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# Content

# From the Editor

Dear Reader,

It is with great pleasure that I present the first issue of Volume 4 of the South East European Journal of Economics and Business. There are nine papers in this issue.

Simeon Papadopoulos and Stelios Karagiannis explore the issue of efficiency in Southern European banking by applying the Fourier functional form and the stochastic cost frontier approach in calculating inefficiencies for a large sample of Southern European banks between 1997 and 2003. Their findings suggest that the largest sized banks are generally the least efficient, while the smallest sized banks are the most efficient. The strongest economies of scale are displayed by Spanish banks, while the weakest economies of scale are reported by Greek banks. Their findings suggest that medium-sized banks report the strongest economies of scale, and the largest and smallest banks weaker economies of scale (ranging between 3.5% and 7%). Therefore, the notion that economies of scale increase with bank size cannot be confirmed. The impact of technical change in reducing bank costs (generally about 3% and 4% per annum) appears to systematically increase with bank size. The largest banks reap greater benefits from technical change. Overall, their results indicate that the largest banks in the sample enjoy greater benefits from technical progress, although they do not have scale economy and efficiency advantages over smaller banks.

In their paper, Hakan Mihci and Devrim Karaman present an empirical investigation of the Northern Cyprus output performance by using a panel data method for the period 1977-2005. They also assess the impact of export orientation on the Northern Cyprus output level. Their empirical results suggest that investment, employment and export variables significantly and positively affect the sectoral production increases in Northern Cyprus. Among other variables, exports of goods and services exert considerable affects on the sectoral production in the case of Northern Cyprus economy. Therefore, the authors suggest that a production structure mostly dependent on foreign demand makes it easier to overcome the restrictions originating from the insufficiency of the domestic market through creating new employment opportunities for highly qualified labor force. Moreover, exports have the potential to increase total factor productivities, and hence, to further improve output expansion of the country.

Hugo Zagoršek, Marko Jaklič, and Aljaž Hribernik's paper provides a socioeconomic analysis of the phenomena of informal economic activity. The paper argues that the shadow economy has been beneficial for Slovenian society since the 19th century and has significantly contributed to the success of the Slovenian economy under the socialist regime. During Slovenia's transitional phase it has stimulated the formal economy, soothed social tensions and allowed export-oriented enterprises to remain internationally competitive by paying lower wages and obtaining cheaper inputs. However, it hinders innovation, impedes entrepreneurship and maintains the status quo, and thus represents an obstacle for future economic development in Slovenia.

Vladimir Vladimirov and Maria Neycheva investigate the non-linear effects of the government budget on short-run economic activity. Their study shows that in the Bulgarian economy under a Currency Board Arrangement the tax policy impacts the real growth in the standard Keynesian manner. On the other hand, the expenditure policy exhibits non-Keynesian behavior on the short-run output: cuts in government spending accelerate the real GDP growth. The main determinant of this outcome is the size of the discretionary budgetary changes. The results of the study imply that the balanced budget rule improves the sustainability of public finances without assuring a growth-enhancing effect.

Davor Špac and Lorenja Mošnja-Škare's paper explores controlling developments in the particular environment of an economy involved in a transition process for almost two decades. The results presented in the paper were founded on the empirical analysis of the most successful Croatian companies, which were used as the sampling population. The presentation of

controlling department existence in Croatian companies and the analysis of management perception of controlling importance were performed together with research on controlling information sources and users. The results were evaluated considering the controlling evolution in developed economies. The controlling evolution was monitored in the Croatian corporate sector, from its "registering" stage, still dominant on the scene, to its "innovation" stage. Future perspectives on controlling development flows in Croatia were assessed.

In their paper, Sergio Ermacora and Senada Smajić examine the make-or-buy decision in the Croatian shipbuilding industry using a Transaction Cost Economics Approach. Shipyards' decision to 'make' a component or to 'buy' it from market firms is analyzed in relation to certain characteristics of the transactions in order to assess whether this decision is made in accordance with the theory's predictions. The empirical investigation, which is based on a sample of 167 observations, suggests that transaction cost hypotheses are only partially confirmed. Namely, while physical asset specificity and complexity are likely to increase the probability that a transaction will be internalized, temporal asset specificity and frequency seem not to affect significantly the integration decision. However, as the analysis leaves much of the variance in the patterns of vertical integration unexplained, the finding presented in this study should be seen as tentative. The authors conclude that the inclusion of the remaining shipyards in the analysis as well as of new and more variables in the model are likely to improve the reliability of the results.

M. Mesut Kayali and Seyfettin Unal analyze the tracking performance of two ETFs, namely DJIST and SMIST, both traded on the Istanbul Stock Exchange, with respect to their own indices. The authors carry out an analysis first to identify each ETF's tracking ability of underlying index, and second to explore whether any differences exist between the return of large-cap and the return of small-cap stock ETFs, and their indices. By employing a data set of calculated daily returns for the specified ETFs and their corresponding indices, t-tests and regression analyses are conducted. The findings suggest that both DJIST and SMIST stocks performed well in tracking their own indices' returns. However, the mimicking ability of DJIST stock is better than that of SMIST.

In their paper, Jelena Zorić, Nevenka Hrovatin, and Giancarlo Scarsi carry out non-parametric relative efficiency comparisons using an international sample of gas distribution utilities from two old and one new EU members, namely the Netherlands, the UK, and Slovenia. By conducting DEA on a cross-sectional sample of gas utilities, they discover that, on average, Slovenian utilities perform less efficiently than UK and Dutch utilities. The authors suggest that, to a large extent, this is due to the less extensive regulation of the Slovenian gas industry as seen in the past. The incentive-based price-cap regulation recently introduced in Slovenia could help close this efficiency gap over time. The authors also find out that different model specifications lead to very similar efficiency scores and rankings, implying that benchmarking can be employed as a useful complementary instrument for monitoring utility performance. In this way, the informational asymmetry between distribution utilities and regulatory authorities can be significantly mitigated.

Panos Moudoukoutas and Abraham Stefanidis discuss Greek shipping IPOs. The authors explain that sharing ownership with outside investors through an IPO has advantages and disadvantages that create dilemmas for company founders. In fact, it can further be a source of disappointment when expectations fall short of reality. That is not the case for the Greek ship owners who floated the shares of their companies to major US Exchanges in the early 2000s, however. The listing has met and even exceeded their expectations: Broadened their capital structure, improved image and prestige, strengthened bargaining power with creditors, and enhanced entrepreneurial opportunities.

At the end, I would like to invite and encourage all our readers to submit their papers. The Journal will continue to focus on research about business enterprises and economies of the countries of South East Europe, while maintaining a strong interest in exceptional papers dealing with universal problems and theoretical issues in economics and business.

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# New Evidence on Efficiency in Southern European Banking

Simeon Papadopoulos, Stelios Karagiannis*

*Abstract:*

***This paper explores the issue of efficiency in Southern European banking by applying the Fourier functional form and the stochastic cost frontier approach in calculating inefficiencies for a large sample of Southern European banks between 1997 and 2003. The findings suggest that the largest sized banks are generally the least efficient, while the smallest sized banks are the most efficient. The strongest economies of scale are displayed by Spanish banks, while the weakest economies of scale are reported by Greek banks. The findings suggest that medium-sized banks report the strongest economies of scale, and the largest and smallest banks weaker economies of scale (ranging between 3,5% and 7%). Therefore, the notion that economies of scale increase with bank size cannot be confirmed. The impact of technical change in reducing bank costs (generally about 3% and 4% per annum) appears to systematically increase with bank size. The largest banks reap greater benefits from technical change. Overall, the results indicate that the largest banks in the sample enjoy greater benefits from technical progress, although they do not have scale economy and efficiency advantages over smaller banks.***

**Keywords:** Southern European banking; economies of scale; efficiency

**JEL:** G21, D21

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## 1. Introduction

The efficient-structure hypothesis suggests that banks that are able to operate more efficiently than their competitors incur lower costs and achieve higher profits and increased market shares that may result in increased concentration. Therefore, according to this hypothesis, efficiency positively influences both market shares and bank profits. This hypothesis is usually referred to as the X-efficiency hypothesis in order to distinguish it from the scale-efficiency hypothesis. The scale-efficiency hypothesis asserts that banks are equally X-efficient (the differences in the quality of management and in production technologies are negligible), and that some banks simply operate at a greater efficiency scale than others. Therefore, these banks enjoy higher profits and increased market shares.

The aim of this paper will be to calculate the cost characteristics of banking markets by applying the flexible Fourier functional form and stochastic cost

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frontier methodologies to estimate scale economies, X-inefficiencies and technical change for a large number of Greek, Italian, Spanish and Portuguese banks between 1997 and 2003. The results suggest that there exist both scale economies and X-inefficiencies, with the latter being considerably greater (confirming the findings of previous studies), indicating that Southern European banks can significantly reduce their costs and increase their profits by eliminating X-inefficiencies. The impact of technical progress in reducing bank costs does not appear to differ according to bank size and ranges between 1,5 and 2%, meaning that technical progress seemed to reduce bank costs by 1,5 to 2% per annum between 1997 and 2003. Section 2 presents a literature review of recent approaches to measuring X-efficiency in banking markets. Section 3 outlines this paper's methodology. Section 4 analyses the empirical results, and concluding comments are offered in Section 5.

## *2. The Measurement of X-Efficiency in Banking Markets*

Recent studies of the U.S banking market (Berger et al., 1993, Kaparakis et al., 1994, Mester 1996, Mitchell 1996) suggest significant X-inefficiencies exist across all bank sizes and that banks can considerably reduce their costs by eliminating them. They also present evidence pointing to the existence of both scale and scope economies of significantly smaller importance. Studies that have used the stochastic cost frontier approach include Berger and Humphrey (l99l), Mester (1993, 1994), Cebenoyan et al. (1993), Elyasiani and Mehdian 1990a), Altunbas et al (1994a, 1994b, 1995), Drake and Weyman-Jones (1992) and Berger et al. (1993b), while studies that have used the DEA approach include Sherman and Gold (1985), Parkan (1987), Vassiloglou and Giolis (1990), Field (1990), Drake (1991), Elyasiani and Mehdian (1990b) and Berg et al. (1993).

Berger and Humphrey (1991) measured inefficiencies in U.S banking for 1984 using the thick frontier version of the stochastic cost frontier approach. Their results seem to suggest that there are significant inefficiencies in the banking system that are operational (stemming from overusing physical inputs), rather than scale or scope inefficiencies. The operational inefficiencies reached 20 to 25 percent, compared with 4.2 to 12.7 percent for scale inefficiencies. Based on these findings, Berger and Humphrey argued that banks would face substantial pressure to cut their costs following moves to deregulate the banking market. Alternatively, banks would have to merge with more efficient institutions or exit the market if they could not compete in an increasingly competitive environment.

Mester (1993) employed the stochastic cost frontier approach to investigate efficiency in American mutual and stock Savings and Loans (S&Ls) institutions in 1991. The empirical findings suggested that, on average, stock S&Ls are less efficient (based on different measures of inefficiency) than mutual S&Ls. The study also found that capital to asset ratios are positively related with efficiency in both mutual and stock (shareholding) S&Ls, and that the more S&Ls rely on uninsured deposits the less efficient they are likely to be. In a similar study, Mester (1994) used the same methodology to study the efficiency of commercial U.S banks operating in the Third Federal Reserve District (parts of Pennsylvania and New Jersey, Delaware) for 1992. The author found significant X-inefficiencies ranging from 6 to 9 percent, although scale and scope inefficiencies were not observed. The X-inefficiency result means that an average bank can reduce its production costs by between 6 to 9 percent if it uses its inputs as efficiently as possible (given its particular output level and output mix).

Cebenoyan et al. (1993) estimated inefficiency scores for 559 S&Ls operating in the Atlanta Federal Home Loan Bank District in 1988, also using the stochastic cost frontier methodology. Their reported results seem to indicate that stock and mutual S&Ls had very similar cost structures (contradicting Mester's findings) and therefore operating efficiency was not related to form of ownership (stock and mutual S&Ls). Moreover, the authors observed that the mean inefficiency score was 16 percent, which means that the average S&L can produce its output by using only 84 percent of the amount of inputs actually used.

In their first study Altunbas et al. (1994a) evaluated inefficiencies for the German banking market, while in

their later study (1994b) examined the Italian credit cooperative banking sector. The methodology used in both studies was the stochastic cost frontier approach. Altunbas et al. (1994a) distinguished between five categories of German banks:

private commercial banks, public savings banks, mutual cooperative banks, central organizations and mortgage banks. Their results indicated that the mean inefficiency score for all banks was 24 percent, suggesting that German banks could produce the same output with 76 percent of their inputs if they were operating efficiently. They also found that mortgage banks were less efficient than the other categories of banks, whereas different ownership characteristics did not seem to have a significant impact on the absolute level of bank inefficiencies in the German market

Altunbas et al. (1994b) analyzed the Italian credit cooperative banking sector between 1990 and 1992. Their findings suggested that the mean inefficiency score for 1990 was 13.1 percent, but these scores appeared to be higher for 1991 and 1992. Moreover, the authors found that banks operating in the North-East Central region of Italy (Veneto and Emilia) were significantly less efficient than banks operating in the North-West and North-East border regions and in the South.

Altunbas et al. (2001) extended the established literature by modelling the cost characteristics of banking markets through the application of the flexible Fourier functional form and stochastic cost frontier methodologies (methodology adopted in this study) to estimate scale economies, X-inefficiencies and technical change for a large sample of European banks between 1989 and 1997. The results reveal that scale economies are widespread for smallest banks (are found to range between 5% and 7%), while X-inefficiency measures appear to be much larger, between 20% and 25%. X-inefficiencies also appear to vary to a greater extent across different markets, bank sizes and over time. This suggests that banks of all sizes can obtain greater cost savings through reducing managerial and other inefficiencies. Their findings also indicated that technical progress has had a similar influence across European banking markets between 1989 and 1997, reducing total costs by around 3% per annum.

Drake and Weyman-Jones (1992) used both the DEA and stochastic cost frontier approaches to compare the efficiency of the U.K. building societies. Their results of the DEA analysis showed that British building societies had a mean inefficiency score of 12.5 percent. Overall efficiency was partitioned into two components: technical efficiency and allocative efficiency. It was found that allocative efficiency accounted for most of the overall efficiency index. Drake and Weyman-Jones argued that their findings suggested that most of the inefficiency that was associated with the U.K building society sector was attributable to a less than optimal allocation of inputs rather than to the inefficient use of these inputs. Furthermore, the findings of the stochastic cost frontier analysis confirmed their DEA results and, moreover, showed that productive inefficiency scores were very low.

Finally, Berger et al. (1993b) used a stochastic cost frontier approach and found that larger banks were on average substantially more X-efficient than smaller banks and suggested that this finding may offset some of the diseconomies of scale that were found to characterise larger banks in many cost studies.

Rangan (1988) and Elyasiani and Mehdian (1990a) tried to break down banking inefficiencies into two distinct groups: pure technical inefficiencies and scale inefficiencies. Rangan (1988) analysed the cost structures of 215 U.S banks and found that the average measure of inefficiency (almost all of which is attributed to pure technical inefficiency) was 30 percent, which means that the banking output could be produced with only 70 percent of the inputs. Elyasiani and Mehdian (1990a) used a sample of 144 U.S banks and estimated that scale inefficiencies reached a very significant value of 38.9 percent, while pure technical inefficiencies were measured at only 11.7 percent, thus attributing vital importance to scale inefficiencies in contrast to Rangan's findings.

Two other studies undertaken by Field (1990) and Drake et al. (1991) applied the DEA methodology to the building societies sector in the U.K. Field (1990) examined 71 building societies in 1981 and concluded that 61 of them were operating inefficiently primarily

due to scale inefficiencies, confirming Elyasiani and Mehdian's (1990a) results. Moreover, Field showed that the overall technical efficiency of banks was negatively related to bank size, in contrast to the findings of most U.S studies that seem to indicate that technical efficiency is actually positively associated with bank size. Drake et al. (1991) found that 63 percent of the building societies included in his sample were inefficient (compared with 86 percent in Field's study) and overall efficiency appeared to be positively related to bank size (contradicting Field's result).

Overall, U.S studies that used the stochastic cost frontier methodology to estimate inefficiency, have generally found average banking inefficiency to be around 20-25 percent. On the other hand, U.S studies that used the DEA methodology have reported findings ranging from around 10 percent to more than 50 percent. These findings are in line with the European stochastic cost frontier studies that generally tend to report low inefficiency scores (between 10 and 20 percent).

## 3. The Methodology

The stochastic cost frontier approach is used in this paper to calculate inefficiency scores for all the banks included in the sample. The stochastic cost frontier approach assumes that a firm's observed cost deviates from the cost frontier because of a random error and possible inefficiency. The cost function that will be estimated adopts the flexible Fourier functional form (following Altunbas et al., 2001), including a standard translog and all first-, second- and third-order trigonometric terms, as well as a two-component error structure, and is estimated using a maximum likelihood procedure. The translog cost function is specified as follows:

$$lnTC = \alpha_0 + \sum_{i=1}^{3} \propto_i lnQ_i + \sum_{i=1}^{3} \beta_i lnP_i + \tau_1 T + \lambda_1 \ln E +$$
$$+ {}^1\!/_2 \left[ \sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{ij}\, lnQ_i\, lnQ_j + \sum_{l=1}^{3}\sum_{m=1}^{3} \gamma_{lm}\, lnP_l\, lnP_m + \phi_{11}\, lnE\, lnE + \tau_{11}\, T^2 \right]$$
$$+ \sum_{i=1}^{3}\sum_{m=1}^{3} \rho_{im}\, lnQ_i\, lnP_m + \sum_{i=1}^{3} K_{il}\, lnP_i\, lnE + \sum_{i=1}^{3} \sigma_{il}\, lnQ_j\, lnE + \sum_{i=1}^{3} X_i\, T\, lnQ_i$$
$$+ \sum_{l=1}^{3} \omega_l\, T\, lnP_l + \sum_{i=1}^{4} [a_i \cos(z_i) + b_i \sin(z_i)]$$
$$+ \sum_{i=1}^{4}\sum_{j=1}^{4} [a_{ij} \cos(z_i + z_j) + b_{ij} \sin(z_i + z_j)] + \varepsilon \qquad (1)$$

*where*

*ln TC = natural logarithm of total costs (financial costs and operating costs)*

*ln $Q_i$ = natural logarithm of bank outputs*

*ln $P_l$ = natural logarithm of input prices (interest rates, wage rates etc)*

*ln E = natural logarithm of equity capital*

*T = time trend*

*Zi = the adjusted values of the log output (ln Q, ln E) such that they span the interval (0, 2 )*

*$\alpha, \beta, \lambda, \delta, \gamma, \tau, \phi, \rho, \kappa, \sigma, \chi, \omega$, a and b are coefficients to be estimated*

Since the duality theorem requires that the cost function must be linearly homogenous in input prices, the following restrictions are imposed on the parameters of equation (1):

$$\sum_{l=1}^{3} \beta_l = 1; \sum_{l=1}^{3} \gamma_{lm} = 0; \sum_{l=1}^{3} \omega_l = 0; \sum_{m=1}^{3} \rho_{im} = 0,$$
$$\delta_{ij} = \delta_{ji} \quad \text{and} \quad \gamma_{lm} = \gamma_{ml} \qquad (2)$$

Following Mester (1996) and Altunbas et al. (1994), we estimate economies of scale by calculating the elasticity of cost with respect to output, holding the product mix and non-output variables constant. A measure of overall economies of scale is given by the following cost elasticity, obtained by differentiating equation (1) with respect to output:

$$SE = \sum_{i=1}^{3} \theta lnTC/\theta lnQ_i = \sum_{i=1}^{3} \alpha_i + \sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{ij} lnQ_j + \sum_{i=1}^{3}\sum_{m=1}^{3} \rho_{im} lnP_m + \sum_{i=1}^{3} \varphi_i T + + \mu_i \sum_{i=1}^{3} [-a_i \sin(Z_i) + b_i \cos(Z_i)] + +2\,\mu_i \sum_{i=1}^{3}\sum_{j=1}^{3} [-a_{ij} \sin(Z_i + Z_j) + b_{ij} \cos(Z_i + Z_j)] \quad (\mathbf{3})$$

if SE < 1 there are increasing returns to scale, which implies economies of scale

if SE = 1 there are constant returns to scale and

if SE > 1 there are have decreasing returns to scale, which implies diseconomies of scale

Scale economy estimates can also be derived for various bank sizes by calculating equation (3) using different mean values for output and input prices for each bank group. Firm-specific scale economy estimates are obtained by using firm-specific output and input prices. Technical progress is measured, as in McKillop et al. (1996) and Lang and Welzel (1996), by the partial derivative of the estimated cost function with respect to the time trend T[1] and is given by

$$\frac{\theta lnTC}{\theta T} = \tau_1 + \tau_{11} T + \sum_{l=1}^{3} \omega_l lnP_l + \sum_{i=1}^{3} X_i lnQ_i \quad (\mathbf{4})$$

## *4. Empirical Results*

This study uses bank balance sheets and income statement data from a number of Greek, Italian, Spanish and Portuguese banks between 1997 and 2003 obtained from the London based International Bank Credit Analysis Ltd's *Bankscope* database.

[1] This T time trend variable is used as a proxy for disembodied technical change and is inferred from changes in a firm's cost function over time. It captures all the effects of technological factors (learning by doing, other organizational changes etc.). Technical progress means that a firm can produce a given output Q using lower levels of total inputs and hence producing at lower cost.

The figures reported in Tables 1-5 indicate that among the four national banking markets under investigation, Portuguese banks were the least efficient (mean 0.2317) and Spanish banks were the most efficient (mean 0.2118) with Italian and Greek banks in the middle (mean 0.2145 and 0.2256 respectively). The mean inefficiency score of 23.17 percent reported for Portuguese banks means that they could produce the same output with only 76.83 percent of the inputs if they were operating efficiently. By the same token, Spanish banks could produce the same output with 78.82 percent of the inputs. The inefficiency scores for each national market are very similar, however, and they are in line with other studies' findings (see Evanoff and Israilevich 1991, Altunbas et al. 2001).

The analysis of bank inefficiency scores in each country separately reveals which size of bank (size is measured by total assets) operates more efficiently than others. In Greece, the largest banks (those with total assets exceeding €20 billion) were the least efficient throughout the period 1997-2003, while the medium sized banks (total assets €2-€20 billion) were the most efficient (although the smallest sized institutions were not far behind). These figures also suggest that the maximum inefficiency score recorded by a Greek bank reached a substantial 0.3762, while the minimum was 0.1494.

With regard to Italian banks, while the largest banks seem to be the most inefficient (as in the Greek sample), the smallest banks are the most efficient throughout the period in consideration. The maximum inefficiency score recorded by an Italian bank was 0.3874 and the minimum was 0.1385.

The inefficiency scores reported for Spanish and Portuguese banks are compatible to those of the Greek and Italian banks. The most important result that seems to apply in all national banking samples is that the largest sized banks are generally the least efficient banks and the smallest sized institutions appear to be the most efficient banks throughout the period 1997-2003. Therefore, inefficiency seems to increase with bank size, although only marginally. Another significant finding is that efficiency appears to improve with time, with all bank sizes reporting better efficiency

scores for the years 2002-3 than 1997-8. This result applies to all four national banking markets.

The scale economy estimates shown in Tables 6-10 indicate that banks in all four markets are characterised by economies of scale. The strongest economies of scale are displayed by Spanish banks (inefficiency scores indicate that they are on average the most efficient banks as well). The economy of scale estimate of 0.9315 means that Spanish banks can double their output by increasing total costs by only 93.15 percent. The weakest economy of scale estimate is reported by Greek banks (0.9624), with Italian and Portuguese banks in between.

With regard to Greek banks, all bank sizes are found to enjoy economies of scale as well, with the medium sized banks (total assets 2€-20€ billion) reporting the highest scale estimates, whereas the smallest banks seem to be associated with weaker economy of scale estimates. Hence, economy of scale figures appear to improve as bank size increases, but only up to a point. The largest banks are not found to enjoy the strongest economies of scale. These findings are generally confirmed in the Italian, Spanish and Portuguese samples, with the best economy of scale figures associated with medium sized banks. The largest banks are found to display diseconomies of scale for 2002-3. Therefore, this paper cannot confirm the assumption that the size of a bank is directly proportional to its economy of scale. Seeking a stronger economy of scale hence is not an incentive for increasing bank size. Moreover, in all four national samples, economies of scale seem to increase with time, with better figures reported for the later years than the earlier years in the period studied. These findings are generally in line with results reported in previous studies (Vennet 1993, Altunbas et al. 2001 and others).

Estimates of technical change are shown in Tables 11-15. The results suggest that technical change plays an important role in all four banking markets by reducing the annual costs of production by about 3-4% per annum. Greek and Portuguese banks are found to be more positively influenced by the effects of technical change (3,9% and 4,2% respectively), with Spanish and Italian banks following at 3,2% and 3,4%. The impact of technical change in reducing bank costs appears to systematically increase with bank size. The findings suggest that the largest banks in our sample are reaping the greatest benefits from technical change (4,3%) and that medium sized banks enjoy the lowest benefits (2,8%). This finding is confirmed in all four national banking markets under examination.[2] These results are in line with earlier findings (Altunbas et al. 2001).

## *5. Conclusion*

This paper uses the flexible Fourier functional form and the stochastic cost frontier methodologies to estimate X-inefficiencies, scale economies and technical change for a sample of Greek, Italian, Spanish and Portuguese banks between 1997 and 2003. The results indicate that inefficiencies range between 20% and 25% in all four national samples. Portuguese banks were the least efficient (mean 0.2317) and Spanish banks were the most efficient (mean 0.2118) with Italian and Greek banks in the middle (mean 0.2145 and 0.2256 respectively). The findings suggest that the largest sized banks are generally the least efficient banks and the smallest sized institutions appear to be the most efficient banks throughout the period 1997-2003. Therefore, inefficiency seems to increase with bank size, although only marginally. Another significant finding is that efficiency appears to improve with time, with all bank sizes reporting better efficiency scores for the years 2002-3 than 1997-8. This result applies to all four national banking markets.

The reported figures for scale economy estimates indicate that banks in all four markets are characterised by economies of scale. The strongest economies of scale are displayed by Spanish banks (inefficiency scores indicate that they are on average the most efficient banks as well), while the weakest economies of scale are reported by Greek banks, with Italian and Portuguese banks in between. Generally, scale economies are found to range between 3,5% and 7%. Typically, medium sized banks report the strongest economies of scale, while the largest and smallest

[2] These estimates should be treated with caution given the problems associated with this method of measuring technical change, as Hunter and Timme (1991) have pointed out.

banks report weaker economies of scale. Therefore, the notion that economies of scale increase with bank size cannot be confirmed. However, economies of scale seem to increase with time, with better figures reported for the later years than the earlier years in the period studied. Therefore, as bank size increases above medium sized banks, inefficiencies increase and economies of scale weaken, providing evidence that the largest bank size is not optimal.

The impact of technical change in reducing bank costs appears to systematically increase with bank size. The findings suggest that the largest banks in the sample reap greater benefits from technical change (4,3%). Greek and Portuguese banks are more positively influenced from the effects of technical change, with Spanish and Italian banks only marginally behind. Technical progress reduces banking costs between 3% and 4% per year. The findings of this study are generally in line with earlier results applying similar methodologies in E.U banking markets. Researchers in the future may examine whether these relationships hold for private, mutual and public banks.

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## *Annex*

| Assets size (m €) | Mean | Median | StDev. | Min. | Max |
|---|---|---|---|---|---|
| 0-500 | 0.2159 | 0.204 | 0.0522 | 0.1243 | 0.3869 |
| 500-2000 | 0.2148 | 0.2216 | 0.0453 | 0.1562 | 0.3782 |
| 2000-10000 | 0.2123 | 0.2154 | 0.0551 | 0.1628 | 0.3712 |
| 10000-20000 | 0.2196 | 0.2019 | 0.0246 | 0.1672 | 0.3465 |
| >20000 | 0.2285 | 0.2452 | 0.0435 | 0.1862 | 0.3476 |
| Greece(all banks) | 0.2256 | 0.2114 | 0.0634 | 0.1494 | 0.3762 |
| Italy (all banks) | 0.2145 | 0.2482 | 0.0724 | 0.1385 | 0.3874 |
| Spain (all banks) | 0.2118 | 0.2576 | 0.0254 | 0.1314 | 0.3756 |
| Portugal(all banks) | 0.2317 | 0.2018 | 0.0355 | 0,1518 | 0.3917 |

**Table 1:** Descriptive statistics of inefficiency scores (1997-2003).

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | 0.2316 | 0.2348 | 0.2417 | 0.2335 | 0.2253 | 0.2216 | 0.2143 |
| **500-2000** | 0.2362 | 0.2227 | 0.2246 | 0.2252 | 0.2143 | 0.2192 | 0.2186 |
| **2000-10000** | 0.2264 | 0.2295 | 0.2342 | 0.2209 | 0.2258 | 0.2164 | 0.2108 |
| **10000-20000** | 0.2212 | 0.2241 | 0.2264 | 0.2231 | 0.2269 | 0.2284 | 0.2345 |
| **>20000** | 0.2415 | 0.2452 | 0.2359 | 0.2335 | 0.2263 | 0.2408 | 0.2316 |

**Table 2:** Inefficiency scores for Greek banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | 0.2189 | 0.2115 | 0.2072 | 0.2044 | 0.2076 | 0.2018 | 0.1980 |
| **500-2000** | 0.2162 | 0.2246 | 0.2016 | 0.2119 | 0.2028 | 0.2132 | 0.2034 |
| **2000-10000** | 0.2154 | 0.2295 | 0.2166 | 0.2192 | 0.2016 | 0.2105 | 0.2062 |
| **10000-20000** | 0.2287 | 0.2212 | 0.2144 | 0.2136 | 0.2049 | 0.2024 | 0.2009 |
| **>20000** | 0.2209 | 0.2298 | 0.2186 | 0.2135 | 0.2142 | 0.2108 | 0.2016 |

**Table 3:** Inefficiency scores for Italian banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | 0.2062 | 0.2048 | 0.2126 | 0.2038 | 0.2123 | 0.2042 | 0.2009 |
| **500-2000** | 0.2116 | 0.2147 | 0.2204 | 0.2175 | 0.2136 | 0.2083 | 0.2043 |
| **2000-10000** | 0.2054 | 0.2095 | 0.2132 | 0.2018 | 0.1958 | 0.2081 | 0.2012 |
| **10000-20000** | 0.2196 | 0.2117 | 0.2148 | 0.2066 | 0.2189 | 0.2022 | 0.1968 |
| **>20000** | 0.2212 | 0.2198 | 0.2156 | 0.2134 | 0.2152 | 0.2128 | 0.2096 |

**Table 4:** Inefficiency scores for Spanish banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | 0.2382 | 0.2426 | 0.2418 | 0.2255 | 0.2216 | 0.2234 | 0.2172 |
| **500-2000** | 0.2318 | 0.2387 | 0.2265 | 0.2346 | 0.2248 | 0.2212 | 0.2089 |
| **2000-10000** | 0.2245 | 0.2217 | 0.2372 | 0.2215 | 0.2156 | 0.2104 | 0.2095 |
| **10000-20000** | 0.2342 | 0.2256 | 0.2284 | 0.2132 | 0.2169 | 0.2088 | 0.2141 |
| **>20000** | 0.2396 | 0.2312 | 0.2438 | 0.2216 | 0.2205 | 0.2246 | 0.2252 |

**Table 5:** Inefficiency scores for Portuguese banks

| Assets size (m €) | Mean | Median | StDev. | Min. | Max |
|---|---|---|---|---|---|
| **0-500** | **0.9434** | 0.9428 | 0.0422 | 0.9142 | 0.9969 |
| **500-2000** | **0.9421** | 0.9216 | 0.0478 | 0.9189 | 0.9823 |
| **2000-10000** | **0.9274** | 0.9272 | 0.0526 | 0.9146 | 1.0362 |
| **10000-20000** | **0.9546** | 0.9061 | 0.0542 | 0.8972 | 0.9734 |
| **>20000** | **0.9712** | 0.9264 | 0.0474 | 0.9065 | 0.9918 |
| **Greece(all banks)** | **0.9624** | 0.9052 | 0.0593 | 0.8834 | 1.0462 |
| **Italy (all banks)** | **0.9473** | 0.9546 | 0.0462 | 0.8648 | 1.0288 |
| **Spain (all banks)** | **0.9315** | 0.9424 | 0.0645 | 0.8436 | 1.0323 |
| **Portugal(all banks)** | **0.9504** | 0.9286 | 0.0470 | 0,8782 | 1.0512 |

**Table 6:** Scale economy estimates (1997-2003).

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| 0-500 | **0.9721** | **0.9562** | 0.9514 | **0.9446** | **0.9283** | **0.9148** | **0.9265** |
| 500-2000 | **0.9642** | **0.9684** | **0.9527** | 0.9608 | **0.9438** | **0.9492** | **0.9365** |
| 2000-10000 | **0.9586** | **0.9508** | 0.9428 | 1.0496 | **0.9518** | **0.9329** | **0.9374** |
| 10000-20000 | **0.9562** | **0.9548** | **0.9486** | 0.9319 | 0.9375 | **1.0868** | **1.0326** |
| >20000 | **0.9627** | 0.9686 | **0.9728** | **1.0632** | 1.0558 | **1.0512** | **1.0479** |

**Table 7:** Scale economy estimates for Greek banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **0.9546** | 0.9578 | **0.9432** | **0.9274** | **0.9162** | **0.9258** | **0.9146** |
| **500-2000** | **0.9466** | 0.9382 | **0.9292** | **0.9365** | 0.9286 | **0.9017** | **0.9054** |
| **2000-10000** | **0.9337** | **0.9416** | **0.9362** | 0.9408 | **0.9278** | **0.9265** | **0.9146** |
| **10000-20000** | **0.9274** | **0.9268** | 0.9275 | **1.0446** | 1.0829 | **1.0265** | **0.9406** |
| **>20000** | **0.9265** | **0.9336** | **0.9512** | **0.9328** | 0.9366 | 1.0134 | **1.0255** |

**Table 8:** Scale economy estimates for Italian banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **0.9412** | **0.9382** | 0.9264 | **0.9165** | **0.9228** | **0.9026** | **0.8936** |
| **500-2000** | **0.9245** | **0.9216** | **0.9028** | 0.9112 | **0.9234** | **0.9405** | **0.8952** |
| **2000-10000** | **0.9286** | **0.9208** | 0.9129 | 0.9008 | 0.9163 | **1.0195** | **0.9041** |
| **10000-20000** | **0.9147** | **0.9228** | 0.9136 | **0.8940** | 1.0738 | **0.8815** | **0.8924** |
| **>20000** | 0.9262 | 0.9216 | **0.9376** | **0.9367** | **1.0015** | **1.0141** | **0.9222** |

**Table 9:** Scale economy estimates for Spanish banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **0.9785** | 0.9766 | **0.9618** | **0.9552** | **0.9414** | **0.9349** | **0.9415** |
| **500-2000** | **0.9802** | **0.9726** | 0.9770 | 0.9564 | **1.0015** | **1.0204** | **0.9826** |
| **2000-10000** | **0.9618** | **0.9626** | **0.9701** | 1.0130 | **1.0108** | **0.9422** | **0.9462** |
| **10000-20000** | **0.9427** | **0.9573** | 1.0286 | **0.9508** | **0.9336** | 0.9478 | **0.9310** |
| **>20000** | **0.9788** | 0.9806 | 1.0019 | **0.9634** | **1.0225** | 0.9989 | **1.0144** |

**Table 10:** Scale economy estimates for Portuguese banks.
Bold values indicate statistical significance at the 5% level.

| Assets size (m €) | Mean | Median | StDev. | Min. | Max |
|---|---|---|---|---|---|
| **0-500** | **-0.034** | -0,028 | 0,0014 | -0,021 | -0,058 |
| **500-2000** | **-0,032** | -0,026 | 0,003 | -0,024 | -0,05 |

| Assets size (m €) | Mean | Median | StDev. | Min. | Max |
|---|---|---|---|---|---|
| **2000-10000** | **-0,028** | -0,025 | 0,0048 | -0,018 | -0,061 |
| **10000-20000** | **-0,033** | -0,032 | 0,0025 | -0,015 | -0,057 |
| **>20000** | **-0,043** | -0,034 | 0,0017 | -0,029 | -0,062 |
| **Greece(all banks)** | **-0,039** | -0,032 | 0,005 | -0,022 | -0,058 |
| **Italy (all banks)** | **-0,034** | -0,027 | 0,0013 | -0,018 | -0,06 |
| **Spain (all banks)** | **-0,032** | -0,022 | 0,0026 | -0,02 | -0,057 |
| **Portugal(all banks)** | **-0,042** | -0,030 | 0,009 | -0,023 | -0,062 |

**Table 11**: Overall technical progress (1997-2003).

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **-0.033** | **-0,029** | **-0.036** | **-0,028** | **-0.042** | **-0,044** | **-0.046** |
| **500-2000** | **-0,042** | **-0,028** | **-0,024** | **-0,038** | **-0,048** | **-0,046** | **-0,052** |
| **2000-10000** | **-0,029** | **-0,025** | **-0,032** | **-0,033** | **-0,018** | **-0,021** | **-0,032** |
| **10000-20000** | **-0,028** | **-0,017** | **-0,025** | **-0,024** | **-0,022** | **-0,036** | **-0,041** |
| **>20000** | **-0,047** | **-0,038** | **-0,044** | **-0,047** | **-0,041** | **-0,051** | **-0,054** |

**Table 12**: Overall technical progress for Greek banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **-0.029** | **-0,028** | **-0.032** | **-0,037** | **-0.031** | **-0,026** | **-0.033** |
| **500-2000** | **-0,032** | **-0,038** | **-0,036** | **-0,028** | **-0,022** | **-0,026** | **-0,042** |
| **2000-10000** | **-0,031** | **-0,025** | **-0,034** | **-0,028** | **-0,041** | **-0,019** | **-0,039** |
| **10000-20000** | **-0,028** | **-0,018** | **-0,016** | **-0,026** | **-0,028** | **-0,032** | **-0,042** |
| **>20000** | **-0,049** | **-0,041** | **-0,051** | **-0,046** | **-0,044** | **-0,053** | **-0,045** |

**Table 13**: Overall technical progress for Italian banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **0-500** | **-0.035** | **-0,033** | **-0.043** | **-0,026** | **-0.032** | **-0,028** | **-0.021** |
| **500-2000** | **-0,032** | **-0,026** | **-0,022** | **-0,019** | **-0,02** | **-0,029** | **-0,031** |
| **2000-10000** | **-0,039** | **-0,037** | **-0,017** | **-0,021** | **-0,032** | **-0,025** | **-0,036** |
| **10000-20000** | **-0,028** | **-0,029** | **-0,041** | **-0,044** | **-0,048** | **-0,04** | **-0,052** |
| **>20000** | **-0,051** | **-0,034** | **-0,042** | **-0,038** | **-0,048** | **-0,05** | **-0,041** |

**Table 14**: Overall technical progress for Spanish banks

| Ass size (m €) | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| 0-500 | -0.036 | -0,031 | -0.022 | -0,032 | -0.031 | -0,028 | -0.029 |
| 500-2000 | -0,033 | -0,026 | -0,034 | -0,037 | -0,042 | -0,039 | -0,045 |
| 2000-10000 | -0,019 | -0,026 | -0,025 | -0,028 | -0,038 | -0,04 | -0,029 |
| 10000-20000 | -0,031 | -0,032 | -0,042 | -0,032 | -0,027 | -0,037 | -0,024 |
| >20000 | -0,048 | -0,045 | -0,044 | -0,06 | -0,052 | -0,048 | -0,053 |

**TABLE 15:** Overall technical progress for Portuguese banks
Bold values indicate statistical significance at the 5% level.

## *APPENDIX*

| Variables | Parameters | Coefficients | Stand. error | t-Ratio |
|---|---|---|---|---|
| Constant | $\alpha_0$ | -0,1826 | 0,00023 | -18,226 |
| $\ln Q_1$ | $\alpha_1$ | 0,3022 | 0,00621 | 64,182 |
| $\ln Q_2$ | $\alpha_2$ | 0,4832 | 0,00284 | 128,12 |
| $\ln Q_3$ | $\alpha_3$ | 0,0016 | 0,00053 | 1,3264 |
| ln E | $\lambda_1$ | 0,3426 | 0,00172 | 2,1682 |
| $\ln P_1$ | $\beta_1$ | 0,7218 | 0,00376 | 44,876 |
| $\ln P_2$ | $\beta_2$ | 0,2866 | 0,00685 | 23,954 |
| $\ln Q_1 \ln Q_1$ | $\delta_{11}$ | -0,0042 | 0,00017 | -84,625 |
| $\ln Q_1 \ln Q_2$ | $\delta_{12}$ | 0,0564 | 0,00086 | 35,724 |
| $\ln Q_1 \ln Q_3$ | $\delta_{13}$ | 0,0367 | 0,00052 | 12,863 |
| $\ln Q_1$ ln E | $\theta_1\lambda$ | 0,0089 | 0,00029 | 35,674 |
| $\ln Q_2 \ln Q_2$ | $\delta_{22}$ | 0,0345 | 0,00384 | 44,828 |
| $\ln Q_2 \ln Q_3$ | $\delta_{23}$ | 0,0524 | 0,00625 | 65,342 |
| $\ln Q_2$ ln E | $\delta_2\lambda$ | 0,0023 | 0,00345 | 9,6245 |
| $\ln Q_3 \ln Q_3$ | $\delta_{33}$ | 0,0076 | 0,00087 | 14,728 |
| $\ln Q_3$ ln E | $\delta_3\lambda$ | -0,0167 | 0,00012 | -10,626 |
| ln E ln E | $\varphi\lambda\lambda$ | -0,0389 | 0,00069 | -9,9263 |
| $\ln P_1 \ln P_1$ | $\gamma_{11}$ | 0,0478 | 0,00582 | 62,682 |
| $\ln P_1 \ln P_2$ | $\gamma_{12}$ | 0,0092 | 0,00232 | 24,782 |
| $\ln P_2 \ln P_2$ | $\gamma_{22}$ | 0,0654 | 0,00946 | 36,894 |
| $\ln P_1 \ln Q_1$ | $\rho_{11}$ | -0,0012 | 0,00037 | -12,528 |
| $\ln P_1 \ln Q_2$ | $\rho_{12}$ | 0,0324 | 0,00030 | 26,595 |
| $\ln P_1 \ln Q_3$ | $\rho_{13}$ | -0,0621 | 0,00028 | -4,6682 |
| $\ln P_1$ lnE | $\rho_1\lambda$ | 0,0087 | 0,00026 | 7,3686 |
| $\ln P_2 \ln Q_1$ | $\rho_{21}$ | 0,0075 | 0,00842 | 16,376 |
| $\ln P_2 \ln Q_2$ | $\rho_{22}$ | 0,0145 | 0,00637 | 38,963 |
| $\ln P_2 \ln Q_3$ | $\rho_{23}$ | -0,0256 | 0,00732 | -8,7562 |
| $\ln P_2$ lnE | $\rho_2\lambda$ | 0,0983 | 0,00072 | 37,645 |
| T | $\tau$ | -0,0045 | 0,00571 | -6,5287 |
| T * T/2 | $\tau_{11}$ | -0,0089 | 0,00826 | -5,8265 |
| $\ln Q_1$ T | $\chi_1\tau$ | 0,0162 | 0,00912 | 4,8761 |
| $\ln Q_2$ T | $\chi_2\tau$ | 0,0082 | 0,00286 | 6,7236 |
| $\ln Q_3$ T | $\chi_3\tau$ | 0,0246 | 0,00067 | 14,862 |
| lnE T | $\chi\varepsilon\tau$ | 0,0204 | 0,00092 | 8,7382 |
| $\ln P_1$ T | $\omega_1\tau$ | -0,0075 | 0,00035 | -2,32 |
| $\ln P_2$ T | $\omega_2\tau$ | 0,0036 | 0,00387 | 3,7628 |
| cos ($z_1$) | $a_1$ | -0,0006 | 0,00726 | -28,529 |

| Variables | Parameters | Coefficients | Stand. error | t-Ratio |
|---|---|---|---|---|
| sin ($z_1$) | $b_1$ | -0,0046 | 0,00245 | -22,965 |
| cos ($z_2$) | $a_2$ | -0,0037 | 0,00016 | -8,7562 |
| sin ($z_2$) | $b_2$ | -0,0079 | 0,00079 | -5,9263 |
| cos ($z_3$) | $a_3$ | -0,0374 | 0,00082 | -3,9852 |
| sin ($z_3$) | $b_3$ | 0,0258 | 0,00658 | 0,7628 |
| cos ($z_4$) | $a_4$ | -0,0183 | 0,00732 | -1,6726 |
| sin ($z_4$) | $b_4$ | -0,1226 | 0,00924 | -2,7255 |
| cos ($z_1$+$z_1$) | $a_{11}$ | 0,0036 | 0,00865 | 6,9547 |
| sin ($z_1$+$z_1$) | $b_{11}$ | 0,0082 | 0,00928 | 11,462 |
| cos ($z_1$+$z_2$) | $a_{12}$ | -0,1430 | 0,00097 | -3,7265 |
| sin ($z_1$+$z_2$) | $b_{12}$ | 0,0152 | 0,00082 | 4,9862 |
| cos ($z_1$+$z_3$) | $a_{13}$ | 0,0126 | 0,00064 | 2,6527 |
| sin ($z_1$+$z_3$) | $b_{13}$ | -0,0038 | 0,00626 | -1,2572 |
| cos ($z_1$+$z_4$) | $a_{14}$ | -0,0042 | 0,00524 | -3,9935 |
| sin ($z_1$+$z_4$) | $b_{14}$ | 0,0081 | 0,00884 | 22,672 |
| cos ($z_2$+$z_2$) | $a_{22}$ | 0,0096 | 0,00378 | 1,7256 |
| sin ($z_2$+$z_2$) | $b_{22}$ | -0,0011 | 0,00545 | -1,7625 |
| cos ($z_2$+$z_3$) | $a_{23}$ | 0,0026 | 0,00265 | 4,1478 |
| sin ($z_2$+$z_3$) | $b_{23}$ | -0,0484 | 0,00088 | -0,7782 |
| cos ($z_2$+$z_4$) | $a_{24}$ | 0,0075 | 0,00028 | 0,8114 |
| sin ($z_2$+$z_4$) | $b_{24}$ | 0,0018 | 0,00045 | 1,3923 |
| cos ($z_3$+$z_3$) | $a_{33}$ | -0,0082 | 0,00362 | -1,7627 |
| sin ($z_3$+$z_3$) | $b_{33}$ | -0,0726 | 0,00726 | -0,3921 |
| cos ($z_3$+$z_4$) | $a_{34}$ | -0,0713 | 0,00628 | -2,6534 |
| sin ($z_3$+$z_4$) | $b_{34}$ | 0,0064 | 0,00822 | 1,9845 |
| cos ($z_4$+$z_4$) | $a_{44}$ | 0,0029 | 0,00248 | 0,1565 |
| sin ($z_4$+$z_4$) | $b_{44}$ | -0,0062 | 0,00099 | -4,6277 |
| | $\sigma^2u/\sigma^2\upsilon$ | 2,3226 | 0,00065 | 32,182 |
| | $\sigma^2\upsilon$ | 0,3064 | 0,00375 | 123,87 |
| $\ln P_3$ | $\beta_3$ | 0,0043 | | |
| $\ln P_1 \ln P_3$ | $\gamma_{13}$ | 0,0089 | | |
| $\ln P_2 \ln P_3$ | $\gamma_{23}$ | -0,0054 | | |
| $\ln P_3 \ln P_3$ | $\gamma_{31}$ | -0,0825 | | |
| $\ln P_3 \ln Q_1$ | $\rho_{31}$ | 0,0162 | | |
| $\ln P_3 \ln Q_2$ | $\rho_{32}$ | 0,0285 | | |
| $\ln P_3 \ln Q_3$ | $\rho_{33}$ | -0,0361 | | |
| $\ln P_3$ lnE | $\rho_3\lambda$ | 0,0029 | | |
| $\ln P_3$ T | $\theta_3\tau$ | 0,0068 | | |

**Table 16:** Maximum likelihood parameter estimation of the cost frontier

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **Greece** | 23 | 22 | 24 | 23 | 23 | 22 | 20 |
| **Italy** | 306 | 312 | 285 | 266 | 291 | 278 | 262 |
| **Spain** | 139 | 142 | 146 | 137 | 128 | 128 | 121 |
| **Portugal** | 40 | 42 | 43 | 39 | 37 | 35 | 36 |

**Table 17**: Number of banks by year

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **Greece** | 2905 | 3160 | 3275 | 3520 | 4280 | 4850 | 5640 |
| **Italy** | 5130 | 5750 | 6220 | 7370 | 7790 | 8940 | 10460 |
| **Spain** | 5050 | 5620 | 6490 | 7130 | 8260 | 8810 | 10100 |
| **Portugal** | 4880 | 5130 | 5560 | 6420 | 7140 | 7830 | 8850 |

**Table 18:** Average asset size of banks by year (m €)

| Variables | Mean | Median | StDev. | Min. | Max |
|---|---|---|---|---|---|
| **TC** | 482 | 54 | 1510 | 16 | 26120 |
| **$P_1$** | 0,016 | 0,012 | 0,0062 | 0,0074 | 0,065 |
| **$P_2$** | 0,062 | 0,054 | 0,007 | 0,0081 | 0,075 |
| **$P_3$** | 0,546 | 0,462 | 0,212 | 0,096 | 0,87 |
| **$Q_1$** | 3270 | 264 | 13745 | 54 | 285490 |
| **$Q_2$** | 2967 | 216 | 11452 | 62 | 316528 |
| **$Q_3$** | 1945 | 128 | 12637 | 12 | 321458 |
| **E** | 419 | 38 | 1876 | 17 | 22574 |

**Table 19:** Descriptive statistics of the output and input variables used in the model (2003).

TC = Total cost (operating and financial) in m €

$P_1$ = Price of labour (total personnel expenses/total assets) in %

$P_2$ = Price of funds (total interest expenses/total funds) in %

total funds = total deposits plus all kinds of bank debt

$P_3$ = Price of capital (total depreciation and other expenses/total fixed assets) in %

$Q_1$ = The value of total loans in m €

$Q_2$ = The value of total securities (all types of securities and investments) in m €

$Q_3$ = The value of all off-balance sheet activities in m €

E = The value of total equities

# An Assessment of Output Performance in Northern Cyprus*

Hakan Mihci and Devrim Karaman**

*Abstract:*

***This paper mainly attempts to investigate empirically the Northern Cyprus output performance by using a panel data method for the period 1977-2005. A supplementary aim is to assess the impact of export orientation on the Northern Cyprus output level. Empirical results suggest that investment, employment and export variables significantly and positively affect the sectoral production increases in Northern Cyprus. Among other variables, exports of goods and services exert considerable affects on the sectoral production in the case of Northern Cyprus economy. Therefore, it can be suggested that a production structure mostly dependent on foreign demand makes it easier to overcome the restrictions originating from the insufficiency of the domestic market through creating new employment opportunities for highly qualified labor force and additional production capacity with productive investments. Moreover, exports have the potential to rise total factor productivities, and hence, to improve output expansion of the country further. In short, one may propose that outward orientation seems to be relevant in achieving higher levels of output in the case of the Northern Cyprus economy.***

**Keywords:** Economic development and growth, island economy, Northern Cyprus economy, panel data analysis

**JEL:** O11, O52

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## 1. Introduction

Although pioneering studies had been done in the early 1960s (Robinson 1960; Kuznets 1960; Demas 1965), the 1980s witnessed an upsurge in the evaluation of the growth and development processes of small island economies (Dommen 1980; Jalan 1982; Hein 1985; Dolman 1985). Until the 1980s, the view that small island economies confront many structural problems in their growth processes dominated the literature. This view mainly depended on the constraints on scale economies originating from smallness, which in turn led to higher unit production costs, and hence, created obstacles to the sustainable growth process. In the middle of the 1980s, World Bank economist T. N. Srinivasan challenged this common view underlying the high and rapid growth performance of many small economies. He argues that smallness is neither a necessary nor a sufficient condition for low and slow growth rates in countries (Srinivasan, 1986). Srinivasan's approach itself has been challenged, as authors have proposed that the structural problems of small island economies not only originate from their smallness but also from their geographical isolation (Briguglio 1995; Milner and

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Westeway 1993).

Furthermore, small island economies are in a very difficult position with respect to two main industrialization strategies. Because of the insufficiency of their domestic markets, these economies cannot pursue import substituting industrialization policies. This insufficiency can force the countries to implement export-oriented industrialization strategies. On the other hand, export-oriented industrialization policies have serious weaknesses in small island economies due to factors such as high transportation costs and the instability of foreign demand. In the literature, however, the emphasis is on export-orientation, since it is argued that insufficient domestic demand can only be substituted with foreign demand, thus partly removing the constraints on scale economies (Alesina and Spolaore 1997; Armstrong and Read 1995). In fact, most small island economies showing high growth performance are those which successfully implemented export-oriented industrialization strategies, and which are geographically close to centre countries (Streeten 1993).

Alongside its peculiar structural characteristics, the Northern Cyprus economy can also be considered within the framework of a small island economy. Northern Cyprus is an independent state situated in the north of Cyprus Island, which in turn is located in the east of the Mediterranean Sea. Northern Cyprus declared its independence in 1983; nine years after a Greek Cypriot attempt to annex the island to Greece triggered an invasion by Turkey. It has received political recognition only from Turkey. The rest of the international community recognises the sovereignty of the Republic of Cyprus over the entire island, including the portion currently under the control of the Northern Cyprus state. The economy of Northern Cyprus is dominated by the service sector, including the public sector, trade, tourism and education, with smaller agriculture and light manufacturing sectors. The economy currently operates on a free-market basis, with a great portion of its administration costs funded by Turkey. Because of its status and the embargo, Northern Cyprus is dependent on Turkish military and economic support (Wikipedia, the free encyclopedia**)**.

The international isolation of the country since its inception has aggravated its economic problems and jeopardizes its long-term growth process. In this context, the economy of Northern Cyprus can be taken as a special case study for the literature on small island economies. Furthermore, the relevance of export-orientation for Northern Cyprus' long-term output performance should be highlighted. In light of the abovementioned considerations, the main aim of this paper is to assess Northern Cyprus' output performance in the last three decades. A supplementary aim is to investigate the impact of export-orientation on Northern Cyprus' output level.

The organization of the paper is as follows: The following section surveys the literature on the major characteristics of small island economies. The third section analyses the structure of the economy of North Cyprus as a special case study of a small island economy. This analysis uses a comparative method. The fourth section is devoted to a review of the quantitative studies attempting to examine special factors determining the output level of small island economies. Consequently, the output performance of the Northern Cyprus economy is empirically investigated by using a panel data model for the period 1977-2005. The last section recapitulates the central discussion.

## *2. Major Characteristics and Problems of Small Island Economies: A Literature Survey*

"The Economic Consequences of Size of Nations" was a conference organized by the International Economic Organization in 1957 and provided the first substantial work investigating the economic consequences of the size of nations. At the same time, the conference, by initiating the distinction between small and large countries, contributed to country typologies in the literature on development. Furthermore, the conference analyzed the impacts of the size of nations on the economic, social and political structure of developed and underdeveloped countries (Robinson 1960).

Later on, the literature started to concentrate on island states, rather than on small economies as such. The fact that island states constitute the greater portion of small economies led the literature to focus on the problems of island economies. In a recent joint study by the World Bank and Commonwealth Secretariat (2000:4), among 45 states defined as small, 31 are island states. Nevertheless, in the literature, there is a growing consensus on the similarity between the major structural characteristics of small continental countries and island states (Armstrong and Read 1995; Dolman 1985; Dommen 1980).

Between these two categories, the most apparent difference can be explained by the concept of isolation. With regard to countries, the concept of isolation refers to the restrictions of a country's economic, political and cultural relations with others. By definition, islands are geographically isolated. They are disconnected from

the mainland, and their degree of isolation directly depends on that distance.

In general, isolation of small island economies jeopardizes foreign trade and restricts their development. Trade, however, is crucial for island states, since small domestic markets preclude scale economies. In the presence of scale economies, however, output could be increased, giving an impetus for the production costs in both private and public sectors to decline, and hence, productivity to rise (Briguglio, 1995).

Furthermore, the lack of scale economies creates obstacles in the production of public services. Due to the indivisibility principle of public services, the access to these services can be unexpectedly costly in small island economies. For instance, Alesina and Spolaore (1997) indicate that education, health and social services are produced with relatively high prices in the case of small island economies.

Additionally, scale economies also affect research and development activities; and small island economies face severe problems in the improvement of local technologies. For this reason, small island states heavily depend on the import of foreign technology (Milner and Westeway, 1993; Selwyn, 1980).

Moreover, the isolation of island economies makes transportation costs relatively high. The lack of alternative modes of transportation and the necessity of scale economies for transportation by sea and air adversely affect transportation costs for these economies (Briguglio, 1995). Distance and high transportation costs directly determine the structure of production in small island economies. Agricultural commodities cannot be diversified, and the production of the manufacturing industry that heavily depends on the imported inputs cannot compete on international markets (Encontre 1999).

The formation of a competitive market structure seems to be extremely difficult for small island economies. The small domestic market creates a natural barrier for the firms willing to enter into the market, and thus monopoly and oligipolistic market structures dominate the economy. Imperfect market structures, on the other hand, lead to welfare losses for the economy in general and for consumers in particular.

Meanwhile, the smallness of the domestic market also prevents the pursuit of an import substituting industrialization strategy in the process of economic development. Island countries that have followed an import substituting industrialization strategy have been observed to suffer from a rise in commodity prices, the spread of low quality goods in the market and the formation of black markets (Briguglio, 1995).

On the other hand, outward orientation as an alternative way to overcome the problems of a small domestic market and to use the advantages of scale economies makes small island states dependent on the rest of the world, as are all other open economies (Streeten, 1993). Nevertheless, small island economies are more vulnerable to external shocks and their growth rates are more open to fluctuations. Meanwhile, some researchers insist that export-oriented growth policies are more advantageous for small economies (Salmon 1999).

Also, smallness causes scarce natural resource endowment and weak linkages between industries (Briguglio 1995; Faruggia 1993). The insufficiency in the domestic provision of raw materials and intermediate goods for the use of industries makes these economies too heavily dependent on imports. The finance of imports, in turn, necessitates foreign currency inflow. But the fact that the range of their exported goods is narrow, coupled with the fact that it is impossible for them to affect the world price of exported and imported goods, leads to economic instability in these countries originating from external shocks (Briguglio, 1995).

Small domestic markets and international specialization in the production of a few commodities create an asymmetry in local production and consumption patterns. While goods produced domestically are intensively exported, consumer goods are generally imported in small island economies. Furthermore, both consumer and producer goods are often demanded by areas within the service sector such as trade, banking and tourism (Khatkhate and Brock, 1980). Therefore, the service sector in general, and the trade and tourism sectors in particular, play a crucial role in the development process of small island economies.

As is pointed out above, one of the most significant structural characteristics of small island economies is their vulnerability to external shocks. According to the World Bank and Commonwealth Secretariat (2000:8), the standard deviation of increases in per capita income levels of small countries is 25 per cent higher than that of large countries. These relatively high fluctuations have their roots in the natural and economic characteristics of small economies. Moreover, the consequences of natural disasters affect a high proportion of the population and damage the stable functioning of the whole economy.

Not only natural shocks, but also economic shocks adversely affect small island economies. The structure of small island economies is influenced by their foreign trade, making them heavily dependent on the conditions of international markets. Such dependence

constitutes the background of the small island economies' vulnerability. A relatively high foreign trade ratio, a narrow range of exported goods and services, and trade relations with a limited number of countries all tend to aggravate economic instability in small island countries.

| Country | Population | Geographic Area ($km^2$) | Per capita Income ($) | Share of Imports in GDP (%) | Distance to the Nearest Continent (km) | Share of the First Two Commodities in Total Exports (%)* |
|---|---|---|---|---|---|---|
| **Africa Averages** | 538,181 | 1,825 | 3,301 | 63 | 950 | |
| Cape Verde | 483,675 | 4,033 | 1,765 | 61 | 600 | 95 |
| Comoros | 757,174 | 2,235 | 369 | 38 | 500 | 95 |
| Mauritius | 1,221,474 | 2,040 | 4,594 | 55 | 1650 | 87 |
| Sao Tome and Princ. | 149,430 | 364 | 964 | 81 | 500 | - |
| Seychelles Islands | 79,154 | 455 | 8,814 | 78 | 1500 | 73 |
| **Asia Averages** | 222,658 | 2,697 | 3,367 | 61 | 2564 | |
| Bahrain | 705,862 | 694 | 12,542 | 62 | 500 | 84 |
| Cook Islands | 18,216 | 236 | 7,332 | 48 | | - |
| Fiji | 833,683 | 18,274 | 2,761 | 62 | 1500 | 75 |
| Kiribati | 95,459 | 726 | 781 | 32 | 1500 | 100 |
| Maldives | 313,352 | 298 | 2,260 | 66 | 600 | 90 |
| Marshall Islands | 57,437 | 181 | 2,108 | 111 | | - |
| Micronesia | 108,826 | 702 | 2,281 | 32 | | - |
| Nauru | 13,107 | 21 | 3,465 | 32 | 300 | - |
| Palau | 19,764 | 459 | 6,174 | 32 | 300 | - |
| Samoa Islands | 182,361 | 2,831 | 1,807 | 76 | 2900 | - |
| Solomon Islands | 453,886 | 479 | 568 | 59 | 700 | - |
| Tonga | 101,607 | 650 | 1,626 | 66 | 3000 | 96 |
| Tuvalu | 10,349 | 26 | 2,285 | 114 | 4000 | - |
| Vanuatu | 203,299 | 12,189 | 1,141 | 68 | 12900 | 74 |
| **Caribbean Averages** | 273,046 | 2,405 | 7,243 | 63 | 464 | |
| Antigua and Barba. | 79,587 | 442 | 9,036 | 71 | 500 | 69 |
| Bahamas | 314,451 | 13,873 | 14,462 | 58 | 900 | 66 |
| Barbados | 268,204 | 430 | 9,867 | 56 | 435 | 64 |
| Dominica | 78,316 | 751 | 3,279 | 59 | 500 | 88 |
| Grenada | 101,924 | 344 | 4,262 | 77 | 160 | 83 |
| St. Kitts and Nevis | 41,674 | 269 | 8,927 | 71 | 500 | 92 |
| St. Lucia | 158,183 | 622 | 4,611 | 69 | 500 | 71 |
| St. Vincent and Gre. | 117,800 | 388 | 3,137 | 63 | 500 | 76 |
| Trinidad and Tob. | 1,297,275 | 4,529 | 7,607 | 41 | 180 | 69 |
| **Europe Averages** | 454,650 | 3,116 | 11,259 | 56 | 179 | |
| **Northern Cyprus** | **215,970** | **3,555** | **5,949** | **37** | **94** | **68** |
| Southern Cyprus | 750,000 | 5,476 | 16,038 | 48 | 94 | 60 |
| Malta | 397,980 | 316 | 11,790 | 82 | 350 | 79 |
| **Overall Averages** | 308,075 | 2,513 | 5,245 | 61 | 1345 | |

**Table 1: Basic Economic and Demographic Indicators for Selected Small Island Economies (2003)**
**Source**: United Nations Statistics Division, www. unstats.org;
World Statistics Pocketbook, www.sids.net;
* 2001 for all the countries except the Northern Cyprus.

On the other hand, tourism is one of the more important sources of export revenues for most island economies. Towards the end of the twentieth century, the share of tourism in total export revenues was 76 per cent in St. Lucia, 61 per cent in Antigua and Barbuda, 55 per cent in Barbados, 51 per cent in Samoa, and 42 per cent in Vanuatu (World Bank and Commonwealth Secretariat, 2000:10-11). Therefore, stability in tourism revenue seems to be vital for the short- and long-term economic performance of small island countries.

Natural and economic shocks in small island economies also have some negative impacts on the flow of foreign financial resources. Foreign investors are relatively more risk-averse in the case of small island countries (Briguglio 1995). Foreign aid and loans have the potential to stimulate investment expenditure of the private sector in small island economies (Collier and Dollar 1999), but the amount of per capita foreign aid and loans recently declined for most small island economies (World Bank and Commonwealth Secretariat 2000).

## *3. The Structure of the Economy of Northern Cyprus as a Small Island State: A Comparative Analysis*

Having a geographical area of 3,555 km$^2$, a population of 215,970 and a national income of $1,283.7 million USD in 2003, Northern Cyprus can be categorized as a small economy according to all criteria used to define smallness [1]. Consistent with this definition, the country shows all the major characteristics of a small island economy indicated in the literature, namely smallness, isolation and vulnerability, and faces important structural problems originating from these specificities.

As in the case of other small island economies, the absence of scale economies also creates problems for the economy of Northern Cyprus. This phenomenon, in turn, affects the degree of its external dependency. Among others, this dependency reveals itself in the import ratio. The ratio of imports to GDP reached 37 percent in Northern Cyprus in 2003. However, this ratio remained well below the average (61%) for the small island economies included in Table 1. This ratio was 48 percent for Southern Cyprus and 82 percent for Malta.

Furthermore, the absence of scale economies associated with poor resource endowment has adverse consequences on the structure of production, reducing the variety of commodities in the case of small island economies. Consequently, the range of export commodities narrows and the risks from foreign trade augment. This pattern seems to be totally valid for the Northern Cyprus economy. The range of commodity production is quite restricted in Northern Cyprus. The economic activities mainly concentrate on the production of a few agricultural commodities (like potatoes, cereals and citrus fruits), a small-scale manufacturing industry (food) and tourism. These commodities and services constitute a significant portion of the total exports of the country. In 2003, the share of processed agricultural and food products rose to 68 per cent of total exports. The limited number of exported commodities makes the country extremely vulnerable to external shocks. In the meantime, the share of the first two commodities in total exports was 79 per cent in Malta, and 60 per cent in Southern Cyprus. This share is considerably higher for almost all the small island economies mentioned in Table 1.

Additionally, the export ratio in Northern Cyprus is low compared to other small island economies (See Table 3). Low export ratios do not only originate from the country's geographic isolation [2] but also from its high degree of economic and political isolation. Consequently, transportation and communication costs rapidly increase, restricting export opportunities. Since the country suffers from a lack of international recognition, it faces relatively more difficulties in establishing multilateral trade relations with other countries. As can be see from Table 2, almost 70

| Northern Cyprus | | Southern Cyprus | | Malta | |
|---|---|---|---|---|---|
| **Exports** | **Imports** | **Exports** | **Imports** | **Exports** | **Imports** |
| Turkey (45) | Turkey (61) | U.K. (19) | U.S. (9) | U.S. (20) | Italy (20) |
| U.K. (23) | U.K. (10) | Russia (9) | Greece (9) | Germany (13) | France (15) |
| **Total**: 68 | **Total**: 71 | **Total**: 28 | **Total**: 18 | **Total**: 33 | **Total**: 35 |

**Table 2:** Country Destination and Origin of Merchandise Exports and Imports of Northern Cyprus, Southern Cyprus and Malta (% of Total)

**Source**: DPÖ (2007) and World Statistics Pocketbook, www.sids.net

percent of the Northern Cyprus trade volume is restricted to only two countries, indicating obstacles to expanding trade relations compared to Southern Cyprus and Malta.

Furthermore, Northern Cyprus trade flows have to take place via Turkey, unless they are produced locally. In short, in the case of Northern Cyprus, one may argue that export orientation could not be used as a substitution mechanism to bypass the problems associated with the existence of the small domestic market, poor resource endowment and absence of scale economies.

Due to its high political isolation and its special economic ties with Turkey, Northern Cyprus is heavily affected by the economic crises experienced in that country. This fact aggravates the economic vulnerability of Northern Cyprus, and produces further instabilities in its long-term economic performance, in

| Income Category | Geographic Region | Share of Exports in GDP | Share of Trade and Tourism in GDP | Share of Agriculture in GDP | Share of Manufac. Industry in GDP | Per capita Foreign Aid ($) in 2000-2003 | Secondary School Enrolment Ratio (%) |
|---|---|---|---|---|---|---|---|
| **High** | | | | | | | |
| Bahamas | Caribbean | 49 | 23 | 3 | 3 | 18.50 | 76 |
| Bahrain | Asia | 80 | 10 | 1 | 11 | 63.25 | 87 |
| Barbados | Caribbean | 50 | 23 | 3 | 5 | 21.00 | 90 |
| Southern Cyprus | Europe | 47 | 19 | 4 | 9 | 51.50 | 93 |
| Malta | Europe | 77 | 16 | 2 | 19 | 27.75 | 87 |
| **High-Middle** | | | | | | | |
| Antigua and Barba. | Caribbean | 62 | 17 | 3 | 2 | 123.75 | - |
| Cook Islands | Asia | 4 | 39 | 13 | 3 | - | - |
| **Northern Cyprus** | **Europe** | **17** | **16** | **10** | **9** | **728.45** | **100** |
| Dominica | Caribbean | 46 | 13 | 15 | 7 | 267.00 | 92 |
| Grenada | Caribbean | 42 | 18 | 9 | 4 | 120.25 | 96 |
| Mauritius | Africa | 56 | 15 | 5 | 19 | 10.75 | 74 |
| Nauru | Asia | 57 | 15 | 17 | 1 | - | - |
| Palau | Asia | 57 | 31 | 4 | 1 | 1672.75 | - |
| Seychelles Islands | Africa | 79 | 23 | 3 | 15 | 149.00 | 100 |
| St. Kitts and Nevis | Caribbean | 46 | 16 | 2 | 8 | 232.00 | 95 |
| St. Lucia | Caribbean | 55 | 18 | 5 | 4 | 119.00 | 76 |
| St. Vincent and Gre. | Caribbean | 46 | 17 | 7 | 6 | 59.00 | 58 |
| Trinidad and Tob. | Caribbean | 56 | 19 | 1 | 15 | -2.50 | 72 |
| **Lower-Middle** | | | | | | | |
| Cape Verde | Africa | 26 | 22 | 6 | 5 | 224.00 | 58 |
| Fiji | Africa | 58 | 14 | 15 | 12 | 42.50 | 76 |
| Maldives | Asia | 88 | 33 | 8 | 8 | 79.00 | 51 |
| Marshall Islands | Asia | 12 | 16 | 10 | 6 | 1173.50 | 65 |
| Micronesia | Asia | 57 | 15 | 17 | 1 | 960.25 | - |
| Samoa Islands | Asia | 27 | 22 | 13 | 17 | 201.25 | 62 |
| Sao Tome and Princ. | Africa | 38 | 9 | 17 | 4 | 224.25 | - |
| Tonga | Asia | 21 | 14 | 24 | 3 | 219.75 | 72 |
| Tuvalu | Asia | 13 | 14 | 19 | 4 | - | - |
| Vanuatu | Asia | 65 | 33 | 21 | 5 | 169.25 | 28 |
| **Low** | | | | | | | |
| Comoros | Africa | 21 | 22 | 41 | 5 | 44.50 | 29 |
| Kiribati | Asia | 47 | 15 | 17 | 1 | 185.50 | - |
| Solomon Islands | Asia | 35 | 9 | 45 | 5 | 122.75 | - |

**Table 3: Selected Small Island Economies According to Income Categories (2003)**
**Source**: United Nations Statistics Division, www. unstats.org;
World Development Indicators Database, www.worldbank.org; DPÖ (2007).

addition to the structural problems inherent for a typical small island state.

According to the level of development measured by per capita income, the variations between small island economies may be mainly attributed to their geographic region, structure of production and export performance (See Table 3).

With respect to geographic region, small island economies situated in the European and Caribbean regions generally attain high income levels, while those in Africa and Asia manifest poor performance in this context. But Northern Cyprus can only achieve moderate per capita income level compared with other small island economies in the European region such as Southern Cyprus and Malta. As mentioned before, the main reason of this relatively poor performance can be associated with the high degree of economic and political isolation of the country.

Furthermore, whereas the export ratio of small island economies in the high-income category averages 61 percent, the average of this ratio is 48 percent for higher middle-income, 40 percent for lower middle-income and only 34 per cent for the low-income country categories (See Table 3). Depending on this statistical fact, it can be argued that the development level of the countries can be raised with an increase in the ratio of the total exports of the goods and the services to GDP in the case of small island economies. However, the export performance of Northern Cyprus does not seem to support this argument. With a 17 per cent export ratio in 2003, Northern Cyprus achieved an export performance far lower than the average of low-income small island economies.

When the production structure of small island economies is observed using the data in Table 3, the countries having relatively large shares of agriculture in GDP attained relatively low income levels. Conversely, counties succeeding in developing their manufacturing industry together with their internal trade and tourism sectors generally possessed high income levels. For instance, whereas the share of the agricultural sector in GDP for high-income countries averaged 3 per cent in 2003, the same share attained 7 per cent for higher middle-income, 15 per cent for lower middle income, and 34 per cent for low-income small island countries. On the other hand, the average of the share of the trade and tourism sectors in GDP for high and middle-income countries ranged from 19-20 per cent. The same share averaged around 15 per cent for low-income small island economies. Northern Cyprus did not exhibit a striking contrast with the averages of its income category (high-middle). Nevertheless, one should notice that while the contribution of the agricultural sector to national output was slightly higher than the average level, that of trade and tourism remained relatively small compared to other island economies of the higher middle-income category.

Exporting a great portion of domestically produced commodities is one of the main characteristics of small island economies. Therefore, the production structure of these economies at the same time reflects the structure of their exported products. Table 4 shows the structure of exported products for selected island states. Besides states located in the European Continent, namely Northern Cyprus, Southern Cyprus and Malta, islands from different geographic regions (Africa, Asia and Caribbean) and extreme income categories are selected in constructing Table 4.

In comparison with the structure of production, the structure of exported products indicates a stronger relation with the development level measured by per capita income (Parilla *et al.* 2007; Velde *et al.* 2007). Agricultural products constitute the greatest portion of exported commodities in Northern Cyprus, Comoros and Kiribati, where per capita income levels are

| Northern Cyprus | Southern Cyprus | Malta | Barbados | Comoros | Kiribati |
|---|---|---|---|---|---|
| Agricultural Products (41.0%) | Food Products (33.0%) | Metal Products (68.0%) | Chemical Products (35.0%) | Agricultural Products (89.0%) | Agricultural Products (93.0%) |
| Food Products (32.7%) | Metal Products (27.0%) | Chemical Products (11.0%) | Food Products (29.0%) | Chemical Products (6.0%) | Other Manu. Ind. (7%) |
| Textile (20.1%) | Chemical Products (18.0%) | Textile (10.0%) | Metal Products (21.0%) | Other Manu. Ind. (3%) | - |

**Table 4: Structure of Exported Products for Selected Island States (% of Total Exports)**
**Source**: World Statistics Pocketbook, www.sids.net

relatively low. On the opposite side, industrial products take the leading portion of total exports in Malta, Barbados and Southern Cyprus, where per capita incomes are relatively high (See Table 1 and 4).

Furthermore, the impact of human capital on economic development in general and the export of industrial products in particular should be mentioned in the case of small island economies (Layne *et al.* 2008; Bunwaree 2001). High technology products constitute 62 per cent of the total exports of Malta, and 21 per cent in Barbados. These constitute only 1 per cent in Comoros, however, where per capita income level is the lowest among the 31 small island economies presented in Table 1. The secondary school enrolment ratio is also very low (29 %) in Comoros. School enrolment ratios attained the very high levels of 87 per cent in Malta and 90 per cent in Barbados. Yet Northern Cyprus, which has a secondary school enrolment ratio of 100 per cent, could not manage to export high technology products owing to its peculiar structural characteristics and, especially, to brain drain.

Moreover, peculiar structural characteristics of the economy of Northern Cyprus can also be detected in the average per capita foreign aid received during the period of 2000-2003. With approximately $730 USD per capita in foreign aid, mostly originating from Turkey, Northern Cyprus obtained an amount of aid significantly higher than the small island states average (See Table 3). Relatively high amounts of foreign aid not only assist in compensating for the poor economic performance of the country, but also contribute to increasing income levels.

From the above analysis, the special features of the economy of Northern Cyprus become more apparent in the context of the experience of small island economies. But the factors determining long-run output performance of the country should be closely investigated. Before attempting to do so, empirical studies focusing on the factors determining output performance of small island economies will be reviewed in the next section.

## *4. Special Factors Determining Output Levels in Island Economies: A Review of Empirical Studies*

Depending on the theoretical background of the neo-classical growth model, one may infer that small island nations are not optimal economic units and that their per capita income levels are expected to be low (Downes 2004; Hammond and Rodriguez-Clare 1993; Looney 1989; Bhaduri *et al.* 1982). Contrary to theoretical expectations, however, the historical economic performance of small island economies seems to be promising. According to the World Bank's classification, most of the small island economies are ranked under the upper-middle and high income economy categories. Therefore, the need emerges for a survey of the literature to investigate empirically the determinants of output level in small island economies.

Some of the empirical studies concentrate on testing the negative relation between country scale and growth performance. Milner and Westaway (1993) could not find a statistically significant relation between country scale and economic growth. Using factor analysis, Armstrong and Read (1998) do not find a negative correlation between country scale measured by population and GNP. Similarly, Easterly and Kraay (2000) do not find significant variation between the growth performance of small and large countries. Furthermore, they find that small countries, although affected by output fluctuations mostly originating from their outward oriented industrialization experience, achieve relatively high per capita income levels. Therefore, the factors that lead to the high output level performance of the small island economies should be closely examined.

By enlarging the small domestic market, and raising productivity and international competitiveness, foreign trade is one of the most decisive factors affecting the output performance of small island economies (Streeten 1993; Ashoff 1989). Due to their structural characteristics, the openness to international trade of small economies is relatively high. For most small economies, the ratio of foreign trade to GDP exceeds 100 per cent. Thus, the multiplier effect of foreign trade on economic growth is expected to be high in the case of small island economies (Ashoff, 1989). Additionally, small island states focusing on the export of goods and services in which they have comparative advantages have realized high output performances, as in the cases of Southern Cyprus and Malta (Read, 2004; Demetriades *et al.* 1993).

The geographic position of the economies also has direct impacts on economic performance. According to the empirical works of Armstrong and Read (2000) and Armstrong *et al.* (1998), one of the most important determinants of the per capita income level for small economies is associated with their geographical position. Small countries situated in rich and dynamic regions like Western Europe have attained higher per capita income levels and average growth rates compared to small countries in other regions [3].

Taking distance as an indicator for easy access to foreign markets, Redding and Venables (2002) demonstrated that 70 per cent of the variations in the per capita income levels could be attributed to the distance factor alone. Meanwhile, owing to their similar geographical positions, convergence of the income

levels of the Pacific island states is tested. The existence of such a convergence could not be found in the quantitative work of Cashin and Loayza (1995).

The effect of human capital in general, and education in particular, on economic growth has also been empirically analyzed in the case of small economies. In his econometric work, Benerjee (1982) found a positive relation between the school enrolment ratio and growth. Similarly, Manning (1982) found a statistically significant association between education and economic growth in the case of small economies. Downes (2004) also showed that education was one of the crucial components of high economic performance in the case of Barbados.

Political sovereignty of small nations should also be investigated in the context of the determinants of their income level. Theoretical expectations indicate that political sovereignty will eventually lead to higher output performance for small island economies (Armstrong and Read 2003). But the findings of current empirical studies surprisingly contradict these expectations. Both the works of Armstrong and Read (2000) and that of Bertram and Karagedikli (2002) demonstrate that small dependent states achieve relatively high growth rates and income levels in comparison to independent small states. The results do not differ even when the income transfers from the centre states are excluded from the analysis. Furthermore, in the work of Bertram (2004), where the conditional convergence hypothesis is tested in the case of small economies, it is found that the economic growth rates of small island economies converge with those of their "metropolitan patrons".

Having reviewed the empirical literature, the paper now concentrates on the output performance of Northern Cyprus, and a quantitative analysis will be performed to this end.

## *5. Panel Data Analysis of the Output Performance of Northern Cyprus*

In this section, the effect of investment, employment and export variables on the output performance of the Northern Cyprus economy are tested by using panel data analysis.

### *5.1. The Model and Data*

The literature survey on the characteristics of small island economies as well as structural analysis of the Northern Cyprus economy underlined insufficient domestic demand as the main economic problem of those nations. Therefore, the main factor stimulating the output level seems to be foreign demand, and thus exports in small island economies. Under these circumstances, in analyzing empirically the output performance of an island economy like Northern Cyprus, exports can be used in the estimated production function alongside other variables. In this framework, an export-augmented Cobb-Douglas production function can be used. This specification permits the inclusion of exports as a third input of production, providing a procedure to capture total factor productivity growth (Medina-Smith 2001; Feder 1983). To explain the rational of the model, it is worth quoting Thirwall (2000:17-18) directly:

> *"The neoclassical supply-side model of the relation between exports and growth assumes that the export sector, because of its exposure to foreign competition, confers externalities on the non-export sector, and secondly that the export sector has a higher level of productivity than the non-export sector. (…) The export sector is likely to be more 'modern' and capital intensive than the non-export sector which to a large extent consists of low productivity agriculture and petty service activities. The externalities conferred are part of the dynamic gains from trade discussed at the beginning, associated with the transmission and diffusion of new ideas from abroad relating to both from production techniques and efficient management practices."*

Therefore, the export-augmented Cobb-Douglas production function is specified as follows:

Y = F (K, L, EXP) where,
Y= aggregate output (real GDP),
K =capital,
L =labor force,
EXP= total real exports of goods and services.

In this study, the main sectors (agriculture, industry and services) of the Northern Cyprus economy are determined as the cross section units, and a panel is constructed. Compared with cross section and time series models, panel data models have some advantages. The rise in the number of observations, and thus the increase in the degree of freedom leading to more confident parameter estimations, can be considered as the most important of these advantages. Additionally, the difference among the cross section units can also be investigated depending on this method (Hsiao, 1996:3). Because of these advantages, the present study employs a panel data model. Due to the lack of sufficient time series and cross section data in the case of the economy of Northern Cyprus, using panel data analysis in the empirical research leads to

more statistically reliable results. Moreover, by defining the main economic sectors as the cross section units, the heterogeneity among these sectors can be examined.

At the initial level, the estimated model can be specified in the following way:

$$(LNGDP)_{it} = \beta_{1it} + \beta_{2it}(LNI_{it}) + \beta_{3it}(LNE_{it}) + \beta_{4it}(LNX_{it}) + u_{it} \quad (1)$$

In this model,

i = cross section units of agricultural, industrial and services sectors

t = years from 1977 to 2005

$LNGDP_{it}$ = natural logarithm of agricultural, industrial and services sectors' output in every year of the study period

$LNI_{it}$ = natural logarithm of the total fixed investments in the agricultural, industrial and services sectors from 1977 to 2005

$LNE_{it}$ = natural logarithm of the number of employed people in the agricultural, industrial and services sectors from 1977 to 2005

$LNX_{it}$ = natural logarithm of the exports of the agricultural, industrial and service sectors from 1977 to 2005

In Northern Cyprus, the single centre which collects the data related to economic and social indicators is the State Planning Organization. The present study uses the data of this organization (DPÖ 2007). Investments are used to proxy capital stocks and include both public and private investments directed toward all sectors of the economy. They are then aggregated into three main sectors. Employment figures are obtained from the aggregation of the number of employed people in all sectors into the three main sectors of the economy. Similarly, exports from all sectors are summed in three main sectors, namely agriculture, industry and service. For the service sector, only tourism revenues are used to represent service exports, since there is no other economic activity within the country which could be included in the exports of this sector.

To measure and estimate the effect of foreign markets, i.e. export growth, on the output performance of the country, elasticities are estimated. For this aim, the model is constructed in a double logarithmic form. Sector output, investment, employment and export variables are first indexed by taking the value of the initial year (1977) of the study period as 100, and then converting indexed values into natural logarithms.

Finally, due to their significance in the production process, both capital and labor have positive effects on overall output level. As mentioned before, depending on the positive externalities in small island economies, exports are also expected to have a positive effect on Northern Cyprus output level.

## *5.2. Estimation Results*

First of all, the stationarity of the variables used in the model should be tested. According to the test results, all of the series are not stationary. Therefore, first order differences of the series are used in the analysis [4]. The estimated model turns out to be a simple growth model:

$$D(LNGDP)it = \beta 1it + \beta 2it\ D(LNIit) + \beta 3it\ D(LNEit) + \beta 4it\ D(LNX\ it) + uit \quad (2)$$

The panel data methods of pooled regression and fixed effect models are performed for the regression. This study preferred to provide the results of both models to get thick modeling with more robust results. Put differently, various possible model results are considered to see whether the significance, size and sign of the coefficients change or not under different modeling approaches. According to the pooled regression results, all explanatory variables are statistically significant variables for the estimated equation. Furthermore, the sign of coefficients are found to have turned out as expected [5].

The estimation results of the fixed effect model indicated that the effect of cross section units, namely the agricultural, industrial and services sectors, on the sector output did not vary considerably. In other words, the results of an F-test do not statistically support sector differences in terms of fixed effects. [6]

Besides the fixed effects, a time effect model is also estimated. In doing so, time effects on the dependent variable could be empirically examined depending on the F-test [7]. Since the F value is greater than the appropriate F-Statistic, the null hypothesis is rejected, and it is concluded that time effects are significant for output growth. Therefore, the time effect regression model is statistically the best model in explaining the variations in output level. Furthermore, the Durbin-Watson test result of the regression indicates that there is no autocorrelation problem in the estimation process.

Pooled, fixed effect and time effect regressions are performed using the EViews program. Fixed effect specification is mainly used to account for time invariant unobservable heterogeneity that is potentially correlated with the dependent variable. Thus, it is also expected to capture the idiosyncratic factors that might have affected sector output growth.

| | | | | |
|---|---|---|---|---|
| *Sample:* | *1977 2005* | | | |
| *Included Observation:* | *27* | | | |
| *Number of cross-section used:* | *3* | | | |
| *Total observations:* | *84* | | | |
| ***Variable*** | ***Coefficient*** | ***Std. Error*** | ***t-Statistic*** | ***Probability*** |
| *C* | *0.012712* | *0.005001* | *2.541618* | *0.0140* |
| *DLNI* | *0.112936* | *0.007990* | *14.13432* | *0.0000* |
| *DLNE* | *0.652533* | *0.123055* | *5.302774* | *0.0000* |
| *DLNX* | *0.165319* | *0.043885* | *3.767078* | *0.0004* |
| $R^2$ | *0.827496* | *Mean Dependent Var.* | *0.079459* | |
| *Adjusted* $R^2$ | *0.729853* | *S.D. Dependent Var.* | *0.217736* | |
| *Sum Squared Resid* | *0.678796* | | | |
| *S.E. of Regression* | *0.113170* | *F-Statistics* | *8.474653* | |
| *Durbin-Watson Stat.* | *2.032020* | *Prob(F-Statistics)* | *0.000000* | |

**Table 5:** Time Effect Model Regression, dependent variable: DLNGDP

Nevertheless, the estimation results showed that the effect of the cross section units on sector output growth did not vary considerably. Conversely, time effects are significantly important in determining output growth in the case of Northern Cyprus.

Regression results suggest that investment, employment and export variables are statistically significant variables since all of them have high t-ratios. The signs of the coefficients are positive as expected, meaning that there is a direct relation between the explanatory variables and sector output. Furthermore, explanatory variables with time effect seem able to explain almost 83 per cent of the changes in sector output.

## *5.3. Evaluation of the Main Findings*

Empirical analysis indicated that there is no considerable variation among the cross section units defined as the agricultural, industrial and services sectors. In other words, particular characteristics of the different economic sectors do not statistically contribute in explaining production increases within the country. Therefore, the existence of homogeneous structure among the sectors can be suggested from the empirical results on the experience of the economy of Northern Cyprus.

On the other hand, empirical analysis reveals that time effects significantly determine the output level of the economy of Northern Cyprus. When time effects are closely examined, interesting results emerge. For example, the Gulf crisis of 1990-91 and severe economic crises in Turkey in 1994 and 2000 adversely affected Northern Cyprus' output level [8]. Such associations may also indicate dependency of the economy of Northern Cyprus on the Turkish economy.

Furthermore, the regression results also proposed that investment, employment and export variables significantly affect sector production increases in Northern Cyprus. Fixed investments play a crucial role in augmenting output increases. The main findings of our empirical analysis confirm this relation. A one percent increase in investment leads to a 0.11 percent increase in production. In fact, the effect of investments on production seems to be relatively low compared to export and employment variables. This can be explained by the low investment efficiency in the country. Furthermore, the amounts of fixed investments in the economy of Northern Cyprus are not high for a typical developing country [9]. Moreover, investors are adversely affected by the economic and political uncertainties of the country, and are unwilling to raise existing levels of investment.

Moreover, the number of employed people had a considerable impact on the total output growth. As to the findings of the current study document, a one percent increase in the number of employed people causes a 0.65 percent increase in sector output. Therefore, the rising quantity and quality of the labor force seems to be vital for raising the output level of the country. As mentioned before, school enrolment ratios are relatively high in Northern Cyprus. Therefore, there is potential for a highly educated labor to be employed in technologically advanced production units. Yet the economy suffers from the existence of such production units, and therefore, highly skilled labor could not be productively employed. Consequently, brain drain is observed, or qualified

labor is heavily employed in an inefficient public sector.

Meanwhile, as indicated above, the production and export structures of the country focus on agriculture, an agricultural-based manufacturing industry, and tourism. These sectors, in turn, necessitate a relatively low-qualified labor force. By gradually shifting low-skilled Turkish labor to the island from the beginning of the 1990s, the employment problem of these sectors was solved. Therefore, the labor force leading to an increased production level in the Northern Cyprus probably originated from a low-skilled labor force shifted from Turkey to the island.

Finally, export exerts considerable effects on sector production in the case of Northern Cyprus. This finding is totally consistent with the literature on small island economies. According to the estimation results, a one percent increase in the export of goods and services has the potential to raise sector output level by 0.16 percent. In this context, the impact of the tourism sector should be underlined alongside the export of commodities in the economy of Northern Cyprus. With the existence of a limited domestic market in the country, foreign market and tourism can play a substitution role to stimulate output levels. Moreover, exports indirectly influence the output level through provoking the growth of total factor productivity (Günçavdı and Küçükçiftçi 2008; SPO 2001; SPO 1994).

## *6. Concluding Remarks*

Different from other island economies, the economy of Northern Cyprus suffers from a lack of international recognition, which in turn raises the degree of its economic isolation. Additionally, due to its special ties with Turkey, the unstable economic structure of that country directly affects Northern Cyprus, making this island economy more vulnerable to external shocks compared to others.

In fact, small island economies function in unfavorable conditions with respect to traditional industrialization strategies. Due to the lack of sufficient domestic markets, these economies cannot follow import substituting industrialization policies. Furthermore, the success of export-led growth strategies suffers from factors such as high transportation costs and the instability of foreign markets in the case of small island economies.

Revealing the major characteristics of a small island state, the Northern Cyprus economy depends on the expansion of goods and services exports to attain high output levels. In fact, Northern Cyprus pursued import substituting industrialization policies until the second half of the 1980s. After that period, however, industrialization policies shifted towards export promotion and emphasis was given to the service sector. Within these, tourism started to play a paramount role.

As far as the production processes of the economy are concerned, one should primarily deal with investment. In this context, the current empirical analysis confirms that fixed capital investments positively affect output growth in the case of the economy of Northern Cyprus. Furthermore, the most important obstacle to the rise of investment levels in the country is its prevailing economic and political uncertainty. Skeptical views concerning the future of the island make investors reluctant to invest more. Additionally, interest rates are relatively high due to the country's heavy dependence on Turkish financial markets. Consequently, high interest rates prevent an increase in investment.

As one of the main factors of production, labor is also very important for output growth. Consistent with the theoretical expectations, the findings of the empirical analysis indicated a positive association with employment and sector production increases in the economy of Northern Cyprus. But the present output structure of the economy requires a low-skilled rather than a highly-educated and qualified labor force. This situation forces young and educated labor to migrate abroad, and pulling instead unskilled labor into the country. The structure of this abnormal labor market leads to a waste of human resources. Therefore, it will be more beneficial to specialize in the production sectors, which would necessitate the use of qualified labor.

Another finding of the empirical analysis indicated a significant contribution of international demand defined as exports of goods and services. Therefore, exports could be considered one of the main motives of the sector output expansion in the economy of Northern Cyprus. A production structure mostly dependent on foreign demand makes it easier to overcome the restrictions originating from the insufficiency of the domestic market through the creation of new employment opportunities for a highly qualified labor force and additional production capacity with productive investments. Moreover, the export of goods and services has the potential to raise total factor productivities, and hence, to further improve the country's output expansion. In short, one may argue that outward orientation seems to be relevant in achieving higher levels of output in the case of the economy of Northern Cyprus.

In this framework, sectors having great potential to contribute to the country's long-run output performance, depending on foreign demand,

should be carefully determined, and both physical and human resources should be devoted to the improvement of these sectors. The higher education sector of the country emerges as the single successful example in this respect. With the support policies of the government and the impact of growing foreign demand, higher education has the potential to create new employment opportunities and significantly contribute to production expansion in the country. Other sectors of the economy should be carefully scrutinized in this context. With its output-enhancing characteristics and foreign demand orientation, the tourism sector merits particular interest.

## *Notes*

1. About the measures of smallness, see Read (2001).

2. According to the demographic and economic indicators mentioned in Table 1, a strong correlation cannot be observed between the geographic isolation measured by the "distance to the nearest continent" and per capita income levels in the case of small island economies (See Table 1).

3. The economic integration of small Western nations into the European Union should also be mentioned in this context.

4. According to ADF-Fisher test statistics, for almost all the variables Chi-Square values are insufficient to reject the null hypothesis of a unit root. When the ADF-Fisher test is used for testing the stationarity of the first differences of all variables, however, as to the Chi-Square values, the null hypothesis of a unit root is rejected for all variables.

5. The estimation result of the pooled regression model is as follows:

$$D(LNGDP)it = 0.01 + 0.10\ D(LNI) + 0.62\ D(LNE) + 0.16\ D(LNX) + u\ it$$

(1.83) (8.60) (6.33) (7.66)

R2=0.60 SSR=1,045893 F-statistic=40.055895

With t-statistics in parentheses.

6. The estimation result of the fixed effects regression model is as follows:

$$D(LNGDP)it = 0.08\ D(LNI) + 0.92\ D(LNE) + 0.17\ D(LNX) + u\ it$$

(7.41) (7.78) (8.18)

Constant terms in the fixed model are:

β1 Agriculture=0.024 β2 Industry=-0.004 β3 Services=-0.016

R2=0.70 SSR=1.045641 F-statistic=37.47570

With t-statistics in parentheses.

According to the results of this estimation and pooled estimation, F-test [F =((SSRPooled-SSRFixed)/(N-1))/(SSRFixed/(NT-N-K))] is performed with null hypothesis Ho: β1 Agriculture= β2 Industry= β3 Services. As to the test result, the calculated F ratio (0,009) is smaller than the critical value (3,15) for $\alpha$= 0.05. Therefore, the null hypothesis that the constant term for all the sectors is identical could not be rejected.

7. Time effects are presented in Table A.

To analyse whether the time effects are statistically significant, an F-test is performed for the null hypothesis Ho: λ1978=λ1979…=λ2005. According to the estimation results, the calculated F ratio is equal to 3,1425. It is smaller than the critical value of 1,70 for $\alpha$= 0.05. Therefore, the null hypothesis of homogeneity of time effects is rejected.

| | |
|---|---|
| 1978—C | 0.024245 |
| 1979—C | 0.062399 |
| 1980—C | 0.053297 |
| 1981—C | 0.179056 |
| 1982—C | 0.018856 |
| 1983—C | -0.171583 |
| 1984—C | 0.067036 |
| 1985—C | 0.055320 |
| 1986—C | -0.054068 |
| 1987—C | 0.002669 |
| 1988—C | 0.082102 |
| 1989—C | 0.019639 |
| 1990—C | -0.066512 |
| 1991—C | -0.025898 |
| 1992—C | 0.103553 |
| 1993—C | -0.000569 |
| 1994—C | -0.013616 |
| 1995—C | -0.002618 |
| 1996—C | -0.009392 |
| 1997—C | -0.057384 |
| 1998—C | 0.004313 |
| 1999—C | 0.079452 |
| 2000—C | -0.043708 |
| 2001—C | 0.095499 |
| 2002—C | 0.010196 |
| 2003—C | 0.002433 |
| 2004—C | 0.017737 |
| 2005—C | 0.055322 |

**Table A:** Time Effects

8. For details, see endnote 7.

9. The rate of fixed investments on the GDP never exceeded 20 per cent during the period of 1977-2005, except for the year 1986 (DPÖ, 2007:10-11).

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# The Shadow Economy and Its Impact on National Competitiveness: The Case of Slovenia

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*Abstract:*

***The paper presents a socioeconomic analysis of the phenomena of informal economic activity. It is argued that the shadow economy has been beneficial for Slovenian society since the 19th century and has significantly contributed to the success of the Slovenian economy under the socialist regime. During Slovenia's transitional phase it has stimulated the formal economy, soothed social tensions and allowed export-oriented enterprises to remain internationally competitive by paying lower wages and obtaining cheaper inputs. However, it hinders innovation, impedes entrepreneurship and maintains the status quo, and thus represents an obstacle for future economic development in Slovenia.***

**Keywords:** shadow economy, Slovenia, competitiveness, socioeconomic analysis **DOI:** 10.2478/v10033-009-0003-6

## 1. Introduction

The shadow economy is a phenomenon that is to a certain extent present in all world economies. It started to attract scientific interest no earlier than the 1970s (Schneider, Enste; 2002) and has since been looked at from many different angles. It has been often found to be an obstacle to free competition that in the end reduces the potential GDP of a country (Fleming et al, 2000). Although it reduces potential fiscal revenues and thus undermines a state's ability to provide public goods, it can not be treated as entirely unconstructive. For example, the shadow economy provides for basic needs and gives income to the people, especially in poorer countries (Fleming et al., 2000). Other researchers have stressed the view of the shadow economy as a realm of hidden enterprise culture that should be harnessed, rather than deterred, and brought into the formal economic sphere (Williams, Windenbank; 2006). In countries in transition it is viewed as an integral part of this process by relieving social tensions and is assumed to diminish in size as conditions that favor its development (high unemployment, lack of legal framework, heavy tax and social security burdens, bureaucracy) normalize and the country adjusts itself to a market economy.

However, we believe that the shadow economy in Slovenia is not just a transitional phenomenon, because it has not significantly declined by the end of transition. Rather, it is an integral part of the country's institutional environment. We assert that it is deeply embedded in the Slovenian business system and is one of the most important "background institutions" (Whitely, 1992) or "contextual factors" (Jaklič, Zagoršek, 2002) that have patterned the social behavior of Slovenian actors over the last two centuries. It has been beneficial for Slovenian society since the 19th century

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and has significantly contributed to the success of the Slovenian economy under the socialist regime. The upsurge in moonlighting activities at the beginning of transition (1990s) was therefore just a natural extension or adaptation of old, deeply entrenched practices, inherited from the past.

Further, we believe that the shadow economy has become an important obstacle to future economic development in Slovenia, as the country is striving to move from an efficiency- based economy to an innovation-based society (Jaklič, 2002). It hinders innovation and maintains the status quo in terms of economic paradigm, which is not sustainable in the long run.

Public authorities would generally attempt to control the shadow economy by prosecution, punishment and education. Some hope for diminishing the shadow economy would also be put on general economic growth (Schneider, 2004). However, should the action against the shadow economy be effective, one needs to understand its underlying causes. These causes are often and at least superficially similar between different countries, e.g. taxes or regulatory burden. Yet underneath these general issues there are important specific triggers that differ from country to country. In the example of Slovenia, we want to show the importance of understanding a broader institutional context when explaining the shadow economy.

In the first section we define the shadow economy and discuss some of its characteristics, especially within transition countries. In the second section we present the data on the persistence of the shadow economy in Slovenia. We add data on economic categories that are considered to have the most impact on the shadow economy. The third and fourth sections are dedicated to socioeconomic analysis of the historical development of the shadow economy in Slovenia before and during the transition period, showing its historical embedment in Slovenian economy and society. The fifth section discusses the problems and challenges that Slovenia faces on its path to an innovation-driven economy, while the last section analyses the negative impact of the shadow economy on competitiveness and the long-term development of Slovenian economy. The paper concludes with a discussion on research limitations and suggestions for future research.

## *2. Characteristics of the Shadow Economy*

There is extensive disagreement among scholars regarding the name applied to the phenomenon of informal economic activity. Apart from the shadow economy, it is also called the grey, unofficial, parallel, underground, hidden or even black economy. Similarly, there exist a number of different definitions of the shadow economy, each focusing on a particular type of informal activity. Schneider and Enste (2000, 2002) define it as "all economic activities, which should be included in the added value, but such a recording is prevented by evasive strategies of private sector. Smith (1994) defines it as "market based production of goods and services, whether legal or illegal, which escapes detection in the official estimates of GDP." Alternatively, Feige (1990) focuses on whether the economic activity adheres to the established, prevailing formal institutional rules of the game. "Adherence to the established rules constitutes participation in the formal economy … whereas noncompliance or circumvention of the established rules constitutes participation in the informal economy (Feige, 1990). Similarly, Portes et al (1989) state that the informal economy is "unregulated by the [formal] institutions of society, in a legal and social environment in which similar activities are regulated." The European Commission (2004) in its report prefers to use the term "undeclared work" instead of "shadow economy" and defines it as "productive activities that are lawful as regards to their nature, but are not declared to the public authorities, taking into account the differences in the regulatory system between the Member States."

Fleming et al. (2000) and Schneider and Enste (2002) divide the shadow economy into four broadly comparable components: the criminal, irregular, household and informal sectors. The criminal sector is defined as illegally produced goods and services, such as the production and trade of illicit narcotics. The irregular sector is defined as legally produced goods and services that evade legal reporting requirements, such as tax evasion. The household sector consists of

household production. And the informal sector is defined as economic activities that circumvent the costs and are excluded form the benefits of law, such as unregulated microenterprise. In our analysis we concentrate mainly on latter three sectors, disregarding purely criminal activities.

The characteristics and drivers of the shadow economy differ for countries on different developmental levels. The shadow economy in the OECD countries is usually attributed to high taxation and onerous labour regulation. In less developed countries (LDC), the driving forces are usually tax and regulation avoidance, corruption and general distrust of citizens towards the political system (Gerxani, 1999). Although the abovementioned aspects are relevant to transition countries as well, Kaufmann and Kaliberda (1996) identify additional dimensions of the shadow economy specific to them: a coexistence of state and non-state activities and enterprises in the unofficial economy; considerable visibility and size of unofficial activities; unofficial activity is mostly nonviolent and non-criminal; activities exist on a continuum in the official/unofficial spectrum – many activities operate in both; social services and state subsidies are accessible to unofficial activities; and the unofficial economy is shallow or sensitive to economic incentives from governments relative to other regions of the world.

The researchers mentioned above suggest that more than in other countries of the world (OECD or LDC), transition economies need relatively minor changes in some government policies and formal institutions, such as reduction of total tax and social security burdens as well as simplification of bureaucratic procedures, to drive the majority of the shadow economy into the formal sector. While we agree with that, our article goes further to argue that a broad institutional context should also be taken into account when explaining the reasons for the shadow economy and we support this assertion with the case of Slovenia. Our analysis shows that the shadow economy has been historically embedded in Slovenian society, a part of the generally accepted "rules of the game," and that the shadow economy and its surrounding institutional setting mutually support each other. As such, the Slovenian shadow economy makes a strong case for the institutional approach to its study and the following paper shows that in order to reduce the extent of the shadow economy, much more is needed than mere tax policy modifications. The following section supports this view by showing that the persistence of the shadow economy in the case of Slovenia can not be explained only by traditional variables e.g. GDP p.c., GDP growth or tax burden, but must be considered from the institutional setting point of view.

## *3. Persistence of the Shadow Economy in Slovenia*

At the beginning of the transition and during the 1990s, the Slovenian shadow economy was considered to be relatively small in comparison to other transition countries (Schneider, 2000; Lacko, 2000, Eilat, Zines, 2000).

| *Author* | *Slovenia* | *Czech Republic* | *Slovakia* | *Poland* |
|---|---|---|---|---|
| Schneider, 2000 | 28,6 | 28,7 | 30,6 | 31,8 |
| Lackó, 2000 | 31,2 | 31,8 | 32,0 | 31,7 |

**Table 1:** Size of shadow economy in Slovenia, Czech Republic, Slovakia and Poland as % of GDP for 1992 (Lackó) and 1993 (Schneider)

***Source:*** Lacko, 2000; Schneider 2000

Yet data after the year 2000 show that this is no longer the case. Schneider (2004) identified the Czech Republic, Poland and Slovakia to have smaller shadow economies than Slovenia. Detailed data can be seen in the following table:

| *Slovenia* | *Czech Republic* | *Slovakia* | *Poland* |
|---|---|---|---|
| 29,4 | 20,1 | 20,2 | 28,9 |

**Table 2:** Size of shadow economy in Slovenia, Czech Republic, Slovakia and Poland as % of GDP for 2002/2003

**Source:** Schneider, 2004

Similarly, in the 1999 World Competitiveness Yearbook (IMD, 1999), Slovenia was ranked last out of 45 countries earning 2,19 points out of 10 for the "degree to which parallel economy impairs economic development in the country." Three years latter, in WCY 2002 it was ranked next to last, before Argentina, but after Russia, India and other transition countries (the Czech Republic, Hungary, Estonia, Slovak Republic, Poland). In the 2003-2005 period it kept being placed near the rear, where it was but then that was already behind the Czech Republic, Slovakia and Estonia (IMD, 2004, 2005, 2006).

At the same time it should be noted that among all the compared countries, Slovenia has since 1993 constantly exhibited the least volatile GDP growth, was not hit by any recession and has remained at the forefront of ex-socialist countries concerning GDP p.c. in nominal and PPP terms (Eurostat $_{(GDP)}$, 2007). Inflation has been kept under control at moderate single-digit levels and has been slowly declining (Eurostat $_{(INFL)}$, 2006). The real exchange rate has been relatively stable throughout that time (ZMAR, 2006). Unemployment has decreased since 1995 and has been relatively lower than in other transition countries (Eurostat $_{(UNP)}$, 2006). Overall, the macroeconomic performance of the Slovenian economy was significantly better than that of other ex-socialist counterparts. Taxes on income and wealth as a share of GDP have risen slightly throughout the transition period in Slovenia. However, they have been in line with other transition countries and are far lower than those of EU-15 economies (Eurostat $_{(TAX)}$, 2006).

Furthermore, from 1995 onwards Slovenia has been heavily engaged in the implementation of *Acquis Communautaire* and it could be rightly argued that it has improved its public governance and regulatory restrictions during the process of accession to the EU, which was concluded in 2004. Corruption had never been a large problem in Slovenia and decreased throughout the studied period (Open Society Institute, 2002).

However, despite these favourable, or at worst neutral developments, the shadow economy in Slovenia has not declined significantly and continues to persist on a relatively high level. While economic development has helped to reduce the shadow economy in some other ex-socialist countries, this has not happened in Slovenia.

This speaks in favour of our hypothesis that the shadow economy is a deeply embedded institution and that it is influenced by numerous factors that go beyond the neoclassic explanation of economic activity.

Further empirical support for the thesis that informal institutions have a significant impact on the extent of the shadow economy is provided by Schneider (2000), who observes that Anglo-Saxon countries (US, Australia and United Kingdom) all have relatively small shadow economies (8,8%; 13,1% and 8,3% of GDP respectively) although the amount of total tax and social security burdens (formal institutions) varies considerably (41,4%; 54,9% and 70,4% of GDP respectively).

In the case of the shadow economy in Slovenia, the combined influence of (economic) history, values and a culture of local mutualism obviously continues to prevail over the influence of economic growth and global market pressures. While further simplification of the complex tax code and reduction of high marginal tax rates would be beneficial with regard to diminishing the shadow economy, it would not be enough. The next sections are dedicated to an explanation of the evolution of the shadow economy in Slovenia.

## 4. Slovenia's Shadow History: from Village Mutualism to Socialist Market Economy

In the 19$^{th}$ century "moonlighting" was essential for the survival of Slovenian peasants and their communities. After the abolishment of feudalism in 1848, Slovenian farmers were stuck with small farms, which they had to buy from previous landowners. In order to do so, they had to take loans in newly created saving and mortgage banks. They were heavily taxed by the Austro-Hungarian Empire due to military needs for the protection of borders. In addition, the hereditary rule stated that the heir had to pay a fair share of the inheritance to his brothers and sisters in money, or the farm was divided in equal parts. Because

of that, and because of the rough farming conditions of the mountainous terrain, small farmers were prevented from accumulating wealth and discouraged from embarking on any entrepreneurial activity that would enable them to improve their farming conditions (Kristensen, Jaklic, 1998). Even today, after one and half centuries, Slovenian farms are extremely small compared to other European countries[1].

From 1868-1890, peasants all over Slovenia were constantly living in a state of crisis, struggling to produce enough to be able to pay rent, taxes and inheritance claims. Few farmers would embark on entrepreneurial activities to improve agricultural productivity and thus restructure farming communities. Rather, they began to cooperate and help each other within their local communities. They started producing wooden crafts or textiles and offering various services on the local "gray" market. United in the face of a "foreign occupier," they gradually institutionalized a system of reciprocity of services and help among neighbors. If this system prevented farmers from engaging in a capitalist process of modernization, it simultaneously prevented the farming communities from destroying their traditional village mutualism and co-operation. Rather than participate in an economy built on principles of market exchange, they developed a system that could be kept secret and untaxed from the Empire authorities and which for these very same reasons had a high degree of legitimacy among the population.

The problem was that this unofficial, "hidden" economic system could not by itself generate the incomes necessary for it to be self-sufficient. Therefore, in order for them to continue with subsistence farming, farmers were forced to generate supplementary wage-incomes from sources outside the system (Cepic et al, 1979). The solutions to insufficient monetary incomes from farming differed substantially from one valley to the next, and even between villages in the same valley. Villages with nearby mines provided easy access to wage incomes. However, as such establishments were owned by foreigners, primarily Germans and Austrians, who managed their property in much the same way as a feudal estate, and because wages were extremely low, it is easy to see that subsistence farming was simultaneously a subsidy to the mine owner in a way that enabled him to reduce the wage bill. Thus the two systems cohabited in a mutually reinforcing way, also reproducing their mutual enmity.

In other villages, one of the basic incomes for smallholders stemmed from working in forests owned by the Catholic Church or in saw mills, which were established primarily by non-Slovenes in the 19th century in continuation of the tradition established in the 14th century, when Slovenians provided merchants from Venice with lumber for ship building. Especially in areas where the saw mills were not owned by the forest owners, smallholders had access to several rather than a single employer and could thus induce various owners to compete in making jobs and pay a bit more attractive. Thus various forms of benevolent paternalistic enterprises have evolved in some valleys, making it possible to enlarge the system of mutualism to the monetary sector and vice versa.

Until the end of the first World War, most Slovenian industrial enterprises were owned by Germans or Austrians, and they seem to have been rather uncontested by an emerging small scale industrialisation that could have grown out of cottage- or craft-production. Perhaps this explains why there was no bourgeois movement to change the situation radically. People who had to leave their farms would have to live as workers on a wage that only allowed them to survive if this could be supplemented with cultivating a small plot of land. Even though the position as a smallholder in Slovenia was not favourable, it was the only possible form of existence. Others would have to exit and voices could not be heard in Vienna. The structure was certainly not very supportive for a modern labour movement. Because of this, a strange combination of village mutualism based on extremely small family farms together with a foreign owned monetary sector combined and secured each other's existence.

There were valley communities that could have broken away from this Slovenian steady state. In Dolenjska, several valley communities were manufacturing iron and metals, often into goods of

[1] 60% of farms have less than 3 hectares and the average size is 3.3 as compared to 14 hectares in the EU (Kovacic, 1996).

high quality to be delivered all over the empire (smoothing irons, candlesticks, stoves, fences, fountains, elements for machines,... ) or luxuries for the Vienna Court. However, it is interesting to note that such communities collapsed because they could not take independent action when events in the larger empire changed their conditions (changes in transport routes, collapses of the Vienna bourse). Such events only help underline that within the monarchy the abovementioned combination of valley communities and foreign enterprises was a lasting strategy for survival.

However, this implied that Slovenia did not create a self-reinforcing indigenous mode of developing and organising industrial enterprises that could challenge foreigners' (non-Slovenes) way of organising work and production. Industrial discipline and capitalist employment contracts were associated with relations to foreigners, and these relations seemed to contrast hightly with the peer-relations the Slovenes had developed among themselves so as to mutually help each other survive on small lots. From this perspective, it is no wonder that Slovenians would often consider the capitalist sector as instrumental to village mutualism, thereby probably paving the way for the importance of the "moonlight economy".

Thus the hidden "valley"[2] system of reciprocity and mutuality was in a way subsidizing the formal capitalist system, which was in the hands of foreigners. In effect, both systems cohabited in a mutually reinforcing way. Since none of them permanently succeeded in dominating the other, they were able to coexist up to the end of the Second World War, when the formal economic system was changed radically.

After WWII, the partisans (communists) knew that the easiest way to gain local support, create legitimacy in a rural society and simultaneously establish authority, was to simply allow people to live on their small lots and to create enterprises that would offer "workers" additional, though not necessarily very high wages (Kristensen, Jaklic, 1998). Thus factories that had been established at the end of WWII could simply be seen as collective associations for the provision of money in terms of wages. The workers could still conceive of themselves as farmers and orient their life and careers toward this form of life with the necessary additional income being provided for as a collective good organized and managed by the socialistic state. Those without land, e.g. craftsmen and technicians, would also find their challenges in the surrounding community, where their skills were welcomed among the house building friends and neighbours and not in a formal economy where they kept working on undemanding and unchallenging jobs. The decisive sign of community integration was the "house and garden", because this could only be achieved through active participation in moonlighting, which meant learning how to play the secret game of local mutualism.

Even managers of socialist enterprises were actively participating in informal activities. Since the effectiveness of Slovenian firms was assessed by their ability to fulfil the needs of the local population, they became increasingly involved in informal transactions of goods and services. Middle managers beside their official duties also took care of a number of covert exchanges that would benefit the mutualism of the village community rather than the books of the firm. They were large consumers of shadow economy products and services, building lavish houses and maintaining expensive lifestyles. As Slovenian companies penetrated the west, they also became providers of foreign currency and western products for the local shadow markets.

The shadow economy introduced elements of a market system into socialist society. It fostered the entrepreneurship and creativity of local people. At the same time it was hidden and thus uncontrolled by the central authorities in Belgrade, which gave it even greater legitimacy. It contributed to the relatively high standard of living in Slovenia compared to other socialist countries or Yugoslav republics. Though there

[2] Instead of the word "locality", we use "valley community" despite the fact that many localities in Slovenia are not situated in a valley. However, the reason is that we think that internal social cohesion and mutual rivalry as a pattern are rooted in a distant past, because Slovenia's continuos geo-political situation has been structured by the Alps. In such societies, locality is more than an administrative abstraction, as it gives social space a physical place. And as Eric Hobsbawm has expressed it, such placed consisted of land, distrust towards cities, towards strangers (especially Jews) and governments (Hobsbawm, 1997).

are huge problems in comparing statistics across the former divide between capitalist and socialist economies, comparisons of the social product by the internal purchasing power show that by 1985 Slovenia's amounted to 85% of Austria's per capita social product (GSP) and was higher than in Portugal, Spain, Greece and Ireland (Potocnik et al, 1996, p.13). Another estimate of GSP p.c. in current prices shows that in 1987 Slovenia achieved 6.202 $ p.c., while Austria stood at 14.870 $ p.c. of GDP (Statistics Office of Austria, Statistics Office of Slovenia, 2006). As GDP is defined more broadly than GSP, it can be argued that Slovenia in 1987 stood at some 50% of Austrian GDP p.c. in current prices. In terms of PPP that ratio would be significantly higher.

A study done in the late 1980s estimated that 43% of all employees were involved in the shadow economy and that additional incomes from those activities equalled 38% of their regular-job incomes. That trend was estimated to even increase in the following years as the economic crisis in Yugoslavia deepened. Most involved in the shadow economy were people with specific technical knowledge, e.g. plumbers, carpenters, whose day jobs had fixed schedules and their wages were relatively low. Thus they had knowledge, time and motivation to engage in the afternoon shadow economy. Other profiles, e.g. clerical workers or top managers, were less engaged in moonlighting. On one hand they lacked specific skills or time and on the other hand their salaries were higher. Shadow economy thus contributed to a lowering in social disparities (Glas, 1991). Altogether, a combination of safe day jobs and a developed shadow economy offered most of the population the opportunity to maintain their standard of living and find a social place by combining modernization and tradition.

Overall, the inefficient formal economics of the socialist period further cemented the shadow economy as an integral and necessary part of the everyday pursuit of better living standards in all sectors of the economy and across all levels of society.

## *5. The Shadow Economy in Transition*

Although transition has brought a number of changes, most people did not suffer a loss in their living standards. Few have become very rich very fast, in contrast to what has happened in certain former socialist societies. The majority of companies have survived the transition without radical restructuring. Workers were able to maintain their social security through working in the company and earning as much money as possible in the untaxed shadow economy sector. As long as they were able to continue with the patterns of the past they resisted any changes that would endanger their "afternoon" activities. For example, when Renault-owned car producer Revoz tried to change working hours so that shifts would start one hour later than before, it faced fierce opposition from workers and unions. Finally, French managers realized that they were facing potential labour unrest because of something that they believed was a minor issue and gave in, deciding to leave existing working hours unchanged.

On the other hand, legitimate companies have also benefited from the shadow economy. It allowed them to pay low wages that would not be possible if workers were not working a "second shift" in the informal economy, and obtain cheaper inputs, produced by small shadow microenterprises. Therefore, they were able to remain competitive in the world markets despite operating with relatively obsolete and less advanced technology.

Estimates of the hidden economy during the economic transition in Slovenia in the 90's range from around 20% to 34% of the GDP: the Ministry of Economic affairs estimated the shadow economy at 22% of the GDP in 1996, Lacko (2000) estimated it at 24% in 1995, while Eilat and Zinnes (2000) assessed it to be 35% of the GDP in 1995. According to Kukar (1995), around 26% of the active population or 239,000 persons actively participated in hidden or unreported activities in 1994. In terms of working hours that was equal to some 80.000 jobs. Rosser, Rosser, Ahmed (2003) in their substantive study, stated the size of shadow economy in Slovenia at 25% of the official GDP. Schneider and Enste (2002) estimated that in

1998, when the transition was coming to its end, 31% of the Slovenian labour force was engaged in the shadow economy, with a product equalling 22,4% of the official GNP.

The shadow economy in Slovenia was acting as a kind of a social buffer, soothing the transition and making social peace possible in spite the fact that in the year 1993, for example, some 130,000 people, or 14,4 percent of the active population, were officially unemployed. In addition to the unemployed, there were also tens of thousands of workers who were retired early rather than made redundant. Equipped with skills and creative energy, they were well able to enter the shadow sector and offer their services.

In the delicate early transition period the shadow economy had a stimulating effect on the official economy, since a large part of the income earned in the shadow economy is immediately spent in the official economy. Schneider and Enste (2002) estimated this portion to be around 70% in the case of Austria, meaning that 70% of the value added produced in the shadow economy would not be produced in the official economy if the shadow economy did not exist ( Schneider & Enste 2002).

The shadow economy has provided strong competition to some legitimate businesses that were operating in a protected, domestic market (e.g. services), forcing them to become more efficient and expand their operations. Legitimate, foreign oriented companies have only benefited from shadow activities, in the form of cheaper labour and input costs. Therefore, the shadow economy has contributed to the better satisfaction of the needs of the society and raised the standard of living. At the end of transition, in 2000, Slovenian GDP per capita measured in terms of purchasing power parity amounted to $17,127 per capita, equal to 64% of the EU-15 average at that time and thus being on par with Greece (Schwab et al, 2002; Eurostat (GDP), 2006; respectively). However, there is no room for complacency where economic development is concerned. The next section shows that the end of one transition brings the start of another and that future success is by no means assured by past achievements.

## 6. Present Challenges: Advancing Through the Stages f Economic Development

After successfully navigating through the transition period, Slovenia today finds itself before the next decisive step: moving from investment-driven economic development to the innovation-driven stage of economic development (Jaklič, 2002).

Successful economic development is a process of successive and co-evolving progress in which enterprises and their supporting environment are able to engage in increasingly sophisticated forms of international competition (Jaklič, 2002). As nations develop, they progress through a number of stages in terms of their characteristic competitive advantages and modes of competing.

In the factor-driven stage, basic factor conditions such as low-cost labour and access to natural resources are the dominant sources of competitive advantage and international products. In the investment-driven stage, efficiency in producing standard products and services becomes the dominant source of competitive advantage. In the innovation-driven stage, the ability to produce innovative products and services at the global technology frontier using the most advanced methods becomes the dominant source of competitive advantage (Porter, 2002).

In 2003, Slovene labour reached 45 per cent of the EU-15 average labour costs (Eurostat (LC), 2006). This meant that it was 92 per cent more expensive than that of the Czech Republic or even 157 per cent more expensive than the 4.11 €/hour average of other ex-socialist EU members. At the same time, Slovene labour achieved 62 per cent of an average EU-15 hourly labor productivity (Eurostat (PROD), 2006). However, the gap between Slovenia and other ex-socialist EU members has been closing, as productivity in other transition countries grew at a faster pace. Calculations show that in the 2000-2003 period Slovene labour productivity grew 3 per cent more than the EU-15 average. On the other hand, labour productivity in the rest of ex-socialist EU members[3] grew on average 11.6 per cent more than the EU-15 average (Eurostat (PROD), 2006).

[3] Lithuania was not included in the calculation as data were not available (Eurostat (PROD), 2006).

Over the same period the relative cost of labour in Slovenia grew 10 per cent faster than the EU-15 average, making Slovenia lose some of its relative competitiveness as cost growth significantly outpaced the growth in productivity. On the other hand, Poland, for example, improved its labour competitiveness (index of 1.15) as relative labour costs grew at the same pace as in the case of the EU-15 average (i.e. remained at 20 per cent of EU-15 average) while its relative productivity grew 15 per cent faster than in the case of the EU-15 average.

Rebernik et al. (2005) have found very unfavourable figures concerning the comparison of value added per employee between Slovenian and EU-15 companies. While in EU-15 the level of value added per employee is positively correlated with the firm's size, in Slovenia this is true only in absolute terms. In relative terms, Slovenian micro companies with up to 9 employees achieve 50% of their EU-15 counterparts' average, while large firms fall 1:4 behind their EU-15 counterparts (Rebernik et. al., 2005). In the case of EU-15 countries, 16% of their exports were classified as hi-tech in 2004. In the case of Slovenia, the figure was a meagre 6% (Eurostat (THE), 2006), while the IMD 2006 Competitiveness Yearbook made an even lower gauge of 5.6% for 2005 (IMD, 2006, p.263).

Porter et al. (WEF, 2006) emphasize that economic development requires continuous evolution of the whole economic environment. Lack of improvement in any important area can lead to stagnation and stalled economic growth. The shift from the second to the third developmental level is highly demanding, as there is no ready-to-use recipe for doing it; on the contrary, each country has to innovate its own way into the club. In the case of Slovenia, the presented figures clearly indicate a slow movement towards an innovation-driven economy and show an uninspiring trend that could lead to slow long-term growth.

Without significant improvement in the level of productivity, and thus value-added, and abandoning a low-cost production strategy, Slovenia will soon not be able to compete with other transition or developing countries that have access to similar technologies but have a much cheaper labour force. The following section describes mechanisms by which a persistent shadow economy prolongs the status quo in terms of productivity and value-added and exerts a negative influence on economic development on the Slovenian economy as a whole.

## *7. The Shadow Economy as an Obstacle to Competitiveness*

As Slovenia is trying to attain the third developmental level, where growth and development depends on the innovative capacity of the society or the enterprises within that society (Schwab et al, 2002; Jaklič 2002), we believe that the shadow economy is becoming an obstacle to its development. It is not the mere extent of the hidden economy, but its impact on national competitiveness that is problematic. Although the size of the shadow economy, which is above 20% of the GDP in the case in Slovenia, cannot qualify as rampant, it still far exceeds the levels from highly developed economies, which Slovenia is eager to join. The following table shows some estimates made by Schneider (2004) for the period of 2002/2003:

| *Slovenia* | *Germany* | *Austria* | *Sweden* | *France* | *UK* |
|---|---|---|---|---|---|
| 29,4 | 16,8 | 10,9 | 18,3 | 14,5 | 12,2 |

**Table 3:** Size of shadow economy as % of GDP for 2002/2003

**Source:** Schneider, 2004

We believe the problem with the shadow economy in Slovenia is threefold: first, it is itself oriented towards low value-added production; second, it impedes the development of entrepreneurship; and third, it inhibits innovation. All this impedes the development of an economy towards higher levels of value-added. While the Slovenian (formal) economy has had to transform according to global competitive pressures, the shadow sector has continued its low-value added and labour-intensive profile as the only way to keep under the radar of authorities.

For developing countries that are mainly copying technologies and are competing on price, the shadow

economy is not problematic. It can even be beneficial, as in the case of Turkey, where shadow operations have been quite large, well organized, flexible and capable of doing business on a large scale, making the unofficial economy even more dynamic than the formal economy (EIU, 1997).

The Slovenian shadow economy, on the other hand, is fragmented, consisting mainly of many microenterprises and unorganized individuals, unable to respond to global challenges or act internationally. The growth of these businesses is in any case restrained by their limited time in the afternoons and limited access to credit markets (Schneider, Enste, 2002). They must also not grow over a certain, rather low, threshold in order to avoid detection from tax authorities, which are strong enough that any undeclared large-scale economic activity would not go unnoticed. Furthermore, the shadow economy in Slovenia is not about undeclared manufacturing of advanced products, but about providing traditional, low value-added products and services. Consequently, any shadow entrepreneur can only cover a geographically limited local market, which reduces competition and seriously impedes learning. Such a shadow economy can only exist since shadow entrepreneurs do not pursue the goal of business growth but merely of modest additional income that allows them to "buy the latest car and build a house and a garden". It is clear that the role of the shadow economy as an institution in Slovenia has not changed since its very beginnings.

The second problem that the shadow economy causes is the impediment of entrepreneurship, which it does in two ways. The first and most important way is through the coexistence of the shadow economy and efficiency-focused large enterprises. Working in a large company offers lower business risk and stress than an individual would have to face in pursuing an entrepreneurial path and it at least superficially guarantees greater social security. In a rather risk-averse Slovenian society (Hofstede, 2006), a promise of a "safe" job in a respected company has usually prevailed over prospects of entrepreneurial success (Groff Ferjančič, 2000). The relatively low wage a worker would receive is then topped up by income from moonlighting and the sum is enough for living a modest life. Second, SMEs, as primary "products" of declared entrepreneurial activity, are subdued to unfair competition from shadow entrepreneurs who do not have to include taxes and salary benefits in their prices. Consequently, instead of fuelling entrepreneurial growth in ambitious SMEs, the Slovenian workforce toils in relatively undemanding and low-paid day-jobs that offer basic social security and earn some additional income by working another few low-value-added-hours in the afternoon.

Small and medium enterprises (SMEs) are an important part of a dynamic economy. Research has shown their importance in the aspects of innovation and economic growth. Acs and Audretsch (1988) found empirical evidence of decreasing return from R&D expenditure in relation to the innovation output. In their further research they found that small firms in the United States produced up to 2.4 times more innovation per employee than larger firms (Acs, Audretsch; 1990, 1991). SMEs can thus be considered highly important in the context of achieving the innovation-driven stage of economic development.

Yet in the field of SMEs, Slovenia faces a double problem. First, it, like other ex-communist countries, exited the socialist era with a great lack of SMEs. Second, among EU candidate countries, Slovenia has had by far the lowest level of new enterprises founded (Bučar, 2002). We also have to add the fact that at the beginning of transition large companies started to cut R&D expenses to survive the transition (Dmitrović, Zupan; 2001; Žnidaršič, 2003). Thus, during transition, the push in innovativeness could have only come from newly founded SMEs, but as there were few SMEs born, little innovativeness was born as well. The combination of a lack of dynamic SMEs and cost-cutting large companies positioned the Slovenian economy as firmly focused on efficiency and low-cost production, i.e. a concept pertaining to Porter's second developmental level.

Understanding the orientation of the shadow economy toward low value-added and its impact on entrepreneurship, it is not difficult to envisage its negative effect on innovation. We believe the major

problem lies in the cohabitation of low value-added jobs and low value-added moonlighting, with low value-added jobs being an indirect consequence of the shadow economic activity. Namely, earning additional shadow income, workers are ready to accept lower salaries in return for the at least provisional social security of a "safe job". This in turn lowers the price of labour, which lowers the pressure on value-added. Less pressure on value-added means less need for innovativeness in all fields. Companies consequently keep lagging behind the best Western performers due to the lack of innovativeness and the vicious cycle is closed. Wages remain low and the shadow economy continues being a necessity.

There are also other reasons why the shadow economy inhibits innovativeness or at least cannot act as an innovation catalyst.

First, due to its focus on small-scale, low value-added production, the shadow economy cannot be seen as a springboard toward innovation that would be significant and valuable in the context of global technological trends. Second, shadow entrepreneurs cannot undertake large and complex projects but have to stick to simpler ones. As they need their business to stay small in order to hide from tax authorities, moonlighters can hardly form interdisciplinary teams that are needed to deal with complex orders. Finally, it could be argued that it actually deters innovativeness since its own innovative potential has been largely exhausted. The production technology of traditional and low value-added products is well known and has not changed much for decades. And even in the case of services and products based on modern technology, e.g. web-design, buyers of shadow economy products and services are cost-focused rather than quality-focused.

There is no surprise that the major problem of the Slovenian economy is a lack of new ideas that would enhance and improve existing capabilities and build international competitive advantage, at least in some niche markets (Jaklič, 2002). Slovenia seems to have already crossed the point where the existing economic structure no longer supports the healthy long-term development of the economy. IMD Competitiveness Yearbooks show that in the 2003-2005 period private final consumption growth was consistently higher than the overall GDP growth (IMD, 2004, p. 564; IMD, 2005, p. 445; IMD, 2006, p. 321), showing a trend which cannot be maintained in the long run.

It is clear that the shadow economy in Slovenia may have been a valuable way for raising living standards throughout the second developmental stage, but it lacks the fundamentals for propelling economic development into the innovation-driven stage as it did not transform accordingly. Porter et al. (WEF, 2006) stress that the competitiveness of an innovation-driven economy depends on its ability for social learning and on the ability of people to rapidly embrace new technologies. The shadow economy in Slovenia obviously does not facilitate this, as it has been largely built on the paradigm of hard physical/manual work, a paradigm that pertains to the second developmental level and has little to do with high value-added, clusters, networks and innovativeness.

## *8. Conclusion*

The aim of this paper has been twofold. First, we wanted to show that the institutional approach to explaining shadow economy is necessary if we want to fully understand it when its behaviour defies our expectations. Second, we wanted to prove our hypothesis that the shadow economy in Slovenia has turned into an obstacle to economic development and growth.

As far as our first aim is concerned, the paper has presented a case of the shadow economy persisting on a relatively high level despite economic circumstances that should lead to its diminishment. By shedding light on historical and social institutions that have been closely related to the development and functioning of the shadow economy, we have sought to explain its persistence. Thus we have made a strong case for an institutional approach to explaining shadow economies.

Next, we have found the impact of shadow economy to be threefold. The shadow economy's orientation toward low value-added, its unfair competition with full-scale entrepreneurship, and its distraction of energy and focus from serious innovation have had an

adverse impact on economic development in Slovenia during the last decade. Data regarding productivity and the number of new SMEs support our hypothesis that a vicious cycle of low value-added cohabitation between regular employment and afternoon moonlighting has taken root in the Slovenian economy.

The implications are at least twofold. With regard to the role of the shadow economy, we have shown that it can act as an important obstacle to economic development in the period when an economy is moving from investment-based growth to innovation-based growth. The key problem that we have identified is the fact that the shadow economy has little or nothing to do with valuable innovations. This serves as a reminder to other countries that have been following Slovenia on her way to economic development. Even though not wide-spread, a persistent shadow economy can slow down economic development.

Second, the case we have made with the institutional approach to explaining the shadow economy stands as an upgrade of the usual practice of explaining the shadow economy by categories such as tax and regulatory burden, corruption, level of GDP p.c. and GDP growth. While these variables are by no doubt important, they are not the only decisive factors. In times when stable growth of GDP p.c., decreasing unemployment, constant improvement in public governance, decreasing inflation and modest tax rates should lead to a decrease in shadow economic activity, as it has happened in other ex-socialist countries, the shadow economy in Slovenia has persisted almost unchanged.

We recognize there are several limitations with regard to our assertions and findings. First, the presented paper has been based on an extensive literature review, and this fact has been at the same time its key strength and its greatest limitation. While the presented data are credible, we believe that the hypothesis they support, i.e. the negative impact of the shadow economy on the competitiveness of Slovenian economy, would best be re-confirmed by further empirical testing. This also is the basis of our first suggestion for further research.

At the same time, we recognize that our assertion that the shadow economy persists unchanged in Slovenia rests on a single research study carried out by Schneider (2004). We would like to support that assertion from a greater number of different sources, but although there has been other research on the shadow economy in East and Central Europe, they have either not included Slovenia, or the comparison between countries is not possible due to different methodologies employed in assessing the extent of the shadow economy in each country. Thus our second suggestion for future research would be to further follow the size and structural nature of the shadow economy in Slovenia per se and in comparison to other post-socialist countries and highly developed economies.

Third, it would be valuable to have an assessment of the shadow economy's stimulating effect on the Slovenian formal economy. So far the exact stimulating effect of the shadow economy in Slovenia on the formal sector has remained unknown, and its closest estimate continues to be Schneider and Enste's (2002) estimate for Austria.

Finally, the shadow economy represents an obstacle to the long-term development of Slovenia because it diverts human resources from long-term entrepreneurial growth to pursuing short-term goals on a small, local scale. Therefore, one of the major challenges for managers and politicians at this time should be to find a way to mobilize the hidden power, creative energy and entrepreneurship of the informal economy and to incorporate it into a formal one, which as a result should become more internationally competitive. Besides favourable taxes and administrative processes in regulating small business, thus stimulating the shadow economy to become part of the formal one, they should creatively take into account the history of valley-mutualism in Slovenia.

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# Determinants of Non-Linear Effects of Fiscal Policy on Output: The Case of Bulgaria

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*Abstract:*

***The paper illuminates the non-linear effects of the government budget on short-run economic activity. The study shows that in the Bulgarian economy under a Currency Board Arrangement the tax policy impacts the real growth in the standard Keynesian manner. On the other hand, the expenditure policy exhibits non-Keynesian behavior on the short-run output: cuts in government spending accelerate the real GDP growth. The main determinant of this outcome is the size of the discretionary budgetary changes. The results imply that the balanced budget rule improves the sustainability of public finances without assuring a growth-enhancing effect.***

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## 1. Introduction

The Keynesian view of fiscal stabilization implies that budgetary expansions foster economic growth in the short-run. When an economy is operating below its potential output, governments should either increase spending or cut taxes in order to reduce fluctuations in demand. On the contrary, recent studies point out that fiscal consolidations could stimulate aggregate activity in the short-run and improve public finances. These effects are called "non-Keynesian fiscal policy effects". Empirical research gives evidence of both traditional Keynesian and non-Keynesian effects of budgetary categories on real growth. This implies that *fiscal policy influences short-run economic activity in a non-linear fashion.*

This study presents the theoretical background as well as empirical evidence of the non-linear effects of government budget. It focuses on the Bulgarian experience under the Currency Board Arrangement (1998-2004) - a few years prior to its EU accession. The analysis shows the presence of non-Keynesian influence of government outlays on output and looks at the factors that determine it. Also, tax policy affects short-run real growth in a traditional Keynesian manner. The non-linearity in the effects of budgetary categories implies that the balanced budget accompanied by growing government could decelerate short-run real growth. In light of this, it is not enough to focus on the budgetary result only, the regulations regarding the budgetary categories themselves should also be considered.

Section 2 of the paper presents the theoretical background as well as empirical research on non-linear fiscal policy effects on output. Section 3 analyzes the effects of fiscal categories in the Bulgarian economy. It focuses also on the determinants of the non-Keynesian

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effects of government spending. The main findings of the study and their practical implications are presented in Section 4.

## *2. Non-Linear Effects of Fiscal Policy: Theoretical Background and Empirical Research*

According to the traditional Keynesian view, fiscal consolidations achieved by a higher tax burden or government expenditure cuts lower GDP growth. In contrast with this view, recent studies emphasize the expansionary influence of budget consolidations on output in the short-run. Studies on non-Keynesian fiscal policy effects show that the response of output in a case of discretionary budgetary interventions depends on a number of circumstances, such as the size and persistency of the fiscal impulse and the composition of the budget adjustments. The level of government debt, as well as the accompanying monetary stance, also matter. Examples of both traditional Keynesian results and non-Keynesian outcomes can be found in European economies. The output responds *in a non-linear fashion* to the fiscal fine-tuning.

According to the *theory* of non-Keynesian effects, fiscal policy affects output either through the demand-side channel or the supply-side channel. One of the explanations of non-Keynesian results on the demand-side is based on the *wealth effect on consumption* (Giavazzi and Pagano, 1990, Alesina and Perotti, 1996, Perotti, 1999). Restrictive budget policy triggers expectations for a future tax cut and a higher present value of household income, which stimulates private consumption and thus output. Opposite to the traditional view, the wealth effect entails an increase in consumption as a result of an expenditure cut. This explanation represents the "expectation view of the fiscal policy".

The effect is stronger when the fiscal changes are perceived as permanent. In addition, the presence of a positive wealth effect might depend on the debt-to-GDP ratio. Economic agents expect that when this ratio reaches a certain high level, an upward jump in taxation will occur. If fiscal restriction is undertaken before this expected level of debt-to-GDP ratio, the probability of a tax increase is lower. These positive expectations generate, in turn, a positive wealth effect on household consumption.

The second strand of expansionary fiscal contractions calls attention to the *credibility effect on interest rates* (McDermott and Wescott 1996, Alesina et al. 1992). This effect works when the debt/GDP ratio is high, that is, during periods of fiscal stress. At high levels of public debt, investors may face an interest rate premium due to the default risks or inflation. Fiscal consolidation can bring a downward pressure on interest rates by reducing the risk premium, which will crowd in private investments.

In addition, there is a *supply-side channel* at work (Alesina and Ardagna 1998, Alesina et al. 2002). According to the *labor market view,* cuts in government employment or transfer payments may increase employment in the private sector and stimulate the economy when it is near its full employment level. Also, higher wages in the government sector put an upward pressure on the business sector wages and increase unit labor costs. This is equivalent to a negative supply shock, leading to a contraction of output. In open economies with a flexible exchange-rate regime, reduced labor costs, resulting from a fiscal restriction, increase the competitiveness of the companies and raise the net export.

The supply-side channel operates in both competitive and unionized labor markets, although in a different manner (Ardagna 2007). An increase in public employment or government wages in the competitive labor markets leads to a fall in private sector employment. As was noted earlier, this results in a real wage increase and a decline in profits, investments, and thus output, in the business sector.

With unionized labor markets, an increase of public employment, wages of public sector employees or unemployment benefits raises unions' wage claims in the private sector, boosts wages and reduces profits and investments. The final result is the same – a negative relationship between government spending, specifically its wage component, and the short-run GDP growth. Table 1 summarizes the expected outcomes (Keynesian vs. non-Keynesian) of a fiscal

adjustment according to the relevant theoretical literature.

The *empirical studies* examine the effects of budgetary interventions either on the short-run output or on the state of public finances. They confirm that the presence of non-Keynesian effects depends on a number of factors such as initial conditions, fiscal impulse's characteristics and macroeconomic environment. The key findings are summarized bellow.

The *composition of budget impulse* is one of the factors that determine the outcome of fiscal intervention. Restrictions on government wages and transfers are more successful in stimulating economic activity in a short-run than a tax increase or a capital spending cut. This result is consistent with the abovementioned labor market view.

According to Perotti (1996), the adjustments of social expenditure and wage government consumption are more persistent and are associated with rising rates of growth and investments than the labor-tax increases or the capital spending cuts. The reason is that *bigger and persistent fiscal adjustments* point to the government's commitment to a longer lasting change of the fiscal regime and, in consequence, are more likely to expand private demand and output.

Another important determinant of expansionary fiscal contractions is the debt-to-GDP ratio. Most European economies in which fiscal adjustments occur have extremely high *debt-to-GDP levels* or rates of debt accumulation. In such periods, a negative shock to government purchases stimulates consumption and output. Conversely, when the fiscal situation in the

| Criteria | | Level | Outcome |
|---|---|---|---|
| **Fiscal framework** | Debt/GDP | Low | Keynesian |
| | | High | Non-Keynesian |
| | Liquidity constraints | Liquidity constrained consumers | Keynesian |
| | | Liquidity unconstrained | Non-Keynesian |
| | Government consumption/GDP | Low | Keynesian |
| | | High | Non-Keynesian |
| **Characteristics of fiscal impulse** | Size | Low | Keynesian |
| | | High | Non-Keynesian |
| | Composition | Expenditure cut (government wages, employment) | Non-Keynesian |
| | | Tax increase or public investments reduction | Keynesian |
| | Permanence | Permanent | Non-Keynesian |
| | | Temporary | Keynesian |
| **Economic conditions** | Monetary policy | Expansionary | Non-Keynesian |
| | | Tightening | Keynesian |
| | Macroeconomic environment | Unfavorable (recession, high interest rates) | Keynesian |
| | | Favorable | Non-Keynesian |

**Table 1**: Non-linear effects of fiscal adjustments

**Sources:** Giavazzi and Pagano, 1990, Bertola and Drazen, 1993, Alesina and Perotti, 1996, McDermott and Wescott, 1996, Perotti, 1999, Ardagna 2004.

country is sound, the traditional Keynesian effects dominate. The share of liquidity-constrained consumers in the economy is also important: the higher the share, the lower the probability of a non-Keynesian outcome (Perotti 1999).

Bertola and Drazen (1993) point out that the effect of public outlays on consumption depends on the initial *government consumption-to-output ratio*. When that ratio approaches a "trigger" value, households expect a further expenditure cut, designed to ensure the sustainability of public finances. The present value of their net income, and hence consumption, grows. If the cut does not materialize, consumption falls significantly. When government spending continues to rise above the "trigger value", agents anticipate a tax cut in the near future and boost their consumption. At the moment of fiscal stabilization, government expenditure falls significantly while private consumption is at a high level.

Alesina et al. (2002) find a strong negative impact of government expenditure on profits and investments in the private sector. Government wages have the largest negative effect on profit, bigger than that of taxes. The study places an emphasis on the positive impact of lower government wage spending and labor tax reductions on labor costs. This evidence is consistent with the labor market view discussed above.

In addition, the paper demonstrates that changes in business investments explain to a great extent the expansionary effect of large fiscal stabilizations in developed economies: prior to the expansionary fiscal adjustment, the growth rate of business investments is negative and contributes negatively to the GDP growth, the latter in this case being small. During and after the adjustment, the growth of private investments is positive and significantly contributes to the high GDP growth. This pattern cannot be observed when fiscal consolidations affect output in the Keynesian (negative) manner.

The studies underline the importance of *accompanying policies*. Monetary stabilizations, falls in real interest rates and currency devaluations play a significant role for the expansionary fiscal consolidations in Denmark (1983-1986) and Ireland (1987-1989). Supporting evidence of this view has been given by McDermott and Wescott (1996), who consider the case of an unsuccessful fiscal adjustment in the UK. Despite the consolidation efforts, the ratio of public debt to GDP increased by 7 percentage points between 1980 and 1984. This outcome reflected the domestic tight monetary policy, which resulted in a sharp appreciation of the national currency. Also, the consolidation was attempted during times of world recession and very high interest rates. Third, fiscal policy mix was not favorable: net capital outlays were reduced while social security benefits rose.

Some authors express a different view about the role of monetary policy for the appearance of non-Keynesian effects. Ardagna (2004) shows that successful and expansionary fiscal contractions have not been the result of expansionary monetary policy or exchange rate devaluations. Hemming et al (2002) point out that alternative monetary regimes have relatively little effect on the size of short-term fiscal multipliers.

The amount of research on the non-Keynesian effects in post-communist countries is limited. Purfield (2003) explores large fiscal adjustments in a number of transition economies, including Bulgaria, between 1992 and 2000. The study analyzes the countries' overall primary balances, rather than the cyclically adjusted ones, as a measure of the fiscal stance. The large and expenditure-based fiscal adjustments are more successful in sustainable improvements in the primary balance within two years of the adjustment. The author does not find episodes of expansionary fiscal consolidations in transition economies. Bulgaria is given as an example of successful fiscal contraction in 1994.

Siwinska and Bujak (2006) focus on the consumption effects of fiscal policy for a sample of 14 transition countries between 1990 and 2001 (Bulgaria included). Budget balances of consolidated central governments that are not cyclically adjusted serve as a measure of the fiscal stance. Consumption reacts in a non-linear fashion to the discretionary budgetary interventions. The households tend to behave in a Keynesian manner when the level of the fiscal deficit is small (within the limits of the mean value plus one standard deviation, calculated for the time period). In "bad times", fiscal

expansions stimulate private consumption but on a much smaller degree than in "good times". In general, the non-Keynesian response of consumption during the periods of fiscal stress does not outweigh the Keynesian effects, observed during normal times. The authors explain this outcome by the bigger portion of liquidity-constrained and myopic consumers in transition countries.

Von Hagen (2004) surveys the fiscal episodes in the New Member States between 1999 and 2002 on the basis of cyclically adjusted general government budget deficits. The author uses "the growth-accounting approach" to calculate the discretionary fiscal impulse. The budget deficit is corrected with the rate of real GDP growth in order to isolate the exogenous from endogenous changes in the fiscal stance. Large expenditure-based budgetary expansions dominate; only five large fiscal consolidations have been observed, all of them in the Baltic States.

Afonso et al (2005) study fiscal consolidations in the eight New Member States, Bulgaria and Romania over the period 1991-2003. They focus on the substantial improvements in the structural budget balances. A Logit model helps to assess the determinants of the successful fiscal adjustments. The results confirm that, similar to advanced European economies, the expenditure-based adjustments tend to be more successful in reducing the general government budget deficits for two consecutive years than the revenue based ones. Three examples of successful fiscal contractions are given for Bulgaria (1992, 1994 and 1997) and one example of an unsuccessful consolidation (1998). According to the authors, expenditure-based consolidations prevail due to the limited administrative capacity of post-communist countries to increase tax revenues and, in comparison with advanced EU economies, start out from higher overall deficit levels when fiscal stabilization seems "inevitable".

On the basis of data for the New Member States from CEE (NMS) between 1993 and 2002, Rzonca and Cizkowicz (2005) find evidence that fiscal adjustments accelerate short-run output growth. The study identifies only the export channel as a source of non-Keynesian effects. The descriptive analysis shows that an important determinant of these effects is the size of the fiscal impulse. Large fiscal consolidations have been almost always accompanied by higher rates of output growth. In support of the relevant studies mentioned above, the study confirms that fiscal consolidations in the NMS have been achieved mainly through expenditure cuts.

## *3. The Effects of Fiscal Policy in The Bulgarian Economy*

This paper investigates the effects of fiscal policy in the Bulgarian economy under the Currency Board Arrangement. The analysis is based on quarterly data for the primary government spending and for the total tax revenue of the general government budget and for the real GDP over the period 1998-2004. The data are first deflated by the GDP deflator (1995=100) and seasonally adjusted. The primary government spending includes wages and social insurance payments, subsidies, expenditure on goods and services, social expenditure and capital outlays.

This study differs from the relevant studies on transition economies mentioned in the previous section in its methodology. In order to isolate the endogenous changes from the exogenous (discretionary) movements of the budgetary categories we apply the HP filter (Hodrick-Prescott filter) with a smoothing parameter λ=480 to the seasonally adjusted quarterly series for the total primary government spending and the total tax revenue.

The HP filter computes the cyclically adjusted measure (X*) of a variable (X) by minimizing the expression:

$$\sum ( X_t - X^*_t)^2 + \lambda \sum [(X^*_{t+1} - X^*_t) - (X^*_t - X^*_{t-1})]^2,$$

where λ is the weighting factor (Hodrick and Prescott 1997).

The cyclically adjusted budgetary items are expressed as a share of real GDP. The coefficient λ=480 for quarterly data corresponds to a value λ=30 for annual data, which is the value used by the European Central Bank (Bouthevillain et al. 2001). The lower the value of the weighting parameter the better the discretionary

policy shocks are captured. The HP filter has been chosen among a number of alternatives for cyclical adjustment because of its popularity, transparency and suitability for international comparisons. For a description of other popular methods, see Giorno et al. 1995 or Blanchard 1993.

The discretionary impulse for government expenditure ($\Delta g_t$) is defined as the difference between the cyclically adjusted value of primary government outlays (expressed as a share of GDP) in the given period ($g_t$) and the cyclically adjusted value of primary government outlays in the previous period ($g_{t-1}$):

$$\Delta g_t = g_t - g_{t-1} \quad (1),$$

where the cyclically adjusted government outlays ($g_t$) is calculated using the HP filter. A positive/negative value of $\Delta g_t$ indicates an expansionary/restrictive fiscal impulse.

The discretionary tax impulse ($\Delta t_t$) can be calculated in an analogous way. It is the difference between the cyclically adjusted value of tax revenues (expressed as a share of GDP) in the given period ($t_t$) and the cyclically adjusted value of tax revenues in the previous period ($t_{t-1}$):

$$\Delta t_t = t_t - t_{t-1} \quad (2),$$

where $t_t$ is the HP filtered tax revenue expressed as a share of GDP.

First, the Granger test was implemented in order to check the causality between the discretionary expenditure impulse and the real GDP growth. We did a regression of the change in expenditure impulse ($\Delta^2 g$) to its lagged values as well as to the lagged values of change in the GDP growth ($\Delta y_{growth}$) with a lag interval of three periods. The regression result (F=2.3) rejected at 0.1 level of significance the hypothesis that the output growth Granger-causes the discretionary fiscal policy.

Figure 1 gives evidence of a negative relationship between the discretionary expenditure changes and the real GDP growth on impact, which implies the presence of non-Keynesian influence of government expenditure. In addition, the correlation between the

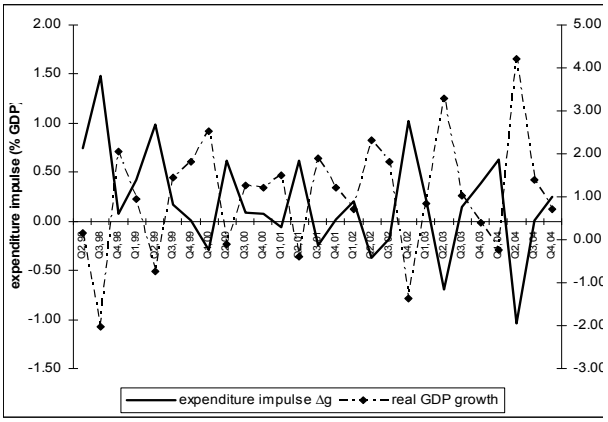


**Figure 1:** Discretionary expenditure changes and real GDP growth
**Source:** author's calculations on the basis of quarterly data from the Ministry of Finance and National Statistical Institute

discretionary expenditure impulse and the real GDP growth is strong and negative (correlation coefficient of -0.97). As can be seen from the graph, the restrictive fiscal impulse has always been accompanied by a positive rate of growth. Such a negative relationship is not observed for all cases of a positive spending shock, but the negative rates of real growth have occurred during periods of larger fiscal expansions.

The descriptive analysis illuminates the behavior of tax policy as well (Figure 2). The lower average tax burden in the economy leads to positive rates of

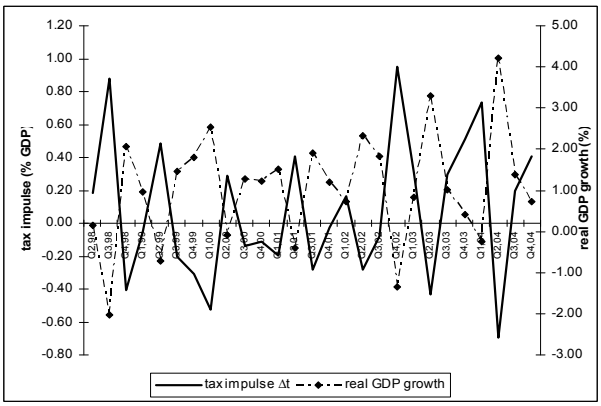


**Figure 2:** Discretionary tax changes and real growth
**Source:** author's calculations on the basis of quarterly data from the Ministry of Finance and National Statistical Institute

output growth (correlation coefficient of -0.92). So, the fiscal categories influence economic activity in Bulgaria *in a non-linear fashion*: while a typical Keynesian result prevails for the tax payments, a non-Keynesian outcome is valid for the government outlays.

Despite the data limitation, the descriptive analysis with yearly data also gives some evidence for existence of non-Keynesian effects. Figure 3 plots the change of annual growth of discretionary expenditure interventions and the rate of change of year-to-year GDP growth. The year-to-year real GDP growth was positive during the whole period under investigation but the growth momentum accelerated when annual budgetary spending was growing at a slower pace. This pattern is observed during the years 2000, 2002 and 2004. In 2000, the real growth was higher than that in the previous year by 3 percentage points: in 1999 the output growth was 2.3%, while in 2000 it rose to 5.4%. During 2002, the growth was 4.9%, which was 0.9 percentage points larger than in 2000. During 2003, the increase of cyclically-adjusted government spending slightly accelerated (0.3 percentage points), while the rate of yearly growth fell by 0.5 percentage points to 4.4%.

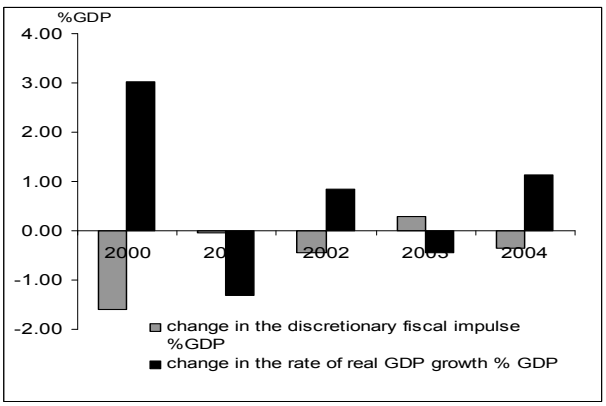


**Figure 3:** Discretionary expenditure policy and real output growth (annual data)

**Source:** author's calculations on the basis of annual data from the Ministry of Finance and National Statistical Institute

However, the negative relationship between the growth of government spending and the real GDP growth is not observed during the whole period under investigation. In several cases, the discretionary expansions have been accompanied by higher positive rates of GDP growth (Figure 1). Also, in 2001 the lower share of government purchases in output did not lead to faster real economic growth. In this vein, the study should answer the question: what are the determinants of non-Keynesian effects of government expenditure on aggregate output in Bulgaria?

An appropriate instrument for evaluating the determinants of non-Keynesian effects of government spending is the Logit regression. The model has the following form:

$$P = E(y = 1 \mid Xi) = \frac{e^{\beta 1 + \beta 2 * Xi}}{1 + e^{\beta 1 + \beta 2 * Xi}} \quad (3),$$

where Xi are factor variables, while y is a binary variable reflecting the influence of the discretionary expenditure impulse on output. It takes the following values:

*y = 1* in case of non-Keynesian influence of government expenditure on output, that is, the discretionary fiscal impulse (Δg) and the real GDP growth ($y_{growth}$) are moving inversely: the restrictive expenditure impulse leads to a positive rate of real GDP growth, while the expansionary expenditure interventions are accompanied by negative rates of output growth;

*y = 0* in case of traditional Keynesian impact of government spending on short-run economic activity, that is Δg and $y_{growth}$ are moving in the same direction: the positive interventions on government spending are accompanied by a positive rate of real GDP growth, while the negative expenditure impulse results in a negative rate of real GDP growth.

E (y=1 | Xi) is the conditional probability of a presence of non-Keynesian effect of the discretionary fiscal impulse. The choice of the factor variables (Xi) depends on the relevant theoretical and empirical findings as well as on the descriptive analysis presented above. According to previous studies, the main determinants of non-Keynesian effects are the size of fiscal impulse and the government debt-GDP-ratio. Also, as discussed above, fiscal restrictions are more likely than fiscal expansions to demonstrate a non-Keynesian impact on output. Each of these likely determinants is tested through the Logit model. A description of factor variables (Xi) is presented in Table 2.

The inclusion of the variable TYPEIMPU in the model would show whether the non-Keynesian effects of government expenditure on output would prevail in case of tight expenditure policy or in case of accommodating expenditure policy. Most of the studies explore the output effects of fiscal consolidations.

| Variable | Description | Values |
|---|---|---|
| **TYPEIMPU** | *Type of the discretionary expenditure impulse* | 1 in case of an expansionary fiscal impulse ($\Delta g > 0$) |
| | | 0 otherwise |
| **SIZEIMPU** | *Size of discretionary expenditure impulse* | 1 in case of large discretionary changes in government expenditure<br>$-\infty < \Delta g < \mu_g - \frac{1}{2}\sigma_g$ or<br>$\mu_g + \frac{1}{2}\sigma_g < \Delta g < \infty$ * |
| | | 0 otherwise<br>$\mu_g - \frac{1}{2}\sigma_g \leq \Delta g \leq \mu_g + \frac{1}{2}\sigma_g$ |
| **SIZET** | *Size of discretionary tax impulse* | 1 in case of a large discretionary change in tax revenues<br>$-\infty < \Delta t < \mu_t - \frac{1}{2}\sigma_t$ or<br>$\mu_t + \frac{1}{2}\sigma_t < \Delta t < \infty$** |
| | | 0 otherwise<br>$\mu_t - \frac{1}{2}\sigma_t \leq \Delta t \leq \mu_t + \frac{1}{2}\sigma_t$ |
| **GOVDEBT** | *Level of government debt* | Nominal variable equal to the debt-to-GDP ratio |

**Table 2:** Definition of the factor variables in the LOGIT model
*$\mu_g$ is the sample average of discretionary expenditure impulse ($\Delta g$), $\sigma_g$ is the standard deviation of the sample;
** $\mu_t$ is the sample average of discretionary tax impulse ($\Delta t$), $\sigma_t$ is the standard deviation of the sample.

The variable SIZEIMPU presents the size of discretionary fiscal impulse ($\Delta g$). Fiscal intervention is defined as "significant" if the discretionary expenditure impulse ($\Delta g$) in a given period lies outside the interval of the mean value ($\mu_g$) plus/minus one half standard deviation ($\sigma_g$). Otherwise, the fiscal intervention is insignificant and is defined as "neutral". The discretionary expenditure impulse is defined as expansionary if its value is greater than 0.47% of GDP ($0.47 = \mu_g + \frac{1}{2}\sigma_g$). The expenditure intervention is restrictive if $\Delta g$ is negative and smaller than -0.07% of GDP ($0.07 = \mu_g - \frac{1}{2}\sigma_g$). If the size of discretionary impulse is between -0.07 and 0.47, the fiscal stance is defined as neutral.

Respectively, SIZEIMPU is 0 when $-0.07 < \Delta g < 0.47$, i.e. when the primary government spending has changed between –0.07% and nearly 0.5% of GDP. If the fiscal intervention is outside these limits, it is regarded as significant and SIZEIMPU equals 1. In this way, the hypothesis that the size of discretionary impulse is an important factor for the appearance of non-Keynesian effects would be verified. The relevant literature concludes that the larger the fiscal impulse, the greater the probability of a non-Keynesian outcome.

The cut-off points for the variable SIZEIMPU are chosen in order to obtain comparable results with the relevant studies (see, for example, Alesina and Perotti, 1996). According to the definitions, during large fiscal expansions/contractions the cyclically adjusted balance improves/worsens by at least 1.5 percentage points of GDP in one year. This results approximately in 0.45 percentage points of GDP in one quarter and completely matches our results. Giavazzi and Pagano (1996) use similar cut-off criteria when defining the size of the fiscal impulse.

The next exogenous variable, SIZET, reflects the size of discretionary tax changes. It is introduced in order to test the relationship between the tax policy and the non-Keynesian response of output to the expenditure policy. SIZET is a binary variable, similar in nature and definition to the variable SIZEIMPU. Its value is based on the size of discretionary tax revenue impulse ($\Delta t$). SIZET is equal to 1 in case of significant tax changes, that is, when the discretionary tax impulse lies outside the interval (-0.14, 0.30).

| | SIZEIMPU | TYPEIMPU | SIZET | GOVDEBT |
|---|---|---|---|---|
| ai | 5.05<br>(1.47)* | 10.05<br>(37.66) | 1.49<br>(0.85) | -0.03<br>(0.03) |
| stat. significance (p-value) | 0.00 | 0.79 | 0.08 | 0.30 |
| Wald statistics | 11.80 | 0.07 | 3.07 | 1.06 |
| exp.(b) | 155.96 | 23156 | 4.44 | 0.96 |
| pseudo $R^2$ | 0.77 | 0.51 | 0.16 | 0.05 |

*st. error of the estimate

**Table 3:** Determinants of non-Keynesian effects: econometric results

The variable GOVDEBT reflects the role of initial conditions, specifically the level of government debt. According to the theoretical explanations, a non-Keynesian result is more probable when the debt-to-GDP ratio is high. In such times of "fiscal stress", economic agents appreciate the authorities' efforts to improve the long-term sustainability of public finances through budget consolidations, which stimulate private demand and output. GOVDEBT is a nominal variable equal to the government debt/GDP ratio.

The Logit model takes the following form:

$$\ln \frac{Pi}{(1-Pi)} = a_0 + a_1 * TYPEIMPU + a_2 * SIZEIMPU + \\ + a_3 * SIZET + a_4 * GOVDEBT \quad (4)$$

The results are presented in Table 3. Two of the exogenous variables have statistically significant regression coefficients: SIZEIMPU and SIZET. The type of discretionary impulse (TYPEIMPU) is not among the factors that determine the appearance of non-Keynesian effects, since these effects have occurred during episodes of both fiscal expansions and fiscal contractions. In addition, the level of government debt does not influence the non-Keynesian response of real output. Such a conclusion is not unreasonable in light of the fact that the non-Keynesian effects in the Bulgarian economy appear as a result of accommodating budget policy as well as restrictive budget policy.

The size of discretionary expenditure intervention presented by the variable SIZEIMPU is a statistically significant determinant of non-Keynesian effects. Similar to the results from relevant studies, the larger the changes in the cyclically adjusted expenditure, the higher the probability of non-Keynesian effects. This probability is equal to:

$$P = E(y = 1|Z) = \frac{\exp(-2.56 + 5.05 * SIZEIMPU)}{1 + \exp(-2.56 + 5.05 * SIZEIMPU)} \quad (5)$$

If the value of the expenditure impulse is outside the limits of mean value plus/minus one half standard deviation, the probability of a non-Keynesian outcome is approximately 0.9. By contrast, small changes in expenditure policy result in traditional Keynesian behavior of aggregate activity in the short run. This implies that larger expenditure cuts could more successfully stimulate the aggregate activity in the Bulgarian economy. The regression coefficient for the variable SIZET is also statistically significant. If the variable SIZET lies outside the interval ($\mu_t$ - ½$\sigma_t$; $\mu_t$ + ½$\sigma_t$), the probability of a non-Keynesian response is near 0.6. It is equal to:

$$P = E(y = 1|Z) = \frac{\exp(-0.98 + 1.49 * SIZET)}{1 + \exp(-0.98 + 1.49 * SIZET)} \quad (6)$$

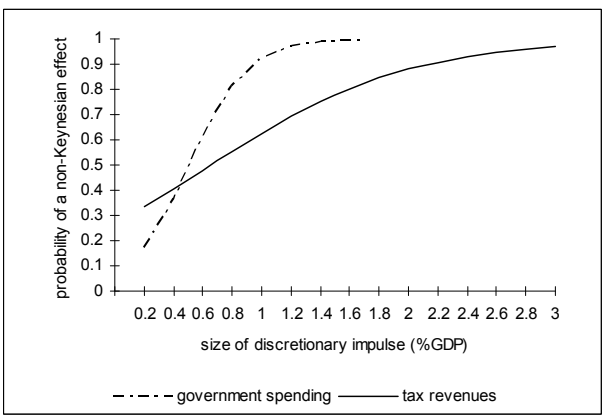


**Figure 4.** Probability of non-Keynesian effects of government expenditure

**Source:** author's calculations (SPSS output)

Figure 4 presents the probability of a non-Keynesian response of output to a discretionary expenditure shock as a function of the size of expenditure impulse as well as of the size of tax revenue impulse in the same period. It implies that the probability of a non-Keynesian result is higher when both discretionary impulses are higher.

Larger increases in the tax revenue-GDP ratios have been accompanied by non-Keynesian effects of budgetary purchases on output. This outcome is due to the fact that under the Currency Board Arrangement, introduced on 1st July 1997, the Bulgarian authorities keep a budget close to balance or in surplus. Both spending and taxes have been moving in an upward direction: in order to keep the government's budget constraint, higher spending requires a higher tax burden. Tax revenue accounted for 30.9% of GDP in 1998 and 33.8% in 2005. During the same period, the primary spending has been growing faster - from 32% to 37.4%, respectively.

The results of this study imply that the balanced-budget policy in countries with a growing public sector could have a negative impact on macroeconomic activity. Thus, the imposition of fiscal rules on the overall budget balance only is not enough with a view to accelerating growth prospects. It is important to evaluate how the country meets the budget balance, by raising taxes and spending or by lowering both, because an expenditure expansion accompanied by a tight tax policy is not likely to create a growth-enhancing environment.

## 4. Conclusion

This study illuminates the macroeconomic effects of fiscal policy in Bulgaria during the period of EU accession. The descriptive analysis shows a negative (non-Keynesian) relationship between the discretionary expenditure interventions and the short-run output growth. On the other hand, the tax policy affects output in the standard Keynesian manner. The size of discretionary impulse is the main determinant of non-Keynesian influence of government outlays: the stronger fiscal expansions/contractions are more likely to decelerate/accelerate GDP growth. This result supports the conclusions of relevant research on both advanced and post-communist economies.

The findings of this study have some important practical implications for Bulgaria's fiscal policy. Due to the fiscal discipline during the Currency Board Regime, introduced in mid-1997, the government debt has been constrained below 60% of GDP. The primary budgetary balance has remained positive since the beginning of the century. Nonetheless, the study suggests that although the balanced budget ensures the sustainability of public finances, it could not guarantee a stimulating effect on output - the fiscal policy mix is a crucial factor for economic growth as well. The government's size was continuously growing during the period under observation. The share of Bulgaria's government sector is among the highest ones in the transition economies, including those countries under a Currency Board Arrangement (Estonia and Lithuania). The presence of non-Keynesian effects of government spending shows that in view of accelerating growth prospects the balanced budget should be achieved by expenditure restrictions and lower taxes rather than a growing government share in the economy.

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# Controlling in Transition Environments: Empirical Evidence from Croatia

Davor Špac, Lorena Mošnja-Škare*

*Abstract:*

***The paper explores controlling developments in the particular environment of an economy involved in a transition process for almost two decades. The results presented in the paper were founded on the empirical analysis of the most successful Croatian companies, which were used as the sampling population. The presentation of controlling department existence in Croatian companies and the analysis of management perception of controlling importance were performed together with research on controlling information sources and users. All the information presented allowed us to make some conclusions about controlling development and to assess its future. Also, recent controlling developments were analyzed in the sample of Croatian SMEs to evaluate its implementation in this group of entities and to assess the factors of potential influence on its development level in a given enterprise, such as: size of the enterprise, management performance (owner-managers or managers), intensity of accounting information use and relation to the business abroad.***

***The results were evaluated considering the controlling evolution in developed economies. Thus, the controlling evolution was monitored in the Croatian corporate sector, from its "registering" stage, still dominant on the scene, to its "innovation" stage. In addition to the current findings, future perspectives on controlling development flows in Croatia were also assessed.***

**Keywords:** controlling, developments, transition, corporate sector

**JEL:** M19, M21, M41 **DOI:** 10.2478/v10033-009-0005-4

## 1. Introduction

Companies from formerly planned economies started to compete in the open market by the end of the 1980s and at the beginning of 1990s when transition processes began. This paper analyzes the controlling developments in specific circumstances of a transitional economy like Croatian, after almost two decades of transition.

The study used the most successful Croatian companies as its sample. Also, we explored the controlling implementation in SMEs, the group of enterprises that make up 98% of business entities in Croatia, as in other countries in transition. Based on research results dating from 2005/2006, together with Osmanagić-Bedenik's results from 2001, estimations of further controlling developments were also included. In this way, controlling development in Croatian corporate sector was monitored starting from its early "registering" phase towards its "innovation" phase in the future, as was its path in developed economies. After considering various theoretical backgrounds, controlling evolution in the world, stage by stage, is presented in short to better understand its growing

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function in a transitional economy like that of Croatia. Since there has been no systematic research on this topic in Croatia, the results should be considered while accounting for the limitations of the present scholars' work. With regard to the role of controlling in contemporary business operation in Croatian enterprises, there are still many relevant fields for further research, especially on possible improvements in its practice as well as the educational sector.

## *2. Controlling – Theoretical Backgrounds*

At present, controlling is the focus of much scholarly research. Some authors define controlling as a "functional management instrument that supports the entrepreneurial process of leading and decisions through defined analysis and presentation of information" (Preisler and Peemoller 1990, p. 16). It is also understood as a "function in the management system that increases efficiency and in such a way makes it possible to cope with changes inside and outside the company" (Weber 1993, p. 46). Also, Weber J., together with other authors (Kupper, H.U. and Zund, A) defines controlling as management support that provides relevant knowledge about important facts and methods. According to the International Group of Controlling, "Controllers design and accompany the management process of defining goals, planning and controlling and thus have a joint responsibility with the management to reach objectives. This means:

- Controllers ensure the transparency of business results, finance, processes and strategy and thus contribute to higher economic effectiveness.
- Controllers co-ordinate sub-targets and related plans in a holistic way and organize a reporting-system that is future-oriented and covers the enterprise as a whole.
- Controllers moderate and design the controlling process of defining goals, planning and management control so that every decision maker can act in accordance with agreed upon objectives.
- Controllers provide managers with all relevant controlling information.
- Controllers develop and maintain controlling systems."

It is obvious that controlling is strictly related to management. Management is responsible for the company's success and controlling is responsible for defining the steps to achieve it, as well as for monitoring these processes. Controlling coordinates all management functions (from planning through organizing, motivating and leading to control) and all the company's departments. The purpose of this horizontal and vertical coordination is the spread of the company's goals throughout the company. Controlling has the task of presenting the company's goals to all of its departments, to define the steps to achieve these goals and to control if the steps stick to the plan by analyzing variations in the processes, finding their reasons and defining how to minimize them. Controlling helps management in performing its functions by providing the necessary information from different sources - inside and outside the company, avoiding in such a way unexpected influences on business continuity towards company's goals. "In general, surprise is a bad thing, both inside and outside the company…" (Parfet 2000, p. 486).

In theory and practice, controlling is often mixed with accounting (especially management accounting – see more in Ryan 1995; Simons 1999; McWatters et all. 2001, etc.). "A fundamental theme in management accounting is that firms use accounting systems to serve two broad objectives: facilitate decision making and mitigate control problems. - Demski and Feltham (1976), Baiman and Demski (1980), Christensen (1981), Baiman and Evans (1983), Penno (1984) Baiman and Sivaramakrishnan (1991), and Antle and Fellingham (1995) are examples of some early studies that highlight distinct control and decision-facilitating roles for accounting information." (Indjejikian and Matejka 2006, p. 849). At its beginning, controlling was a part of the accounting system and their tasks were very similar, but fast changes in business environments presented a new dimension that produced the main task of controlling. This task was the prediction of future changes in order to keep the company prepared before they actually happen. "Accrual accounting is a formalized anticipatory statement of stocks and

flows… These accruals, however, are surely not happenstance. Rather, they are estimates – estimates that can be interpreted as expectations…" (Demski 2004, p. 519). Although the most important source of information for controlling is still considered to be the accounting system, other sources inside (other departments) and outside the company are necessary in the contemporary environment. Controlling is focused not only on measurable (numeric) variables but also on immeasurable ones (such motivation, customer satisfaction and similar), as well as defining deviations and the reasons for their appearance. In other words, a multifunctional approach and quality variables analysis are inevitable in fulfilling the controlling "navigator" purpose.

In this paper, we tried to track the controlling development process from the "registrator" towards the "innovator" in transition environments. We explored its current presence and organization in the most successful Croatian companies, while evaluating its future developments in relation to the demand for employees in controlling. We particularly stressed the controlling developments in Croatian SMEs, since they presented 98% of the Croatian enterprises that arose during the transition period as the result of privatization and breaking up of the large enterprises and the self-employment of many people who lost their jobs in the process. Most were usually very small entities featuring an owner that oversaw management, occasionally using accounting information to make business decisions and mostly acting within the national market. It was interesting how controlling could develop in such environments, keeping in mind underlying theories of its development as discussed above. Therefore, we developed a set of hypotheses that we have empirically tested in chapter 5 on the sample of Croatian enterprises:

*H1: Controlling implementation is positively associated with the intensity of accounting information use.*

*H2: Controlling implementation grows with the enterprise's size.*

*H3: Controlling implementation increases if the enterprise is somehow related to business abroad.*

*H4: Controlling implementation increases if the owners are not performing the management function at the same time.*

## 3. Methods

There were several common scientific methods combined in this research. A historical method was used for the presentation of controlling development. The inductive-deductive method allowed us to make scientific conclusions based on the data collected mainly by the direct observation method and the method of group inquiry. Statistical methods were employed to present the distribution of variables in the sample.

We have performed the structural analysis and have also tested the hypotheses by means of logit regression (software: SHAZAM Professional Edition). Controlling implementation (CONTROLC) was the dependent variable (1 for developed or developing controlling versus 0 for not developed), and four independent variables followed:

INTENSIC= intensity of accounting information use (1 for regular or 0 for occasional use)

SIZEC=enterprise's size (1 for middle-sized or 0 for small according to Croatian Accounting Act criteria, NN 90/92)

ABROADC=relation to the business abroad (1 if it exists or 0 if it doesn't exist)

MANAGC=management function performance (1 by manager or 0 by owner him/herself).

All variables in the model, both dependent and independent, were dummy variables.

We tried to assess the probability of controlling implementation (CONTROLC or Y in the expression below) in Croatian enterprises depending on the variables stated above, by the use of the binary logit model (Greene 2000, p. 814):

$$\text{Prob}(Y=1) = e^{\beta' x} / (1 + e^{\beta' x}) = \Lambda(\beta' X), \qquad (1)$$

based on the logistic function (Studenmund 2001, p. 442):

$$\ln (Y/[1-Y]) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i . \quad (2)$$

The logistic functions (estimations of parameters $\beta$) as well as the marginal effects of the explanatory variables X (INTENSIC, SIZEC, ABROADC and MANAGC) on the probability of controlling implementation in Croatian SMEs were presented, and the functions were tested by the likelihood ratio test. The functions' prediction success was also presented.

The research was performed in the period from the beginning of September to the end of December 2005 on the sample of 190 successful Croatian companies comprising 175 Croatian companies with the highest revenues in 2004 and the 15 largest Croatian banks (62 responded). Enterprises classification criterion by size was based on the ex-Croatian Accounting Act (Official Gazette No. 90/92, in force until January 2006).

There was also another sample of 65 Croatian SMEs randomly selected (52 responded) that was analyzed in the period 2005-June 2006. Among this group of entities, 85% were limited liability companies, 12% joint stock companies and the others were partnerships or limited partnerships (please see the SMEs sample description presented below):

## *4. Controlling Developments and Recent Improvements*

Controlling implementation dates from the beginning of the 20th century in USA but it started to develop more rapidly after the First World War in companies like Sears, General Motors, Standard Oil and DuPont. They began expanding their range of products and opening subsidiaries, first in different parts of the USA, and then also in other countries. That's why they needed a function that could help management to set the company goals, monitor their achievements and to coordinate different subsidiaries and departments.

After developing in the USA, in the middle of the 20th century, controlling started to be implemented in the West European companies, first through the subsidiaries of the American multinational companies, and then also by companies which operated exclusively in the national market. In 1992 and 1993 the Association of companies for research on the controlling and controllers' education analyzed the controlling presence and development level on a sample of 905 Austrian business entities. The requested turnover of the analyzed companies was over 70 million ATS, with their assets valued at least 15 million ATS and the number of employees over 100. The return rate in the research was 33.37%. The results were as follows:

- 52.90% of the entities had established a controlling department
- in 18.20% of the companies controlling was performed by some other department
- 29.10% of the companies didn't have a controlling department and its tasks were performed by management

In 66% of the analyzed companies controlling was the

| *Feature* | *Small enterprises* | *Medium-sized enterprises* |
|---|---|---|
| Average number of employees | 15 | 94 |
| Assets | < 1 million euros in 75% of enterprises | > 1 million euros in 86% of enterprises (half of them > 4 million euros) |
| Total revenues | < 2 million euros in 91% of enterprises | > 2 million euros in 70% of enterprises (but less than 8 million euros) |
| Relation to business abroad (existence or absence of any kind of foreign relation in a given enterprise) - the number of entities involved in foreign relations / total number of entities in the sample | 56% | 88% |

**Table 1:** Sample Description
**Source:** authors' research.

direct responsibility of the management. The controlling department was established at the first hierarchic level in 24% of the companies; at the second level in 63% of the cases, and at the third level only in 13% of the companies. (Osmanagić-Bedenik 2004, p. 33).

Controlling has gradually entered companies among all developed European countries. According to McKinsey's research performed in 1974 on the sample of 30 large German companies, controlling was implemented like an independent department in 90%. The research of the demand for controllers by the German newspaper "Frankfurter Allgemeine Zeitung" showed a demand for only 5 employees (controllers) in the period 1949-1959. In the 1960s and onwards, the demand started growing, approaching 250 employees in the period 1985-1989 (Osmanagić-Bedenik 2004, p. 38). Such a significant increase confirmed the growing importance of controlling, both for the management of the companies and for the companies themselves. This was also proved by the research results presented at the 2nd congress of Controlling in St.Gallen, 1988 (table 2).

| Number of employees | % of companies with controlling organized as an independent department |
|---|---|
| less than 100 | 5% |
| from 100 to 500 | 51% |
| from 500 to 1 000 | 70% |
| more than 1000 | 96% |

**Table 2:** Presence of Controlling in Swiss Companies in 1988.
**Source:** Osmanagić-Bedenik, N., 2004, 43.

This research showed also that in companies with fewer than 100 employees the controlling tasks were performed by the finance and accounting department. In companies with 100 - 500 employees the controlling department was directly responsible to the finance and accounting manager (linear structure) in 50% of cases. In companies with more than 500 employees controlling was established like an independent department.

Similar results could be found not only in Switzerland and Austria but in the companies of all developed European countries.

The intensive expansion of controlling was closely related to the functions delegated to this department. At its beginning, controlling was more or less occupied only by "registering" the changes in the company. At this time most of the information that controlling analyzed to help the management came from inside the company due to more or less stable environment. The changes that happened at the beginning of the 70s with the petrol crisis and the saturation of demand "forced" controlling to change. It became a "navigator" which analyzed internal as well as external information, while its coordination function (horizontal and vertical) also started to have greater influence.

From the beginning of the 1990s, controlling became in charge of predicting future environment changes, transforming in this way into an "innovator". This new controlling function was given special importance after new markets opened in Eastern Europe (Czech Republic, Poland, Russia, Romania, Bulgaria, Croatia etc.), Asia (China, India, Pakistan, etc.) and the appearance of aggressive competition from the rising Asian tigers like Korea, Taiwan and Malaysia. In this period the coordination among the departments and subsidiaries (especially in different countries) started to be of extreme importance because a problem in one subsidiary or in one country undergoing aggressive competition had strong repercussions throughout the entire multinational company, and could cause losses in market share within a short period. In the 21st century, firms cannot just operate in different countries; they must develop global strategies to coordinate their operations at all phases of the value-adding chain (D'Amours et al. 1999.). Controlling that acts as a coordinator, integrator of business functions and provider of information among different functions in the company, and that responds to the local environment, is one of the most important parts of any successful enterprise.

In the 1960s budgeting and controlling process development became highly important in the non-profit and government sector as well (one example was the U.S. Department of Defence) with clear needs for

experts in planning and budgeting (and afterwards in controlling). The process of developing controlling and planning in government institutions has accelerated since then.

Controllers must have a high level of education and different skills to fulfil the most difficult demands of the job. Usually, the formal request for these experts is at least a university degree in economy (very often with a specialization in finance and management accounting), and a few years of experience in finance and/or accounting. Controllers must also know well all the instruments that help management lead a company, such as strength, weakness, opportunity and threat matrices, analyses of different indicators (liquidity, profitability etc.), ABC analyses and the Balanced scorecard model (which analyzes four perspectives: economic-financial, internal processes, customers and learning and development). In this way, the controller doesn't only consider financial indicators, but non-financial ones as well, such as customer satisfaction, quantity and quality of education, communication and continuity of the operation processes in the company. Controllers are also required to be team players, to understand cultural differences (especially in multinational companies), to be familiar with the company's branch, to have excellent communication and informatics skills, to be acquainted with methods of motivations and similar issues. In short, they must be persons with a high potential to learn business process and everything related to them. Such high requirements are necessary to provide management with the right information at the right time and to offer the best instruments to enable the successful accomplishment of business goals. That's why the controlling department is considered a good place to teach future managers and to prepare them to take an important position in the company. There are many similarities between a controller's and a manager's work. The main difference is that controllers are managers' advisers, while managers utilize advice to make decisions. A high quality controlling system is a precondition of successful management - "…bad systems or rules, not bad people, underlie the general failings of the board of the directors." (Jensen 1993 in Farber 2004, p. 542).

## *5. Controlling Developments in Croatian Companies – Present Situation and Perspectives*

### *5.1. Controlling Developments in the most successful Croatian Companies*

Croatia, like most Eastern European countries, began transforming itself from a planned to a market economy at the beginning of the 1990s, meaning Croatian companies have been fighting on the open market for almost two decades. It has been a complex and difficult process where "…top government and private sector leaders have little or no experience governing market oriented private firms…"; "Countries that are in the transition process from central planning to a market economy all face the same problems but they each have their own approach to solving the problems they encounter." (McGee and Preobragenskaya 2006, p. 244, 272). These facts motivated us to explore the penetration of controlling into Croatian companies trying to survive in severe business environments, burdened with problems common to all transition countries as well as with the peculiarities of the Croatian economy itself.

In 64.52% of the most successful companies in the sample, controlling was being done, either as an independent department or incorporated into another.

The results could be compared with Osmanagić-Bedenik Nidžara's research (2001), published in the 2nd edition of the book "Kontroling: abeceda poslovnog uspjeha" (Controlling – the Alphabet of Business Success), 2004. Her research (2001) has shown that 53% of the analyzed companies performed controlling in some capacity. It seems that in 4 years the share has risen around 12 percentage points, which means that Croatian companies have been recognizing the value and power of controlling in their day to day business.

According to the company size defined by the Croatian Accounting Act (Official Gazette 90/92 – the thresholds were raised later by the new Accounting Act – Official Gazette 146/05 and 109/07), controlling was present in 67% of large Croatian companies and in 55% of medium sized companies in 2005 (all among the group of most successful companies). The greater

share in large companies was related to the superior resources they had at their disposal to implement controlling.

The organisation of controlling as an independent department in the company is also an important indicator of its development. The results are presented in Figure 1.

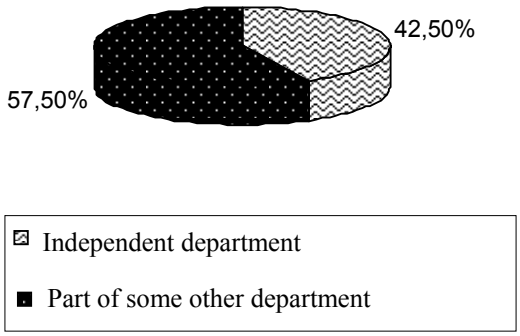


**Figure 1:** Organisation of Controlling in Croatian Companies in 2005
**Source:** authors' research.

Obviously, in 58% of companies, controlling was organized as part of some other department, usually finance or accounting - departments where controlling started to develop first, as in other countries. The rates of the independence of controlling departments in Switzerland ranged from 51% in medium sized companies to 90% in large ones. For transitional environments such as Croatia, which has only a short history of controlling developments, independent controlling departments were seen in 40% of cases, also a good result.

Controlling organization can influence one of the main controlling tasks, support of the management's decision-making process, which provides the necessary information to managers, on time and in the requested form. We have explored the sources of information that after integration and coordination were presented to managers by controlling departments.

The most important and often used sources of information for controlling were accounting (in 82.05% of companies), marketing and sales (69.23% of companies), finance (43,59% of companies), followed by the investment, production, external sources and human resources departments in the observed sample of companies. From this we can conclude that the higher presence of controlling in, or near, the finance and accounting department led to more frequent use of information from these sources for advising management. The limitation of this information is that it is usually based on historical data that in a turbulent environment may have lost its relevance. One positive aspect is that marketing and sales were also among the most important providers of information, and their knowledge of market development (and that of the entire environment) could give controlling the better material than accounting and financial data to make better predictions. It is obvious that the information controlling analyzes comes from all the parts of the company and from sources outside the company, all of which resulted in the perception of controlling information as highly valuable to management.

In order to confirm the ability of controlling to provide valuable and useful information to the top management, we searched for the most intensive users of controlling information in the sample. We supposed that if the information that controlling provided weren't relevant for management decisions, top management would not use them.

Our assessment that the information provided by controlling was considered of high importance was confirmed, since 100% of the top management, moreover 65% of the owners and 60% of the department directors were users of such information. This proved that good controlling work based on internal historical data as well as external data can provide useful information to management for their decision making. As is obvious from Figure 2, 80% of those interviewed responded that controlling was of high importance in their business decision-making process. Also, it must be pointed out that no one considered controlling to be of little or no relevance to decision-making.

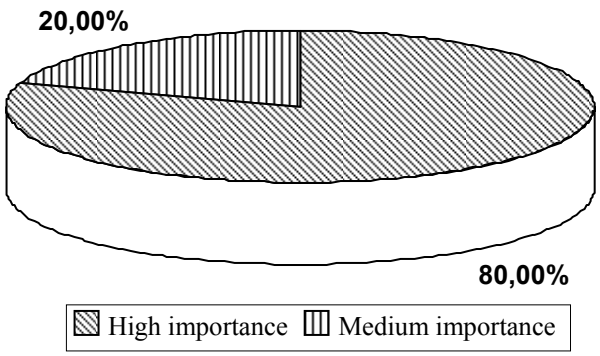


***Figure 2:*** *Evaluation of Controlling Importance in Decision Making in Croatian Companies in 2005*
***Source:*** *authors' research.*

The significant role of controlling in the decision making process was especially associated with companies that had prevalent ownership of foreign companies (multinational companies). In these companies, 95% of the managers declared that controlling was highly important in their decision-making process. Relating those results to Osmanagić-Bedenik's, where 97% of those interviewed declared that controlling helped them in achieving their goals, it was clear that controlling was considered a very important factor for the companies' success.

### *5.1.1. Evaluation of Future Developments*

After presenting the actual situation of controlling in the most successful Croatian companies, its future development was evaluated. Research results indicate that more than 30% of the companies in the sample without controlling are planning to implement it in the near future. Taken together with the companies that have already implemented controlling, the share of successful Croatian companies that will have controlling organized in the near future could be higher than 75%. In addition, 14% of the companies without controlling have developed it on the group level. The assumption is that these companies will also implement controlling soon, because growing competition and fast changes on the market will compel them to organize a controlling department on a higher level. This assumption makes the "controlling companies" share increase to 81%.

The presence of controlling in successful Croatian companies could reach around 75-80% in the next few years. This increase is also related to the demand for employees in controlling. The data derived by analysis of the Croatian employment web site MojPosao.net (the biggest employment web site in Croatia) in the last few years, and projections for the year 2006 based on the first 5 months, are presented in Figure 3.

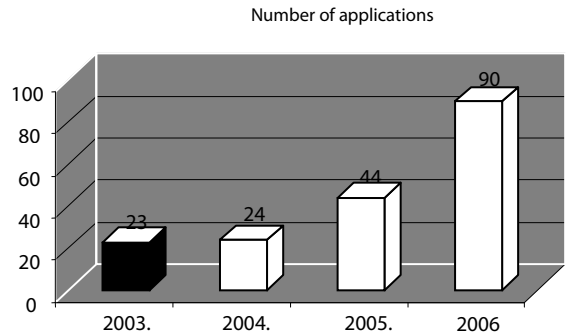


**Figure 3:** Demand for Controllers according to the Employment Web Site MojPosao.net

It is clear that the demand for controllers is growing rapidly. Assuming the trend continues, within a few years it will reach more than 200 controllers annually. A similar trend was noticeable according to another Croatian employment web site (Posao.hr), where in the first 10 months of 2005, there was a demand for 14 controllers, and for 21 in the first 8 months of 2006. The analysis of the demand for controllers in 2005 was stratified by regions, employing the observation method on the employment web sites Moj.Posao.net and Posao.hr. The results showed that the highest demand for controllers was in the capital city (Zagreb) and its surrounding areas (55%). This was expected because most industry and the most successful companies are situated in this region. The demand from other parts of Croatia (29%) also indicated an awareness of the need for controllers. This means that some of the most successful companies are switching their activities to other regions, since smaller Croatian regions are trying to attract investments through different tax policies to help their development. Part of the companies (16%) related to multinational companies with subsidiaries in different regions and/or

countries were recruiting new employees that would probably be switched from one place to another.

Companies usually employ young people with some experience as controllers that are prepared to confront fast and extensive changes to their workplace and type of work. Working experience demanded for controllers in Croatia was analyzed and is presented in Figure 4.

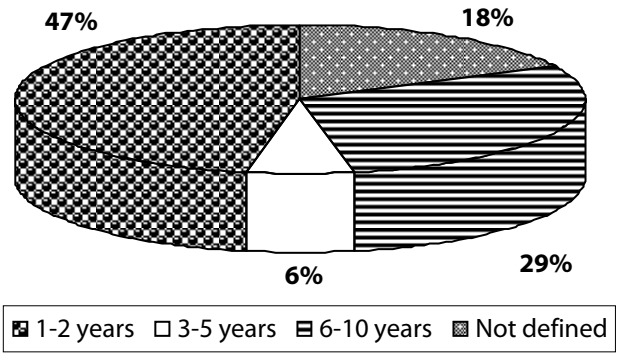


**Figure 4:** Analysis of the Required Working Experience for Controllers in Croatia in 2005 according to Croatian Employment Web Sites
**Source:** authors' research.

Most of the companies were looking for employees with 3 to 5 years (29%) of experience, while only 6% of the companies searched for employees with more than 5 years of experience. The high share of companies that did not define a required amount of working experience indicates that Croatian companies were less concerned with experience than other criteria like education or special knowledge and skills. Most companies (78%) required a second university degree - BSc (at least 4 years of undergraduate education), followed by (12%) those that required the first university degree - BBA (at least 2 years of undergraduate education). In addition, knowledge of at least one foreign language (mostly English) and excellent computer skills (especially MS office and SAP programs) were necessary. Other required skills were excellent time management, communication, decision making, a capacity for teamwork, and organizational and analytical skills. These employees were expected to be strong, open-minded, flexible, challenge receptive and focused on solutions. Accounting (local and IFRS) and statutory system knowledge were also required. The expectations of these employees were undoubtedly high, and include considerable hard work. On the other side, there is a high satisfaction level with dynamic work full of challenges and opportunities for promotion towards the top management levels. According to research performed by the employment web site Moj.Posao.net, controllers were the best paid specialist employees in in Croatia.

The growing trend of demand for controllers and high requirements for the controller position has been recognized by academic institutions. This discipline has found its place in the curriculum of Croatian universities. Today, controlling is taught at three Croatian universities (University of Zagreb, University of Šibenik and University of Rijeka). Also, professional associations, such as the Croatian association of accountants and financial experts (Hrvatska zajednica računovođa i financijskih djelatnika) are supporting the development of controlling by organizing professional and scientific conferences and publishing articles that explore controlling tasks and duties.

## *5.2. Controlling Developments in Croatian SMEs*

Croatian SMEs account for 98% of the total number of business entities, accounting for 38% of the total revenue and 56% of employees in Croatia (Analysis of Financial Results of Enterprises, FINA, 2006).

This situation is opposite to that before the start of transition processes (early 1990s), which was characterized by large state or socially-owned enterprises employing hundreds or thousands of people. The processes of restructuring and privatization produced high unemployment, with many people attempting to start their own business to survive. This is why a great number of small enterprises emerged. Radical transitional changes introduced competition, running businesses in an open market, and responsibility for one's own decisions or actions with regard to private interests and profit. Switching into new, strange environments was not easy and high quality information on the process of decision making became a precious resource. Previously, decisions were mostly based on intuition and ad-hoc solutions. Information systems were rudimentary, with most

information provided by accountancy that was nothing more than bookkeeping – a passive, static, uniform system, existing solely to meet the rules and information requirements typical for an economy of high government regulation and legal influence. Accounting was just a routine practice of following rules that changed frequently. Accountants lost a great deal of time trying to implement them, leaving very little time for cost or management accounting. Thus, accounting reform began immediately in the early 1990s in an attempt to align with the new requirements of the changing business environment. It had to transform the uniform and passive accounting system into a modern one comparable to its role and function in developed countries. Management accounting has started developing and as businesses grow, the need to develop controlling became obvious. Controlling used a great deal of information from accounting as its basic source. Such a process could not be emulated by smaller enterprises that were too scarce of resources to organize their own accounting systems (usually performed by outside agencies), not to even mention controlling systems. Intensifying competition in a young market economy prompted controlling to be increasingly considered a necessity, even by smaller entities.

Four hypotheses (H1-H4) developed in Chapter 2 were empirically tested on the sample of Croatian SMEs and the results are presented below.

As we have previously mentioned, accounting is considered the main source of information that controlling collects, processes and prepares for the use of management. Because of this we have explored the relation between the use of accounting information and controlling implementation in Croatian SMEs.

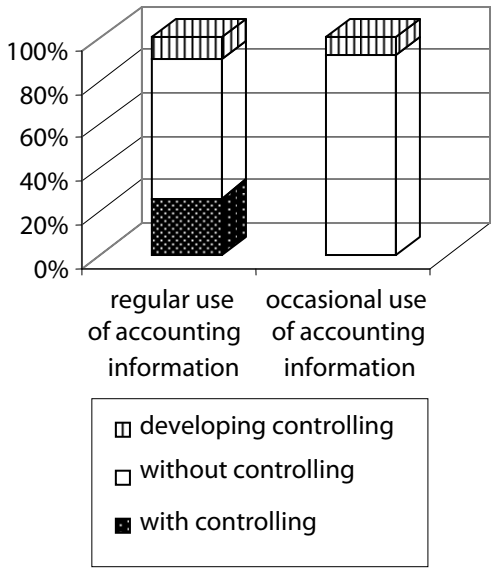


**Figure 5:** Controlling Implementation in Relation to Accounting Information Use in Croatian SMEs in 2005
**Source:** authors' research.

According to the figure above, in the sampled enterprises where management decisions were often made intuitively, using the accounting information only occasionally, controlling was not used. Regular use of accounting information indicated that management was aware of the importance of having high-quality, reliable, timely information at its disposal, and in doing so creating the basis for improving information sources by the development of controlling as its support. This correlation is also confirmed by logit regression[1] (3), which is presented in the appendix.

The dependent variable of regression (3) is the log of the odds[2] that controlling would be developed or develop (CONTROLC) in a given enterprise versus the situation where it is not developed (i.e. where it is not implemented at all). It is obvious from the regression that the probability of its implementation in a given enterprise is positively related to the intensity of accounting information use (INTENSIC). The null hypothesis that the INTENSIC coefficient is zero is rejected in favor of the alternative (H1) that it is positive, at a 10% significance level. The marginal effect is 0.28205. SMEs where accounting information

is only occasionally used have a probability of controlling implementation of 0.07692, while it increases to 0.35897 if the accounting information is used regularly. The likelihood ratio test indicates that the null hypothesis that slope coefficients are zero is rejected at the 5% significance level. The model predicts 71% of the observations correctly (see the prediction success table no. 3 in the appendix).

Controlling implementation in Croatian SMEs is presented in the figure below.

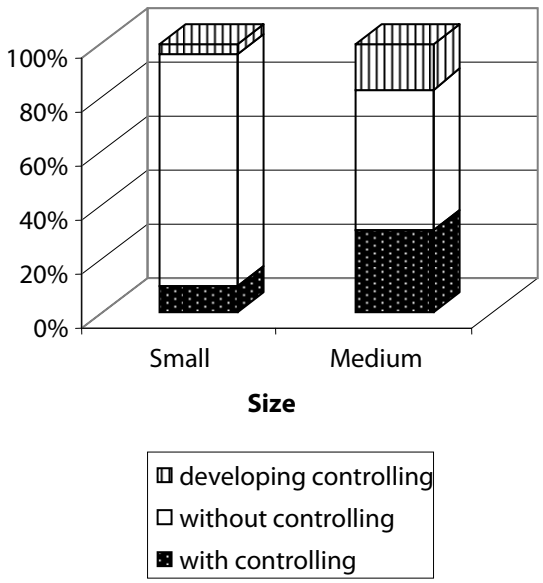


**Figure 6:** Controlling Implementation in Croatian SMEs in 2005
**Source:** authors' research.

Controlling was not implemented in more than two thirds of sampled Croatian SMEs. It existed in 20%, for an average of 5.4 years. As was expected, the share of enterprises that developed controlling was three times higher in medium sized enterprises than in small ones.

Perspectives on future development were also explored. Only 10% of SMEs invested efforts in developing controlling over the course of the next 2 years. Once again the ratio was four times higher for medium-sized enterprises than in small enterprises.

Thus, hypothesis H2 is accepted according to the regression (4) in the appendix. There is a positive coefficient of variable SIZE related to the log of the odds that controlling would be implemented (CONTROLC) in a given enterprise, confirming the positive influence of the enterprise's size (middle-sized versus small-sized) on the probability of controlling implementation at a 1% significance level. The marginal effect of 0.34033 indicates the increase of probability of controlling implementation for a middle size enterprise (0.47826) in relation to small enterprise (0.13793). The function predicts 71% of outputs correctly (please see the prediction success table no. 4 in the appendix).

In addition to the size criterion, we tested the eventual influence of relations to business abroad on controlling implementation in a given SME. The results are presented below (figure 7).

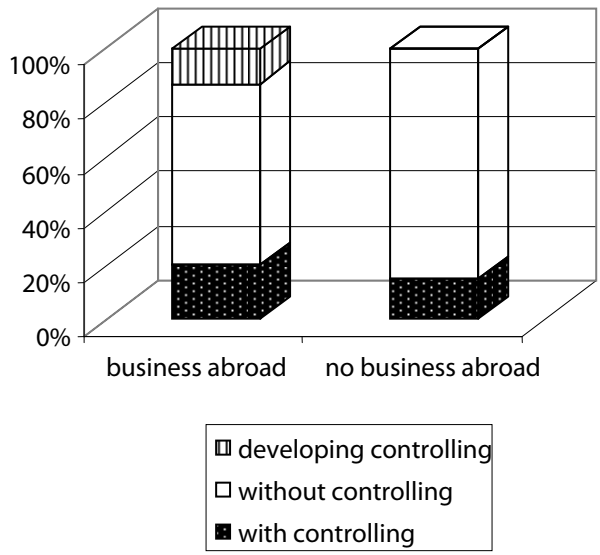


**Figure 7**: Controlling Implementation in Relation to the Croatian SMEs' Business Abroad in 2005
**Source**: authors' research.

Obviously, better results for controlling implementation were related to the enterprises being involved in business abroad. There were also more intensive activities with regard to its development. Such a relation is expectable, since running a business on foreign markets brings more complex information requirements compared to those of domestic markets, making the benefits of developing a controlling function more obvious. Although structural analysis indicates such a relation, hypothesis H3 was rejected (regression 5) in favour of the null hypothesis that this variable's coefficient is not different than zero (p

value=0.22779). Also, the rejection was confirmed by a likelihood ratio test = 1.66933 with 1 d.f. p= 0.19635.

In addition, a frequent situation among Croatian SMEs is that owners manage the enterprises themselves. It was interesting to explore how such a situation influences controlling developments in a given enterprise.

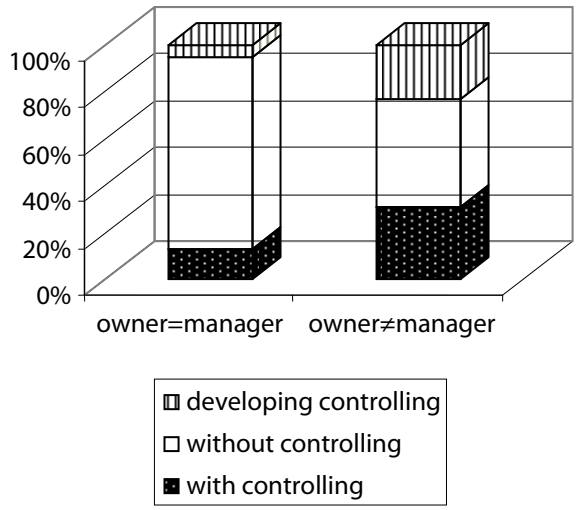


**Figure 8:** Controlling Implementation in relation to Integration of Ownership and Management in Croatian SMEs in 2005
**Source:** authors' research.

In accordance with the historical trend of separating management from owners as the business grows and its management develops independently, controlling was more intensively present or the process of its development was going on in more than half of the cases where the owner did not operate as a manager at the same time.

Hypothesis H4 is accepted based on the logit regression 6 presented in the appendix. The log of the odds that controlling would be developed or was in the process of developing (CONTROLC) in a given enterprise is found positively correlated with the separation of the owner from management (variable MANAGC). Thus, the variable MANAGC influences positively the probability of having controlling implemented in a given enterprise (level of significance 5%). The probability of controlling implementation increases in case the owner does not operate as the manager at the same time with the marginal effect of 0.33333. The probability of having controlling developed or developing in an SME where the owner acts also as a manager is 0.20513, while it increases to 0.53846 where those functions are separated. The function predicts 73% of cases correctly (please see the prediction success table no. 6 in the appendix), so the results suggest a good fit.

## *6. Conclusions*

In this paper, we have presented research results on the actual situation of controlling implementation in the transitional environment of Croatia and have also assessed its future developments. We have performed research on its presence in the most successful companies, as well as in Croatian SMEs. The demand for controllers was explored across the whole territory of Croatia.

Controlling is implemented in more than 60% of the most successful Croatian companies in the sample and the share is still growing, with expectations that more than 75% of Croatian successful companies will have an organized controlling department (or at least with a controller) in the next few years (2-3).

The controlling development process is going very slowly in Croatian SMEs, where it is modestly present (in less than one third of sampled SMEs) and has taken only small steps forward (10% of sampled SMEs plan to introduce it in the next 2 years). In order to understand controlling implementation in Croatian SMEs, 4 hypotheses were tested. The SMEs with implemented or developing controlling were primarily middle sized entities and particularly those with management separated from the owners, where accounting information was used regularly. The influence of running the business abroad on controlling implementation was not confirmed by a logit analysis test.

It seems there are encouraging controlling development trends in Croatia, mostly related to successful enterprises with substantive resources that enable them to organize this function.

Although controlling has been developing very slowly in Croatian SMEs, the need for its establishment is evident. This is because, as in any transitional economy, SMEs emerge and disappear in very short cycles, sometimes within months. Controlling should not be considered a "luxury," something hardly affordable because of scarce resources. Its implementation does not have to necessarily follow the expensive organizational solutions usually encountered in large companies. It should be organized in an effective and efficient way to break a "magic cycle" of falling deeper and deeper into crisis due to a lack of relevant information that could help handle the problems when/before they emerge, avoiding in this way the loss of control over the business.

The enterprises in transition economies like those in Croatia are still in the process of learning market laws and controlling has been developing simultaneously. However, it still hasn't reached the level it enjoys in developed economies. The growing demand for controllers in Croatia is evident, but it is still the most intensive in the Croatian capital (Zagreb) and its surrounding area. Also, controlling development is supported by the Croatian educational system by introducing the study of controlling at several Croatian universities. The controlling department is independently organized in most of the successful companies analyzed, but that is not the case in around 60% of companies and 20% of their management still do not consider it of great importance to their decision making. This situation needs a lot of investment and effort before controlling reaches its "innovator" stage. In other words, the "innovator" stage means the *qualitative change of controlling tasks*, while we are still discussing only *its presence* in Croatian enterprises.

Thus it is not enough to have controlling organized in a given enterprise, but to improve the use of controlling, to force it to move toward more developed stages. Introducing controlling into a larger number of Croatian companies and upgrading its use requires both the help of the education system and continuing education.

Although it was presented earlier that the educational system (formal and informal) has been gradually identifying the necessity for a stronger push towards controlling driven by the increasing needs of enterprises, the actual situation is far from ideal. The process of the introduction of new studies or courses in the university programs needs time, while high market demand is present at this moment.

For this reason our suggestion for companies is further valorisation of controlling work and tasks by rewarding controllers in different ways, in the first place financially but also by motivation, providing them the possibility of hierarchical growth in the company. Alternatively, the companies would probably have to accept the high mobility of these employees.

The increased market demand gives companies the possibility of internal controlling education of employees with high potential. This is recommended to be organized in cooperation with institutions of higher education and professional associations so that the employees can obtain certificates and/or diplomas that would be recognised on the labour market. In this way the company will receive controllers that are already familiar with the company structure, targeted market and strategic goals and will not need introductions to the business. In addition, these employees will be pleased that their potential and knowledge have been recognized and that the company gives them the possibility to upgrade their knowledge. This will improve the company's spirit, with employees that aren't there only because of money but feel a sense of belonging to the company. This is extremely important for controllers because they are informed about the most important issues concerning the company (internal and external) and their loyalty is critical. A controller's work demands a lot of sacrifices both professional and personal, with a lot of overtime work under stress which often is even impossible to reward financially. This is the reason why internal education is an optimal way to decrease (if not even to stop) controller outflow from the company and also diminish (or even avoid) the introduction costs for new employees (controllers). It is also important that in this process the government contributes legislation. They should allow the recognition of internal diplomas and certificates provided by certified institutes and

schools on the labour market. In this way the employees will appreciate even more the opportunity provided by their employers, consequently deepening their loyalty.

With regard to SMEs without sufficient resources or the possibility to organize controlling on a cost-benefit basis, one possible solution could be the change of the profile of accountants towards small business advisors. Actually, they already offer a wide set of services together with accounting services, trying to help small business entrepreneurs with financial, tax and other advices but "…the limited varieties of management advisory services they offer, their inability to effectively market what they do offer, and their lack of knowledge of the unique context, challenges and prospects of small business, have been recognized as perennial problems. Identification of these problems has prompted calls for enriched and more specialized education of accountants in order for these professionals to develop an improved skill set." (Bisman 2007, p. 58). Since controlling has traditionally used the most quantity of information from accounting data, joining the controller's tasks together with those of the accountant could be one solution for smaller businesses. In this way the accountant should serve as a "small business advisor". Educating accountants as small business advisors has been successfully performed (e.g.) at Charles Stuart University, Bathurst, Australia during the last 10 years. Croatian universities should also follow their example, since 98% of enterprises in the Croatian economy are SMEs, and smaller enterprises have no one other than their accountants to ask for advice. Controlling knowledge could substantively improve their advising services. This should be kept in mind in the process of designing and developing university programs as well as programs for permanent education.

Following these recommendations in upgrading the higher education system, together with permanent education programs could significantly contribute to controlling development in Croatia.

## Endnotes

[1] about logit regression, please, see more in: Demaris 1992; Bierens 2004; Greene 2000; Hair at all. 1998; Studenmund 2001.

[2] «Odds refer to the ratio of the number of times a choice will be made divided by the number of times it will not.» (Studenmund 2001, p. 442)

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## *Appendix*

***H1: Controlling implementation is positively associated with the intensity of accounting information use.***

***H1 ACCEPTED***

ln (CONTROLC / [1-CONTROLC]) = -2.4849 + 1.9051 INTENSIC (3)
(1.0912)
t=1.7458
p=0.08084 n=52, iterations=4

CONTROLC= controlling function development (1=developed or developing; 0= not developed)
ln (CONTROLC / [1-CONTROLC]) = log of the odds that controlling would be developed or developing – versus - it wouldn't be implemented at all in a given enterprise
INTENSIC= the intensity of accounting information use (1=regular use; 0=occasional use)

Probabilities of having controlling function developed or developing:
Prob (CONTROLC=1) =0.076924 if INTENSIC=0
Prob (CONTROLC=1) =0.35897 if INTENSIC=1
Marginal effect=0.28205

Log-likelihood function= -28.986
Log-likelihood (0) = -31.240
Likelihood ratio test = 4.50856 with 1 d.f. p= 0.03373

Prediction success table (3)

| | | Actual | |
|---|---|---|---|
| | | 0 | 1 |
| Predicted | 0 | 37. | 15. |
| | 1 | 0. | 0. |

***H2: Controlling implementation grows with the enterprise's size.***

***H2 ACCEPTED***

ln (CONTROLC / [1-CONTROLC]) = - 1.8326+ 1.7456 SIZEC (4)
(0.68134)
t=2.5619
p=0.01041 n= 52, iterations=4

SIZEC= enterprise's size (1=middle sized enterprise; 0=small enterprise)

Probabilities of having controlling function developed or developing:
Prob (CONTROLC=1) =0.13793 if SIZEC=0
Prob (CONTROLC=1) =0.47826 if SIZEC=1
Marginal effect=0.34033

Log-likelihood function = -27.555
Log-likelihood (0) = -31.240
Likelihood ratio test = 7.36962 with 1 d.f. p= 0.00663

Prediction success table (4)

| | | Actual | |
|---|---|---|---|
| | | 0 | 1 |
| Predicted | 0 | 37. | 15. |
| | 1 | 0. | 0. |

***H3: Controlling implementation increases if the enterprise is somehow related to the business abroad.***

***H3 NOT ACCEPTED***

ln (CONTROLC / [1-CONTROLC]) = -1.7047 + 1.0116 ABROADC (5)
(0.83874)
t=1.2061
***p=0.22779*** n= 52, iterations= 3
ABROADC=relation to the business abroad (1=if it exists; 0=if it doesn't exist)

Probabilities of having controlling function developed or developing:
Prob (CONTROLC=1) = 0.15385 if ABROADC=0
Prob (CONTROLC=1) = 0.33333 if ABROADC=1
Marginal effect= 0.17949

Log-likelihood function = -30.405
Log-likelihood (0) = -31.240
Likelihood ratio test = 1.66933 with 1 d.f. ***p= 0.19635***

Prediction success table (5)

| | | Actual | |
|---|---|---|---|
| | | 0 | 1 |
| Predicted | 0 | 37. | 15. |
| | 1 | 0. | 0. |

***H4: Controlling implementation increases if the owners are not involved in management at the same time.***

***H4 ACCEPTED***

ln (CONTROLC / [1-CONTROLC]) = - 1.3545 + 1.5087 MANAGC (6)
(0.68321)
t=2.2082
p=0.02723 n= 52, iterations=4

MANAGC=management function performance (1=if owner≠manager, 0=if owner=manager)

Probabilities of having controlling developed or developing:
Prob (CONTROLC=1) =0.20513 if MANAGC=0
Prob (CONTROLC=1) =0.53846 if MANAGC=1
Marginal effect= 0.33333

Log-likelihood function = -28.762
Log-likelihood (0) = -31.240
Likelihood ratio test = 4.95555 with 1 d.f. p= 0.02601

Prediction success table (6)

| | | Actual | |
|---|---|---|---|
| | | 0 | 1 |
| | 0 | 31. | 8. |
| Predicted | 1 | 6. | 7. |

# The Make-or-Buy Decision in the Croatian Shipbuilding Industry: A Transaction Cost Economics Approach

Ermacora Sergio, Smajić Senada*

*Abstract:*

***This paper examines the make-or-buy decision in the Croatian shipbuilding industry using a Transaction Cost Economics Approach. In other words, shipyards' decision to 'make' a component or to 'buy' it from market firms is analysed in relation to certain characteristics of the transactions in order to assess whether this decision is made in accordance with the theory's predictions.***

***The empirical investigation, which is based on a sample of 167 observations, suggests that transaction cost hypotheses are only partially confirmed. Namely, while physical asset specificity and complexity are likely to increase the probability that a transaction will be internalised, temporal asset specificity and frequency seem not to affect significantly the integration decision. However, as the analysis leaves much of the variance in the patterns of vertical integration unexplained, the finding presented in this study should be seen as tentative. The inclusion of the remaining shipyards in the analysis as well as of new and more variables in the model are likely to improve the reliability of the results.***

**JEL:** D23, L14, L22, L62

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## 1. Introduction

This paper considers the transaction cost explanation of the make-or-buy decision. A Transaction Cost Economics (TCE) approach is used as it allows for accounting not only for production costs but for transaction costs as well, which may be equally important in deciding whether to internalise the production of an input or to contract it out from market firms. There are a number of studies that have applied a transaction cost economics approach and their results usually confirm the predictions of the theory, i.e. the probability that a firm will internalise a transaction is higher when the production process implies relationship-specific assets as well as when complexity, uncertainty and frequency are relatively high compared to other inputs. However, the majority of these studies focuses on industries other than manufacturing and refers in particular to cases in the United States and the United Kingdom.

Towards the goal of improving our understanding of the decision to vertically integrate, this research applies the transaction cost approach to commercial shipbuilding, an industry that has been insufficiently researched in Croatia, a developing, former socialist

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Eastern European country. The main objective is to assess whether, in the case of Croatian shipyards, the theory is confirmed by the empirical work; in other words, whether, after controlling for several effects, different characteristics of a transaction such as asset specificity, complexity and frequency affect significantly the choice of alternative organisational forms. Another objective is to identify if the size of the shipyard has a significant influence on the governance choice. Finally, the study aims at finding out whether diverse subsystems[1] are likely to affect the integration decision differently.

The rest of the paper is structured as follows. Section two gives an overview of the literature regarding the theoretical foundations of TCE and its empirical application on the make-or-buy decision. Various concrete definitions of transaction costs are cited, which are necessary to explain the intrinsic differences with neoclassical production costs. Following this, the theoretical foundations of the TCE approach are presented with a particular emphasis on the work of its founder, Oliver Williamson. In addition, the concepts of make-or-buy and hold-up are explained in detail. The last part of the section refers to the empirical evidence of the TCE theory with a particular emphasis on its application on the make-or-buy decision.

The third section is an overview of the historical development of the Croatian shipbuilding industry, which gives a background for the empirical work presented in the fourth section. The first part of the section analyses the industry during the Yugoslav socialist period, which was unique as almost the whole production process was organised in-house. In addition, the difficulties encountered in the restructuring of Croatian shipyards in the post-transition period and the solutions to these problems are presented. Finally, an overview of the current state of the industry is given with a particular emphasis on the outsourcing decision and supply chain.

In the fourth section the empirical analysis is carried out. First, the differences between the application of the TCE approach in a typical manufacturing industry and in the shipbuilding industry are described. This is because the process of building a ship is considered to be more similar to a construction project than to manufacturing operations, and hence, this can affect the circumstances that give rise to opportunistic behaviour and to the subsequent hold-up problem. Second, the methodology used to perform the test as well as the data and the way it was collected are described. Furthermore, the variables used in the empirical model and their expected impact on the make-or-buy decision are explained. Finally, the results of the empirical estimation with different functional forms are presented and discussed. The final section gives concluding remarks; the issues raised in the previous sections are analysed in more detail and some directions for future research are given.

## 2. Literature Review of Transaction Cost Economics

> *"The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism"*
>
> *Coase (1937: 391)*

A fundamental question for the firm is to decide what it will make and what it will buy. Historically, this decision has been made taking into account only the costs of production, but firms are becoming more aware of the strategic implications of such decisions and understand the importance of considering several other factors. As explained by Williamson (1985:17) the make-or-buy decision is the paradigm problem of TCE which is solved by the "economic institutions of capitalism (who) have the main purpose and effect of economising on transaction costs". TCE analyses simply why firms exist and what their economic function is; in other words, why certain transactions are organised internally while other are mediated through markets (Milgrom and Roberts, 1992).

### 2.1 What are Transaction Costs?

Providing an answer to the question posed in the above subtitle is indeed crucial, as without a clear-cut definition the transaction cost approach will be unable to explain the differences amongst the choice of

[1] The ship is a system of different parts: in this study components and tasks are grouped in five subcategories (hull, machinery, outfitting, electrical and a miscellaneous category)

governance structures. It is hence important to distinguish transaction costs from the already well defined category known as production costs.

Amongst the first who tried to answer this question was Ronald Coase (1937:391) in his seminal article "The Nature of the Firm" where he notes that the most important costs "of organising production through the price mechanism are that of discovering what the relevant prices are…and the costs of negotiating and concluding separate contracts for each exchange transactions which takes place on the market". However, Hodgson (1988) argues that this definition may refer only to the costs of gathering the relevant price information rather than on the total cost of completing the transaction. Kenneth Arrow (1969) defines such costs as the costs of running the system, succeeding in this way in distinguishing them from the costs of producing goods and services that are included in the production function. Hodgson (1988) criticised this definition for being too vague.

Williamson (1985: 19) uses an analogy and explains transaction costs as "the economic equivalent of frictions in physical system". Furthermore, he argues that although several economists were aware of the problem of 'frictions', they were not able to define it. However, Hodgson (1988) debates that an analogy is not a substitute for a definition and criticised it for being misleading. Additionally, he refers to the work of Dahlman (1979) for being able to give a more precise definition of the analysed concept of transaction costs. Dahlman (1979: 148) includes three different types of costs; search and information costs, bargaining and decision costs, policing and enforcement costs, that he merges into a single one as they all "represent losses due to lack of information". Dahlman's definition makes a clear distinction between transaction costs that arise due to information imperfections and production costs that arise due to the use of factors of production. Hendrikse (2003) notes that this distinction is crucial for TCE theory as this approach simplifies these costs so that they can be determined separately and added together to obtain the costs associated with a particular governance structure. His final note is "that production costs can be ignored in determining the most efficient choice of governance" as this choice is based on minimising transaction costs (Hendrikse, 2003: 211). However, Rao (2003) argues that concentrating only on the costs of information and related organisations may sometimes be insufficient to understand total costs, and suggests the inclusion of opportunity costs of alternative governance structures as a solution.

In one of the most important classifications, Milgrom and Roberts (1992) distinguish between two types of transaction costs. The first type, known as coordination costs, includes the direct costs of collecting and transmitting information as well as the costs of delays resulting from the communication and elaboration of this information. These costs occur because decision makers face insufficient or inaccurate information and are closely associated with the make-or-buy decision. Coordination problems are resolved by organising transactions through different governance structures. The second type, known as motivation costs, is related to informational asymmetries and imperfect commitment. These costs are associated with the 'hold-up' problem, as motivational problems are likely to increase the incentive for some parties involved in the contract relationship to engage in opportunistic behaviour.

## *2.2 Theoretical Background of the Transaction Cost Economics Paradigm*

The theoretical background of the transaction cost paradigm was first introduced by Coase (1937), who explained that the boundaries of the firm do not depend only on the available technology, but on the costs of transactions as well. He explained that in some instances the costs of contracting in the market may be higher than those of exchange inside the firm. The costs of these transactions may be reduced by internalising some activities into the firm. The Coasian framework helps to understand not only the existence of the firm, but also its size and scope. According to his work, the size of the firm is identified by the point where the marginal cost of transacting in the market equals the marginal cost of additional mistakes and more administration in the firm. His contribution is important because using the transaction as the basic

unit of analysis and identifying uncertainty as a relevant factor in decision-making[2], he was able to represent the firm not only as a part of the market but also as an alternative to it; in other words, a firm can decide whether to organise a transaction internally or through the market mechanism.

The questions raised by Coase (1937) on the nature of the firm were later developed by Williamson in his famous books *Markets and Hierarchies* (1975) and *The Economic Institutions of Capitalism* (1985), who created a stronger basis for the transaction cost approach. The main idea of this approach was to describe firms not in neoclassical terms, i.e. as a production function, but in organisational terms, i.e. as governance structures (Boerner and Macher, 2002). Williamson's framework is based on the interaction between two behavioural assumptions (bounded rationality and opportunistic behaviour) and three dimensions of transactions (asset specificity, uncertainty and frequency).

Bounded rationality is explained by Simon (1961: xxiv) as human behaviour that is "intendedly rational, but only limitedly so". In other words, decision-makers are constrained by neurophysiological limits that are reflected in the lack of cognitive capabilities of processing and storing information, and by language limits, which refer to the inability to express thoughts and feelings in a way that is fully comprehensive to others (Rindfleisch and Heide, 1997). Parties involved in a contract cannot take into consideration every possible contingency, which precludes the writing of complete contracts. However, as explained by Williamson (1975) bounded rationality becomes important only once the cognitive limits are reached. On the other hand, opportunism, defined by Williamson (1975: 26) as "self interest seeking with guile" involves "false or empty, that is, self-disbelieved, threats and promises" in the expectation of obtaining an advantage (Goffman, 1969: 105). Arrow (1969) explains that a transaction is subject to hazards of opportunistic behaviour when information is unequally distributed between the parties involved in this transaction. Yet Williamson (1976) argues that it is not asymmetric information *per se* that gives rise to opportunistic behaviour, but it must be accompanied with high costs of achieving information parity, as well as with a small number condition. The latter condition is necessary as among large number of bidders opportunistic inclinations won't be successful (Williamson, 1976). However, as explained by Douma and Schreuder (1998), not everyone behaves opportunistically, although it is difficult to distinguish *ex ante* parties who will behave opportunistically from those who won't. To safeguard against such behaviour, TCE matches transactions that differ in their attributes, with the appropriate governance structures "in a discriminating way" (Williamson, 1985: 18). There are three critical dimensions of transactions:

a) **Asset specificity** refers to the degree to which a transaction needs to be supported by a relation-specific investment that cannot be redeployed without additional costs.[3]
b) **Uncertainty** about future events and other parties' actions, which is closely linked to bounded rationality
c) **Frequency** with which the transaction occurs that may be one-off or recurrent

Although each of these dimensions is important, the first, asset specificity, is considered crucial when deciding upon the preferred governance structure.

### *2.2.1 The 'make-or-buy' Decision*

A fundamental decision that a firm has to face is the determination of when it will buy from the spot market and when it will make its own inputs. New information technologies as well as faster and more efficient ways of communicating have increased the interest in this question.

[2] According to Knight (1921) the economic system is either complex or dynamic, which creates limitations known as uncertainty

[3] Williamson (1991) distinguishes amongst six types of asset specificity. First, site specificity, refers to assets that are closely located to reduce transportation and inventory costs. Second, physical asset specificity, refers to relationship specific machinery and equipment. Human asset specificity is the third type, which refers to transaction-specific know-how and skills whose value is lower outside a specific relationship than inside it. Fourth is brand name capital which is an intangible asset reflected in consumer perceptions. The fifth, dedicated assets are investments in plant and equipment made to satisfy a specific customer. The last, temporal specificity, refers to the importance of scheduling and using assets at a particular point of time

The make-or-buy decision can be easily explained: economic decision-makers will choose the governance structure that minimises transaction costs. In other words, firms will organise production internally if this is the most efficient solution; otherwise, the firm will buy the necessary components from the spot market. However, while the classical literature on vertical integration focuses on the simple dichotomy between the decisions to 'make' or 'buy', TCE augments the possible arrangements with a wide range of market-based governance structures that represent valid alternatives to both spot market transactions and vertical integration (Joskow, 2003). This is to say, governance structures include markets, hierarchies and hybrids. As explained by Shelanski and Klein (1995) the anonymous spot market is used in the case of simple transactions where basic commodities are traded, as the price mechanism allows the participants to adapt quickly to changing circumstances. On the other hand, when specialised assets are at stake and when product or input markets are thin[4], integration may be desirable. TCE posits that such hierarchies represent the safeguard against opportunistic behaviour "as they provide efficient mechanisms for responding to change where coordination adaptation is needed" (Klein, 2004: 4). However, compared with a more decentralised governance structure, hierarchies tend to increase administrative and bureaucratic costs, and are likely to remove incentives to maximise profits (Bigelow, 2004). However, these two governance arrangements[5] are just two polar cases. Between these two poles there is a variety of hybrid modes that include various types of franchises, joint ventures, long-term contracts, holding companies and public enterprises. It should be noted that there is a trade-off between better coordination and protection for specific investments that can be achieved in the firm on one side, and higher incentives of market relations on the other side (Shelanski and Klein, 1995). However, different organisational forms are never assessed alone; their efficiency is examined in relation to other modes of governance. Next, the hold-up problem is analysed in more detail.

### *2.2.2 The 'Hold-up'[6] Problem*

When contracts are incomplete and the relationship involves transaction specific investments, one party may act opportunistically by attempting to renegotiate the terms of the contract, ex-post. In such cases, it may happen that a desirable investment from a welfare perspective will not be realised because of the fear of post-contractual opportunism; this situation is known as the 'hold-up' problem (Besanko et al, 1996). The hold-up problem arises because appropriable quasi-rents are created. As explained by Klein, Crawford and Alchian (1978), while the rent is simply the profit that a firm expects to get in the case when a specific asset is used, assuming that all goes as planned, the quasi rent is the extra profit that the firm gets if everything goes as planned, versus the profit the firm would receive if it had to turn to the second-best alternative. When a specific investment is made and such quasi-rents are created the possibility of *ex-post* opportunistic behaviour becomes real. The hold-up problem is crucial for the make-or-buy decision as it influences the chosen governance structure.

When the degree of asset specificity is low and there are no quasi-rents, the cost of purchasing the component from the market ('buy' strategy) is the lowest. On the other hand, when the degree of asset specificity is high and quasi-rents are at stake, vertical integration (the "make" strategy) is chosen, as ownership of transaction-specific assets is a way of safeguarding against opportunistic behaviour. Finally, when the degree of asset specificity is at an intermediate level (Hendrikse; 2003), or a relationship does involve only physical asset specificity (Monteverde and Teece, 1982a; Masten *et al*, 1989), a hybrid governance structure may be chosen to minimise transaction costs. It should be noted, however, that hybrid organisational structures and

[4] A market is said to be thin when there is only a small number of buyers and sellers

[5] 'buy' in the case of spot markets and 'make' in the case of vertical integration

[6] The possibility of hold-up influences the choice of organisational arrangements, i.e make-or-buy; the higher the probability of ex-post opportunistic behaviour the more likely is the transaction to be internalised.

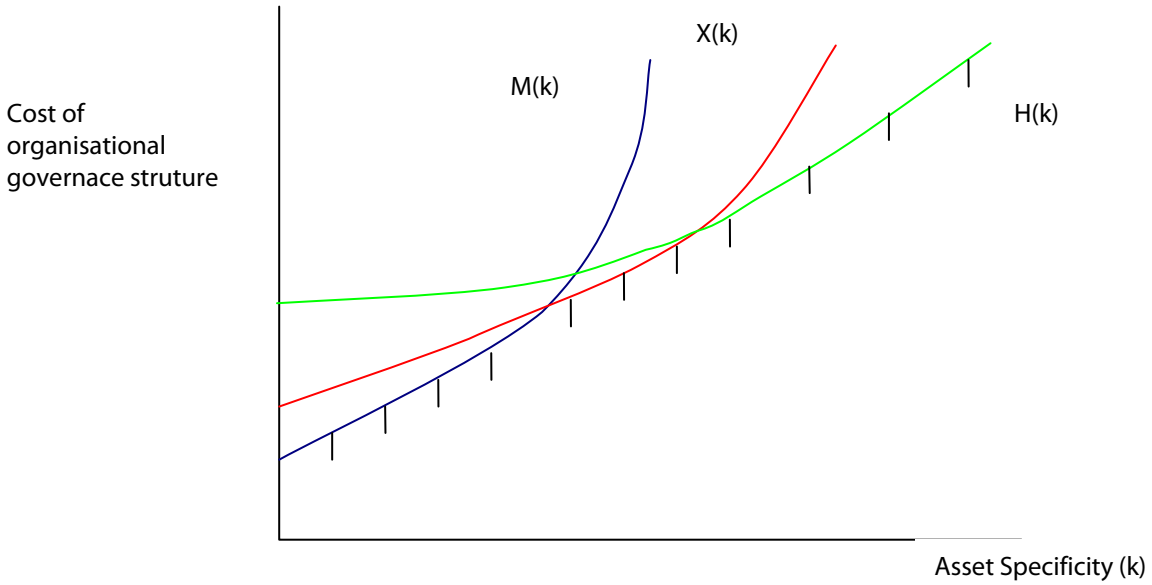


**Figure 1: Efficient governance structure choice in relation to asset specificity**
Source: Hendrikse (2003: 215)

vertical integration can only mitigate opportunistic behaviour.

To conclude, it is important to stress that both the make-or-buy decision and the hold-up problem are important factors to consider when analysing the Croatian shipbuilding industry because of the important role played by outsourcing and contract design in this industry.

## *2.3 Empirical Evidence on Transaction Cost Economics*

The emergence of TCE during the 1970's and 1980's has created a substantial body of empirical work, and the number of studies has been estimated in a recent survey by Boerner and Macher (2002) to be over 600. Transaction cost reasoning has been applied in several business-related fields, as well as in other disciplines that are not so closely related to business (Boerner and Macher, 2002; Klein, 2004).

The empirical literature on TCE employs a variety of econometric and historical methods. According to these methods, most authors (Klein and Shelanski, 1995; Boerner and Macher, 2002; Klein, 2004) have divided the empirical literature into three broad categories:

1. Qualitative case studies
2. Quantitative studies
3. Cross-sectional econometric analysis

The first category refers to researches based on a particular event or transaction. The TCE literature contains a large number of good case studies, of which one example is Williamson's (1976) analysis of cable television franchising[7]. Case studies are the most frequent form of empirical analysis in TCE due to following reasons. First, the main variables in the TCE analysis are very difficult to measure quantitatively and are usually collected using questionnaires and surveys. As a result, the data are based on the respondents' stated beliefs and subjective valuations. Secondly, as these measures are based on ordinal ranking, it is hard to compare data obtained from different industries. However, although case studies are not affected by these problems, they have been criticised for being too specific.

The second category includes quantitative studies that examine some specific aspects of governance structure or contract. Good examples of this category are Masten's (1984) investigation of the contracting practices in the US aerospace industry and Walker and

[7] Other examples of case studies refer to organisational arrangements between rail operators and freight (Palay, 1984), between coal mines and electric utilities (Joskow, 1985) and the acquisition of Fisher Body by GM (Coase, 2000; Klein, 1988; Klein, 2000).

Weber's (1984) study of automobile component procurement. These studies usually use a probit or logit model, where the dichotomous dependent variable is the chosen governance structure ('make' or 'buy') while the independent variables, measured by proxies such as asset specificity, uncertainty and frequency are the key attributes of the transaction. In general, the results of these models are consistent with the predictions of the theory.

The third category attempts to measure transaction costs directly and consistently across different firms and industries. Levy's (1985), MacDonald's (1985) and Caves and Bradburd's (1988) examinations of vertical integration are only some of the examples included in this category[8].

The first part of this section has tried to categorise the empirical literature in TCE. Next, the analysis will assess the empirical work on component procurement and, in particular, the one related to shipbuilding, as a background for the empirical investigation that will be undertaken in section three.

The contribution of Masten (1984) on the make-or-buy decision, as well as that of Masten *et al.* (1991) and Love and Stephen (1999), in the particular case of the shipbuilding industry, have been very significant, and represent the basis of this paper. Masten (1984) analyses the procurement decision in the US aerospace industry using a sample of 1,887 components that are either coded as made or bought, and focuses on the effect of asset specificity and uncertainty as determinants of vertical integration. Questionnaires were designed to collect information about the different variables included in the model that were completed by a team of company representatives. Using a probit model since the variable is dichotomous (either 'make' or 'buy') Masten concludes that the probability that a transaction will be internalised is higher the more complex and specific the design of a component.

Additionally, Masten *et al* (1991) analyse the procurement decision in a large US naval shipbuilder. While other studies assess the make-or-buy decision in the manufacturing industry, their study attempts to test the TCE hypothesis in the construction industry. Using a probit estimation as well as a two stage approach, Masten *et al* (1991) investigate the relationship between in-house production and asset specificity, along with complexity and other control variables. The results indicate that temporal specificity has the most significant influence on the integration decision followed by human asset specificity. However, the estimated coefficient on physical asset specificity is significantly negative, which can be explained by the recent theoretical and empirical developments suggesting that problems related to relationship-specific physical capital can be dealt using quasi-vertical integration[9]. In addition, they found evidence that the firm is more likely to integrate activities that are more similar to their core business, such as labour intensive operations and those that are candidates for "load levelling".

Finally, Love and Stephen (1999), in a study of UK naval shipbuilding augmented Masten *et al*'s (1991) model with a variable that controls for economies of scale and with another variable that captures the effect of frequency on the cost of hold-up. They found that the number of suppliers, as well as the degree of human asset specificity, is not likely to affect the cost of hold-up, while the other TCE variables such as frequency, physical and temporal specificity are in accordance with the theory's predictions.

The importance of these studies in terms of this paper is multiple. First, the study of Masten (1984) is significant because of the use of a qualitative dependent variable model such as probit, in which the values of this dependent variable are bounded by 0 and 1, which will also be applied in the empirical section of this paper. Second, the work of Masten *et al* (1991) indicates that shipbuilding is an industry suitable to be analysed through a TCE lens, while the applied methodology shows that transaction costs can be analysed using complex econometric techniques.

[8]Beside these three main categories, transaction cost economists are trying to implement new methods with the aim of overcoming the shortcomings of the techniques currently used. One modern approach that is gaining increasing importance is the two stage approach first implemented by Masten *et al* (1991) as well as panel data estimation, good examples of which are the estimation of Gonzalez-Diaz *et al* (2000) of subcontracting decisions in the Spanish construction industry and Bigelow's (2004) analysis of the US automobile industry.

[9] In other words, these specialised assets are owned by the prime contractor

Third, the research of Love and Stephen (1999) is notable for the inclusion of several control variables and because it indicates that more than one precedent study exists in the area to follow. Finally, all these studies used questionnaires to collect the data used in their empirical investigations.

## *3. The Croatian Shipbuilding Industry*

### *3.1. Historical Overview*

Shipbuilding and ship-repairing activities in Croatia have a long tradition. Thousands of vessels of all types were built by local inhabitants from time immemorial until today. Most of the shipyards on the Eastern Adriatic coast were founded as Austrian Naval Arsenals in the nineteenth and beginning of the twentieth century. They were amongst the most successful shipyards from that time, and specialised in the construction of naval ships, ranging from battleships to cruisers and submarines (www.hb.hr). Some decline in the shipbuilding activity was registered during the first Yugoslav (1918-1941) and Italian administration, as the administrative centres were far from the coast and not interested in developing the littoral economy (Bartlett *et al*, 2002). After World War II, the eastern Adriatic coast became part of the Federal Republic of Yugoslavia, and so was the case with its shipyards. However, almost 80% of the shipbuilding capacity was severely damaged or in need of replacement (Bateman *et al*, 1998). The Yugoslav state, which was the new owner of the shipyards, started the reconstruction of the existing complexes and the building of a new shipyard soon after the end of the world's largest conflict. However, in socialist countries profitability was not a determinant of the efficacy of a firm, and hence it was not shipyards' main concern as before and still is the case in modern capitalistic economies. Shipyards were organised in accordance with socialism's principles of production: they were multifunctional units in which shipbuilding was just one objective, while other objectives were the provision of social services to employees and the maintenance and enforcement of some political power and control (Bitzer and von Hirschhausen, 1997). To achieve these aims socialist countries tended to organise the complete production process in-house. However, when almost all transactions are internalised, transaction costs are likely to rise substantially. As explained by Coase (1937) and Williamson (1975; 1985) the costs of transacting may be reduced by combining different governance structures, or, in other words, by organising some activities inside the firm while contracting out others from the market.

As was the case with other socialist countries, Yugoslav shipyards were characterised by a high degree of self-sufficiency; deep vertical integration with the in-house capacity to manufacture almost everything that went into a modern ship apart from some sophisticated components. The three largest shipyards, Uljanik, 3Maj and Brodosplit were already almost completely vertically integrated and self-sufficient in the 1950s: they produced diesel engines, ship outfits, cranes, generators, machinery equipment including winches, accommodation, sanitary equipment, switchboards, etc. In some cases these shipyards produced even the actual capital equipment used in the production process[10] (Bateman *et al*, 1998). On the other hand, the two medium-sized shipyards – Kraljevica and Trogir – were involved in some ship-repairing work and in the construction of smaller and less complex ships. These shipyards were less vertically integrated than the three largest ones, and bought-out the majority of parts, components and subcomponents from the latter. This tendency can be explained by the lower degree of asset-specificity necessary to build less complex ships, and by the insufficient amount of competent and specialised human capital in these territories.

It is important to stress the escalation of the Yugoslav shipbuilding industry, which in the 1960s and 1970s was ranked as the world's third largest by tonnage output after Japan and South Korea. However, despite the high level of productivity and lower wages compared with Japan and Western European Countries, Yugoslav shipyards encountered several difficulties to break even. The number of orders

[10] For example, Uljanik started the production of welding machines soon after the introduction of welding techniques in the hull construction, while 3Maj produced cranes used in the construction phase.

reduced during the 1980s and crashed after Yugoslavia incurred the biggest financial crisis in its history and finally disaggregated (Bartlett *et al*, 2002).

### *3.2 The Post-Socialist Period*

After becoming independent in 1991, Croatia inherited the major part of the former Yugoslav shipbuilding capacities. However, the industry was highly indebted, partly because of some unprofitable contracts concluded at the end of the 1980s and partly due to the unsuccessful 'shock therapy'[11] programme in 1989 (Bateman *et al*, 1998). On the other hand, the transition from planned to market economy implied profitability as an important factor when considering the efficiency of a company: once the planned economy had been left behind, the choice between different ways of transacting (governance structures) made in accordance to the related transaction costs became an important factor influencing profitability. It became clear that large and highly vertically integrated firms, with almost 10,000 employees and 90% of production made in-house would be stagnant and inefficient due to high transaction costs[12]. For this reason, the restructuring of the industry was necessary with particular emphasis on reducing the number of employees and increasing the level of outsourcing in key areas.

However, the necessary restructuring of the industry was put on hold during the war (1992-1995) and as a result, the Croatian shipbuilding industry fell in world rankings from the third position in 1990 to the thirteenth position in 1996 (Ministry of Economic Affairs, 1997). In 1995, the Croatian Government introduced the "Rehabilitation Act of Special Enterprises" that included state-owned shipyards: the act involved three steps. The first, rehabilitation, was designed to reduce the inherited debt of the previous state. To achieve this aim a debt for equity swap was arranged and, as a result, several state agencies became owners of parts of the industry (Croatia Outlook, 1997). The second phase, restructuring, has been carried out by a German consulting team that concentrated its efforts on the industry's problems and their possible solutions (Bateman *et al*, 1998). According to these recommendations, large shipbuilding firms were split in different parts in order to focus on their core activities. First of all, shipbuilding concerns got rid of unnecessary departments by privatising, selling or simply closing them. On the other hand, departments producing marine equipment, such as those that produced diesel engines, machinery, electrical parts and capital equipment, as well as the shipyards itself were organised as independent companies inside shipbuilding groups[13]. The rationale behind this decision can be explained as follows: internal organisation costs tend to be higher when transactions are intrinsically different, either by their location or some other characteristics, from other operations in which the firm is engaged (Masten *et al*, 1991: 14)[14]. Furthermore, another important part of the plan was to increase outsourcing in key areas and to develop a network of reliable small and medium suppliers and subcontractors, as several components and tasks were highly location and temporal specific. In addition, in order to gain and maintain competitiveness in the global ship market, the shipyards were supposed to specialise in certain areas of shipbuilding. Finally, shipyards introduced new types of erection technologies based on principles such as structural building in blocks, block outfitting to a maximum degree and several others (Kanerva *et al*, 2002).

Although progress has been significant, problems still remain as the government's attempts to privatise the remaining shipyards were not successful. In addition,

[11] According to this strategy the Yugoslav government made large investments in order to restructure large shipyards in a short period of time. However, even after these huge investments shipyards were still not competitive in the world shipbuilding market.

[12] This because the socialist way of organising production created a significant administrational and bureaucratic burden that increased prohibitively the costs of transacting (and organising production) within shipyards

[13] For example, the shipyard in Split organised the construction of new ships in two companies: Brodosplit specialised in the production of large commercial ships and Brodosplit-BSO focused on the construction of smaller specialised ships, offshore objects and naval vessels.

[14] In other words, the bigger the differences between the shipyard's primary operations and other activities, the higher the transaction costs of organising these activities in-house.

many shipyards[15] tend to suffer from labour supply difficulties and are forced to hire workers from other countries such as Bosnia and Herzegovina, the Slovak Republic and the Philippines.

### *3.3. The Present State of the Industry*

The shipbuilding industry is a branch that operates on the global market and in the case of Croatia is almost completely orientated on export. According to the scope of business, capacity and size of ships built, Croatian shipyards can be classified by three main categories (Croatian Chamber of Economy, 2003):

- Large shipyards – Brodosplit, 3Maj, Uljanik, Trogir, Kraljevica and Brodosplit-BSO.
- Medium-sized shipyards – less than 10.
- Small shipyards – several dozens specialised in the construction and repairing of small ships, usually on the coast, though some yards were recently built inland as well.

As this study focuses on large shipyards, it is necessary to calculate a concentration index to confirm the importance of these. However, there is no data available for sales of new ships referring to the Croatian shipbuilding industry as a whole[16]. However, as the smallest among the large shipyards accounts for approximately 2% of the total turnover of these six shipyards, and that there are less than 10 medium shipyards, we believe that the market share of large shipyards should not be less than 80%.

| No | Company | Total Turnover (in 1000 HRK) |
|---|---|---|
| 1. | BRODOSPLIT BRODOGRADILIŠTE | 1.763.714 |
| 2. | ULJANIK BRODOGRADILIŠTE | 1.389.882 |
| 3. | 3. MAJ BRODOGRADILIŠTE | 1.127.918 |
| 4. | BRODOTROGIR | 568.181 |
| 5. | BRODOGRADILISTE KRALJEVICA | 128.910 |
| 6. | BRODOSPLIT-BSO | 119.000 |

Market share Brodosplit-BSO =

$$\frac{Turnover\ (Brodosplit-BSO)}{Total\ turnover\ (large\ shipyards)} = \frac{119000}{5097605} = 0.0233 = 2.33\%$$

**Table 1: Market share calculations**
Source: Croatian Chamber of Economy, 2005. " *Shipbuilding Industry"* Zagreb

The large shipyard group employs 12,400 employees in total, and are supported by a net of almost 1,500 companies (marine equipment producers, subcontractors, salespersons, etc), in particular SME's located close to shipyards. According to the 2005 world order book the Croatian shipbuilding industry was in fourth place with 69 contracted ships, behind Japan, South Korea and China (Croatian Chamber of Economy, 2005).

| | COUNTRY | NUMBER | DEADWEIGHT(in tdw) |
|---|---|---|---|
| 1. | Japan | 1063 | 80.707.413,00 |
| 2. | Korea (South) | 1038 | 75.505.799,00 |
| 3. | China | 706 | 34.996.822,00 |
| **4.** | **Croatia** | **69** | **3.482.869,00** |
| 5. | Taiwan | 45 | 2.735.495,00 |
| 6. | Poland | 78 | 2.704.811,00 |
| 7. | Germany | 101 | 2.637.842,00 |
| 8. | Denmark | 16 | 1.736.400,00 |
| 9. | Philippines | 25 | 1.324.883,00 |
| 10. | Iran | 28 | 1.223.800,00 |

**Table 2:** NEW BUILDINGS WORLD ORDER BOOK (3. 3. 2005.)
**Source:** Croatian Chamber of Economy, 2005

It is important to note that Croatian yards are prevalently focused on commercial shipbuilding, especially cargo vessels. As opposed to EU shipyards, which focus on the construction of ships for special purposes and high-tech ships, or Far East yards, specialised in the construction of low-tech ships,

[15] Especially those located close to the Italian border due to higher wages offered by the local shipyard Fincantieri
[16] We tried to collect this figure by enquiring with the Croatian Chamber of Commerce, the Croatian Statistical Bureau and the Croatian Ministry of Finance, without success.

Croatian shipyards have found their place in the world's shipbuilding market by constructing specialised medium-complex merchant ships and offshore platforms[17]. On the other hand, while during the socialist period several warships were built, only a few small naval vessels and submarines were constructed after Croatia gained independence.

### *3.3.1 Outsourcing and Supplier Chain*

As in other parts of the world, outsourcing in the Croatian shipbuilding industry began with two important areas: special equipment and workforce. However, Croatian shipyards have tried to be selective when considering the outsourcing decision, warned by bad experiences in European shipyards where outsourcing brought several new problems as technical coordination between different parties involved was difficult to manage, especially because of scheduling and complex installation.

According to its components the ship can be divided in 4 main subsystems, and the supply chain can be explained through the different processes involved in them[18]:

1. Hull erection – this is one of the most important processes in a shipyard's business, and in the Croatian case it is performed prevalently by shipyards themselves. They just procure the raw material necessary for the hull, such as steel plates, panels, welding material, paints and other chemical products and perform the necessary tasks and operations such as plate cutting and forming, welding, coating and painting. Only a few components are outsourced and subcontractors are used in periods of higher demand and for jobs with uneven workload.
2. Engine, machinery and related installation – several shipyards in Croatia used to manufacture their own engines and machinery. The large shipyard groups produce engines under licence of the world's biggest marine engine manufacturers, as well as other equipment such as cranes (3Maj, Brodosplit), generators, battery chargers (Uljanik) and several other components. However, it is necessary to note that the satellite firms producing engines and machinery are just divisions inherited from the socialist period, and that these represent more a burden than a necessity for modern shipyards. On the other hand, shipyards tend to buy machinery from Croatian suppliers when possible[19], and usually perform the related installation in-house.
3. Outfitting – Apart form some components, Croatian shipyards do not produce marine equipment, but are supported by an efficient network of domestic and foreign suppliers and subcontractors. On the other hand, the equipment is usually completely installed by the shipyard's workforce.
4. Electrics and electronics – No shipyard in Croatia produces electrical and electronic parts. They are all outsourced, partly from local suppliers (less complex parts) and partly from international suppliers (more complex parts such as radar and navigation systems). In addition, the installation of these parts is often performed in-house, while some parts are installed by the manufacturer of the component itself.

It is interesting to note that some important tasks such as design and engineering have not been outsourced because of high human specificity related to the characteristics of the ship produced and of the yard itself. When they are subcontracted, this is done on a per-discipline basis only[20] (Kanerva *et al*, 2002). However, the problem with some Croatian shipyards is that the outsourcing decision is still too influenced by the direct purchase costs, and it does not take in consideration the possible transaction costs. The more components are delivered by suppliers the more complex coordination becomes (Bitzer and von Hirschhausen, 1997). In other words, as the level of

[17] For example, the shipyard at Kraljevica is one of only two yards in the world actually building asphalt tankers, while the shipyard at Uljanik has a share of 8.1% in the world order book for car carriers.
[18] Data have been collected through questionnaires and structured interviews with managers/engineers in the relevant companies
[19] Due to several pressures form various ministries pushing to increase the quantity of Croatian materials and inputs installed in a ship. Shipyards are obliged to incorporate domestic inputs even when their price is 15-20% higher then their foreign counterparts.
[20] i.e. steel, piping, machinery, outfitting, electricity, etc

| | Company | | | | | |
|---|---|---|---|---|---|---|
| | **Brodosplit** | **3Maj** | **Uljanik** | **Trogir** | **Kraljevica** | **Brodosplit-BSO** |
| **Only shipyard** | 50-60% | 50-60% | 50-55% | 55-65% | 55-65% | 60-65% |
| **Shipyard group** | 35-45% | 30-40% | 35-45% | / | / | / |
| **Employees** | 4.361 | 2.321 | 1.998 | 1.307 | 557 | 200 |

**Table 3:** The level of outsourcing in major Croatian shipyards and number of employees
**Source:** Structured interviews with shipyards' and Croatian Shipbuilding Corporation's representatives

outsourcing increases, the coordination costs, which are just a type of transaction costs, increase as well.

If we take a further look at the level of outsourcing, it ranges between 35% and 65% depending on the shipyard, type of ship and several other characteristics.

As can be noted from table 3, the three biggest shipyards, according to the number of employees, tend to rely less on outsourcing than the three smaller ones. These differences are even more evident when considering the whole shipyard groups[21]. On the other hand, smaller shipyards tend to rely more on procurement; these have concentrated on steel and piping work while subcontracting outfitting and similar tasks.

It would have been interesting to study the link between the performance of individual shipyards and their level of outsourcing. However, the present state of the industry makes a similar analysis worthless; shipyards are still under restructuring and are not profitable. Furthermore, the recent unfavourable changes in the US dollar exchange rate and in the price of steel in the world market, as well as political interests in different counties where the shipyards are located, make it impossible to link the performance of these shipyards directly with their organisational arrangements. Nevertheless, it is useful to note that many shipyards in Western European countries have increased their level of outsourcing to almost 70%, which has allowed them to drastically decrease the number of workers and to concentrate on their core business (Bitzer and von Hirschhausen, 1997). These shipyards usually perform better than those relying more on in-house production as they are able to reduce costs and attenuate the traditional problem in shipbuilding- uncertainty of demand.

[21] That include plants producing diesel engines and other marine equipment

The world shipbuilding industry has experienced significant changes during the last 20 years. From a heavy industry it has turned to a high-tech, logistically intensive production process (Bitzer and von Hirschhausen, 1997). Nevertheless, it still remains primarily a construction industry. Modern shipyards in developed countries increasingly rely on suppliers for manufacturing and even more for developing components and parts. Some shipyards have already moved towards an assembly type of production facility, in which they concentrate only on their core business, which is steel processing, hull production, piping and machinery installation as well as coordination and management of the complete project (Kanerva *et al*, 2002). This enables them to economise on transaction costs by focusing on primary activities while outsourcing other operations that differ substantially from these. Croatian yards are following the steps of these shipyards by restructuring their organisations from highly-integrated to non-integrated production structures. However, a developed network of efficient and loyal suppliers and subcontractors is the necessary condition for the success of these yards. Finally, the yards have to weigh the total costs associated with the "make" and "buy" strategy, and only then decide on their preferred governance structure.

## *4. Data, Methodology and Results of The Empirical Investigation*

### *4.1 Specific Characteristics of the Construction Project*

Amongst the several differences between the construction project and manufacturing activity, the

most important are the immobile nature, uniqueness and high variety of the final product (Gonzalez *et al*, 2000; Masten *et al*, 1991). While manufacturing operations imply the production of several smaller parts and products in different locations, the construction project consists of building a single or a small number of immobile structures in a particular location. On one hand, the manufacturing industry is characterised by mass production in which the use of specific assets is usually economical. On the other hand, the output of the construction project must be adaptable to particular buyers and uses. Because of the uniqueness of the final product and the unique location where the construction takes place, the assets used in the construction project are less likely to be transaction specific, i.e. they tend to be mobile and adaptable to several different uses (Gonzalez *et al*, 2000). Hence, physical asset specificity is considered to be a less important determinant of the governance structure in the construction industry than in manufacturing.

Another important characteristic of construction activities is the wide variety of final products that involve the mixture of dissimilar intermediate activities (Gonzalez *et al*, 2000). Furthermore, the production process in the construction industry usually implies the integration of relatively low technology and labour intensive activities (Hagedoorn, 1993; Eccles, 1981; Masten *et al*, 1991). In addition, Gonzalez *et al* (2000) note that in the construction industry each contract represents an important part of a firm's overall sales, i.e. the demand is of a discrete nature.

It is necessary to stress that the unique nature and location of the construction project prevents the possibility of holding buffer inventories, such as those used in the manufacturing industry. Eccles (1981) argues that in a similar environment the importance of timing and coordination becomes crucial. As many different tasks and specialities are involved simultaneously, it may happen that a new phase cannot begin until one or more others have been accomplished. This means that these phases must be scheduled strictly for the operations to proceed in a particular order. In other words, when delays happen these may prevent other activities from being completed until the precedent phase is accomplished or a new schedule is made. This may seriously affect the construction project by increasing its costs. A similar situation increases the potential for ex-post opportunistic behaviour. Even though the physical assets and human capital used to complete a phase of work may not be relationship specific, it is often extremely difficult to find another supplier that could perform the task or produce the component to suitable quality. On the other hand, as explained by Masten *et al* (1991) the contracting solution can just imperfectly solve similar hold-up problems, depending on the nature of the transaction. However, some specifications and completion dates may vary during the course of the project, changing in this way the original plan as well as its costs. Hence, as it is impossible to account for all possible contingences even in the most simple setting without incurring additional costs, contracting does not represent an acceptable solution in the construction as well as in other industries when transactions are complex and highly uncertain.

In sum, the distinctive characteristics between construction and manufacturing operations are likely to influence the choice of organisational form to a certain degree. In other words, the construction industry is usually associated with a higher degree of temporal specificity, which means that the chosen mode of organising a transaction will be prevalently determined by the degree to which some operations require precise scheduling. On the other hand, transaction specific physical assets and human capital tend to influence the choice of governance structure less than in manufacturing activities. However, they may influence the organisational choice of some construction activities when components that are standardised or used in a large number are produced (Masten *et al*, 1991).

## *4.2. Data and Methodology*

To test whether the analysed shipyards tend to choose their organisational structure in accordance to that predicted by the theory of transaction costs, a probit or logit model can be used since the dependent

variable is dichotomous: the two models give qualitatively similar results with the main difference represented by the slightly fatter tails of the logistic distribution (Gujarati, 2003: 614). Each sample component or task is coded as being prevalently produced/performed in house or by an external supplier/subcontractor[22]. Following Masten's (1984) model and augmenting it according to Williamson (1985) the objective is to test the following model[23]:

Make strategy

$$G_i = G_i^* \quad \text{if} \quad L_i^*(\omega_i) < \widetilde{L}_i(\lambda_i, \omega_i, \phi_i)$$

And buy strategy

$$G_i = \widetilde{G}_i \quad \text{if} \quad L_i^*(\omega_i) \geq \widetilde{L}_i(\lambda_i, \omega_i, \phi_i)$$

Where:

$G_i$ = chosen institution; $G_i^*$ = internal; $\widetilde{G}_i$ = external;

$L_i^*$ = internal costs; $\widetilde{L}_i$ = market costs;

$(\lambda)$ = specificity; $(\omega)$ = complexity, $(\phi)$ = frequency

According to the approach used by Monteverde and Teece (1982), Masten (1984) and Masten *et al* (1991) a list of 61 components and tasks was obtained, each of which was identified as either a "make" or "buy" item by a team composed by engineers in the three analysed shipyards. The procurement teams were asked to respond a questionnaire designed to elicit relevant information about each chosen component/task such as the amount of relationship specific human capital and physical assets involved in the production process, the extent of damage to the production programme associated with having a time delay in the supply of a component/task, the complexity of a component/task and the frequency with which these components/tasks are used. It should be noted that the data refer to components and tasks that are installed or performed in a typical multipurpose medium ship, rather than in any particular ship. In this way the data should reflect the construction characteristics of commercial shipbuilding in general without being influenced by idiosyncrasies related to the construction of a particular vessel. It is important to note that most variables[24] are ranked on a 10-point scale. The exceptions to this scale are the dummy variables associated with different shipyards (SHIPYARD and SHIPYARD2), those that link components/tasks to different subsystems (HULL, ELECTRICAL, MACHINERY, OUTFITTING) and those used to indicate shipyards' size (SIZEDOLLAR, EMPLOYEES and DWT).

### *4.2.1 Description of Variables*

As explained by Love and Stephen (1999) shipbuilding is essentially a construction project. Even though the ship is by its nature mobile, the bulk of the vessel involves the erection of several components and subcomponents and the execution of different tasks in a particular location. In addition, as it the case in most construction programmes, the importance of precise scheduling of different phases of work is also critical. Furthermore, because of the non-standardised nature of the components installed into the ship and the discrete nature of the production process, buffer inventories are not an economical safeguard against opportunistic behaviour. Moreover, as explained by Masten *et al* (1991), due to the complexity of modern ships and the uncertain demand, contracting solutions to the hold-up problem may be highly inefficient. When the level of complexity is high, it is necessary to take into account several different outcomes and writing a contract that is precise enough and at the same time flexible enough to allow changes in specifications is extremely expensive. In similar situations, firms are likely to choose vertical integration.

To assess the importance of transaction costs in the choice of governance structure in the Croatian shipbuilding industry, five TCE variables have been developed. There are three measures of specificity[25] as

[22] Several other empirical papers have used the same methodology, of which the most important are Masten (1984), Monteverde and Teece (1982) and Masten *et al* (1991)

[23] Masten's 1984 paper predates Williamson's 1985 book *The Economic Institutions of Capitalism* in which he identifies frequency as an important determinant of a firm's governance structure

[24] all the TCE variables

[25] Only three measures are used of the five explained by Williamson (1991). Site specificity is not used as it tends to be less important due to the distinctive characteristics of construction operations. On the other hand, dedicated assets are more likely to be used in naval

well as complexity and frequency. The first measure (HUM) corresponding to human asset specificity was obtained by asking the respondents to specify the degree to which the component or task uses the skills and knowledge of workers who have little alternative productive use. Given that Croatian shipyards have each specialised in the production of medium complex ships, the production process should imply some human relationship specific assets[26]. Furthermore, the lower complexity of tasks and the relatively large number of producers of similar ships indicates that the human capital acquired may not have a high degree of specificity (Masten *et al*, 1991). Although the theory predicts that specific human capital is likely to raise the costs of market organisation, it may be more expensive to manage workers with similar skills. However, the variable HUM is expected to have a positive effect on the integration decision in commercial shipbuilding, even though significantly weaker than in manufacturing activities.

The second measure (AS) based on the extent to which the component/task uses equipment or facilities which have little alternative productive use was created to reflect physical asset specificity. As explained in the previous section, physical assets in construction operations tend to be less relation specific, which is also true for shipbuilding. This is because most of the equipment is designed to be mobile to allow activities on different locations around the ship while other equipment such as welding and cutting machines is often used in other industries without any modifications (Love and Stephen, 1999). Even though TCE predicts that physical asset specificity will increase the costs of organising transactions through markets, relationship-specific assets are less likely to be important in this context due to the distinctive characteristics of shipbuilding.

The third measure of specificity (TEMP) refers to the need for precise scheduling and is represented by the extent of cost involved in having a time delay in the supply of a component or task. As explained by Love and Stephen (1999) the key factor here is the cost of delay, which is the sum of penalties arising from the failure to deliver the product according to the contract terms and the opportunity cost of idle resources. The need for precise scheduling tends to increase the potential for hold-up and hence is associated with an increase in the costs of external procurement. Therefore, the variable TEMP is expected to positively affect shipyards' decision to vertically integrate.

Besides the variables concerning specificity, two other TCE variables are used. The extent of complexity of components to use or tasks to perform (COMPLEX) is expected to positively affect the decision to organise production internally. Complexity is usually associated with increasing the costs of internal organisation, because the firm must internalise activities outside its core competencies. However, it is argued that greater complexity increases the ink costs of contracting relative to the costs of vertical integration, which increases the probability of the latter (Williamson, 1979). Similarly, the frequency with which a component is used or a task is performed (FREQ) is also expected to increase the probability of vertical integration. This is because investments in specialised assets are easier to recover when the frequency of a transaction is higher (Williamson, 1985).

To avoid misspecification of the model, several control variables are introduced. Following Monteverde and Teece (1982b) a control variable referring to the identity of sample firms is included. As the model is a combined cross-section aggregating the data of three Croatian shipyards, two dummy variables (SHIPYARD and SHIPYARD2) are used to control for systematic differences regarding vertical integration in these firms. The omitted category is the smallest amongst the three shipyards included in the investigation: Brodosplit BSO.

The second set of control variables relate to system effects. As the ship is a system of different parts, the analysed components and tasks were grouped into four categories (hull, machinery, outfitting and electrical) and a fifth miscellaneous category. Monteverde and Teece (1982) use this set of variables to assess if different subsystems display significantly different levels of vertical integration. For this purpose,

shipbuilding where series of vessels are produced for the same customer over a longer period of time (i.e. Ministry of Defence) which is not the case in commercial shipbuilding.

[26] e.g. Uljanik shipyard is specialised in the production of car and livestock-carriers and is one of the most important producers of these types of vessels

four dummy variables are created to represent each component's/task's membership in a subsystem. The omitted category is the miscellaneous one.

Coase (1937) argues that firms are more likely to integrate activities that are similar to their core business, as different activities tend to increase the degree of uncertainty and as a result, the costs of internal organisation. As shipbuilding involves primarily the coordination of labour intensive activities, as a measure of similarity with shipbuilding's core business, a variable (LABOUR) was included that reflects the relative capital-labour intensity of the production process (Masten *et al*, 1991). It is expected that the costs of internal organisation will be lower the higher the degree of labour intensity of production of a component or completion of a task.

To determine whether size of a shipyard is a significant indicator of the procurement decision, alternative measures of size (annual turnover expressed in American dollars, the number of employees in the shipyard and the total deadweight tonnage of the ships produced in the year 2004) are introduced in the last three specifications. However, because of the high collinearity between these variables and the dummy variables for shipyards, these measures cannot be included simultaneously in the model specification: either one or the other control variable can be used in the model. The following part will deal with the estimation of the make-or-buy decision in the Croatian shipbuilding industry.

### *4.3. Results*

Appendix 1 presents the correlation matrix of the variables used in the regression models. All the transaction cost variables are positively correlated with the internal organisation decision, with the highest degree of correlation represented by the variable FREQ while other TCE variables have relatively low coefficients. The only exception is the variable proxy for human asset specificity, which is slightly negatively correlated with vertical integration (-0.1131). The correlation between TCE variables is almost always positive, except in the case of frequency, which is negatively related to HUM and COMPLEX. On the other hand, it is necessary to note the high correlation coefficient between the last two mentioned variables (0.6372). Amongst the control variables, the labour intensity of production is strongly positively correlated with the 'make' decision. Finally, the alternative measures used as proxies for size are all positively related to integration.

The results of the probit and logit estimation are presented in Appendices 2 and 3 respectively. Even though either one or the other can be used to analyse similar datasets, the results of both are presented in this study as a mean of comparison. In addition, it is necessary to stress that since the independent variables are all ordinal in value, there is no natural interpretation of the coefficient and hence, the focus will be on the sign and significance of these coefficients. The study is presented as follows. First, specificity variables are included in the first three models. Next, the other two TCE variables that are likely to affect the decision to vertically integrate are introduced in models 4 and 5. Finally, in the last six models variables are added to control for different factors.

The first one is a simple model that tests the influence of just one variable, TEMP, on the integration decision. The coefficient on this variable is positive and highly significant at the 0.01 level. However, it is worth noting that the pseudo $R^2$ in the probit regression is 0.0434, which means that changes in this variable alone explain just 4.34% of the changes in the dependant variable. Yet as other variables are introduced in the model TEMP becomes insignificant and in certain specifications even negative. This leads us to conclude that the need for precise scheduling is likely to have just a weak influence on the integration decision, which is in contrast to theory predictions and previous studies (Masten *et al*, 1991, Love and Stephen, 1999) that found the probability that a component or task will be internalised increases when a delay in the supply of these is likely to substantially increase costs. Surprisingly, nor human asset specificity has the expected impact on the integration decision. The coefficient on the variable HUM is significant as expected but negative, indicating that the need to employ transaction-specific human assets tends to

reduce the costs of organising transactions through markets. On the other hand, the results indicate that the more specific to a company are the assets used in the production of a component or completion of a task, the higher is the probability that the production process will be internalised. In other words, the variable AS is positive and significant at the 0.01 and 0.05 level depending on the specification of the equation.

When considering the influence of the other two TCE variables, their effect varies across different models. Complexity has an insignificant effect in models 4 and 5 but becomes positively significant after the control variable that reflects the relative capital-labour intensity of the production process (LABOUR) is introduced, while the variable FREQ is significant in the first models but becomes insignificant in model 8 when dummy variables indicating different shipyards are included.

The last three models presented in Tables 5 and 6 are models that include control variables. Model 6 adds the relative capital/labour intensity of production to control for similarity between the component or task's production process and the company's core activities. The variable LABOUR is positive and highly significant as predicted, which means that the probability of integration is higher when the production process is labour intensive, i.e. when it is more similar to shipyards' main operations. The improvement of fit is striking, from 0.1781 to 0.3545 in the probit estimation, relative to the previous model. As explained previously, the second set of control variables deals with the influence of different subsystems on the integration decision. According to the regression results, the machinery, outfitting and electrical subsystems are likely to be differently, i.e. less integrated than the omitted category which is the miscellaneous one, while the probability for the hull subsystems of displaying different levels of integration in comparison to the omitted category is not significant[27]. In addition, the dummy variables SHIPYARD and SHIPYARD2 are positive and significant at the 5% level, indicating that the probability for shipyards Uljanik and Trogir to internalise another transaction is higher than for Brodosplit-BSO. In other words these two shipyards seem to be more vertically integrated than the latter one. Nevertheless, the last two sets of control variables improve substantially the explanatory power of the regression model. Finally, the empirical results indicate that size of the shipyard is likely to be a significant determinant of the 'make' decision as all the alternative measures used of size are positive and significant at the 1% level.

In sum, model 8 seems to be the most useful model for predicting the probability of vertical integration as the goodness of fit (pseudo $R^2$) is the highest both in the probit and logit estimation.

## *5. Conclusions and Directions for Further Research*

This paper analyses factors influencing vertical integration in the Croatian shipbuilding industry using a Transaction Cost Economics approach. As opposed to the vast empirical literature analysing the make-or-buy decision, which is largely consistent with the transaction cost theory of the firm, the empirical results of this study give only a weak and in some way contrasting support to TCE hypothesis as only a few key variables – physical asset specificity and complexity – significantly increase the probability that a transaction will be internalised. Surprisingly, temporal specificity is not likely to influence the choice of governance structure; it seems that managers in the analysed shipyards are not aware of the possible problems and cost increases that might arise from the failure to install a component or perform a task on time. Additionally, even though according to TCE theory frequency is considered to be an important predictor of vertical integration when specialised governance structures are at stake[28], in the presented setting it is not likely to increase its likelihood. However, as in commercial shipbuilding, asset specificity is less important than in other environments, frequency might not to be a crucial element when

[27] The variables MACHINERY and OUTFITTING are significant at the 0.05 level while the variable ELECTRICAL is significant at the 0.01 level

[28] "The cost of specialised governance structures will be easier to recover for large transactions of a recurring kind" (Williamson, 1985: 60)

considering the choice of governance structure. However, the most striking finding is the negative and significant sign associated with the variable HUM, indicating that the presence of human relationship-specific assets increases the probability that a component/task will be outsourced. Although the theory predicts that specific human capital is likely to raise the costs of market organisation, it seems that the analysed shipyards find it more expensive to manage workers with similar skills.

When all five TCE variables are included in the specification (Model 5), the changes in these variables explain only 17.80% of the changes in the dependent variable (governance structure) according to the probit estimation presented in Appendix 5. This means that in the case of Croatian shipyards TCE theory explains less than a fifth of the variation in the decision to 'make' or 'buy'. Yet when other control variables are introduced, in particular labour intensity of production, the fit of the model (pseudo $R^2$) increases significantly to 0.4519, which means that variations in the independent variables explain 45.19% of the variations in the dependent variable. However, as the analysis leaves much of the variance in the patterns of vertical integration unexplained, the finding presented in this study should be seen as tentative.

There are several possible explanations why the obtained results do not give strong support to TCE theory. On one hand, these results might have been affected by several different methodological problems. First of all, it is necessary to remind that TCE variables are very difficult to measure accurately, i.e. it is very hard to find appropriate proxies for them. For this reason, this study is based on data collected using questionnaires filled by relevant persons employed in the analysed shipyards. However, as explained in the literature review of this paper, data collected in this way are based on the respondents' stated beliefs and subjective valuations. A good example is given by Masten (1994) and it is related to his previous study of the procurement decision in naval shipbuilding (Masten *et al*, 1991). Namely, he noted that the correlations between the two respondents for each variable used in the study were particularly low, and in some cases the correlations across variables were higher than those within the same variable. Hence, the results may be unrealistic as affected by this problem. More objective measures are necessary to increase the reliability of the results and to enhance the comparability across different industries and countries.

A second source for the problems is the absence of some control variables. Although some control variables are included in the final model, we were unable to gain important data about other control variables that may have an important and significant effect on the decision to vertically integrate, such as the engineering effort involved in developing a component/task or the extent to which a component/task is a candidate for 'load levelling'[29]. The non-inclusion of relevant control variables may substantially change the results of a study and lead to incorrect conclusions. It is hence important to take into account the interaction between TCE variables and other potentially relevant effects (Boerner and Macher, 2002).

Third, sample-selection problems may arise because the sample is not representative for the entire population of firms (Bigelow, 2004). As in most TCE studies, this research does not examine the relationship for an entire population of firms. This is because we did not dispose with the relevant data for all six large shipyards in Croatia. Hence, the presented results may be biased.

Finally, many authors have argued that several transaction cost studies may be methodologically flawed because they do not take into account the possible endogeneity problem (Masten, 1994; Bigelow; 2004). This problem arises from the assumption that the level of asset specificity is independent from the choice of alternative governance arrangements. They explain that the level of asset specificity is in fact endogenous, as firms' managers are usually those who make decisions regarding whether to invest in specific assets or not. However, controlling for endogeneity is

[29] As explained by Masten *et al* (1991) highly technical, engineering-intensive activities lie outside shipbuilder's main business. As a result, the costs of internal organisation tend to be higher the higher the engineering effort associated with developing a component/task. On the other hand, shipyards often face the problem of underutilisation of skilled employees. To solve this problem, companies tend to internalise the production of some components that use related skills and that can be produced in periods of lower demand.

extremely difficult, as it is necessary to find a suitable instrumental variable. As a result only a few researches have tackled this problem directly (e.g. Love and Stephens; 1999) finding that results change substantially when data were analysed using structural equations in comparison to reduced form equations. Hence, endogeneity bias may be another source of the weak support for TCE theory.

However, besides the possible methodological problems that might have affected the results of this study, it is necessary to concentrate also on alternative explanations. The question that arises naturally from these results is whether TCE theory is generally valid or is Croatia, and in particular its shipbuilding industry, a special case that does not fit the TCE hypothesis. It is important to remind that the Croatian state was part of the former Yugoslavia until 1991, when it proclaimed independence. Furthermore, as is well known, the former Yugoslavia was a socialist country, a centrally planned economy where amongst the most important objectives were full employment and social rights. As a consequence, the production process was organised almost completely inside shipyards, in accordance with the socialist principles of production. Croatian shipyards began the restructuring process that implied decreasing drastically the number of employees and increasing the level of outsourcing in 1995. Nevertheless, this process is not yet complete and organisational structures are still changing in Croatian shipyards. On the other hand, the analysed shipyards have not yet been privatised and decisions are often driven by political interests and lobbies rather than cost minimisation reasoning. Hence, we believe that the weak support of TCE theory has been primarily the consequence of country factors such as those explained above and of its historical background. This does not mean that TCE is flawed. As demonstrated by the vast amount of empirical work in accordance with theory predictions, it seems that TCE is at least valid for highly developed countries such as US and the UK. However, to test its overall validity, further research based on other developed as well as developing countries is necessary. This study is, to our knowledge, the first empirical work that analyses the make-or-buy decision in a former socialist Eastern European country using a TCE approach. Nevertheless, significantly more effort is necessary. As explained by Williamson (1992: 349), "Transaction cost economics needs to be refined and extended. It needs to be qualified and focused. It needs to be tested empirically". However, econotribologists[30] must be aware of the possible methodological problems that might undermine the correctness of their results, such as difficulties related to variables measurement, missing control variables, simultaneity and selection biases. Hence, they must also concentrate on solving these problems to increase the reliability and comparability of the obtained results.

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[30] Transaction cost economists (neologism from ECONO(MICS) + TRIBOLOGY, the science of the mechanisms of frictions) as explained by Masten (2001)

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http://www.hb.hr – This website address is correct at time of writing (22nd July 2007)

## *Appendices*

## *Appendix 1: Correlation matrix*

| | make | temp | hum | as | freq | complex | labour | hull | machinery | outfitting | electrical | all | shipyard | shipyard2 | sizedollar | employ. | dwt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAKE | 1.0000 | | | | | | | | | | | | | | | | |
| TEMP | 0.2391 | 1.0000 | | | | | | | | | | | | | | | |
| HUM | -0.1131 | 0.4089 | 1.0000 | | | | | | | | | | | | | | |
| AS | 0.2094 | 0.3124 | 0.3731 | 1.0000 | | | | | | | | | | | | | |
| COMPLEX | 0.0226 | 0.2628 | 0.6372 | 0.4993 | 1.0000 | | | | | | | | | | | | |
| FREQ | 0.3889 | 0.3404 | -0.2591 | 0.0058 | -0.2177 | 1.0000 | | | | | | | | | | | |
| LABOUR | 0.4456 | 0.1783 | 0.0702 | 0.0184 | -0.0470 | 0.1384 | 1.0000 | | | | | | | | | | |
| HULL | 0.2089 | 0.1728 | -0.1224 | 0.1988 | -0.1729 | 0.2681 | -0.0358 | 1.0000 | | | | | | | | | |
| MACHINERY | -0.3305 | -0.1855 | 0.2205 | -0.0324 | 0.2318 | -0.5918 | -0.2466 | -0.3414 | 1.0000 | | | | | | | | |
| OUTFITTING | -0.0127 | -0.2206 | -0.1534 | -0.1081 | -0.1627 | 0.0222 | 0.1556 | -0.2937 | -0.3782 | 1.0000 | | | | | | | |
| ELECTRICAL | -0.1004 | 0.0096 | -0.0058 | -0.0778 | 0.0708 | -0.0096 | -0.0396 | -0.1676 | -0.2158 | -0.1857 | 1.0000 | | | | | | |
| ALL | 0.2915 | 0.3057 | 0.0456 | 0.0099 | 0.0365 | 0.4468 | 0.2075 | -0.2110 | -0.2716 | -0.2337 | -0.1334 | 1.0000 | | | | | |
| SHIPYARD | 0.1402 | -0.0722 | -0.2540 | -0.1729 | -0.1842 | 0.1483 | -0.0907 | 0.0677 | -0.0170 | -0.0282 | -0.0357 | 0.0083 | 1.0000 | | | | |
| SHIPYARD2 | -0.0120 | -0.1834 | -0.1586 | 0.0234 | -0.0898 | 0.1224 | -0.1935 | 0.0677 | -0.0170 | -0.0282 | -0.0357 | 0.0083 | -0.5755 | 0.0677 | | | |
| SIZEDOLLAR | 0.1626 | -0.2223 | -0.4264 | -0.1942 | -0.2908 | 0.2707 | -0.2523 | 0.1322 | -0.0332 | -0.0551 | -0.0697 | 0.0162 | 0.8018 | 0.0274 | 1.0000 | | |
| EMPLOYEES | 0.1634 | -0.2086 | -0.4144 | -0.1958 | -0.2840 | 0.2615 | -0.2379 | 0.1271 | -0.0319 | -0.0530 | -0.0670 | 0.0155 | 0.8435 | -0.0462 | 0.9973 | 1.0000 | |
| DWT | 0.1611 | -0.1667 | -0.3715 | -0.1949 | -0.2583 | 0.2301 | -0.1932 | 0.1103 | -0.0277 | -0.0459 | -0.0581 | 0.0135 | 0.9324 | -0.2410 | 0.9636 | 0.9806 | 1.0000 |

*Appendix 2: Probit make-or-buy estimation*

| | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
|---|---|---|---|---|---|---|---|
| Constant | -0.860 | -0.561 | -0.881 | -0.947 | -1.608 | -3.905 | -2.969 |
| | (3.95)*** | (2.37)** | (3.27)*** | (3.20)*** | (4.32)*** | (5.88)*** | (3.26)*** |
| TEMP | 0.108 | 0.156 | 0.137 | 0.139 | 0.062 | 0.002 | -0.032 |
| | (3.12)*** | (3.77)*** | (3.15)*** | (3.15)*** | (1.27) | (0.04) | (0.57) |
| HUM | | -0.123 | -0.169 | -0.188 | -0.129 | -0.187 | -0.212 |
| | | (2.79)*** | (3.42)*** | (3.16)*** | (2.12)** | (2.45)** | (2.65)*** |
| AS | | | 0.156 | 0.144 | 0.142 | 0.204 | 0.187 |
| | | | (3.13)*** | (2.74)*** | (2.80)*** | (3.12)*** | (2.62)*** |
| COMPLEX | | | | 0.044 | 0.073 | 0.174 | 0.227 |
| | | | | (0.65) | (1.03) | (2.07)** | (2.51)** |
| FREQ | | | | | 0.130 | 0.163 | 0.121 |
| | | | | | (3.53)*** | (3.48)*** | (2.04)** |
| LABOUR | | | | | | 0.402 | 0.428 |
| | | | | | | (5.60)*** | (5.10)*** |
| HULL | | | | | | | -0.335 |
| | | | | | | | (0.81) |
| MACHINERY | | | | | | | -0.869 |
| | | | | | | | (1.82)* |
| OUTFITTING | | | | | | | -0.941 |
| | | | | | | | (2.30)** |
| ELECTRICAL | | | | | | | -1.383 |
| | | | | | | | (3.14)*** |
| SHIPYARD | | | | | | | |
| SHIPYARD2 | | | | | | | |
| SIZEDOLLAR | | | | | | | |
| EMPLOYEES | | | | | | | |
| DWT | | | | | | | |
| Observations | 167 | 167 | 167 | 167 | 167 | 167 | 167 |
| Robust t-statistics in parentheses | | | | | | | |
| * significant at 10%; ** significant at 5%; *** significant at 1% | | | | | | | |
| **Pseudo $R^2$** | **0.0434** | **0.0845** | **0.1240** | **0.1259** | **0.1780** | **0.3530** | **0.3838** |

| | **Model 8** | **Model 9** | **Model 10** | **Model 11** |
|---|---|---|---|---|
| Constant | -4.708 | -4.603 | -4.469 | -3.992 |
| | (2.56)** | (2.79)*** | (2.86)*** | (3.01)*** |
| TEMP | 0.022 | 0.006 | 0.000 | -0.014 |
| | (0.41) | (0.11) | (0.00) | (0.25) |
| HUM | -0.200 | -0.195 | -0.194 | -0.193 |
| | (2.63)*** | (2.50)** | (2.48)** | (2.47)** |
| AS | 0.182 | 0.194 | 0.197 | 0.202 |
| | (2.24)** | (2.35)** | (2.37)** | (2.44)** |
| COMPLEX | 0.283 | 0.272 | 0.267 | 0.255 |
| | (3.03)*** | (2.99)*** | (2.96)*** | (2.85)*** |
| FREQ | 0.032 | 0.050 | 0.057 | 0.077 |
| | (0.57) | (0.85) | (0.96) | (1.27) |
| LABOUR | 0.551 | 0.529 | 0.520 | 0.496 |
| | (3.32)*** | (3.64)*** | (3.75)*** | (4.04)*** |
| HULL | -0.424 | -0.411 | -0.405 | -0.390 |
| | (0.99) | (0.93) | (0.91) | (0.87) |
| MACHINERY | -1.313 | -1.262 | -1.235 | -1.154 |
| | (2.62)*** | (2.46)** | (2.40)** | (2.24)** |
| OUTFITTING | -0.949 | -0.955 | -0.956 | -0.958 |
| | (2.09)** | (2.12)** | (2.13)** | (2.16)** |
| ELECTRICAL | -1.524 | -1.517 | -1.511 | -1.490 |
| | (2.99)*** | (2.94)*** | (2.93)*** | (2.92)*** |
| SHIPYARD | 1.682 | | | |
| | (2.23)** | | | |
| SHIPYARD2 | 1.330 | | | |
| | (1.89)* | | | |
| SIZEDOLLAR | | 0.000 | | |
| | | (2.40)** | | |
| EMPLOYEES | | | 0.001 | |
| | | | (2.44)** | |
| DWT | | | | 0.000 |
| | | | | (2.49)** |
| Observations | 167 | 167 | 167 | 167 |
| Robust t-statistics in parentheses | | | | |
| * significant at 10%; ** significant at 5%; *** significant at 1% | | | | |
| **Pseudo $R^2$** | **0.4519** | **0.4464** | **0.4430** | **0.4322** |

*Appendix 3: Logistic make-or-buy estimation*

| | **Model 1** | **Model 2** | **Model 3** | **Model 4** | **Model 5** | **Model 6** | **Model 7** |
|---|---|---|---|---|---|---|---|
| Constant | -1.383 | -0.897 | -1.436 | -1.566 | -2.672 | -6.818 | -5.428 |
| | (3.87)*** | (2.33)** | (3.18)*** | (3.11)*** | (4.08)*** | (5.53)*** | (3.35)*** |
| Constant | 0.173 | 0.259 | 0.235 | 0.242 | 0.112 | 0.015 | -0.045 |
| | (3.08)*** | (3.60)*** | (3.05)*** | (3.01)*** | (1.32) | (0.16) | (0.43) |
| TEMP | | -0.206 | -0.288 | -0.326 | -0.221 | -0.322 | -0.376 |
| | | (2.68)*** | (3.17)*** | (2.94)*** | (2.08)** | (2.07)** | (2.19)** |
| HUM | | | 0.257 | 0.235 | 0.230 | 0.354 | 0.334 |
| | | | (3.04)*** | (2.71)*** | (2.77)*** | (2.86)*** | (2.58)** |
| AS | | | | 0.082 | 0.127 | 0.300 | 0.399 |
| | | | | (0.72) | (1.04) | (1.98)** | (2.27)** |
| COMPLEX | | | | | 0.215 | 0.281 | 0.217 |
| | | | | | (3.45)*** | (3.22)*** | (2.04)** |
| FREQ | | | | | | 0.698 | 0.755 |
| | | | | | | (5.39)*** | (4.94)*** |
| LABOUR | | | | | | | -0.482 |
| | | | | | | | (0.66) |
| HULL | | | | | | | -1.353 |
| | | | | | | | (1.69)* |
| MACHINERY | | | | | | | -1.560 |
| | | | | | | | (2.23)** |
| OUTFITTING | | | | | | | -2.256 |
| | | | | | | | (3.00)*** |
| ELECTRICAL | | | | | | | |
| SHIPYARD | | | | | | | |
| SHIPYARD2 | | | | | | | |
| SIZEDOLLAR | | | | | | | |
| EMPLOYEES | | | | | | | |
| DWT | | | | | | | |
| Observations | 167 | 167 | 167 | 167 | 167 | 167 | 167 |
| Robust t-statistics in parentheses | | | | | | | |
| * significant at 10%; ** significant at 5%; *** significant at 1% | | | | | | | |
| **Pseudo $R^2$** | **0.0430** | **0.0848** | **0.1247** | **0.1270** | **0.1781** | **0.3545** | **0.3851** |

| | **Model 8** | **Model 9** | **Model 10** | **Model 11** |
|---|---|---|---|---|
| Constant | -10.970 | -10.103 | -9.605 | -8.115 |
| | (2.83)*** | (3.01)*** | (3.05)*** | (3.14)*** |
| TEMP | 0.045 | -0.004 | -0.016 | -0.045 |
| | (0.45) | (0.04) | (0.17) | (0.44) |
| HUM | -0.336 | -0.323 | -0.321 | -0.319 |
| | (2.24)** | (2.19)** | (2.20)** | (2.19)** |
| AS | 0.385 | 0.411 | 0.412 | 0.410 |
| | (2.25)** | (2.32)** | (2.34)** | (2.39)** |
| COMPLEX | 0.570 | 0.521 | 0.503 | 0.460 |
| | (2.89)*** | (2.78)*** | (2.74)*** | (2.63)*** |
| FREQ | 0.049 | 0.095 | 0.111 | 0.151 |
| | (0.47) | (0.88) | (1.03) | (1.39) |
| LABOUR | 1.227 | 1.117 | 1.078 | 0.980 |
| | (3.20)*** | (3.48)*** | (3.57)*** | (3.81)*** |
| HULL | -0.734 | -0.665 | -0.656 | -0.642 |
| | (0.85) | (0.73) | (0.72) | (0.73) |
| MACHINERY | -2.368 | -2.182 | -2.105 | -1.900 |
| | (2.40)** | (2.18)** | (2.12)** | (1.97)** |
| OUTFITTING | -2.033 | -1.945 | -1.915 | -1.836 |
| | (2.08)** | (2.10)** | (2.11)** | (2.14)** |
| ELECTRICAL | -2.828 | -2.751 | -2.712 | -2.606 |
| | (2.65)*** | (2.62)*** | (2.62)*** | (2.65)*** |
| SHIPYARD | 4.134 | | | |
| | (2.50)** | | | |
| SHIPYARD2 | 3.412 | | | |
| | (2.33)** | | | |
| SIZEDOLLAR | | 0.000 | | |
| | | (2.68)*** | | |
| EMPLOYEES | | | 0.002 | |
| | | | (2.70)*** | |
| DWT | | | | 0.000 |
| | | | | (2.63)*** |
| Observations | 167 | 167 | 167 | 167 |

Robust t-statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

| **Pseudo $R^2$** | **0.4805** | **0.4675** | **0.4612** | **0.4433** |
|---|---|---|---|---|

# Tracking Accuracy of Large and Small-CAP ETFS: an Empirical Analysis Of The Istanbul Stock Exchange

M. Mesut Kayali, Seyfettin Unal*

*Abstract:*

***In this study, we examine the tracking performance of two ETFs, namely DJIST and SMIST, both traded on the Istanbul Stock Exchange, with respect to their own indices. We carry out an analysis first to identify each ETF's tracking ability of underlying index, and second to explore whether any differences exist between the return of large-cap and the return of small-cap stock ETFs, and their indices. By employing a data set of calculated daily returns for the specified ETFs and their corresponding indices, t-tests and regression analyses are conducted. Our findings suggest that both DJIST and SMIST stocks performed well in tracking their own indices' returns. However, the mimicking ability of DJIST stock is better than that of SMIST. Possible explanations regarding this difference are that the SMIST's introduction into the market is relatively new compared to the DJIST, and that the SMIST represents small-cap stocks with considerable illiquidity problems, while the DJIST represents large-cap stocks. Despite the odds, against the SMIST, it still shows a tracking performance that should be acknowledged, given both its place in an emerging market and its strength within such a short period of time.***

**Keywords:** Exchange Traded Funds, Tracking Accuracy, Dow Jones Istanbul 20, Turkish Smaller Companies Istanbul 25.

**JEL:** G12, G15.

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## 1. Introduction

The basic premise of Exchange Traded Funds (ETFs) is to deliver returns in line with their target benchmarks. The most common way of evaluating their performance is to determine how closely their return tracked the return of their underlying indices. The smaller the differences between the returns of ETFs and their corresponding indices, the more successful the ETFs are in mirroring the performance of their benchmarks.

The tracking performance of ETFs depends upon their liquidity. The returns of relatively new and illiquid ETFs, tracking indices including small-cap or emerging market stocks, may depart from the returns of their underlying benchmarks. However, their tracking performance may proliferate over time as investor interest grows sufficiently.

This paper investigates the tracking abilities of the two ETFs listed on the Istanbul Stock Exchange (ISE). One of them is the Dow Jones Istanbul 20, the first ETF in Turkey when it was introduced in 2005. The other is the Turkish Smaller Companies Istanbul 25, the first

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style ETF traded on the ISE since August 24, 2006. Although there are several ETFs traded on the Turkish market, our study focuses on only these two, based on their unique comparable features of being large-cap and small-cap. We compare the daily returns of those ETFs with the daily returns of their underlying indices, take the differences and average them out. We test the null hypothesis that the differences between returns are zero. As a result, we find that the average daily returns are not statistically and significantly different from each other. Also, we perform a regression of returns for each ETF and find that the DJIST tracks its benchmark better than the SMIST does.

This paper is organized as follows: the next section provides a brief review of the related literature, the third section describes the data and the methodology, the fourth section comments on the empirical results, and the last section concludes the paper.

## 2. Brief Review of the Related Literature

Khorana et al. (1998) examine the extent to which WEBS returns track the return on the underlying MSCI index. They provide the first evidence on the performance of WEBS. They find that over the six-month period following their introduction, WEBS returns closely track the underlying MSCI country index.

Patro (2001) provides empirical evidence that the WEBS have been successful in matching the performances of the market indexes they represent. They cannot reject the null hypothesis that the difference between the WEBS returns and the corresponding MSCI market index returns is zero for all seventeen WEBS at the 1 percent level.

Pennathur et al. (2002) study the performance of iShares from April 1996 to December 1999. They extend the work of Khorana et al. (1998). Their single-index model demonstrates that iShares replicate the home index.

Conducting a comparative performance analysis of ETFs and index funds with respect to their benchmark indices, Rompotis (2005) reports no excess return is produced by ETFs and index funds over their benchmark indices. The study also reveals an analogous tracking ability of ETFs and index funds based on the computation of their average tracking errors.

Kuo and Mateus (2006) perform an analysis on the performance and persistence of 20 iShares MSCI country-specific exchange-traded funds (ETFs) in comparison with the S&P 500 index. They provide evidence that ETFs can beat the U.S. market index based on risk-adjusted performance measures. They also conclude that past performance of iShares MSCI country-specific ETFs can predict future performance, suggesting that investors could use past annual return for selecting iShares MSCI country-specific ETFs to predict future annual returns.

Harper et al. (2006) compare the returns of international ETFs with the returns of their underlying market indices over the sample period from April 1996 to December 2001. They contribute to the existing literature on ETFs by verifying the high tracking accuracy of the ETFs to the underlying indices.

Iseri and Aktas (2006) evaluated the tracking performance of the DJIST during 2005. They compare the percentage changes between the beginning value and ending value of the DJIST and the DJTT20 index. They also show the trend in both price series graphically and conclude that the DJIST and the underlying index move in tandem.

Kayali (2007a) analyzes the difference between the closing price of the DJIST and the net asset value of the underlying portfolio in terms of New Turkish Lira (TRY) for the first year of its trading. He finds that the average TRY difference is statistically significant but not significant economically. Also, he provides empirical evidence that deviations of prices from NAV do not persist over time and vanish on the second day of their occurrence.

Kayali (2007b) tests the investor sentiment hypothesis well-known in the closed-end fund literature by using the percentage premiums and discounts of the DJIST in 2005. He looks into their behavior in up and down markets. He finds that the DJIST trades at discounts in both market conditions, the discount being larger in rising markets. This finding contradicts the investor sentiment theory.

Kayali (2007c) studies the mispricing issue of the DJIST during 2005. As a result, he finds that the DJIST is statistically mispriced on average but not to the extent that arbitrage is granted frequently. Also, the percentage deviations of prices from NAV do not behave differently in high and low volatile underlying markets for at least the first year.

## 3. Data and Methodology

In the study, we conduct the analysis on daily returns of indices and ETFs for the DJIST 20 and the SMIST 25. The returns are calculated by using daily closing index values of the DJIST 20 and the SMIST 25. Index data are obtained from their original Internet websites (www.djist.com and www.smist.com) for overlapping time periods, starting on August 24, 2006, which is the date the SMIST's ETF began trading on the Istanbul

Stock Exchange (ISE), and ending on August 31, 2007. The period covers the data of 254 trading days. Within the covered period, four days are omitted due to missing unreachable data values. Yet the data still cover one year of trading days. Daily closing stock price data for DJIST and SMIST are collected from CNNTurk's website (www.cnnturk.com). In order to verify the reliance of stock price data set, several randomly-selected data are also cross checked with daily closing prices announced on the ISE website. Stock price data also cover the same period between 8-24-2006 and 8-31-2007. A recent picture of DJIST and SMIST, regarding their market data and industrial breakdown is reflected in Table 1.

The return series used in the empirical analysis are computed as follows:

$$r_t = [( p_t - p_{t-1} ) / p_{t-1}]*100,$$

where $r_t$ is the return on day $t$ and $p_t$ and $p_{t-1}$ are the closing prices of the ETFs, or the levels of the corresponding indices, on days $t$ and $t$-1.

In order to assure the tracking accuracy of ETFs, we run two regressions of daily returns on each ETF against their corresponding returns on the indices. Below is the empirical computations employed:

$$r_{ds,t} = \alpha_{ds} + \beta_{ds} r_{dx,t} + e_{ds,t}$$

$$r_{ss,t} = \alpha_{ss} + \beta_{ss} r_{sx,t} + e_{ss,t}$$

where $r_{ds,t}$ and $r_{ss,t}$ are the returns on ETF stock of DJIST and SMIST, respectively, on day t, and $r_{dx,t}$ and $r_{sx,t}$ are the returns on the DJIST and SMIST indices, respectively, on day t. The statistical analysis is performed on the SPSS.

## 4. Empirical Findings

### 4.1. Summary Statistics and t-Tests

As shown in Table 2, the total one-year holding period returns for the DJIST index and ETF are 36.27% and 43.23%, respectively, while corresponding returns for the SMIST index and ETF are 36.31% and 35.03%, respectively. In terms of daily return performances, reflected in Table 3, the daily mean returns for the DJIST index and ETF are both positive and fall between 0.1375% and 0.1571%, and those for the SMIST are also positive and remain between 0.1350% and 0.1320. With respect to the highest and lowest levels, daily returns hit as high as 5.2820% and fall as low as -6.4858% for the DJIST index and ETF. On the other hand, the highest and lowest daily returns for the SMIST index and ETF are 5.7613% and -7.0539%,

| DJIST | | SMIST | |
|---|---|---|---|
| Market capitalization | $55.7M | Market capitalization | $0.9M |
| Average daily trading volume | $10.7M | Average daily trading volume | $1.2M |
| **Sector breakdown** | | **Sector breakdown** | |
| Banking | 45.14% | Oil, Gas & Petrochemical | 18.55% |
| Conglomerates | 14.61% | Transportation | 11.16% |
| Petroleum | 10.17% | Banking | 10.97% |
| Telecom | 9.23% | Construction | 9.75% |
| Steel & Metal | 7.81% | Media | 7.85% |
| Food & Beverage | 4.53% | Insurance | 6.88% |
| Retail | 3.61% | Automotive | 6.26% |
| Others | 4.87% | Logistics | 6.09% |
| | | Food & Beverage | 4.79% |
| | | Consumer durables | 4.59% |
| * As of August 31, 2007 | | Conglomerates | 3.76% |
| | | Others | 9.36% |

**Table 1:** Recent market data and characteristics of DJIST and SMIST*
**Source:** www.djist.com and www.smist.com

| | DJIST | | SMIST | |
|---|---|---|---|---|
| | Index | ETF | Index | ETF |
| **Number of trading days** | 254 | 254 | 254 | 254 |
| **Minimum** | 353.28 | 9.24 | 249.05 | 8.96 |
| **Maximum** | 548.54 | 15.05 | 379.99 | 13.75 |
| **Beginning value (8/24/2006)** | 362.06 | 9.46 | 253.78 | 9.22 |
| **Ending value (8/31/2007)** | 493.38 | 13.55 | 345.92 | 12.45 |
| **Percentage change** | 36.27 | 43.23 | 36.31 | 35.03 |

**Table 2:** Summary Statistics

| | DJIST | | SMIST | |
|---|---|---|---|---|
| | Index return | ETF return | Index return | ETF return |
| **Minimum** | -6.4858 | -6.2745 | -6.3440 | -7.0539 |
| **Maximum** | 5.2820 | 5.2448 | 4.6940 | 5.7613 |
| **Range** | 11.7677 | 11.5193 | 11.0380 | 12.8153 |
| **Mean** | 0.1375 | 0.1571 | 0.1350 | 0.1320 |
| **Standard deviation** | 1.7386 | 1.7349 | 1.6404 | 1.7302 |
| **t-statistics** | -0.587 | | 0.055 | |
| **p-value** | 0.558 | | 0.956 | |

**Table 3:** Daily Returns (%)

respectively.

Keeping in mind the ups and downs in Turkish politics, especially between April and August 2007, these highest and lowest points should be considered understandable, even moderate. Moreover, Table 3 provides the results of a *t*-test that suggests that mean return differences of the DJIST are not statistically different from zero at the 1% level with a t-value of -0.587 and a p-value of 0.558. Similarly, the test results for the SMIST also verify that at the 1% level, differences in mean returns of the SMIST are statistically insignificant, with a t-value of 0.055 and a p-value of 0.956. Table 3 also reports the standard deviations in the index and ETF returns of the DJIST and the SMIST. As can be seen, these data also reflect the close relationship of ETFs with their underlying indices, thus implying their high tracking abilities. In addition, the Figures 1 and 2 are drawn to reflect the tracking performances of the DJIST and the SMIST stocks. Figure 1 shows the DJIST stock's relative return performance with its underlying index, as DXRET and DPRET refer to index return and stock return, respectively. In Figure 2, the SMIST stock's relative return performance with its underlying index is drawn, as SXRET and SPRET refer to index return and stock return, respectively.

### *4.2. Results of Return Regressions*

The results of regression equations are summarized in Table 4. The analysis provides the estimates of coefficient, t-statistics and p-value for DJIST and SMIST. By examining the R-squares of regression equations, we attempt to determine the ETF stocks' mimicking performance of underlying indices. In this respect, a higher R-square means higher tracking accuracy (or lower tracking error). A higher tracking accuracy (or lower tracking error) is an indication that ETF stock return closely imitates the return pattern of the underlying index.

| | DJIST | | | SMIST | | |
|---|---|---|---|---|---|---|
| | **Constant** | **Beta** | **R-square** | **Constant** | **Beta** | **R-square** |
| **Coefficient** | 0.02639 | 0.953** | 0.908 | 0.008412 | 0.868** | 0.753 |
| **t-statistics** | 0.795 | 49.840 | | 0.155 | 27.685 | |
| **p-value** | 0.428 | 0.000 | | 0.877 | 0.000 | |

** Statistically significant at the 1% level.

**Table 4:** Regression analysis between index returns and ETF returns

According to the regression outcomes, we find a 90.8% of R-square for the DJIST equation, implying that ETF stock return quite accurately mimics the return on its corresponding index. Even though being fairly lower than that of the DJIST, an R-square of 75.3% for the SMIST demonstrates that its stock return also accurately imitates the return on the underlying index. This fair difference between the two stocks' R-square estimates is not contrary to expectations. First, we carry out the study by using the data set that begins with the first day when SMIST stock started trading. Since SMIST stock is considerably new and started trading about 19 months later than DJIST stock, it may require some period of time in the market to accustom to SMIST stock. Second, this distinction may be attributable to market capitalization impact. This is because the securities represent two groups of stock indices with differing market capitalizations, large-cap and small-cap. This realized difference is also highlighted by standard deviations in Table 3. There is only a slight difference in the DJIST's standard deviations of returns, 1.7386 versus 1.7349, whereas the same values for the SMIST are 1.6404 and 1.7302. Overall, the analyses confirm that both ETF stocks of the DJIST and the SMIST accurately follow their corresponding underlying indices, although DJIST stock mimics its index better than SMIST stock.

## *5. Concluding Remarks*

In this study, we attempt to analyze the tracking performance of two ETFs on their underlying indices. In order to reveal whether any differences exist with respect to their mimicking performance, we choose to compare DJIST stock to SMIST stock. Using a one-year data set, consisting of 254 trading days, our purpose is to demonstrate similarities or differences, if any, in the tracking abilities of these two stocks in an emerging market.

In the hope that our study opens a new path for further research on ETFs in Turkey, we also remind that the paper is the first, to the best of our knowledge, to identify the tracking ability of ETFs with two different features. That is, the DJIST follows an index representative of large capitalization stocks. On the other hand, the SMIST represents another index that consists of small capitalization stocks.

By employing first a *t*-test and then a regression of daily returns of each stock on their underlying indices, we reach two conclusions. First, both stocks accurately track their underlying indices. Second, DJIST stock's tracking performance is fairly better than that of SMIST. Considering that the SMIST is relatively new compared to the DJIST, and that our data set starts with the first day of the SMIST's introduction, this result is quite understandable. Moreover, the SMIST is representative of small-cap stocks, whereas the DJIST is representative of large-cap stocks. Despite the fact that the SMIST is relatively new, this performance is unexpectedly strong. A possible explanation for this lies in its portfolio component. Compared to the heavy weight of the banking sector in the DJIST, the banking sector constitutes only about 11% of the SMIST portfolio. In addition, with respect to the number of industries covered, the SMIST reflects a more diversified portfolio. This implies that the SMIST or future the SMIST-like ETFs may be expected to open a new path for more diversified portfolio alternatives for investors. As a result, the study introduces preliminary evidence for the literature on ETFs in an emerging market by looking at the subject from another angle.

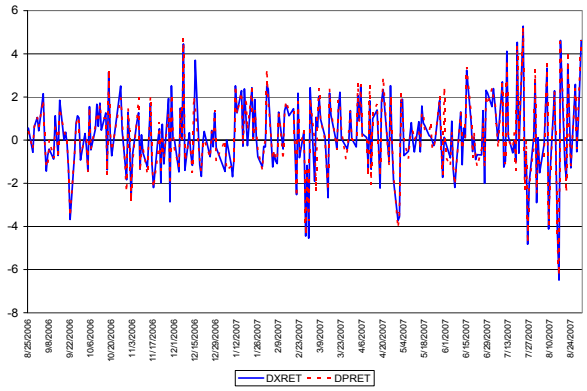


**Figure 1**

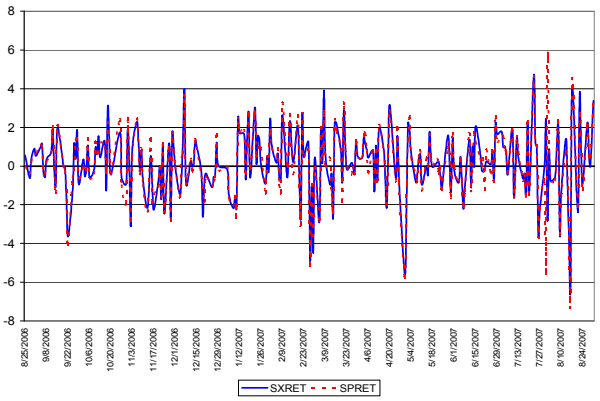


**Figure 2**

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# Gas Distribution Benchmarking of Utilities from Slovenia, the Netherlands and the UK: an Application of Data Envelopment Analysis

Jelena Zorić, Nevenka Hrovatin, Gian Carlo Scarsi*

*Abstract:*

***This paper carries out non-parametric relative efficiency comparisons using an international sample of gas distribution utilities from two old and one new EU members, namely the Netherlands, the UK, and Slovenia. By conducting DEA on a cross-sectional sample of gas utilities, we discover that, on average, Slovenian utilities perform less efficiently than UK and Dutch utilities. To a large extent, this is due to the less extensive regulation of the Slovenian gas industry as seen in the past. The incentive-based price-cap regulation recently introduced in Slovenia could help close this efficiency gap over time. The authors also find out that different model specifications lead to very similar efficiency scores and rankings, implying that benchmarking can be employed as a useful complementary instrument for monitoring utility performance. In this way, the informational asymmetry between distribution utilities and regulatory authorities can be significantly mitigated. For the wider and more successful implementation of international benchmarking in the future, it is also important that coherent regional and international data is made available to regulators.***

**Key words:** price regulation, international benchmarking, comparative efficiency analysis, DEA, gas distribution utilities

**JEL:** C61, D24, L51, L95

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## 1. Introduction

In 1998, the European Commission (EC) introduced a Gas Directive (98/30/EC) with the aim to reduce gas prices, boost economic efficiency, and promote gas-to-gas competition. In the EU's view, greater competition in the area of energy-related activities should contribute to lower operating costs and to strengthening the competitiveness of EU economies. The Gas Directive set the general rules for the internal natural gas market. Key points of the directive were the gradual and progressive opening up of the natural gas market, the abolition of exclusive rights, the introduction of non-discriminatory access to the gas network, and the unbundling of internal utility accounts. On 26 June 2003, the EU passed a new Gas Directive (2003/55/EC), which resulted in further liberalisation of the market. The new Gas Directive requires that: (a) all non-household customers become eligible by 1 July 2004 and all customers become eligible by 1 July 2007; (b) regulated third-party access

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(rTPA) is implemented; (c) a regulatory body is empowered; and (d) rigorous demands for the separation of TSO (Transmission System Operator) and DSO (Distribution System Operator) activities are imposed on natural gas market participants.

As transmission and distribution activities remain regulated due to their natural monopoly character, liberalisation of the gas sector is typically combined with a (re-) regulation of the use of network prices. Regulatory authorities around the world have adopted a variety of approaches to regulate distribution prices. The most common incentive-based schemes are based on price capping, revenue capping, yardstick regulation, and various benchmarking methods.[i] Under price capping, prices are set in advance for a period of (generally) three to five years, thus allowing the firm to benefit from any cost savings made during that period, but they are recalculated at regular intervals in order to bring them back in line with underlying costs. The price cap (RPI-X) usually allows the utility to increase its overall price level by a yearly rate of inflation, as measured by the previous year's Retail Price Index (RPI), minus a percentage efficiency factor (X) that reflects the real cost reduction expected by the regulator.

However, due to the imperfect information available to the regulator, there are some problems with price cap regulation because the regulator does not know a firm's true costs. High costs may be due to either a firm's particular production situation or to sheer inefficiency. Thus, if price caps are set too high, there is the possibility of a welfare loss while, if they are too low, firms might encounter financial viability problems. In setting the initial price level and the yearly efficiency factor X in price cap regulation, the regulator can use some form of cost-based benchmarking. In this case, benchmarking is used to establish a larger information basis for more effective price cap regulation that reduces the informational asymmetry between firms and regulators. Frontier-based benchmarking methods identify or estimate the efficient performance frontier from sample best practice. The efficient frontier is then a benchmark against which the relative performance of all firms is measured. In the case of small countries, international benchmarking appears to be particularly advantageous since a limited number of firms tend to operate in each sector. International comparisons also enable regulators to measure efficiency relative to international best practice.

In this paper we compare the performance of gas distribution utilities from the Netherlands, the UK, and Slovenia. International benchmarking is conducted using Data Envelopment Analysis (DEA), which is a non-parametric (linear programming) frontier benchmarking method. One of our main aims is to ascertain whether relative efficiency differences are demonstrable for gas distribution utilities between one of the EU's newcomers and two of the most established EU member states. To the authors' knowledge, this is one of the first studies on international gas benchmarking, as opposed to the more traditionally explored area of electricity distribution.[ii] The slower pace of liberalisation in the market for natural gas and its less extensive regulation as a result of the traditional principle of negotiated third-party access may explain the relative novelty of gas distribution benchmarking.

## *2. Gas Distribution in the UK, the Netherlands and Slovenia*

Gas distribution in the three countries examined differs both at an average size and an ownership level. In the UK, gas distribution has been traditionally linked to gas transmission and has been provided jointly by Transco, formerly part of British Gas, the integrated gas monopolist privatised in 1986 by Margaret Thatcher's government. At the beginning of the current decade, Transco underwent some further transformation after its more or less passive incorporation into the National Grid Company of electricity to form the new corporate bundle that is today known as National Grid/Transco (NGT). NGT is in mixed private ownership of UK and international investors. The previous Gas Area Boards, known under Transco as Local Distribution Zones, have been partially disentangled from the main NGT structure in 2004: four out of eight were sold off (Scotland, Wales and West, North of England, and South of England) to national and international investors, some of whom were electricity companies or

other utilities. The average size of a UK Local Distribution Zone is much larger than that of any other firm in our sample as British gas distribution companies tend to cover entire bundles of counties. On 1 April 2002, the UK's gas distribution sector became subject to a separate five-year price control formula (RPI-X), as distinct from the gas transmission formula. From 1 April 2004, this single distribution price control formula was disaggregated into eight separate formulae (network price control formulae) to cover the activities of the eight regional gas distribution networks (NGT 2005).

Gas distribution in the Netherlands has undergone a restructuring process after the liberalisation of the sector was pushed forward in the early nineties with some delays as opposed to the liberalisation of electricity, which were mainly due to political opposition and the strong corporate entrenchment of some of the actors in the market. At the beginning of the decade, the number of county-based and municipal gas distributors in the Netherlands totalled around 25, although this figure is bound to decrease as a result of the possibility of mergers reaching the gas industry after having already touched the electricity networks sector. All of the Dutch gas distributors are controlled by public owners in the form of (mainly) local and county councils, although privatisation might be on the political agenda at some stage in the not too distant future. However, the smaller companies will be likely to stay in public ownership for some foreseeable time to come. The Dutch regulator DTE has imposed price-capping (CPI-X regulation) since 2002, where efficiency objectives (X-factors) of the individual companies were determined by means of the benchmarking of total expenditure being made up of operating and capital costs. The regulatory formula being chosen is in line with the equivalent form of regulation adopted in the electricity distribution industry. In the Dutch benchmarking analysis of gas distribution utilities, DEA was chosen as the official benchmarking method (DTE 2001).

As regards Slovenia, the natural gas transmission network is owned and operated by former gas monopolist Geoplin. Until early 2003, Geoplin enjoyed a monopoly on import, transportation, and transit of natural gas throughout Slovenia.[iii] Today there are 17 local distribution utilities that distribute natural gas to households, small industry, and commercial users in more than 60 municipalities.[iv] End natural gas users in Slovenia are supplied via both the transport and local distribution networks.[v] The ownership structure of gas distribution companies is quite diverse: six companies are majority-owned by one or more municipalities, seven of them are majority owned by domestic private investors, two of them are majority owned by foreign private investors, and one company does not have a majority owner (AERS 2005a). To comply with the EU legislation, namely the Gas Directives (98/30/EC) and (2003/55/EC), Slovenia had to adopt the Energy Act (1999) and the amended Energy Act (2004). Therefore, the process of liberalisation of the Slovenian natural gas market to a large extent resembles what other EU countries were witnessing. The natural gas market in Slovenia has been opened for eligible customers at the beginning of 2003. After the amended Energy Act (2004) was passed, all customers except for households became eligible as of 1 July, 2004. Accordingly, the percentage of eligible customers in the Slovenian gas market rose from 50% in 2003 to 90.4% in 2004 (AERS 2005a).[vi] On 1 July 2007 the Slovenian natural gas market fully opened, while in the UK and the Netherlands the market has been fully liberalised several years before. In Slovenia, the amended Energy Act (2004) furthermore introduced regulated TPA, which replaced negotiated TPA for access to transmission and distribution networks. Economic regulation of network charges for distribution networks is based on the price-cap methodology (CPI-X). To assess and allow eligible costs, the Energy Agency of the Republic of Slovenia (AERS) intends to conduct benchmarking of controllable operating costs using both domestic and foreign gas distribution comparators by means of DEA. The starting regulatory period has been originally set to be the two-year lag 2006-2007. Finally, it has been decided that the regulatory period should be one year only (AERS 2005b).

## 3. Methodology

There has always been a close link between the measurement of efficiency and the use of frontier functions, which are used as standards against which to measure a firm's efficiency. Modern efficiency measurement begins with Farrell (1957), who drew on the work of Debreu (1951) and Koopmans (1951) to define a simple measure of firm efficiency that could account for multiple inputs and easily generalise to multiple outputs. Efficiency measures typically assume that the production or cost function of the fully efficient, or 'best-practice', firm is known. However, this is rarely the case, meaning that the production or cost frontier must be estimated or constructed from sample data. Different techniques can be utilised: one of the ways to obtain the frontier and corresponding firms' efficiency scores is via Data Envelopment Analysis.

DEA entails the use of linear programming methods to calculate (rather than estimate) a non-parametric piece-wise efficient frontier. Firms that make up the frontier encompass the less efficient firms. Efficiency measures are then calculated relative to this frontier. The relative efficiency score of the firm is calculated on a scale of 0 to 1, with the frontier firms receiving a score of 1. DEA models can be either input or output oriented, and can be specified according to either constant returns to scale (CRS) or variable returns to scale (VRS). DEA with constant returns to scale was introduced by Charnes, Cooper and Rhodes (1978), while in Banker, Charnes and Cooper (1984) variable returns to scale are assumed. Output-oriented models maximise the output vector for a given amount of inputs, while input-oriented models minimise the input vector for a given level of outputs. Given that most distribution utilities have an obligation to meet demand, they can only become more efficient by providing a predefined output level with fewer inputs. We will therefore use an input-orientation approach in what follows.

Assume there is information on *K* inputs and *M* outputs for each of *N* firms. For the *i*-th firm, these are represented by the column vectors $\mathbf{x_i}$ and $\mathbf{y_i}$, respectively. The *K*×*N* input matrix **X** and *M*×*N* output matrix **Y** represent the data for all *N* firms. The linear programme of input-oriented CRS envelopment model is formulated as follows:[vii]

$$\begin{aligned} &\min_{\theta,\boldsymbol{\lambda}} \theta \\ &\text{st} \quad -\mathbf{y_i} + \mathbf{Y}\boldsymbol{\lambda} \geq 0 \\ &\qquad \theta \mathbf{x_i} - \mathbf{X}\boldsymbol{\lambda} \geq 0 \\ &\qquad \boldsymbol{\lambda} \geq 0, \end{aligned} \tag{1}$$

where $\theta$ is a scalar and $\boldsymbol{\lambda}$ is a *N*×1 vector of constants. The value of $\theta$ obtained will represent the technical efficiency score (*TE*) of the *i*-th firm. The linear programming problem must be solved *N* times, once for each firm. Essentially, the problem takes the *i*-th firm and then seeks to radially contract the input vector $\mathbf{x_i}$ as much as possible, while still remaining within the feasible input set. The inner-boundary of this set is a piece-wise linear isoquant, determined by the observed data points. Since $\theta$ is a feasible solution to (1), the optimal value $\theta \leq 1$. If $\theta = 1$, the current input levels can no more be proportionally reduced, indicating that a firm is on the frontier. Otherwise, if $\theta < 1$, then the firm is dominated by the frontier.

DEA can also accommodate 'environmental' or non-discretionary variables. These variables are beyond managerial control but still affect the efficiency of the firm. For example, for regulated distribution utilities the size of the service area, population density, and peak demand are supposedly exogenous factors. Assume there are *L* environmental variables to be added to the model, denoted by the *L*×1 vector $\mathbf{z_i}$ for the *i*-th firm, and *L*×*N* matrix **Z** for the full sample. Environmental or non-discretionary variables can be introduced through an additional set of constraints to the model sub (1) as input (a), output (b), or as 'neutral' variables (c):

$$\begin{aligned} &\text{a)}\ \mathbf{z_i} - \mathbf{Z}\boldsymbol{\lambda} \geq 0, \\ &\text{b)}\ \mathbf{z_i} - \mathbf{Z}\boldsymbol{\lambda} \leq 0, \\ &\text{c)}\ \mathbf{z_i} - \mathbf{Z}\boldsymbol{\lambda} = 0. \end{aligned} \tag{2}$$

If one is unsure about the direction of the influence of environmental variables, then these variables can be included in the linear programming problem as neutral variables (Coelli, Rao and Battese 1998).

In the VRS DEA model, a convexity constraint is added to (1):

$$\sum_{i=1}^{N} \lambda_i = 1. \quad (3)$$

This additional constraint ensures that the firm is compared with other firms of a similar size. When not all the firms are operating at the optimal scale, then technical efficiency as calculated by the constant returns to scale model ($TE_{CRS}$) will include 'pure' technical efficiency ($TE_{VRS}$) as well as scale efficiency ($SE$):

$$TE_{CRS} = TE_{VRS} \times SE. \quad (4)$$

By conducting both CRS and VRS DEA, one can obtain a scale efficiency measure for each firm.

Technical efficiency is a necessary, but not a sufficient condition for achieving cost efficiency. It may be the case that a technically efficient firm uses inappropriate mixes of inputs given the relative prices it faces. If price information is available and a behavioural objective, such as cost minimisation, is appropriate, then it is possible to measure technical efficiency ($TE$) as well as allocative efficiency ($AE$). Hence, the measure of cost efficiency ($CE$) is defined as:

$$CE = TE \times AE. \quad (5)$$

Cost efficiency has the property of multiplicative separability into input-allocative and technical efficiencies.[viii] All three efficiency measures are bounded between 0 and 1. A firm is cost-efficient if and only if it is both technically and allocatively efficient. Cost efficiency is obtained by solving the following linear program:

$$\begin{aligned} &\min_{\lambda, \mathbf{x}_i^*} \mathbf{w}^{\mathrm{T}} \mathbf{x}_i^* \\ &\text{s.t.} \quad -\mathbf{y}_i + \mathbf{Y}\boldsymbol{\lambda} \geq 0 \\ &\qquad \mathbf{x}_i^* - \mathbf{X}\boldsymbol{\lambda} \geq 0 \\ &\qquad \boldsymbol{\lambda} \geq 0, \end{aligned} \quad (6)$$

where $\mathbf{w}$ is a strictly positive $K\times1$ vector of input prices and $\mathbf{x}_i^*$ is the cost minimising vector of inputs for the $i$-th firm, given input prices $\mathbf{w}$ and output levels $\mathbf{y}_i$. The total cost efficiency of the $i$-th firm is calculated as the ratio of minimum to observed cost:

$$CE = \mathbf{w}_i^{\mathrm{T}} \mathbf{x}_i^* / \mathbf{w}_i^{\mathrm{T}} \mathbf{x}_i. \quad (7)$$

The input-allocative measure of efficiency can be then obtained residually using (5).

A central aspect of DEA is the choice of appropriate input and output variables. The variables should reflect the main aspects of resource use in the activity concerned. DEA does not require the specification of a cost or production function. However, efficiency scores tend to be sensitive to the choice of input and output variables. Also, as more variables are included in the model, the number of firms on the frontier increases. Further, the method does not allow for stochastic factors and measurement error.

An alternative to the DEA would be to employ parametric (statistical) frontier methods, namely Corrected Ordinary Least Squares (COLS) and Stochastic Frontier Analysis (SFA). They typically require a cost function to be specified. Similarly to the DEA, a drawback of the COLS method is that it does not allow for stochastic errors and relies heavily on the position of a single most efficient unit. In contrast, the SFA method allows the inclusion of a stochastic error. However, it makes strong assumptions on the distribution of both the errors and the inefficiency term.[ix] The SFA method is therefore not particularly recommended in the presence of small samples. As this is the case in our study, we decided to conduct the analysis by employing the DEA. DEA is also the preferred choice made by many energy regulators that use benchmarking in price regulation (e.g., the Dutch regulator DTE, the Norwegian regulator NVE and the Austrian regulator E-Control).

Despite extensive research carried out in the field of efficiency measurement, so far there is no consensus in the academic literature on which method has been found to perform the best. Since the various benchmarking methods may lead us to different results, and none of the methods has been proven to be superior with respect to the others, it is important to be aware of the advantages and disadvantages of applying the different benchmarking approaches to measure a firm's performance. In addition, it is important to examine the sensitivity of the efficiency scores and rank orders to model specification.[x]

## 4. Data and Model Description

Regulators can use cross-country benchmarking in order to evaluate the performance of domestic utilities within the larger context of international practice. So far, only a few regulators have applied international benchmarking methods. The most relevant difficulty with international comparisons regards the comparability, quality, and availability of data. Since the heterogeneity of firms in an international framework is wider, quality of data is even more important than in national comparisons. The data should adequately represent different types and sizes of utilities, and should take into account differences in technical standards, accounting principles, and environmental characteristics. Further, when comparing monetary units, the correct handling of currency exchange rates is particularly significant. Purchasing power parity units (PPP) are normally used in order to correct for international differences in relative prices. Relative differences in input prices beyond the control of the firm could also be considered (e.g. wage rates, taxes, and rates of return on capital). These issues can only be tackled in time and through closer co-operation between regulators (Jamasb and Pollitt 2001).

### Sample and variables

The international gas benchmarking based on the operating expenditure of distribution and supply activities is performed using a sample of 42 gas distribution utilities in the year 2003 from:[xi]

- Slovenia (SLO): 14 companies;
- The Netherlands (NL): 21 companies; and
- The United Kingdom (UK): 7 companies.

The following variables were used in the comparative efficiency analysis:

1. operating expenditure of gas distribution and supply activities (*OPEX*, in EUR, PPP-adjusted);
2. number of customers (*CUST*);
3. gas throughput supplied (*OUTPUT*, in cubic metres);

| Variable | Country | N | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|---|
| *OPEX* (thousands EUR, PPP) | UK | 7 | 261,909 | 68,197 | 192,859 | 398,103 |
| | NL | 21 | 24,698 | 28,472 | 3,395 | 97,594 |
| | SLO | 14 | 1,747 | 2,260 | 76 | 8,418 |
| | Total | 42 | 56,583 | 99,111 | 76 | 398,103 |
| *CUST* (number of customers) | UK | 7 | 2,447,224 | 691,968 | 1,671,850 | 3,835,972 |
| | NL | 21 | 209,589 | 239,729 | 17,993 | 915,270 |
| | SLO | 14 | 6,478 | 14,708 | 6 | 54,172 |
| | Total | 42 | 514,824 | 933,635 | 6 | 3,835,972 |
| *OUTPUT* (thousands $m^3$) | UK | 7 | 7,587,792 | 2,242,947 | 5,587,123 | 12,047,916 |
| | NL | 21 | 713,840 | 718,633 | 66,958 | 2,460,579 |
| | SLO | 14 | 20,426 | 23,735 | 621 | 69,173 |
| | Total | 42 | 1,628,361 | 2,891,891 | 621 | 12,047,916 |
| *PEAK* ($m^3$/day) | UK | 7 | 48,977,331 | 13,356,546 | 32,031,755 | 75,879,258 |
| | NL | 21 | 5,261,354 | 5,610,676 | 451,900 | 17,311,908 |
| | SLO | 14 | 123,609 | 142,013 | 4,706 | 486,327 |
| | Total | 42 | 10,834,768 | 18,572,700 | 4,706 | 75,879,258 |
| *NET* (km) | UK | 7 | 30,653 | 8,819 | 22,512 | 46,619 |
| | NL | 21 | 3,718 | 4,085 | 315 | 17,403 |
| | SLO | 14 | 159 | 168 | 9 | 491 |
| | Total | 42 | 7,021 | 11,685 | 9 | 46,619 |

**Table 1**: Descriptive statistics of the variables included in the analysis

4. peak demand (*PEAK*, in $m^3$/day); and
5. network length (*NET*, in km).

The descriptive statistics in Table 1 show some considerable size differences between the utilities. UK utilities are the largest in size, followed by their Dutch and Slovenian counterparts. In order to ensure comparable data on operating expenditure (OPEX) for gas distribution utilities from Slovenia, the Netherlands and the UK, some of the figures had to be appropriately adjusted.

The OPEX data on Slovenian gas distribution utilities were gathered from the income statements of distribution companies. In the past, regulation of gas distribution companies in Slovenia was assigned to local planning authorities. Thus, at a state level, the market for natural gas was less regulated than the electricity market. Another reason for less extensive regulation in gas was the principle of negotiated third-party access introduced by the Energy Act of 1999. Through an Amendment to the Energy Act in 2004, regulated third-party access and the legal separation of distribution system operation from supply activities were introduced (AERS 2005a). However, since the framework prices for the use of distribution network have only recently been set by the Slovenian energy regulator, we were unable to obtain separate distribution and retail cost data. The Slovenian OPEX data thus include supply costs, operation and maintenance costs related to gas distribution networks, labour costs, overheads, and metering costs. Annual depreciation and gas purchasing costs were excluded from OPEX.

Comparable data on operating expenditure for Dutch utilities was obtained from the Dutch energy regulator DTE (2001). UK and Slovenian OPEX data are given for 2003, while Dutch data were only available for 1999. Thus, they had to be adjusted for both the inflation rate and for improved network efficiency over the relevant regulatory period. Adjustments to the 2003 level were made by rescaling costs down in accordance with the final CPI-X formula as applied to the Dutch gas utilities by DTE. This might provide non-Dutch companies with a benchmarking advantage if the Dutch companies managed to undercut the CPI-X price control between 2000 and 2003. The Dutch regulator separates operating (OPEX) and capital expenditure (CAPEX) for accounting purposes, but applies total cost (TOTEX) benchmarking. In the Netherlands, there is already unbundling of network and supply OPEX in place and separate regulation for each. Since in 2003 such a split was not yet in place for Slovenia, benchmarking had to be conducted for the total of network and supply OPEX. Therefore, for the purpose of this benchmark, OPEX items for network and supply activities were summed up.

OPEX data for UK utilities was provided by the UK regulator OFGEM. The basic principle for establishing the OPEX split for UK distribution companies is the methodology developed by the UK gas transmission system operator NGT (formerly Transco) in agreement with the British regulator OFGEM as part of the process for the sale of up to four Distribution Networks by Transco in 2004. The methodology utilised by Transco allocates direct and indirect costs between the eight Distribution Networks. OPEX relates to the gas network only and does not include supply and metering costs. The basis for determining the cost of gas supply is a combination of OFGEM's (2004) analysis of the costs associated with the supply of gas to household (domestic) customers and the analysis of the financial accounts of Centrica plc for the period ending 31 December 2003 with respect to the costs they incur when supplying gas to their customers.[xii] The abovementioned OFGEM analysis was also the basis for estimating metering costs.

## *Model specification*

The technology of network services is difficult to model. There is a general agreement with Neuberg (1977) on the four main factors that affect the cost of electricity (and gas) distribution: energy throughput, the number of customers/connections, network length, and the area of supply. On the other hand, there is no consensus in the literature on how to treat capital. Some authors consider it endogenous, while others consider it exogenous. The length of distribution pipes, for example, may be considered an input, but it may be affected by the location of customers (output), which is not controllable in the

| Variables | | |
|---|---|---|
| **Input** | **Output** | **Environmental**[1] |
| - number of employees<br>- network length (km)<br>- transformer capacity (MVA)[2]<br>- OPEX (PPP)<br>- TOTEX (PPP)<br>- controllable OPEX (PPP) | - number of customers<br>- total energy delivered (GWh, $m^3$)<br>- residential sales (GWh, $m^3$)<br>- non-residential sales (GWh, $m^3$)<br>- service area ($km^2$)<br>- maximum (peak) demand (MW, $m^3$/day)<br>- network length (km) | - network length<br>- service area<br>- maximum demand<br>- transformer capacity<br>- residential sales<br>- non-residential sales<br>- share of residential sales<br>- customer density (per $km^2$)<br>- network mix<br>- customer mix<br>- distribution losses (GWh, $m^3$)<br>- GNP per capita (PPP) |

[1] Different models include different assumptions about environmental variables.
[2] Applies to electricity distribution only.

**Table 2**: Variables employed in benchmarking studies of electricity and gas distribution companies

short run and may be subject to a universal service obligation to supply.[xiii] With respect to the other outputs, single-variable measures such as either total gas delivered or the number of customers can be chosen. Nevertheless, many researchers prefer multiple outputs. Table 2 provides the list of variables commonly employed in the international benchmarking studies. In some cases, physical measures of inputs as proxies for operating and capital costs are used. However, the primary aim of regulators when using benchmarking is to promote cost savings in the utilities that result in lower prices for final users. From this point of view, cost-based benchmarking should be preferred (Jamasb and Pollitt 2001).

The findings of the literature review presented in Table 2 served as a starting point in constructing our model. To test for the sensitivity of the results with respect to the different variables included in the model, we decided to calculate efficiency scores for various model specifications, as shown in Table 3. We applied the DEA method in an input-minimising mode with both constant and variable returns to scale (CRS and VRS specification). Since very high correlation between the variables *OUTPUT* and *PEAK* was discovered, the two variables are not jointly included in any of the specified models.[xiv]

The models specified in Table 3 allow us to obtain cost efficiency scores. By conducting constant and variable returns to scale analyses, scale efficiency scores can be obtained residually. Since we do not have separate data on input prices and input quantities, it is not possible to disentangle cost (overall) efficiency into technical and allocative efficiency components.

## *5. Results*

OPEX DEA was run with DEA Excel Solver by J. Zhu (2003). Average cost efficiency scores from the three countries considered are reported in Table 4. The cost efficiency scores obtained from all five DEA CRS models put companies from mature regulatory environments at an advantage, apparently marking out a difference between Slovenia and the two older EU member states. The average efficiency of UK gas distribution utilities is 77.7%, which is slightly higher than the 73.1% efficiency level reported for Dutch utilities. One out of the five models actually favours Dutch companies, but the differences are negligible. Average sample efficiency is 60.4%. Slovenian utilities, with an average efficiency score of 32.6%, are clearly lagging behind.

DEA VRS models concede that the companies need not necessarily be operating at the optimal scale of

| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| *OPEX* | I | I | I | I | I |
| *CUST* | O | O | O | O | O |
| *OUTPUT* | O | | O | O | |
| *PEAK* | | O | | | O |
| *NET* | | | O | NI | NI |

Legend:
I – input variable
O – output variable
NI – non-discretionary input (environmental variable)

**Table 3**: DEA models used

| Efficiency scores | UK | Netherlands | Slovenia | Total |
|---|---|---|---|---|
| *CE_crs1* | 0.715 | 0.702 | 0.282 | 0.564 |
| *CE_crs2* | 0.713 | 0.688 | 0.235 | 0.541 |
| *CE_crs3* | 0.715 | 0.723 | 0.462 | 0.635 |
| *CE_crs4* | 0.873 | 0.769 | 0.351 | 0.647 |
| *CE_crs5* | 0.870 | 0.771 | 0.303 | 0.632 |
| *CE_vrs1* | 0.973 | 0.753 | 0.455 | 0.690 |
| *CE_vrs2* | 0.960 | 0.721 | 0.415 | 0.659 |
| *CE_vrs3* | 0.977 | 0.786 | 0.522 | 0.730 |
| *CE_vrs4* | 0.975 | 0.801 | 0.523 | 0.737 |
| *CE_vrs5* | 0.962 | 0.791 | 0.483 | 0.717 |
| ***CE_crs_average*** | 0.777 | 0.731 | 0.326 | 0.604 |
| ***CE_vrs_average*** | 0.969 | 0.770 | 0.480 | 0.707 |

**Table 4**: Average DEA cost efficiency scores using CRS and VRS specification

activity. As a result, each company is compared only with other companies of a similar size. Due to the considerable size differences in our sample, the VRS assumption seems to be plausible. By construction, DEA VRS models display higher efficiency scores, with an average sample efficiency of 70.7%. However, both DEA versions arrive at similar conclusions with regard to country performance. Once again, UK utilities, with a cost efficiency of 97%, prove to be the most efficient on average. They are followed by Dutch utilities, with an average cost efficiency score of 77%. Slovenian firms again prove to be the least efficient ones and could, on average, theoretically produce the same output level at 48% of their current operating costs. All five DEA VRS models produce very similar results by country.

The difference between the average CRS and VRS cost efficiency scores is ascribed to scale efficiency. The results on average scale efficiency for the three countries are reported in Table 5. The scale efficiency scores are obtained residually from the reported CRS and VRS cost efficiency scores. With an average scale efficiency score of 94.8%, Dutch utilities are found to be the most scale efficient. They are followed by UK and Slovenian utilities with 80.2% and 67.4% average scale efficiency, respectively. Apparently, Dutch utilities are operating very close to the optimal size, while, on the other hand, Slovenian utilities are too small to fully exhaust economies of scale and UK utilities appear to be too big and are found to operate in the region where returns to scale are already decreasing.

The low efficiency scores of Slovenian gas distribution utilities can be explained by the fact that, in the past, gas distribution utilities were controlled by local planning authorities and faced no explicit efficiency incentives whatsoever.[xv] The incentive-based price-capping recently introduced in Slovenia could, however, help improve on this. In addition, these utilities appear to be too small to reach the optimal size of operation, which implies that Slovenian authorities might also consider the possibility of merging some of them.

| Efficiency scores | UK | Netherlands | Slovenia | Total |
|---|---|---|---|---|
| *SE_1* | 0.735 | 0.932 | 0.620 | 0.817 |
| *SE_2* | 0.742 | 0.954 | 0.566 | 0.821 |
| *SE_3* | 0.731 | 0.921 | 0.885 | 0.870 |
| *SE_4* | 0.896 | 0.959 | 0.670 | 0.877 |
| *SE_5* | 0.904 | 0.975 | 0.627 | 0.881 |
| ***SE_average*** | 0.802 | 0.948 | 0.674 | 0.853 |

**Table 5**: Average DEA scale efficiency scores

From a regulatory point of view, it is encouraging that the different models provide the same results with respect to the utilities' efficiency. If this were not the case, any one-to-one translation of efficiency scores into X-factors would be unjustified. However, the applied economic literature reveals either mixed or negative evidence on the cross-model consistency of computed efficiency scores.[xvi] In an attempt to

establish the conditions in which frontier benchmarking techniques are most useful to regulatory authorities, Bauer et al. (1998) defined a set of consistency conditions that, if met, would make the choice of a particular method trivial. The efficiency scores obtained by different techniques should be consistent in their efficiency levels, rankings, and identification of the best and worst performers. However, in the absence of any consensus on the most appropriate technique to use, model specification, and variables, a purely practical approach would entail the combination of results from different models. In this case, benchmarking should only be used as a complementary instrument in price-cap regulation, and not as the regulator's main tool.

Our sample shows that the different models applied yield quite similar results with respect to relative efficiency scores. All models identify the same best practice, while in the case of 'worst practice' we get different results. The correlation matrix between cost efficiency ranks obtained from the different models is given in Table 6. The results indicate a relatively high correlation between the rank orders produced by the models. Nevertheless, the established consistency of efficiency scores is only based on the results of the DEA method. As already pointed out, in a number of studies it was found that benchmarking is, to a certain extent, influenced by the techniques chosen, model specification, and variables included in the model. Therefore, rather than using efficiency estimates in a mechanistic way, regulators are advised – and are increasingly becoming aware of this issue – to use benchmarking as one of the instruments for price regulation purposes.

## 6. Conclusions

This paper carried out a relative efficiency comparison of gas distribution utilities from two 'older' European Union countries and one newcomer. We used non-parametric benchmarking analysis (DEA) to assess an international cross-section of gas utilities subject to economic regulation in their respective countries. DEA cost efficiency results show that Slovenian gas distribution utilities perform, on average, less efficiently than their UK and Dutch counterparts. This suggests the presence of an efficiency gap between two old and one new EU member countries. The regulatory reforms recently introduced in Slovenia aim to raise the performance of gas distributors. UK utilities are found on average to be the most cost efficient, whereby the differences with the Dutch distributors are small when constant returns to scale are assumed, while the variable returns to scale assumption results in somewhat more striking differences. On the other hand, Dutch utilities are found to operate very close to the optimal size and thus outperform the UK utilities with respect to the scale efficiency. Reassuringly, different model specifications lead to relatively stable efficiency scores and rankings. Nevertheless, regulatory authorities are not encouraged to use benchmarking as their main instrument for monitoring utilities' performance, ase benchmarking can be influenced by the variables, model specification, and methodology

| | *R_crs1* | *R_ crs2* | *R_ crs3* | *R_ crs4* | *R_ crs5* | *R_vrs1* | *R_ vrs2* | *R_ vrs3* | *R_ vrs4* | *R_ vrs5* |
|---|---|---|---|---|---|---|---|---|---|---|
| *R_crs1* | 1.000 | 0.922 | 0.853 | 0.852 | 0.797 | 0.732 | 0.653 | 0.711 | 0.676 | 0.628 |
| *R_ crs2* | | 1.000 | 0.780 | 0.781 | 0.850 | 0.680 | 0.749 | 0.666 | 0.612 | 0.676 |
| *R_ crs3* | | | 1.000 | 0.672 | 0.620 | 0.778 | 0.705 | 0.806 | 0.678 | 0.632 |
| *R_ crs4* | | | | 1.000 | 0.938 | 0.632 | 0.557 | 0.550 | 0.809 | 0.780 |
| *R_ crs5* | | | | | 1.000 | 0.572 | 0.619 | 0.490 | 0.748 | 0.833 |
| *R_vrs1* | | | | | | 1.000 | 0.896 | 0.939 | 0.868 | 0.776 |
| *R_ vrs2* | | | | | | | 1.000 | 0.849 | 0.759 | 0.823 |
| *R_ vrs3* | | | | | | | | 1.000 | 0.766 | 0.674 |
| *R_ vrs4* | | | | | | | | | 1.000 | 0.920 |
| *R_ vrs5* | | | | | | | | | | 1.000 |

* All correlation coefficients are significant at the 0.01 level (2-tailed significance level).

**Table 6**: Correlation coefficients between cost efficiency ranks given by different DEA CRS and VRS specifications*

employed. Benchmarking can, however, be viewed as an extremely effective complementary regulatory instrument.

Gas networks used to be regulated in the past without any explicit reference to economic benchmarking, mainly because of the lack of reliable technical and cost data, coupled with a sometimes strong opposition from private-sector industry lobbies. Thanks to benchmarking analysis, the information asymmetry traditionally observed between utilities and regulatory authorities can be mitigated. By aiming at fairly exposing individual strengths and weaknesses to the scrutinising power of data comparisons, international benchmarking can therefore be used to assess gas companies running distribution as a territorial monopoly in their respective regions. Our study is one of the first contributions to international gas benchmarking as opposed to the more explored electricity sector. It is also one of the first studies on relative performance of gas distribution utilities from Central and Eastern European (ex-)transition countries. The study provides an important indication on the presence of a significant performance gap between the companies from the new and the old EU member states and specifies the need to introduce incentive-based price cap regulation of gas distribution companies. For the wider and more successful implementation of international benchmarking in the future, it is of paramount importance to ensure the provision of harmonised regional and international data to national and international regulators, along with the full integration of European datasets. Co-operation between regulators would relax certain limitations of the analysis related to data comparability, availability and small sample size. In the presence of large samples, the study could be further improved by the use of alternative parametric frontier methods (e.g., SFA). All of this would in turn contribute to improved reliability of efficiency results which is of paramount importance if the results are to be used in economic policy-making.

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## *Endnotes*

[i] For a general discussion of these models, see Joskow and Schmalensee (1986). For an overview of the main benchmarking methods used in the OECD and a few other countries, see Jamasb and Pollitt (2001).

[ii] A number of empirical studies with a cross-country focus have addressed the issue of relative efficiency and performance, e.g.: Pollitt (1994), IPART (1999), Jamasb and Pollitt (2003), Hattori (2002), Hattori, Pardina and Rossi (2000), Estache, Rossi and Ruzzier (2004), and Hrovatin et al. (2005). However, such studies focussed on the electricity sector.

[iii] The Slovenian market heavily depends on imports since Slovenia produces negligible quantities of natural gas. Geoplin imports natural gas from three sources (Russia, Algeria, and Austria) on the basis of long-term take-or-pay contracts.

[iv] The majority of local distribution utilities are, besides natural gas distribution, also engaged in other activities such as district heating, water supply, etc.

[v] Large industrial customers, power generation utilities, non-energy users, local distribution, and district heating utilities are supplied directly via the transport/transmission system, while small industrial customers, commercial users, and households are supplied via local distribution networks.

[vi] However, most eligible customers still have long term contracts with Geoplin, which will expire partially in 2007 and in 2010. These contracts prevent them from purchasing natural gas on the open market (Hrovatin and Švigelj 2004).

[vii] The envelopment model is a corresponding dual problem of the multiplier model, i.e. the primal problem (Cooper, Seinford and Tone 2003). Since the envelopment form involves fewer constraints than the multiplier form ($K+M < N+1$), it is usually the preferred form to solve.

[viii] Separability may also be exploited in order to decompose technical efficiency into scale, congestion, and 'pure' technical efficiency as in Fare, Grosskopf and Lovell (1985).

[ix] For SFA methods, a good reference is Kumbhakar and Lovell (2000).

[x] For example, see Bauer et al. (1998), Estache, Rossi and Ruzzier (2004), Farsi and Filippini (2004), Jamasb and Pollitt (2003), and Farsi, Filippini and Greene (2005).

[xi] Due to missing data, four companies from the Netherlands and one company each from the UK and Slovenia had to be excluded from the sample.

[xii] Centrica plc (retailing as British/Scottish Gas) is the largest retail supplier of gas in the UK.

[xiii] As far as electricity distribution is concerned, Pollitt (1994), IPART (1999), and Estache, Rossi and Ruzzier (2004) treat line length as an input, while Jamasb and Pollitt (2003) and some regulators use line length as an output.

[xiv] Dyson et al. (2001) for example suggests that dropping a strongly correlated variable may significantly influence efficiency results.

[xv] The distribution of natural gas in Slovenia is a local optional, not a national and universal public service. This is in stark contrast to electricity distribution, which is mandatory and a nationwide recognised public service. In some other countries, universal service obligations are enforced on both sectors.

[xvi] For example, see Estache, Rossi and Ruzzier (2004), and Farsi and Filippini (2004).

# To List or Not To List: Expectations versus Reality for Greek Shipping IPOs

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*Abstract:*

***Sharing ownership with outside investors through an IPO has advantages and disadvantages that create dilemmas for company founders. It can further be a source of disappointment when expectations fall short of reality. That's not the case for the Greek ship owners who floated the shares of their companies to major US Exchanges in the early 2000s, however. The listing has met and even exceeded their expectations: Broadened their capital structure, improved image and prestige, strengthened bargaining power with creditors, and enhanced entrepreneurial opportunities***

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## 1. Introduction

Equity financing through a private placement or an IPO has become a popular source of financing in recent years. In the 1990's, this trend was confined mostly to high-technology companies reaching for both the funds and the visibility associated with a successful IPO in a major Exchange, especially the American Stock Exchange (AMEX), the New York Stock Exchange (NYSE), and the National Association of Securities Dealers Automated Quotations (NASDAQ). In 1999 alone, 544 companies completed successfully an IPO in one of these exchanges raising $87.2 million on average and $23.6 billion in total (NYSE, 2001). In early 2000s, this trend was extended to traditional sectors, such as shipping. In 2005 alone, seven Greek shipping companies floated their shares in US Stock Exchanges, bringing the total number of listed Greek companies to 13.

Sharing ownership with outside investors through an IPO has advantages and disadvantages that create dilemmas for company founders. Taking a company public provides access to present and future equity financing, augments credibility, improves bargaining power with creditors, enhances corporate prestige, and fosters employee motivation. At the same time, public listing incurs direct and indirect costs, such as underwriting and registration fees, disclosure requirements, and exposes companies to unfriendly or hostile takeovers.

The advantages and disadvantages of an IPO may not be well known in advance, however. This is especially the case for indirect benefits, such as the improvement of corporate image and prestige and the extension of business relations that enhance the entrepreneurial function of the company that take time to materialize. This means that a post-IPO world may not be as rosy and cozy as anticipated when the IPO decision was made. So, to list or not to list?

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The answer to this question depends upon a number of additional factors that eventually tip the balance between benefits and costs, such as the state of the equity markets and each particular industry, and the company size –to mention but a few. Equity financing, for instance, is much easier in "bull" rather than in "bear" markets. Equity financing is also easier in industries on a cyclical upturn rather than downturn, especially for larger companies with solid financials, as has been the case with the Greek shipping industry in the early 2000s, the subject of this paper.

At that time, Greek ship owners had it all: A resurgence in global equity markets led by robust commodity prices, a cyclical upturn in both cargo volumes and rates, and a reputation as the world's most astound shipping tycoons that tipped the balance between listing benefits and costs in favor of the former. As our survey of 10 out of 13 Greek listed companies indicates, a listing in major US Exchanges, allowed them to augment and diversify their sources of financing, improve their image and prestige, strengthen bargaining power with creditors, and enhance their entrepreneurial opportunities –meeting and even exceeding their expectations.

Arguing this contention in more detail, the remaining of the paper is in two sections. The first section discusses some theoretical insights on the costs and benefits of going public, while the second section discusses the results of our survey.

## *2. To List Or Not To List: Some Theoretical Insights*

As is the case with every business decision, the decision to go public through an IPO involves a number of direct and indirect costs and benefits that must be carefully addressed and evaluated.

One benefit of going public is the immediate (primary offering) and future (secondary offering) access to equity capital that can be used as an efficient exit mechanism for company owners and venture capitalists, debt retirement, capital expansion, and for "account rebalancing" (Black and Gilson, 1998; Pagano, Panetta & Zingales, 1998; Brennan and Franks, 1997; Röell, 1996; Zingales, 1995).

Another benefit is improved liquidity and risk sharing. Listed shares are far more liquid than non-listed shares, which make them more appealing to investors, especially to those who take an opportunistic approach to investing (Ritter and Welch, 2002, Pagano, 1993, Amihud and Mendelson, 1988). Listed shares can be further part of a diverse portfolio, which appeals to conservative investors who prefer a diverse over a non-diverse portfolio of equities.

A third benefit is the enhanced visibility and corporate image that comes with increased publicity. Regulatory agencies and Exchanges require listed companies to release certain information to the public, and therefore are much more likely to receive the attention of mass-media than private enterprises. Press releases, interviews, news stories, analyst reports and daily stock market tables comprise a free and flexible communication mechanism that improves recognition among the company's current and future stakeholders (Pollock and Gulati, 2007, Cook et al., 2006; Frieder and Subrahmanyam, 2005).

A fourth benefit of going public is the signals it conveys to potential creditors about the financial health of the corporation (Deeds et al., 1997; Leland and Pyle, 1977). To qualify for an IPO, companies must comply with Exchange and government agency requirements that convey a positive signal to creditors about the financial health of the company. Therefore, IPO enhances financial transparency and improves bargaining power with banks and other financial institutions (Fombrun and Van Riel, 1998). Bankers, for instance, feel more comfortable lending funds to known companies that have already passed the screening test of a reputable institution, rather than to unknown companies that never took or failed such test. This implies that listed companies have a greater bargaining power when it comes to funding negotiations (Rajan, 1992). This is especially the case for companies in capital intensive industries, such as companies in the shipping.

A fifth benefit is the fostering of new business opportunities brought about by the enhanced credibility and corporate profile that attracts the attention of potential inter-organizational partners or alliance candidates, and new customers. Lenders,

partners, and suppliers perceive listed companies as more reliable partners (low risk) than non-listed companies, strengthening existing business relationships and encouraging vertical and horizontal entrepreneurial networking (Ravasi and Marchisio, 2003; Barry et al., 1990).

A sixth benefit of going public is the introduction and implementation of equity- based compensation packages that improve the recruitment and retention of qualified managers and employees, aligning their interests with those of the corporation (Bolton & von Thadden, 1998; Holmstrom & Tirole, 1993).

In short, corporations that consider a public offering expect a number of benefits that range from broadening their capital structure and improved liquidity to the lowering of cost of capital and the expansion of business opportunities. These benefits must be compared and contrasted with a number of expected costs.

One cost of going public is investment banking fees, which account to around 7% of the issue value in the US and 6% in Japan (Hansen, 2001; Chen & Ritter, 2000).

Another cost is Exchange registration fees, due diligence and Stock Exchange listing fees, and auditing, certification and dissemination expenses (Barry et al., 1991). These expenses are rather fixed, in the range of $250,000-300,000, and therefore they burden disproportionably smaller companies rather than larger companies (Ritter, 1987).

A third cost is underpricing, due to the asymmetry of information between corporate insiders and outsiders. In general, individual and institutional investors aren't as informed as insiders about the real value of the issuing firm, which affects negatively the average quality of the issuing firm and leads to underpricing of the shares issued to the public (Derrien and Kecskés, 2007, Ritter, 2003; Booth and Chua, 1996; Rock, 1986). Adverse selection cost is larger for younger and relatively young firms with a short track record and little visibility (Chemmanur and Fulgieri, 1999).

A fourth cost of going and remaining public is compliance with strict and explicit disclosure requirements that often makes an IPO much more costly than alternative sources of financing (Campbell, 1979). In the US, for instance, securities market regulations, such as the *caveat emptor* (buyer beware) require the disclosure of information that inevitably becomes available to third parties, including current and potential competitors (Yosha, 1995).

A fifth cost of going public is associated with decrease or loss of corporate control and vulnerability to the threat of unfriendly or hostile takeovers (Pagano and Röell, 1998).

In short, an IPO has a number of direct and indirect benefits that range from access to present and future equity financing, to enhancement of corporate prestige and employee motivation (see Table I). At the same time, an IPO has direct and indirect costs, such as underwriting and registration fees, disclosure requirements, and exposes companies to unfriendly or hostile takeovers.

Some IPO costs and benefits may not be fully known in advance, however. This is especially the case for indirect benefits, such as the enhancement of corporate image and prestige and the extension of business relations that upgrade the entrepreneurial function of the company that take time to materialize. This means that anticipated IPO benefits may fall short of actual IPO benefits, and in some cases, the gap between expectations and reality may be sufficient enough to tip the balance towards the costs.

In addition, IPO benefits and costs depend on macroeconomic and microeconomic conditions, such as the state of the equity markets or particular industries and the company size, that may broaden or narrow the gap between anticipated and actual IPO benefits (Pagano, Panetta & Zingales, 1998; Röell, 1996). Equity financing, for instance, is more accessible in rising rather than in declining equity markets (Derrien and Kecskés, 2007). Equity financing is also easier in industries on a cyclical upturn rather than downturn, especially for larger companies with solid financials that lead their industry, as has been the case with the Greek shipping industry in the early 2000s.

## *3. Greek Shipping IPOs; Expectations versus Reality*

There have been the best and the worst times for the Greek shipping industry, which owns the world's

second largest fleet in terms of tonnage, behind Japan (UNCTAD Secretariat, 2006). In the early 2000s, there was the best time. Greek ship owners had it all: First, a cyclical upturn in the shipping industry that created the need for additional capacity. Between 2002 and 2006, the Greek fleet has increased by about 7% annually, in terms of capacity, while in 2006 alone the Greek tonnage additions were 11 million deadweight tons (see Figure I). Second, a resurgence in global equity markets fueled by robust commodity prices, rising cargo volumes and rates (Grammenos and Marcoulis, 1996). Third a reputation as the world's most astounding shipping tycoons (Stefanidis et al., 2007).

These favorable conditions tipped the balance between listing benefits and costs for 13 companies that launched successful IPOs in US Exchanges (see Table II).

For years, Greek shipping companies have relied on plain or syndicated loans from Greek and Far East banks to finance and expand their operations, especially the upgrading and expansion of their fleet (Grammenos & Choi, 1999). This finance structure is reflected in the high interest expense as a percent of EBIT. Even after going public, such an expense approaches or exceeds 50 percent of EBIT. Aries Maritime Transport's interest expense, for instance, accounts for close to 56 percent of EBIT; Quintana Maritime's percent is 49.24, and Omega Navigation's percent is 34.29. But which expected benefits tipped the decision of these companies to go public? Did expectations meet reality?

To address these questions, we formulated five propositions:

*Proposition 1: Following an IPO, improved visibility of the shipping company increases its bargaining power with banks and other financial institutions.*

*Proposition 2: Following an IPO, improved visibility of the shipping company lowers its cost of credit for loans from banks and other financial institutions.*

*Proposition 3: Following an IPO, improved visibility of the shipping company increases its image and prestige to the stakeholders.*

*Proposition 4: Following an IPO, improved visibility of the shipping company increases the development of inter-organizational relationships.*

To test these propositions, we first conducted a number of in-depth interviews with industry specialists that helped us understand the Greek tycoons' mindset and identify the sources of their success[1]. Then, we conducted our own survey of the 13 Greek shipping operators at that time listed in the US equity markets (NYSE and NASDAQ, 2006), which yielded 10 responses (76 per cent).

The survey was carried out through self-administered questionnaires filled in by the CEO of the company, while, only in three cases, we got feedback from the CFO. Except for one case, a minimum of six-month period lapsed between the listing date and the date the survey was conducted (January 2007), which allowed a feedback on both anticipated and actual IPO benefits –a unique feature of our study.

The questionnaire is in two parts. The first part relates a number of factors that were important on the decision of the company to go public in the US stock market. It includes the anticipated benefits such as 'To diversify sources of finance', 'To increase the visibility of the company', 'To facilitate ownership status restructuring'. The second part examines to what extent these benefits were achieved after the IPO. To assess the importance of each factor, the Likert scale from 1 to 7 was used, where 1 represents the least importance and 7 represents the most importance.

Table III summarizes the *anticipated* IPO benefits. Top on the list is financial diversification (mean score 6.60), followed by improved access to capital (6.20), and external growth stimulation (6.00). High up on the list are also the credit cost reduction, the better bargaining power with banks and institutions, followed by increased corporate visibility and improved corporate image.

Table IV summarizes the *actual* IPO benefits. Financial diversification continues to top the list followed by

improved access to capital, too, but the external growth stimulation gives its place to the lower cost of credit. Other factors, such as the improvement of company image and prestige, and debt equity rebalancing have moved up on the list, while bargaining power with creditors has roughly maintained its ranking in both tables. So have actual IPO benefits met the expectations of Greek ship-owners?

To address this question, we have calculated the "gap" between *anticipated* and *actual* benefits. For most factors addressed, actual benefits far exceed anticipated benefits (see Table V). This means that the IPO had a positive –beyond expectations– impact on certain business objectives. This is especially the case for four factors where the gap is larger and statistically significant, the building of inter-organizational relationships, the improvement of corporate image and prestige, the reaching of existing and potential stockholders, and the gaining of greater bargaining power with creditors (see Table VI).

These findings are further confirmed by the post-IPO benefits correlation coefficient matrix (see Appendix): The shipping companies' augmented visibility that followed the IPO is positively correlated with their bargaining power with potential creditors (correl. coeff.: 0.851, sign. level: 0.05); the improved visibility and the positive signals of financial health is positively correlated with corporate creditworthiness, translating into lower credit costs (correl. coeff.: 0.707, sign. level: 0.05); the improved visibility is positively correlated with corporate reputation, image and prestige (correl. coeff.: 0.917, sign. level: 0.01); the improved visibility is positively correlated with the development of genuine inter-organizational relationships and networks and the exploitation of entrepreneurial opportunities (correl. coeff.: 0.732, sign. level: 0.05).

Our findings are consistent with a number of similar studies. Pagano, Panetta & Zingales (1998), for instance, find that the companies go public to rebalance their accounts after a period of high investment and growth rather than to simply raise equity capital. The authors further confirm that public companies experience a lower bank borrowing cost after the IPO. Rajan (1992) finds that access to equity markets and public information dissemination elicits competition among lenders that ensures a lower cost of credit. Ravassi & Marchisio (2003) find that enhanced visibility and trustworthiness expands the number of opportunities for collaboration in new development initiatives.

## *4. Conclusion*

An IPO has always been an appealing proposition for companies seeking to broaden and diversify their sources of financing, improve liquidity, and enhance corporate profile that translates to better internal and external relations. These benefits come at a cost, however, which includes listing and underwriting fees, compliance expenses, equity price concessions, and exposure to hostile takeovers.

While some of these costs and benefits are well-known in advance, others aren't, especially when it comes to indirect benefits and that makes an IPO an uncertain proposition: the post IPO world may save positive or negative surprises. IPO costs and benefits are further sensitive to the prevailing economy, equity market and industry conditions at the time the IPO decision is under consideration that may tip the balance in either direction. A declining economy, a sagging equity market, and an industry in a cyclical downturn tip the point towards the costs. A growing economy, a rising equity market, and an industry in a cyclical upturn tip the point in favor of the listing benefits, especially for industry leaders, as has been the case with the 13 Greek shipping companies that floated their shares in US Exchanges in the early 2000s.

As our survey confirms, the listing has met and even exceeded Greek shipping companies' expectations: Broadened and diversified capital financing, improved image and prestige, strengthened bargaining power with creditors, and enhanced entrepreneurial opportunities-meeting and even exceeding their expectations. These findings are consistent with a number of similar studies.

Simultaneously, the paper has certain policy implications for companies considering going public. First, they should choose carefully the right place, the right exchange to list their shares. A reputable and

visible exchange is far more effective in improving corporate image and prestige that eventually translates into tangible benefits such as the strengthening of bargaining power with creditors, the lowering of cost of credit, and the creation of entrepreneurial networks and opportunities. Second, they should choose the right time, that is when financial markets are in a bull phase and the industry they are in is in a cyclical upturn. Third, they should keep a closer eye on the indirect benefits of an IPO, rather than on the direct benefits of immediate capital growth. These implications can further be supported if this survey is also conducted in other highly globalized industries, in different business settings.

## Note

[1] We have particularly benefited from the many constructive comments made by Mr. Konstantinos Voulgaris.

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## *Tables*

| BENEFITS | | COSTS | |
|---|---|---|---|
| ***Direct*** | | ***Direct*** | |
| 1 | Access to direct financing, ownership restructuring and exit strategy | 1 | Underwriting and offering registration fees |
| 2 | Improved liquidity and portfolio diversification for current and potential investors | 2 | Investment banking costs |
| ***Indirect*** | | ***Indirect*** | |
| 1 | Augmented visibility and publicity that improves corporate profile | 1 | Underpricing or adverse selection costs |
| 2 | Improved creditworthiness, greater bargaining power with banks and financial institutions, lower cost of credit | 2 | Compliance |
| 3 | Enhanced corporate credibility and development of a network of inter-organizational relationships | 3 | Exposure to tax authorities scrutiny |
| 4 | Attractive compensation schemes for employees | 4 | Distortion of capital structure and decrease or loss of corporate control |

**Table 1:** Benefits and Costs of Initial and Follow-on Public Offerings

| | Company | Stock Exchange | Entry Year | EBIT | Debt | Interest Expense | Interest Expense/ EBIT |
|---|---|---|---|---|---|---|---|
| 1 | Aries Maritime Transport Ltd. | Nasdaq | 2005 | 33,564,000 | 284,800,000 | 18,793,000 | 55.99% |
| 2 | Danaos Corporation | NYSE | 2006 | 146,265,000 | 741,070,000 | 23,415,000 | 16.01% |
| 3 | Diana Shipping Inc. | NYSE | 2005 | 67,721,000 | 39,450,000 | 2,731,000 | 4.03% |
| 4 | DryShips Inc. | Nasdaq | 2005 | 131,415,000 | 577,200,000 | 20,398,000 | 15.52% |
| 5 | Excel Maritime Carriers Ltd. | NYSE | 1999 | 77,608,000 | 226,840,000 | 9,538,000 | 12.29% |
| 6 | FreeSeas Inc. | Nasdaq | 2005 | 152,000 | 13,120,000 | 0 | 0.00% |
| 7 | General Maritime Corp. | NYSE | 2001 | 244,757,000 | 50,000,000 | 32,400,000 | 13.24% |
| 8 | Navios Maritime Holdings Inc. | Nasdaq | 2005 | 65,994,000 | 545,380,000 | 13,569,000 | 20.56% |
| 9 | Omega Navigation Enterprises Inc. | Nasdaq | 2006 | 12,260,000 | 240,460,000 | 4,204,000 | 34.29% |
| 10 | Quintana Maritime Ltd. | Nasdaq | 2005 | 10,895,000 | 459,500,000 | 5,367,000 | 49.26% |
| 11 | StealthGas Inc. | Nasdaq | 2005 | 17,221,000 | 150,430,000 | 2,685,000 | 15.59% |
| 12 | Top Tankers Inc. | Nasdaq | 2004 | 88,861,000 | 564,100,000 | 20,177,000 | 22.71% |
| 13 | Tsakos Energy Navigation Ltd. | NYSE | 2002 | 173,002,000 | 1,110,000,000 | 11,247,000 | 6.50% |

**Source:** Adapted from NYSE and NASDAQ, 2006

**Table 2:** Greek Shipping Companies Listed in the US Stock Exchanges and their Interest Expense

| | Mean | Std. Deviation |
|---|---|---|
| To broaden and diversify capital financing structure | 6.60 | 0.70 |
| To achieve improved access to capital | 6.20 | 1.14 |
| To stimulate external growth | 6.00 | 1.25 |
| To lower cost of credit | 5.40 | 1.26 |
| To rebalance the debt to equity level | 5.10 | 1.60 |
| To reach efficiently groups of existing and potential stakeholders | 4.50 | 1.78 |
| To gain greater bargaining power with banks and institutions | 4.30 | 1.89 |
| To increase the visibility of the company | 4.10 | 2.28 |
| To improve the image and prestige of the company | 3.30 | 1.49 |
| To support establishment of strategic alliances | 3.20 | 1.69 |
| To facilitate ownership status restructuring | 2.80 | 1.87 |
| To build a network of inter-organizational relationships | 2.70 | 1.57 |
| To let shareholders sell part of their stocks | 2.30 | 1.64 |

**Table 3:** Anticipated IPO Benefits (Scale 1-7)

| | Mean | Std. Deviation |
|---|---|---|
| To broaden and diversify capital financing structure | 6.44 | 0.73 |
| To achieve improved access to capital | 6.33 | 0.71 |
| To lower cost of credit | 6.33 | 0.71 |
| To stimulate external growth | 6.22 | 1.09 |
| To improve the image and prestige of the company | 6.00 | 1.50 |
| To rebalance the debt to equity level | 6.00 | 1.22 |
| To reach efficiently groups of existing and potential stakeholders | 5.78 | 1.99 |
| To increase the visibility of the company | 5.67 | 1.00 |
| To gain greater bargaining power with banks and institutions | 5.56 | 2.01 |
| To build a network of inter-organizational relationships | 4.44 | 1.42 |
| To facilitate ownership status restructuring | 3.67 | 1.66 |
| To let shareholders sell part of their stocks | 3.67 | 2.00 |
| To support establishment of strategic alliances | 3.67 | 1.58 |

**Table 4:** Actual IPO Benefits (Scale 1-7)

| | GAP |
|---|---|
| To broaden and diversify capital financing structure | -0.16 |
| To achieve improved access to capital | 0.13 |
| To stimulate external growth | 0.22 |
| To support establishment of strategic alliances | 0.47 |
| To facilitate ownership status restructuring | 0.87 |
| To rebalance the debt to equity level | 0.90 |
| To lower cost of credit | 0.93 |
| To gain greater bargaining power with banks and institutions | 1.26 |
| To reach efficiently groups of existing and potential stakeholders | 1.28 |
| To let shareholders sell part of their stocks | 1.37 |
| To increase the visibility of the company | 1.57 |
| To build a network of inter-organizational relationships | 1.74 |
| To improve the image and prestige of the company | 2.70 |

**Table 5:** Anticipated and Actual IPO benefit Gap

| | t | df | Sig. (2-tailed) |
|---|---|---|---|
| To build a network of inter-organizational relationships | -4.47 | 8 | 0.0021 |
| To improve the image and prestige of the company | -4.08 | 8 | 0.0035 |
| To reach efficiently groups of existing and potential stakeholders | -2.73 | 8 | 0.0260 |
| To gain greater bargaining power with banks and institutions | -2.68 | 8 | 0.0278 |
| To lower cost of credit | -2.29 | 8 | 0.0509 |
| To increase the visibility of the company | -1.94 | 8 | 0.0883 |
| To let shareholders sell part of their stocks | -1.74 | 8 | 0.1202 |
| To rebalance the debt to equity level | -1.64 | 8 | 0.1388 |
| To broaden and diversify capital financing structure | 1.15 | 8 | 0.2815 |
| To support establishment of strategic alliances | -1.08 | 8 | 0.3122 |
| To facilitate ownership status restructuring | -1.08 | 8 | 0.3129 |
| To achieve improved access to capital | 0.43 | 8 | 0.6811 |
| To stimulate external growth | -0.21 | 8 | 0.8417 |

**Table 6:** Paired samples t-test of the expected benefits before the IPO and the achieved benefits after the IPO

## Figures

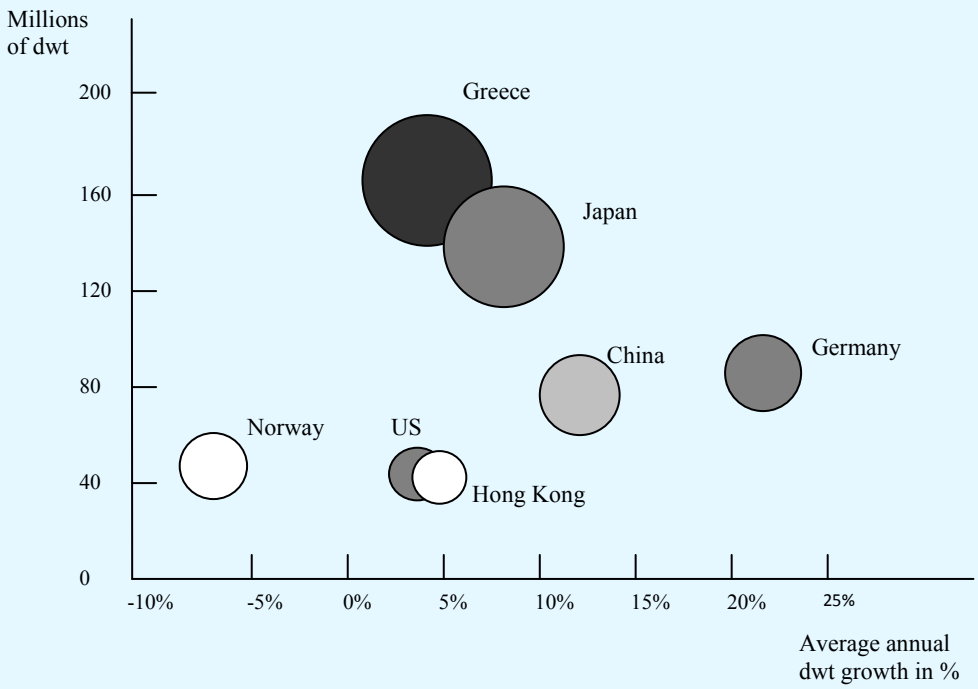


**Figure 1**: Controlled fleet growth of major shipping nations as of July 1st, 2006 (dwt – yearly average growth rate 2002-2006)

## Appendix: The correlation matrix

| | | To broaden and diversify capital financing structure | To increase the visibility of the company | To facilitate ownership status restructuring | To support establishment of strategic alliances | To gain greater bargaining power with banks and institutions | To improve the image and prestige of the company | To let shareholders sell part of their stocks | To stimulate external growth | To lower cost of credit | To reach efficiently groups of existing and potential stakeholders | To achieve improved access to capital | To build a network of inter-organizational relationships | To rebalance the debt to equity level |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **To broaden and diversify capital financing structure** | Pears. Correl. | 1.000 | 0.057 | 0.035 | 0.254 | 0.410 | 0.229 | 0.029 | 0.175 | 0.406 | -0.010 | -0.081 | -0.456 | 0.281 |
| | Sig. (2-tailed) | | 0.883 | 0.930 | 0.510 | 0.274 | 0.553 | 0.942 | 0.653 | 0.279 | 0.980 | 0.836 | 0.217 | 0.464 |
| | N | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To increase the visibility of the company** | Pears. Correl. | | 1.000 | **0.829**** | 0.553 | **0.851**** | **0.917**** | **0.688*** | -0.381 | **0.707*** | 0.462 | 0.177 | **0.732*** | 0.510 |
| | Sig. (2-tailed) | | | 0.006 | 0.122 | 0.004 | 0.001 | 0.041 | 0.311 | 0.033 | 0.211 | 0.649 | 0.025 | 0.160 |
| | N | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To facilitate ownership status restructuring** | Pears. Correl. | | | 1.000 | **0.667*** | **0.814**** | **0.854**** | **0.905**** | -0.230 | 0.640 | 0.468 | 0.320 | 0.653 | 0.492 |
| | Sig. (2-tailed) | | | | 0.050 | 0.008 | 0.003 | 0.001 | 0.552 | 0.064 | 0.204 | 0.402 | 0.057 | 0.178 |
| | N | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To support establishment of strategic alliances** | Pears. Correl. | | | | 1.000 | **0.696*** | 0.580 | 0.395 | **-0.675*** | 0.447 | 0.013 | -0.335 | 0.241 | 0.516 |
| | Sig. (2-tailed) | | | | | 0.037 | 0.102 | 0.292 | 0.046 | 0.227 | 0.973 | 0.378 | 0.533 | 0.155 |
| | N | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To gain greater bargaining power with banks and institutions** | Pears. Correl. | | | | | 1.000 | **0.955**** | **0.675*** | -0.291 | 0.646 | 0.254 | 0.029 | 0.471 | 0.407 |
| | Sig. (2-tailed) | | | | | | 0.000 | 0.046 | 0.447 | 0.060 | 0.509 | 0.940 | 0.200 | 0.277 |
| | N | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To improve the image and prestige of the company** | Pears. Correl. | | | | | | 1.000 | **0.708*** | -0.305 | **0.707*** | 0.462 | 0.236 | 0.644 | 0.408 |
| | Sig. (2-tailed) | | | | | | | 0.033 | 0.425 | 0.033 | 0.211 | 0.542 | 0.061 | 0.275 |
| | N | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To let shareholders sell part of their stocks** | Pears. Correl. | | | | | | | 1.000 | 0.152 | 0.530 | 0.388 | 0.442 | 0.629 | 0.408 |
| | Sig. (2-tailed) | | | | | | | | 0.695 | 0.142 | 0.302 | 0.234 | 0.070 | 0.275 |
| | N | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| **To stimulate external growth** | Pears. Correl. | | | | | | | | 1.000 | -0.270 | -0.090 | 0.377 | -0.312 | -0.374 |
| | Sig. (2-tailed) | | | | | | | | | 0.483 | 0.819 | 0.317 | 0.413 | 0.322 |
| | N | | | | | | | | 9 | 9 | 9 | 9 | 9 | 9 |
| **To lower cost of credit** | Pears. Correl. | | | | | | | | | 1.000 | **0.771*** | 0.500 | 0.455 | **0.866**** |
| | Sig. (2-tailed) | | | | | | | | | | 0.015 | 0.170 | 0.218 | 0.003 |
| | N | | | | | | | | | 9 | 9 | 9 | 9 | 9 |
| **To reach efficiently groups of existing and potential stakeholders** | Pears. Correl. | | | | | | | | | | 1.000 | **0.860**** | 0.437 | 0.565 |
| | Sig. (2-tailed) | | | | | | | | | | | 0.003 | 0.239 | 0.113 |
| | N | | | | | | | | | | 9 | 9 | 9 | 9 |
| **To achieve improved access to capital** | Pears. Correl. | | | | | | | | | | | 1.000 | 0.331 | 0.289 |
| | Sig. (2-tailed) | | | | | | | | | | | | 0.384 | 0.451 |
| | N | | | | | | | | | | | 9 | 9 | 9 |
| **To build a network of inter-organiz. relationships** | Pears. Correl. | | | | | | | | | | | | 1.000 | 0.358 |
| | Sig. (2-tailed) | | | | | | | | | | | | | 0.344 |
| | N | | | | | | | | | | | | 9 | 9 |
| **To rebalance the debt to equity level** | Pears. Correl. | | | | | | | | | | | | | 1.000 |
| | Sig. (2-tailed) | | | | | | | | | | | | | |
| | N | | | | | | | | | | | | | 9 |

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

# Guide for Submission of Manuscripts The South East European Journal of Economics and Business

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