to the World Tourism Organization, 698 million people travelled to a foreign country in 2000, spending more US\$ 478 billion. International tourism receipts combined with passenger transport currently total more than US\$ 575 billion- making tourism the world's number one export earner, ahead of automotive products, chemicals, petroleum and food (WTTC, 2001). "The sector is growing faster than the economy as a whole. WTTC/ WTO (2002) reports shows that in 1998, the Travel & Tourism economy is expected to generate, directly and indirectly, 11,6% of GDP (Gross Domestic Product) and nearly 231 million jobs in the world-wide economy. These figures are forecast to grow to 12,5% and 328 million respectively by 2010.

There were about 698 million international tourist arrivals worldwide in 2000, nearly 50 million (7.3%) more arrivals than in 1999 - the highest growth rate in nearly a decade. All regions in the world grew, and the fastest developing region continued to be East Asia and the Pacific with 14.6% growth, and 16% of the total market.

Europe saw an increase of 25 million international tourists (5.9% growth rate), and had 57.7% of the market share - by far the largest among the world's regions. The Americas are the second-biggest region, with 18.5% of arrivals (WTTC, 2002).

The WTO statistic resources (2002) refers, that international tourist receipts grew by 5%, totalling US\$ 478 billion in 2000, with an additional US\$ 97 billion from international transport carriers earned outside the country of

origin. Receipts per arrival averaged US\$ 700 in 1999. Air transport increased its share against road in international holidays; together these two account for 85% of all international trips. Rail and sea transport remain below 8% each.

There are many hidden costs to tourism, which can have unfavourable economic effects on the host community. Often rich countries are better able to profit from tourism than poor ones. Whereas the least developed countries have the most urgent need for income, employment and general rise of the standard of living by means of tourism, they are least able to realize these benefits. Among the reasons for this are large-scale transfer of tourism revenues out of the host country and exclusion of local businesses and products (WTO, 2002).

The tourism industry generates substantial economic benefits to both host countries and tourists' home countries. Especially in developing countries, one of the primary motivations for a region to promote itself as a tourism destination is the expected economic improvement. As with other impacts, this massive economic development brings along both positive and negative consequences. Jobs generated by Travel and Tourism are spread across the economy - in retail, construction manufacturing and telecommunications, as well in travel companies. They have a high proportion of women, minorities and youth, are predominantly in small and medium sized enterprises and offer good training and transferability. This pattern applies to developed and emerging economies alike" (WTTC / Green globe reports, 2002).

4. Notional approaches and tools of Sustainability

Sustainability, for tourism as for other industries, has three interconnected aspects: environmental, socio-cultural, and economic. Sustainability implies permanence, so sustainable tourism includes optimum use of resources, including biological diversity; minimization of ecological, cultural and social impacts; and maximization of benefits to conservation and local communities. It also refers to the management structures that are needed to achieve this.

Some organizations prefer to speak of sustainable development of tourism, rather than sustainable tourism, for two main reasons:

1. For tourism to be sustainable it needs to be integrated into all aspects of development.
2. Some aspects of tourism, such as long-haul air travel, may simply not be

The stakeholders, such as the national tourism boards, international organisations like Green Peace, Green Globe, WTTC, Tourism Concern, etc., hoteliers, restaurant owners, merchandisers, employees of tourist enterprises, residential public communities should taking action by inventing strategies and measurements of conservation and sustainable development (Muller, 1991). The pressure groups combat the huge economical profits, towards the future positive implementation of tourism aspects. The human intervention is necessary to grown profit. Sustainable Tourism Development has appeased the problems by setting pressure on government and incentives to the voluntary participation, and at the meantime by decreasing the amount of leakage and reducing the interest rate (Pearce, 1991).

4.1.2. Sustainability principles and its primary focus

Sustainability criteria often used in tourism include environmental, social, cultural, economic, educational and local participatory aspects (Mowforth and Munt, 1998). The environmental, social, economic experimental and planning issues included in this definition have been operationalized into 12 principles of sustainable tourism (table1), based on (Eber, 1992:1-5) combined with two principles from ecotourism (WWF, 1995). Table 1 indicates to which of these criteria each sustainability principle is primarily related (McCool F., Moisey R., 2001).

The sustainable approach to tourism is relevant to the industry, which needs to ensure its long-term viability; to resource managers, who need to secure the natural and cultural resource base; to local residents, to ensure that their quality of life is maintained; and to the tourists, who prefer to maintain quality experiences in the destination that match their motivation and recreational needs. Consequently, sustainable tourism has to address environmental, socio-cultural, economic, experiential and quality-of-life issues as well as the planning and management practises of the industry.

Table 1: Sustainability principles.

Sustainability principles	Primary focus
Sensible use of nature resources	Environmental
Reduction of consumption and waste products	Environmental
Maintain diversity of plants and animals	Environmental
Studies of environmental and social impacts	Environmental and social
Responsible marketing of tourism	Environmental and social
Support of local economy	Economic
Tourism supports improvements in the area	Economic
Cooperation with local residents	Local participation
Consultation of interest groups including stakeholders	Local participation
Integration of tourism into local, regional and national planning	Planning
Information and nature interpretation for tourists	Educational
Training of staff	Educational

Source: (McCool F.& Moisey R., 2001:291).

4.2 The Carrying Capacity, a useable tool to achieve sustainability

Central to the concept of sustainability is the idea of carrying capacity. Quite simply, the carrying capacity of a site, resort, or even a region refers to its ability to absorb tourism use without deteriorating. In other words, capacity intervenes in the relationship between the tourist and the tourist resource, or destination. The concept of carrying capacity like sustainability, has its routes in resource management, but it is particularly important now in a situation where finite destination resources are under growing pressure from users (Cooper, Fletcher, Gilbert, Shepherd, and Wanhill, 1998:109-110).

Mathieson and Wall (1982:21) define the carrying capacity as the maximum number of people who can use without an unacceptable alteration in the physical environment and without unacceptable decline in the quality of experience gained by visitors. The main problem with carrying capacity is that the concept is easy to grasp but very difficult to put into practise because carrying capacity is management decision. Managers of the tourist destination, as well as the tourist themselves, decide what is unacceptable and

when the quality of experience has declined. Indeed, any destination can be managed to a high or a low capacity, a level that is determined as much by management as by the innate characteristics of the resource, culture and so on.

The valuation of carrying capacity does not exist if it is isolated from the other applicable concepts. Nevertheless the importance of its practice provides incentives for growing a sustainable tourism model, and being awarded from its positive aspects.

5. The applicable concepts for sustainable development

Butler (1997); McCool and Moisey (2002) define the following applicable concepts for sustainable tourism development such as:

Resource valuation: The concept of heritage implies the valuation of reserving through the time the historical sites and monuments.

Output equity: A valuation for “intersectional equity” is required to reconcile the variety of contemporary uses through policies that prevent the depletion of the resource upon both tourism and other activities depend.

Homeostatic systems adjustment: An intervention in the market is required to maintain the balances and the planning perspectives.

Carrying capacity: The link between resource valuation and equity outputs can be made through the concept of carrying capacity and homeostatic adjustments. The model of carrying capacity is an optimising model for relating of visitor numbers to resources.

5.1. Indicators for monitoring evaluation sustainability’s effectiveness

The youngest of all tools of sustainability are those now described as sustainability indicators, the development of which arose from the Rio Summit of 1992 (Lea, 1993, (4):120-134). It is now commonly accepted that conventional indicators of ‘well-being’ (such as Gross national product-GNP) give a restricted, partial and one-sided view of development. It is the search for indicators which show linkages between economic social and environmental issues and the power relationships behind them which has given rise to the development of so called sustainability indicators. Thus far, such indicators have been developed as trials and are currently applied only at local authority level.

One important aspect that has been built into these indicators from their inception has been the participation of local community members in their formulation. There is no doubting here the genuine and different attempt to promote such participation as part of the development of sustainability indicators (Cater, 1995). There is also no doubting that it is precisely this participation which has led to the use of indicators which are much less remote and much more comprehensible to people than are nationally and internationally derived measures such as GNP, gross domestic investment, and the like.

But their acceptance will face an uphill struggle. The measures most frequently used as the level of national economy relate precisely to that: the economy. Other relevant factors are externalised (that is ignored). Moreover, their use is well entrenched and perpetuated by conservative media which accept new ideas with reluctance unless they are forced to do so by a public that has already moved ahead (Lea, 1993; McCool, Moisey, 2002) The need to include the social, cultural, environmental and aesthetic factors which our commercial world and controllers normally externalise has not led to a quick redress for such factors, despite public debate of issue.

We summarize with some indicators for achieving and monitoring sustainability aspects in tourism destinations, as are defined by J. Lea.

1. Area protection
2. Visitor management techniques
3. Environmental impact assessment
4. Carrying capacity calculations
5. Consultation/participation techniques
6. Codes of conduct
7. Sustainable indicators

6. Positive and negative impacts from sustainable tourism development

Although the growth of Mass tourism has negative effects on the environment, cultural and social ethics, the balanced growth can bring positive impacts on the above and could be the source of economic integration, not only in a particular destination but for the general society, in all social, cultural, economical and environmental issues (McKercher, 1993, 14(2):131-136).

Briefly, sustainable tourism:

Table 2: Negative and positive impacts of sustainable tourism development

Negative Impacts	Positive impacts
<u>Economic frame</u>	
Leakage - import - export	Foreign exchange earnings
Enclave tourism	Contribution to government revenues
Infrastructure cost	Employment generation
Increase in prices	Stimulation of infrastructure investment
Economic dependence of the local community on tourism	Contribution to local economies
Seasonal character of jobs	
<u>Socio-cultural frame</u>	
Change or loss of indigenous identity and values - commodification - standardization - loss of authenticity - adaptation to tourist demands	Tourism as a form for peace
Culture clashes - economic inequality - irritation due to tourist behaviour - job level friction	Strengthening communities
Physical influences causing social stress - resource use conflicts - cultural deterioration - conflicts with traditional land-uses	Facilities developed for tourism can benefit residents
Ethical issues - crime generation - child labour - prostitution and sex tourism	Revaluation of culture and traditions
	Tourism encourages civic involvement and pride
<u>Environmental frame</u>	
Depletion of natural resources - water resources - local resources - land degradation	Financial contribution - direct financial contributions - contribution to government revenues

Negative Impacts	Positive impacts
Pollution <ul style="list-style-type: none"> - air pollution and noise - solid waste and littering - sewage - aesthetic pollution 	Improved environment management and planning <ul style="list-style-type: none"> - cleaner production techniques - pollution prevention and waste minimization techniques
Physical impacts <ul style="list-style-type: none"> - construction activities and infrastructure development (land deterioration) - deforestation and intensified or unsustainable use of land - trampling on vegetation-soil - anchoring and other marine activities - alteration of ecosystems by tourist activities 	Environmental awareness raising <ul style="list-style-type: none"> - sustainable consumption
Loss of biological diversity	Protection and preservation
Depletion of ozone layer	Alternative employment (mainly agricultural)
Climate change	Regulatory measures help offset negative impacts

Source: WTO/U.N.E.P., 2002.

7. Case Study: A paradigm of practising sustainability in a tourist resort

The case study of Phillip Island (Australia) - Ecotourism

The case study of Phillip Island in Victoria prefecture of Australia is a proof that the ecologically sustainable tourism is not a pipe dream.

The last few decades when the tourism board of Victoria in Australia, considered that the increased tourism flow could affect the ecosystem (by disturbing the balance in “the life of the little penguins”), took action and promoted a new form of tourism the ecotourism, to preserve the rich sea fauna. The system adopted by the local authorities and the participation of the citizens was really warm.

They focused on preserving the penguin’s colony which was seriously at risk of being loved to death. The threat of the tourism invasion, at late 60s invaded the island. The participation of the local community in

combination with the measurements taken was really important at the mid '80s. It was the time when both the economic significance of the RIPR as a tourist attraction, at the potential threats to the reserve's long term future, was recognised by the Victorian State Government. A reorganisation of the reserve's committee of management resulted, and a penguin Protection plan was developed in 1985 (Weaver & Oppermann, 2000:373-375).

This plan involved the allocation of substantial funds for scientific research into the little penguin, the purchase of land in the adjoining Summerland Estate for rehabilitation as penguin habitat, and the preparation of a comprehensive management plan.

The penguin protection plan quickly acted to arrest the decline in penguin numbers and later brought about a significant increase in breeding pairs. In 1995 penguin numbers were at record levels and the visitation continued to remain in high levels approximately 500,000 visitors annually.

Actions taken: they designed visitor facilities (special stand from where the visitors could observe the penguins, elevated broad walks, visitors' centre which provide interpreted displays, printed material and audio-visual facilities .The high profile that the reserved has developed over the ten past years. It also sought and attained sponsorships from local and interstate business. For example ESSO Petroleum Company in 3 years offered the amount of \$150.000 for feeding the penguins. They also donated \$100.000 for audio-visual equipment. This strategic plan also proved beneficial by creating employment and wealth to the local community.

Mission statement: Tourism can be used to fund conservation activities to providing effective management regimes are in place and the primary concern of managers remains the area and its wildlife. Indeed it is this concern that ensures the long-term viability of the resource. The excellent management and marketing capacity of the management committee provide a resource to be utilised in this regard (Harris & Leiper,1995:20-26).

8. Strategies and Key ideas to achieve sustainable tourism development

In conclusion we summarize some of the action points, which should be practised to achieve sustainability in growing tourism assumption. The strategies to practise sustainable development, the role of governmental

legislation and local participation, are issues which need further investigation in each case. Also some key ideas provided to enhance the notion of sustainability and its implications to a cluster of economic sufficiency, social equity and environmental conservation factors.

8.1. The framework of national strategies for sustainable tourism development

Common national strategies to achieve sustainability aspects provided below, by the WTO and U.N.E.P. (United Nations Environment Program) boards (ed. 2002). The assumption of sustainable tourism development, should be balanced with broader economic, social and environmental objectives at national and local level by setting out a national tourism strategy that is based on knowledge of environmental and biodiversity resources, and is integrated with national and regional sustainable development.

Action issues:

- establishment of a national tourism strategy that is updated periodically and master plan for tourism development and management
- development of coherent policy to reflect tourism's challenges
- work with the tourism industry to learn about the realities shaping available choices, while helping create an environment in which higher standards can be delivered
- integration of conservation of environmental and biodiversity resources into all strategies and plans
- enhancement prospects of economic development and employment while maintaining protection of the environment sustainability in tourism and related activities
- strengthening of the coordination of tourism policy, planning development and management at both national and local levels

In conclusion, we summarize to some key actions should be taken by the stakeholders for the benefit of sustainable tourism development, considering its positive implications in a socio-cultural, economic, environmental, development and conservation scheme:

- The hopes for changes should be replaced from realistic agendas for action.
- An assessment of tourism potential should be included in each national development perspectives and plans.

- An identification of suitable types of development should be investigated.
- Local control over the tourism industry should involve governmental intervention.

9. Conclusion

By investigating efficiently the survey of Sustainability in Tourism, is clearly obvious that tourism and sustainable development are compatible, they can coexist. Notions such as the applicant concepts, the notion of the aspects of sustainability, the carrying capacity subject can provide a catholic view regarding the strengths and the opportunities of growing sustainable development in the tourism industry. A weakness in order to achieve sustainable tourism development is the lack of experience, knowledge and financial resources, and the limited involvement of local authorities and governmental legislation. Environmental instruments should be designed to facilitate the integration of environmental policy with other policies, such as regional development plans.

Removal and correction of administrative and governmental intervention failures are therefore of importance for a proper integration of environmental policy with sectional policies. This may end up in a better synergy and coordination of tourist activities with other socio-economic activities.

It is important that decisions with influence life at the local level will be taken at the lowest possible level of governance. Knowledge of the area involved and its problems increase local support in the development of a suitable action plan for sustainable tourism. The role of the local authorities should therefore be strengthened. Education, information, promotion and training are therefore important measures in this context. Sustainable tourism is by no means a non-viable option.

Sustainability, for tourism as for other industries, has three interconnected aspects: environmental, socio-cultural, and economic. Sustainability implies permanence, so sustainable tourism includes optimum use of resources, minimization of ecological, cultural and social impacts; and maximization of benefits to conservation and local communities. At the end the potential dimension to make tourism a form of Sustainable Development, by practising Governmental Legislation and

its applicable concepts, in a few years should be viewed as a part of larger policy framework designed, to be achieved a sustainable society.

At the end we summarize by answering to the following question: “Is it possible to create and practise a new model of mass tourism with sustainable values?” Tourism development with sustainable concepts, or preferably, the ideal profile of mass tourism under sustainable values can be achieved by long term marketing policies, strategic management planning and the participation of the local communities and the governmental legislation.

REFERENCES

- Boyer.M. (1993), “Typologies Et Changements Dans Le Tourisme”, Centre De Hautes Etudes Touristiques, Paris: Les Cahiers Du Tourisme.
- Brandon P. (1993), “Ecotourism and Conservation: A Review of Issues”. Working Paper 33, World Bank Environment Department.
- Briassoulis H. (1995), “The Environmental Internalities of Tourism: Theoretical Analysis and Policy Implications”, Edition Sustainable Tourism Development, pp. 25.
- Briguglio L. (1995), “Sustainable tourism”, Paris: Cassel
- Buttler R.(1995), “Tourism and the Environment: Sustainability and Economic Restructuring”, London: Edit. Sustainable Tourism, a Geographical Perspective, pp. 49.
- Buttler R. (1997), “The concept of carrying capacity for tourism destinations”, In *Tourism Development : environmental and community issues*, Cooper C.P and Wanhill S.R.C., ed. Chichester: Wiley, p. 11-22.

- Cater E. (1995), "Environmental considerations in sustainable tourism", *Geographical Journal*, 161(1): 21-28.
- Coccosis H. (1996), "Sustainable Tourism? European Experiences", In: Edwards J.A., Coccosis H. "Tourism and sustainability: Perspectives and implications." Oxon U.K.: Priestley, (1) pp. 10.
- Coccosis H.& Nijkamp P. (1995), "Sustainable tourism development" In: *Assessing The Interaction Between Heritage Environment and Tourism: Mykonos*, UK: Ed.Ashgate Publishing Ltd., pp. 105.
- Coccosis H. - Tsartas P. (2001), "Sustainable tourism development and the environment", Athens : Kritiki.
- Cooper C., Fletcher J., Gilbert D., Shepherd R., and Wanhill S. (1998), "Tourism principles and practise", London: Prentice Hall, (2): 109-110, 185-198.
- Cooper & Lockwood (1991), "Progress in tourism recreation and hospitality management", Chichester: Wiley, Vol. 4: Chapters 3, 9, 10.
- Cooper & Lockwood (1991), "Progress in tourism recreation and hospitality management., Chichester: Wiley, Vol.6: Chapters 1,2,3,4,5.
- Cooper & Lockwood (1991), "Progress in tourism recreation and hospitality management", Chichester: Wiley, Vol. 5: Chapters 10, 18, 19, (pp. 297-308).
- Eber S. (1992), "Beyond the Green Horizon. Principles of Sustainable Tourism: A discussion paper", London: World Tourism Concern and Wide Fund for Nature".
- Gartner W. (2001), "Tourism development - Principles, procedures and policies", Translation- edited, Korres G., Drakopoulos S., Athens: Ellin.
- Godall B. (1994), "The Promotion of Destination Regions", London: THHP.
- Green Globe Global(2000), Green Globe 21, Sustainable 21st Century Tourism, www.greenglobe21.com
- Gunn C.(1988), "Tourism Planning", New York: Taylor and Francis.

- Hall C.& Lew A.(1998), “Sustainable Tourism- Looking Backwards in Order to Progress?”, *Sustainable Tourism. London: A Geographical Perspective*, pp. 25.
- Harris R. & Leiper N. (1995), “Sustainable Tourism-An Australian Perspective”, New York: THHP, Chapter 5, (D. Scrase - Phillip island penguin reserve.), p. 20-26.
- Harrison L., Husbands W. (1996), “Practising responsible tourism”, London: Wiley.
- Herbin J. (1993), “Tourisme et environment”, Paris: La Documentation Française.
- Holden A. (1996), “Alternative and Sustainable Tourism” – The Way Forward, London: UNL.
- Hughes G. (1996) “The cultural constructions of sustainable tourism”, London: HTTP.
- Igoumenakis N.(1998), “Tourism Development”, Athens :Interbooks.
- Inskeep E.(1991), “Tourism Planning: An integrated and sustainable development approach”, London: Routledge.
- Komilis P. (2001), “Ecotourism: The alternative perspective of sustainable tourism development”, Athens: Propombos.
- Komilis P. - Vagionis N. (1999), “Tourism planning, principles and practices of valuation”, Athens: Propombos.
- Lawson F., Baud-Bovy M. (1977), “Tourism and recreation development”, London: The architectural press.
- Lea J. (1993), “Tourism and Development in the Third World”, London: HTTP, pp. 120 - 130.
- Lindeberg K. (1994), “An Analysis of Ecotourism Contribution to Conservation and Development”, London: Wiley.
- Mathieson A. and Wall G., (1989),” *Tourism: economic, physical and social impacts*”, London: Loongman, pp. 105-115.
- McKercher B.(1993), “The unrecognized threat to tourism. Can tourism survive sustainability?”, *T.M.*, 14 (2): 131-136.
- McCool S. and Moisey N. (2001), “Tourism, Recreation and Sustainability: Linking culture and the environment”, Oxon, U.K.: CABI Publishing.

- Middleton (1998), Part Four “ International Cases of Good Practice for Sustainability, pp. 201-224./ Appendix Ii Environmental Regulations, Market Mechanisms and Self Regulatory Codes of Conduct Influencing the Tourism Industry. pp. 250-257.
- Mowforth M.and Munt I. (1998), “Tourism and sustainability: New tourism in the third world”, London: Routledge.
- Muller D. (1991), “The Thorny Path to Sustainable Tourism”, London:THHP.
- Murphy P.E. (1994), Tourism and sustainable development In: Theobald W. ed. Global tourism: the next decade, Oxford: Butterworth – Heinemann, pp. 274-290.
- Murphy P.E. (1985) “Tourism: A community approach”, London: Routledge.
- Pearce D. W. (1991), “Towards the sustainable economy : environment and economies”, Royal Bank of Scotland Review, No 172, pp. 3-14.
- Pearce D. W. (1989), “Tourist development”, Harlow, (England): Longman.
- Reid D. (1995), “Sustainable Development, An Introductory Guide”, London: Earthscan Publications.
- Scheyvens R.(1999), “Ecotourism and the empowerment of local communities”. T.M., vol. 20, N.2, pp. 245-249.
- Sue B.- Ladkin A.(1997), “Sustainable tourism: A regional perspective”. T.M, vol 18, No 7, pp. 433-440.
- Theobald W.(1991), “Global Tourism in Next Decade”, London: Pitman Publishing.
- Tsartas P. (1996), “Tourists, travel, resorts: sociological approach to tourism”, Athens: Exantas.
- Tsartas P. (2001), “Qualitative characteristics and tendencies of internal tourism demand”, Athens: EKKE.
- U.N.E.P. (United Nations Environment Program) Reports, (2001, 2002, 2003).
- Varvaressos S.(1999), “Tourism development and administrative decentralization”, Athens: Propombos.
- Varvaressos S.(1993), “The coveted tourism upgrade and its way to achieve. Basic weakness: The shortage of strategic tourism planning”, Athens: Tourism and Economy, 180: 110-117.

- Vincent M.(1991), "Tourism environment and development". T.M., Vol 12, N. 2, pp.112- 118.
- Wall P.(1986),"Tourism, Social, Economical and Physical Impacts", London: THHP.
- Weiler B.& Davis D.(1993), "An exploratory investigation into the roles of the Nature based tour leader". Tourism Management, London: THHP, 14 (2): 91-98.
- Weaver D.& Oppermann M.(2000), "Tourism Management", Australia: Wiley, pp. 373-375.
- Williams A. & Shaw G.(1996), "Tools for Sustainable Analysis in Planning and Managing Tourism and Recreation in the Destination". London :Wright, pp. 75.
- World Tourism Organization (WTO) (1997), "Sustainable tourism development: Guide for local planners", Madrid.
- WTO/ Green Globe Board (1997) Report "Tourism towards Sustainability".
- WTO/ Green Globe Board (2000)Report "Sustainable Tourism planning".
- WTO (2000) Report "Sustainable Tourism development".
- World Travel and Tourism Council (WTTC), World Tourism Organization (WTO) and Earth Council (EC) (1997), "Agenda 21 for the Travel and Tourism Industry: Towards to Environmentally - Sustainable Development."

THE RIO - ANTIRIO BRIDGE. HOPE FOR THE DEVELOPMENT OF WESTERN GREECE

G. KOLOVOS

T.E.I. of Piraeus

Abstract

Objective of present article is: a. the presentation of history of crossings of narrow Rio - Antirrio, the documentation of necessity of manufacture of Bridge, the description of history of auctioning and manufacture of work, the presentation his technical and economic elements, the examination of proposals of exploitation of worksite and the formulation of questions that results round the repercussions in the region and in the environment afterwards the completion of manufacture of Bridge.

JEL classification: H53, L61, L74, L90.

Keywords: The Vision, the company, Bridge, pylon, deck, tolls, Administration premises, Theme Park, hope.

1. Introduction

In the beginning of the last century, the transport was made through rowing and sailing boats owned by the inhabitants of Nafpaktos and Antirrio. The usual trips at the time were Nafpaktos – Rio, Nafpaktos –Aigio, Kryoneri – Patra and Monastiraki – Psathopyrgos. After the Second World War, the increasing needs for transport of goods and vehicles, brought the first ferry boats. The line Rio – Antirrio started in 1946 with the ferry boat Socrates Iasemidis, on the initiative of Epaminondas Kypriadis. The effort met the fierce opposition of the hotel owners in Patra, the Railways of Northern and Western Greece and many others whose interests were hurt. The name Iasemidis was chosen to honour a professor and minister of that time, who made a law about agricultural cooperatives. Kypriadis who, as an agronomist, had founded cooperatives in Farsala, Sofades and Velestino, had the idea of connecting the channel with ships and since he failed to obtain support form the state he started implementing his plan with the help of the cooperatives of the region¹.

Because at that time there were no special docks in any of the ports, ferry boats simply placed their catapult on the sand. The vehicles were charged on the ship by dockers who moved them on metal corridors so that they would not sink. Gradually, more ships entered the line, such as the car ferry Rodos that could carry railway wagons and the ferry boat Eleana, with Costas Katsaounis as a captain, that was in service up to 1978². And of course the famous small passenger ship Kalydon that was in service up to the late 60ies, in the line Patra – Kryoneri and that the elderly still remember nostalgically. The trips in the 50ies were still infrequent, there was one departure every hour, while only one ferry had the permission to travel by night. In the 60 and 70ies, the improvement of the harbour installations and the increase of passengers, brought more ships to Rio.

When the weather was bad at the Channel, the line closed. Hundreds of people trapped in cars and buses, waited for the weather to improve and for Rio to open. However, the question if Rio can be crossed is not at all recent. It seems that the first to realize it were Heraklides, when 3,200 years ago they tried to cross the channel. In the late 12th century AD, waves of Dorian people led by the Yllos, Hercules' son, tried to pass to Peloponnese from Sterea Hellas. Their first attempt through the region of the Isthmus of Corinth failed and then Yllos remembered the prophecy he had been given earlier by the Oracle of Delphi referring to "the narrow waters of the wide meadows" (Apollodoros, library B' 167 – 176). The Dorian people thought the prophecy referred to the narrow channel of the wide sea, on the right of Isthmus and hurried to the region of Nafpaktos, where according to ancient authors, they constructed their ships. However neither that attempt was successful. The troops were hit by famine and most ships sank at their attempt to cross the sea. A new prophecy came from the Oracle of Delphi attributing the evil to the wrath of God Apollo. To propitiate the god, according to the Oracle, the Heraclides should sent into exile the murderer of the oracle priest Karnos from Akarnania for 10 years and take as a guide the "triofthalmos" (three-eyed). Indeed, they sent into exile Ippotis (Hercules' great grand son) who had killed the oracle priest but did not know who the "three-eyed" was. The Dorian people were trying to interpret the prophecy when they came across Oxylos from Aetolia, who was returning to his homeland after a year of exile in Ilia. Oxylos was riding an one-eyed horse. The Dorian people immediately

recognized the “three-eyed” and having Oxylos as a guide they crossed the sea in their ships to Peloponnese through the channel Rio – Antirrio³.

1.1. Modern times

Rio remains closed when there are eastern, northern-eastern, southern eastern and western winds, that is when the wind blows along the Corinthian Gulf (even 5 – 6 beauforts are enough to close the passage). On the contrary, when the wind are of northern or southern direction, then the volume of the mountains on both sides of the channel stops and moderates their force. The eastern winds can carry on up to two hours while the western ones up to six hours, but the former are more dangerous because they break suddenly like a storm with high waves and rain. Every year, the coast of Antirrio is pushed back from the respective coast of Rio by 8 mm. This means that after 120 years, the two coasts will be farther from each other by 960 mm.

The Rio –Antirrio bridge, which will have four pylons, and will be a cable bridge. This means that the charge of the bridge is transferred directly to the pylons, through inclined cables instead of the deck suspended from the central cables, as is the case of the suspension bridges. (In cable bridges the deck is suspended, keeping the balance through cables on one pylon, while in the suspension bridges the deck is suspended between two pylons). In this particular case, we have a more rigid construction, with less deformations and therefore a lighter and more streamlined deck. It is worth noting that the concept of this particular bridge belongs to Chinese Tee Whan Lee, who expressed it at the international conference held at the University of Patra in 1977 and was convened on the initiative of the professor Bouda⁴.

The channel is characterized by sandy and unstable subsoil, strong currents, deep waters, high seismicity, while its length is 2,252 m. This particular combination of adverse environmental conditions puzzled the engineers about the type of construction they should choose. After several studies, which were confirmed with experiments on a bridge model, the solution that was chosen was to support it on foundations of low depth and great width, that is short and wide. So, the four enormous bases the foundations on which the 4 pylons will be supported, made of concrete, have a diameter of 90 m. The footing of the bases are fixed at depths ranging from 48 to 64 m, on the sea bed that has previously been reinforced by means of iron pipes 25 – 30

m long and 2m in diameter. Above the iron pipe and underneath the footing there is a layer of sandy gravel up to 3 m wide. In this way, both the connection and the adjacency to the ground is achieved and as a result the seismic accelerations are significantly reduced. Therefore, in case of an earthquake, the bases can slide on the footing surface and the layer of the sea bed and after a few seconds gain their balance on the sea bed. The technique used for the foundation, is similar to the one used for the foundation of an oil pumping platform in the open sea. Two floating platforms (after the necessary modifications) were used at the works, Lisa A and Sar 3. Both participated in the construction of the Severn Bridge near Bristol. Lisa, was also used for the construction of a bridge in Tokyo, Japan.

The Bridge can withstand an earthquake with a ground acceleration coefficient of 48% (according to the law of probability, an earthquake of that strength occurs once every 2000 years), while it will be able to absorb translocations of up to two meters among whichever of its bases. It can withstand an impact of a tanker of 180,000 tons at a speed of 16 knots and a wind speed of 250 km per hour, which corresponds to a typhoon. Three hundred sixty eight durable cables, uniformly distributed, in eight groups in the shape of a fan (two per pylon), of 32 km overall length and weighing 5,000 tons, will keep the deck suspended in the air – from the heads of the four pylons. The deck, (slightly arch-shaped) will be a complex construction of prefabricated sections of steel and concrete, which are projected symmetrically on the sides of the pylon and are suspended with suspension cables. The suspension cables, will consist of galvanized wire-ropes with a multiple anticorrosive coating. With access bridges of 392 meters on the side of Rio and 239 on the side of Antirrio, it will be the biggest cable bridge in the world. For the construction of access bridges, prefabricated concrete beams will be used.

The characteristics of the bridge include also: the reinforcement of the sea bed with 450 metal columns, 2 meters in diameter and 25 meters long, base diameter 90 meters (the biggest ever constructed for a bridge), a suspended deck 2,252 meters long (world record), and overall bridge length 2,862 m, distance between the pylons 560 m, overall pylon height 227 meters, pylon height from the base up to the sea 65 meters, pylon weight 170,000 tons, pylon diameter 90 meters, height of roadway above the sea 48 m, height of the pylon from the roadway to the top 113 m, overall pylon weight 170 thousand tons, footing diameter 90m, footing area 6,500 sq m.(the biggest

footing ever constructed for a bridge and for the foundation of a bridge 65 meters deep), overall cable length for the support of the roadway 40 km, concrete volume for the overall construction of the bridge 260,000 cubic meters, roadway width 27 meters with two traffic lanes and one auxiliary lane per direction, two walkways for the free pedestrian traffic, continuous passage of vehicles, regardless of weather conditions (for preventive reasons, it is likely that the passage of heavy trucks will be prohibited in exceptionally rare cases of stormy winds), service time of the bridge 120 years, which can be completed, depending on the maintenance interventions that will be considered necessary. For big ships coming through Rio – Antirrio, a provision has been made for a navigation area 300 meters wide and 50 meters high above the sea level⁵.

The construction works began in July 1998 at the coast of Antirrio, where a dry tank was created, in which the foundations of the four pylons of the bridge⁶ were successively laid and throughout the construction all the environmental studies provided for by the contracts were observed. It is worth noting that during the construction of the works no work accident happened (the most serious accident was finger sprains⁷).

The completion of the bridge construction within the expected time limits, is considered to be a work of national as well as European importance, this is why it is integrated with the Transeuropean Transport Networks as a part of the highway Patra – Athens – Thessaloniki and moreover, according to the resolution of the EU Summit Conference in Essen, it has been included in the 14 European works of first priority. The construction of the bridge, of an original budget of 645 million euros, has significantly delayed (as the construction of the rest of the big works in the prefecture of Achaia), as a result the wider area that the works will serve, has been deprived of the multiplying growth prospects that the completion of the works offers. Here we must mention that the last bid for tenders (two bid for tenders, one in 1978 and one in 1987 and a load of discussions since 1964 when the first works for the sea bed impression were carried out, were absolutely fruitless) was held in 1991, while the reference date for the beginning of the works is considered to be the 24th December 1997. Complex and strenuous negotiations preceded, between the Group Gefyra (bridge) that was appointed contractor of the works, the Hellenic State, the European Bank of Investments and the Group of Commercial Banks. The seven-year works include:

- The two-year (1998 – 1999) prefabrication period where the basic activities are the completion of the definite study of the bridge and the construction of the worksite facilities, mainly the dry tank.
- The five-year (2000 – 2004) construction period of the bridge.

The company Gefyra S.A. was founded in 1995 by the French group Groupe GTM and six contractor companies with the exclusive aim of entering into a concession contract with the Hellenic State for the construction of the bridge Rio – Antirrio.

The overall cost of the works will amount to nearly 803 million euros and its financing comes from the following sources: 10% capital stock, 45% financing contribution of the State, 45% loans of the European Bank of Investments, with the guarantee of the commercial banks group. The overall period of concession will be 42 years, including the study and construction period amounting to 7 years (of exploitation of the bridge by the construction company, up to 24th December 2039 unless the works has been depreciated earlier). It must be noted that the equity capitals of the contractor amount to just 69 million euros, the investment subsidies 385 million euros, while 349 million euros come from a loan of the European Bank of Investments.

The contractual delivery date is 25/12/2004, but the Hellenic government has offered the construction company a premium of 50,000 euros for each day that the bridge is completed earlier. So, the 3.5 kilometer-long suspension bridge, is expected to be given to the traffic in 12 August 2004. It takes only 5 minutes to cross it, in comparison to 30 minutes today (when the weather is good and there is no additional traffic due to holidays)⁸.

Tolls will be charged after the delivery of the works for commercial use (12th August 2004) while their ceiling prices are provided for in the construction and concession contract. The basic toll for recreational vehicles and small farm vehicles up to two meters high is fixed at 9.70 euros. For frequent users, there will be weekly cards of ten passages at the price of 60 euros as well as monthly cards of seven passages worth 75 euros (table 1). From the beginning of 2005, there will be electronic tolls, too. Only cyclists and pedestrians are exempted from tolls (even though it is unknown whether pedestrians will be allowed to use it, despite the fact there is the possibility). As far as the bus service (KTEL) is concerned, negotiations will be made according to each case so as to take into account any particularities.

Table 1:

TOLL RATES FOR 2004		
BASIC CROSSING		
Motorcycles		€1,50
Cars		€9,70
Trucks		
2 axles		€15,00
3 axles		€24,90
4 axles		€34,90
5 axles		€44,00
Bus		
20 seats		€23,50
20-40 seats		€33,50
Above 40 seats		€51,00
CARD 10 CROSSINGS		
This card permits to make 10 crossings during its validity period		
	Validity	Validity
	one month	one week
Cars	€75,00	€60,00
Trucks		
2 axles	€143,00	€135,00
3 axles	€237,00	€224,00
4 axles	€330,00	€314,00
5 axles	€418,00	€396,00

It is worth noticing that the delivery of the works will be preceded by three-day artistic events highlighted by the concert conducted by Mikis Theodorakis⁹ in the Castle of Antirion and on 8th August the bridge will welcome the torch relay carrying the Olympic flame for the Olympic Games of Athens.

Beside the tolls that are going to be situated near Antirrio, there will be the Administration premises, which will be divided in three levels and will be of a total area of 2,064 sq. m. The premises will be in the form of a pyramid of glass, laid with its top downwards and its base upwards. At the first level there will be an entry only on the eastern side, while the western side it will be underground. There, all the electromechanical installations with the

generator of low and medium voltage can be found, as well as the central air-conditioning, the storehouse, the archives, the machine works, the electrical works and the post office facilities. The people working at the tolls can enter and be led through an underground tunnel to the tolls from this level. At this level, all the necessary facilities for the tolls personnel have been provided for, such as changing rooms, a bar, a restaurant etc. The second level, which is at the height of the toll station will serve two different purposes: the reception, the working area and the offices. The reception and the working area have been specifically studied and arranged concerning the materials and the lighting, so as to present in an enjoyable and hospitable environment, through photos and images, different stages of the construction. Moreover, different characteristic accessories used, will be exhibited in the form of sculptures. The imposing scale model of the bridge, which is now hosted in the temporary exhibition hall, will occupy the main position of this room. The office area has been designed to the highest specifications of acoustics, air-conditioning and lighting, creating an enjoyable environment and the most appropriate working conditions for the employees. In this area, the conference hall occupies the prominent position, situated inside the triangle glass construction and overlooks the toll station and the Bridge. There will be surveillance and control of the car traffic on a 24-hour basis every day, so that the intervention will be prompt in case of an emergency. From here, every entry corridor to the toll station will be inspected. The car traffic will be recorded and information will be collected for economic and statistic reasons. All this information will be stored and elaborated in the data control room , which is at the same level¹⁰.

The group Gefyra intends, together with the completion of the bridge, to put a specific construction in the area where the worksite is situated today presenting the names of the 1600 people who participated to its construction and will be a sight on its own. In Antirrio and in an area of 420 square meters, an exhibition center is already in operation, where visitors can watch in a specific projection hall of 100 seats, filmed snapshots from the works, while an impressive scale model 8X3 of the works offers the possibility of understanding its execution method. In the scale model hall, two plasma displays project videos of the employees during different stages from the beginning of the construction up to this day. One aisle, with old pictures, is dedicated to the great works of Charilaos Trikoupis, while

another one presents a photographic history of the Greek and international bridge building, with characteristic examples from the ancient times up to this day. Four electronic computers provide continuous access to the web page of the bridge, while the dominant element is the photos by Nikos Daniilidis, in the years after 1997.

The study for the development of the worksite was elaborated by Mr. Polydoridis, a professor of architecture at the University of Patra. This place covers a coastal area of about 310,000 square meters, with a very good orientation and view to Antirrio. The proposed enlarged final area of study is 450,000 square meters in area. This particular study proposes the separation of the land in three areas. For the first area, it is proposed to develop a Cultural and Commercial Center. For the second area, it is proposed to develop an Urban Neighbourhood and finally for the main area of the study, the worksite field of the Bridge, it is proposed to use the land basically as a Theme Park. The Park includes: the Park of the Nations, The Aquarium, The Beach of the Nations, The Floating Theater, the Anchorage, the Guests' House, The Botanical Garden of Recreation and Promenade, the Fun Park and the Time-Engine (Theater I – max). At the same time, the study suggests the regular public transport between the park and the urban areas around (Nafpaktos – Rio – Patra), the creation of three large squares (of Culture, of the Nations, of the Theater) as well as a dense network of walkways and walking axes¹¹. Other suggestions of local organizations are about an exhibition center, a park, a marina and a keel workshop, etc.

The cause for the construction of the bridge is considered to be the unhindered and most rapid communication and passage of vehicles among the two regions (which up to now has depended on the weather, the employees of the ships, the ship owners and the dock workers). The reason is that Achaia and Aetoloakarnania should be a unified and inseparable geopolitical, economical and operational web, in which the bridge will act as a positive growth coefficient of the Western Hellas. Moreover, if this work is linked to the upgrading of the axes Kalamata – Pyrgos – Antirrio – Agrinio – Ioannina – Igoumenitsa, and Patra – Athens, its is most likely that there will be a general growth in the wider area, whilst at the same time, it is expected to contribute to the increase of competitiveness of the Piraeus port as well.

In 1995, the traffic between Rio – Antirrio, with the existing ferry lines, were on average 7,000 vehicles a day, today it amounts to 8,500 vehicles a

day, while after the completion of the bridge, the average will reach 10,000 and during peak days 25,000 vehicles or more. It is estimated that the passage time will be 4 to 5 minutes, much less than 30 minutes or more needed today¹². According to a study by the University of Patra (1987), the traffic increase in comparison to 1985, will be enhanced by the independent growth of the local traffic, as a direct consequence of the operation of the bridge. So, the facilitation of transport and the reduction of the passage time are expected to cause impacts at a regional level in the work market, in the trade and tourism.

However and because the overall development burden from the combination University Campus – Hospital – National Road – Bridge will probably be enormous for such a small area, the general growth might cause the creation of a small but rival town for Patra, in Rio. It must be noted here that according to the Hellenic Ministry for the Environment, Physical Planning and Public Works, Rio within the next decade is expected to increase in population by 20,000 people¹³. It is therefore essential to pursue the urban growth at the core of Rio, so that it can respond as a center of urban services and at the same time prevent the immoderate growth in the rest of the area.

Here, we must particularly make a reference to the non provision of a railway junction on the bridge. The OSE (Hellenic Railway Organization), since 2004, intends to re-operate its long abandoned network in Aetoloakarnania (Kryoneri – Agrinio) and proceed to the junction Kalamata – Antirrio, Antirrio – Ioannina and Ioannina – Kalambaka (with the financing of the European Union, western railway axis) and perhaps the railway junction Rio – Antirrio would be of general interest. However, the question to be asked is how much time a railway junction would require to depreciate its construction cost, given that the construction rate of infrastructure in our country is rather problematic and the completion of a railway junction could not be expected earlier than 2012. In addition, it must be taken into account that the construction cost would rocket up, technically it would make the construction even more difficult, the delivery time would be longer, and the mentality of the people who dealt with the works and preferred to give priority to the creation of a road junction¹⁴.

The impacts from the connections are considered to be: increase of the land value, more rapid growth rates in the towns of Messologgi, Agrinio, Nafpaktos, unhindered and problems-free connection North – South

(Thessaloniki, Ioannina – Athens, Kalamata) and important increase of the traffic load in the proximity of the bridge, especially in the first years of operation.

Some questions that might arise are the following:

- In which kilometrical range around the bridge, the consequent benefits and impacts will extend.
- To what extent the dependence of the area of Rio on Patra will be strengthened.
- To what extent the implementation of the connection, will intensify the demand for first or second residence in the areas of Rio and Antirrio.
- What levels the enlargement of the Metropolitan area of Patra will reach and what displacement of the population center of gravity will arise for the two sides of the Bridge.
- Which and to what extent, will be the impacts of the urbanization, not only on the side of Rio but also on the side of Antirrio, and how can such an incident lead to a conflict between these two areas.
- To what extent, will the area be disturbed by undesired and troublesome uses.
- The displacement of the population center of gravity and service center towards Rio – Antirrio, what loads it will impose on all the infrastructure networks and to what extent they are easy or able to be transformed.
- To what extent the pricing policy of tolls will facilitate the frequent users of the bridge.
- Which and to what extent, will be the investments that will be made in the area and by which sectors.
- To what extent, there will be companies that will prefer this area for re-installation and what impacts they will have on the unemployment of the area.
- To which height the surplus values will range.
- Which action will be taken to restore, show off, maintain and promote the Castles of Rio and Antirrio as Byzantine monuments that must be preserved.
- Which will be the activities for the protection of the sea and coastal ecosystems of the Corinthian and Patra Gulf.
- How the bridge will be able to operate in an integral way, given that the western axis (Ionian road) and the upgrading of the motorway Corinth –

Patra are still being studied and their completion is not expected soon.

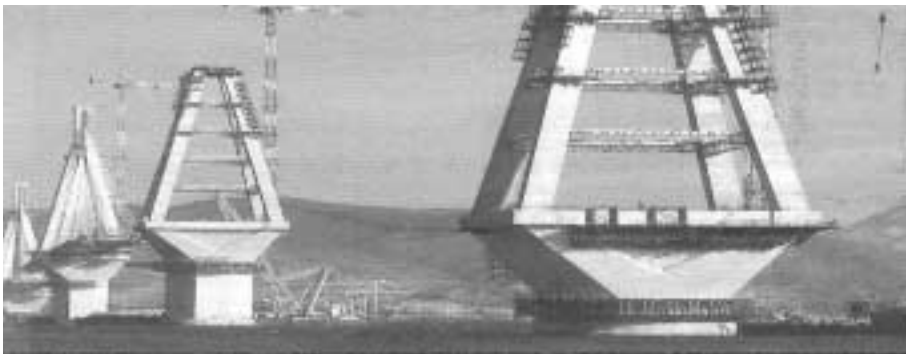
- Which will be the connection of the area through bus lines with the neighbouring prefecture capitals.
- Where will be employed the 500 people working in the ships of the existing line and what solution will be given to the employees who are about to retire¹⁵, (Gefyra S.A. has confirmed that there is no possibility of employment for them)¹⁶.
- Where will be employed 1350 people who are directly or indirectly related to the construction of the bridge, after the completion of the works¹⁷.
- To what extent the bridge will influence the tourism of the area and what are the possibilities of full tourist service and canalization to other destinations of the wider area.

The basic question remains the existence or not of a fire safety and fire protection system. According to the plaintiff report to Areios Pagos (the Supreme Court), by Mr. Madouvalos Petros, a New democracy MP, on April 2004, there is not such a system although it is provided for in the contract between the Hellenic state and the construction company. On the contrary, it has been required to provide for fire fighter shifts on a 24 hour basis so as to avoid any incident. According to Mr Madouvalos, to a question asked in the Parliament in 2003, the Hellenic Ministry of Public Order confirmed that the responsibility of fire protections belongs to the Hellenic Ministry for the Environment, Physical Planning and Public Works, (refusing to install a fire protection system) while the latter confirmed that all the necessary measures will be taken in cooperation with the Ministry of Public Order. Mr. Madouvalos claims also that the installation of such a system cannot be done now, given that the relevant pipes are huge and must be installed at the construction stage of the works. On the contrary, on its side, the construction company confirms that all agreements provided for in the contract have been observed and that there are all the relevant provisions for the safety of the bridge¹⁸.

In the beginning of 1889, Charilaos Trikoupis, in a speech addressed to the Parliament, inspired by a relevant publication by Emile Burnouf who used to be Director of the French Archeological School of Athens, referred to the necessity of bridging the channel. 114 years later, the enormous and exceptionally complex vision of this politician originated from Messologgi,

(that will bear his name), seems to be completed soon. We all hope that it will not only be a growth opportunity for the wider area and the promotion of the country, but also the beginning of a new growth course for our country.

1.2. Photographs¹⁹





The Bridge from Antirion side.



The bridge deck with the impressive suspension cables.



The pylon of the Bridge from the ship.



Just a few meters remaining to join the deck.



The bridge from the ship.



The deck is ready to join the Rio side.



The Administration Premises and the tolls on the side of Antirio.



The bridge from Rio.



Just a few meters remaining to join the Peloponnese to Sterea Hellas.



A world come and world go.



One of the pylons.



The bridge from Antirio side.



A photo of the exhibition hall.



Part of the deck.



An impressive corridor of the exhibition.



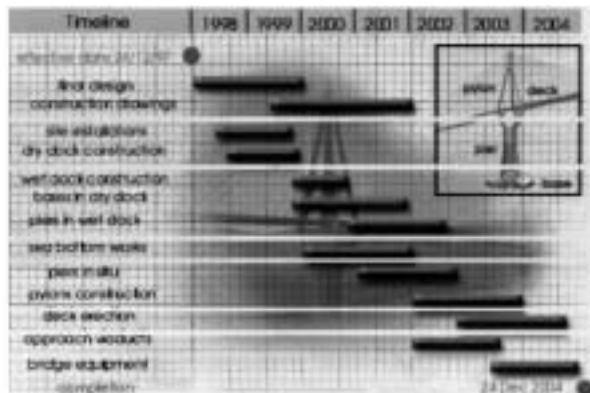
When history meets technology.



The Rion - Antirion bridge is located at the intersection of two major roads:

- the Patras - Athens - Thessaloniki motorway which links the three most important cities of Greece and forms part of the European motorway network,
- the Kalamata - Patras - Igoumenitsa Western axis.

The bridge will facilitate communication between Greece and Italy (and thus Western Europe) through the harbors of Patras and Igoumenitsa.



The Greek company Gefyra S.A. was formed in 1995 by VINCI from France and six Greek contractors for the sole aim of entering with the Greek State into the Concession Contract for the Rion-Antirion bridge. As

the Concessionaire, Gefyra S.A. is responsible for the design, construction, financing, maintenance and operation of the bridge during the 42-year concession period. To satisfy its commitments, it signed to date more than 50 agreements including the major design and build contract with the Contractor and the exhaustive financing documentation with the Creditors.

During the construction period, the Concessionaire ensures a sound overall financial scheme for the project including the details for its day-to-day funding needs. Gefyra S.A. is based in Halandri near Athens and is currently employing around 10 individuals.

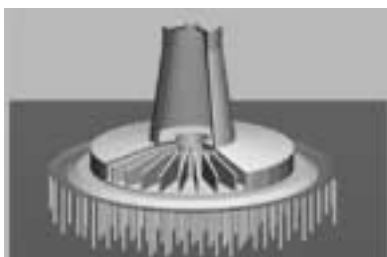
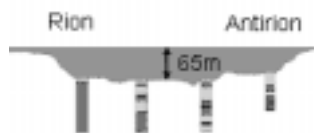
The shareholders of Gefyra S.A. are as follows:

VINCI	53.00%
ELLINIKI TECHNODOMIKI - TEB S.A.	15.48%
J & P - AVAX S.A.	11.20%
ATHENA S.A.	7.74%
PROODEFTIKI S.A.	7.74%
PANTECHNIKI S.A.	4.84%
Total	100.00

A great dream

The bridge environment presents an exceptional combination of adverse physical conditions:

- water depth up to 65 m
- weak sea bed
- strong seismic activity and possible tectonic movements.

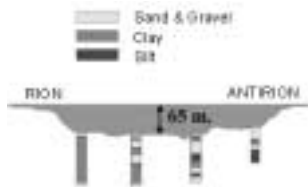


Top world ranked specialists from France and Greece have collaborated to design this high tech project which includes sea bed reinforcement (by 65 meter water depth), 90 meters diameter piers (the largest piers ever built for a bridge) and a 2,252 m fully suspended deck (a world record).

Technique - Physical data

First, the bridge has to span a stretch of water of some 2,500 meters.

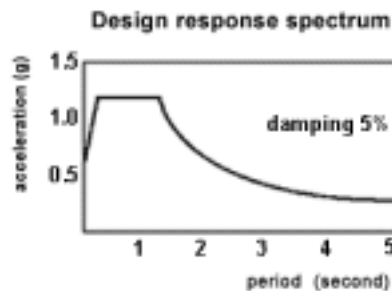
Moreover the physical features of the strait present an exceptional combination of adverse conditions, which makes this project unique:



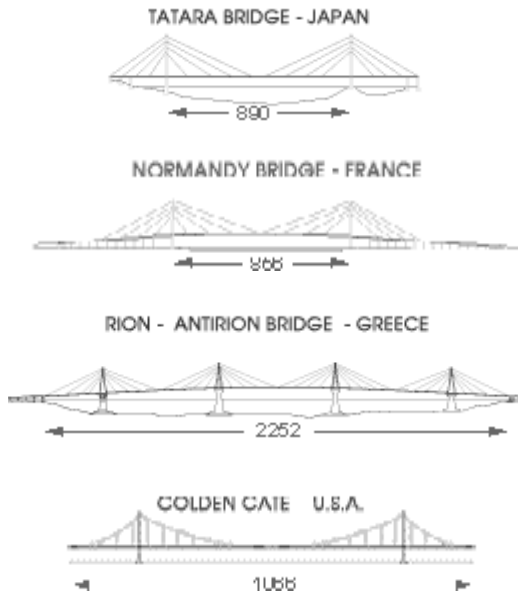
- water depth up to 65 meters,
- absence of stiff seabed subsoil,
- strong seismic activity
- and possible tectonic movements.

The seabed profile presents steep slopes on each side and a long horizontal plateau about 60 meters below sea level. No bedrock has been encountered during investigations down to a depth of 100 meters below seabed. Based on a geological study, it is believed that the thickness of sediments made of thick layers of clay mixed in some areas with fine sand and silt is greater than 500 meters.

In addition when defining the specifications for the bridge, the Greek State has imposed stringent design seismic loading: a peak ground acceleration equal to 0.48 g and a maximum spectral acceleration equal to 1.20 g between 0.2 and 1.0 second. As an example, these specifications are more severe than the accelerations recorded on 17 August 1999 during the Izmit 7.4 Richter scale earthquake.

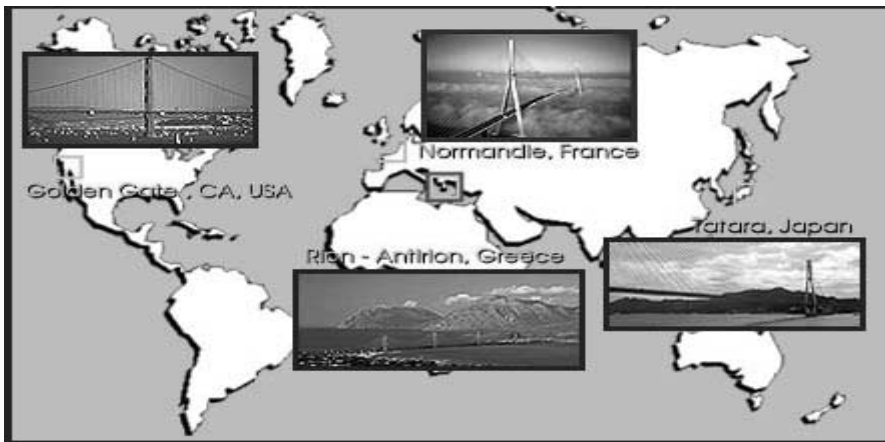


At the end of the 20th century, the question still was "how can be built a bridge here?"



Comparing to scale the Rion-Antirion bridge with world famous bridges demonstrates the magnitude of the project undertaken. The Tataru bridge in Japan and the Normandy bridge in France are the cable-stayed bridges with the longest spans in the world (respectively 890 meters and 856 meters). With a reference span of 560 meters, the Rion-Antirion bridge shall rank in the top 10 list of the world longest span for cable-stayed bridges. However with its 4 pylons (compared to the usual set of 2), it is the cable-stayed bridge with the longest

suspended deck (2,252 meters) in the world. Such outstanding deck length outperforms the total deck length of the well-known Golden Gate suspension bridge (1,966 meters).



The Rion- Antirion bridge will be the longest cable stayed bridge in the world with a continuous deck of 2,250.

NOTES

1. Newspaper Ethnos tis Kiriakis, 21/12/2003.
2. The captain, received an award for his contribution at a conference about transport that was held on 15th November 2003, in Patra.
3. Magazine Georama, November – December 2003.
4. Conference on Transport, Patra 15/11/03.
5. Newspaper Ta Nea, 26/05/01.
6. Magazine Geotropio, of the newspaper Eleftherotypia, 02/11/02.
7. Bassilis Efthimiou, in charge of Public Relations of Gefyra S.A. in the worksite.
8. Magazine Geotropio, of the newspaper Eleftherotypia, 02/11/02.
9. Finally the concert became without the composer because his serious illness.
10. Connection the work and adventure of people, Edition Zefxi Rio – Antirrio, Issue 08, April 2004, article: the administration premises “opens its wings” ... by Komi Xenoyannis, Civil Engineer – in charge of the Coordination of the Construction Works of the Administration Premises and operation of the bridge.
11. Connection the work and adventure of people, Edition Zefxi Rio – Antirrio, Issue 08, April 2004.
12. Construction Company.
13. Newspaper I Axia, 05/04/03.
14. Conference on transport, 15/11/03, Patra.
15. Newspaper Express, supplement Patra – Western Hellas, 06/03.
16. Yannis Freris, in charge of the Public Relations of Gefyra S.A., 06/05/2004.
17. Newspaper Imera, 03/09/03
18. Yannis Freris, in charge of the Public Relations of Gefyra S.A., 06/05/2004.
19. The photos (apart from the first fourths) were taken on 08/05/04 by the author.

REFERENCES

- Alderfon P. (1984), Sea Transport operations and Economics, Witherby.
- Kolovos G. (2004), Transport Substructures in the prefecture of Achaia.
- Shimojo T. (1977), Economic analysis of shipping freight - kobe.
- Stopford Martin (1995), Maritime Economics - Rourtedge, London.
- Vlachos G. - Fournarakis N. (1998), Applications of the New information improvement in Quality of Services and the possibilities of operating Cost Reduction in Modern Vessels, Article published in the Journal of Science and Technology, vol. 1 - N^o 5, Nicosia, Cyprus.