

CORPORATE GOVERNANCE,
OWNERSHIP STRUCTURE AND
CORPORATE EFFICIENCY: THE
CASE OF UKRAINE

by

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Abstract

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The goal of the paper is to examine the effects of different ownership structures and of the quality of corporate governance on the Farrell measure of efficiency. Data Envelopment Analysis and Limited Dependent Variable Estimations are applied to the set of Ukrainian joint-stock companies listed on the First Securities Trading System. The domestic organization ownership is found to enhance efficiency the most, while managerial ownership has a detrimental effect on efficiency. Foreign owned firms are relatively inefficient; however foreign ownership is found to have a positive and significant effect on corporate governance quality. State ownership and concentrated ownership rights improve efficiency. The quality of corporate governance is found to have a positive impact on efficiency of domestically owned firms.

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GLOSSARY AND ABBREVIATION

Corporate Governance. A field in economics that investigates how to secure/motivate efficient management of corporations by the use of incentive mechanisms, such as contracts, organizational designs and legislation.

JSC. Joint-Stock Company.

Commission. Ukrainian Securities and Stock Market State Commission.

PFTS. First Securities Trading System.

DEA. Data Envelopment Analysis.

OLS. Ordinary Least Squares.

CIS. Commonwealth of Independent States.

FSU. Former Soviet Union.

OECD. Organization of Economic Cooperation and Development.

Chapter 1

INTRODUCTION

Whenever there is a division of ownership and management in a firm there exist a well-known principal-agent problem. The essence of the problem comprises in how owners/investors can be ensured that the hired professional managers run the company in line with the best interests of its owners or that they work with greatest possible efficiency that consequently maximizes the added value of the firm and the welfare of the owners.

The issue of corporate governance has become extremely important in the last decades since corporations have reached a remarkable output growth and at present produce more than 90% of all world output. As a result economists, governments and businesses in the world have extensively explored the problem of effective corporate governance. Against the background of well-known bankruptcies of transnational corporations, e.g. Maxwell Group, Enron, WorldCom, the corporate governance issue is becoming one of the central issues in the secure and continuous economic development in the world.

The problem of corporate governance is even more critical in transition economies, in particular in the countries of former Soviet Union. A tremendous

principle-agent problem originated from state ownership, a problem that has not been recognized for many decades and became a norm in every-day life. The importance of the corporate governance problem can partially explain the differences on economy's investment inflows and consequently its growth rates in transition countries of Central Europe and CIS. Unless property rights of investors are strongly protected, hardly anyone will be willing to invest their money. And now when private ownership appears in FSU countries the urgent establishment and enforcement of the proper corporate governance principles is vital for enhancing the development of enterprises, as well as, of the economy as a whole.

When the law does not protect property rights properly, investors either will not invest into the economy or they will try to establish an internal corporate governance system in enterprise themselves, for instance through ownership structure, incentives mechanism etc.

Research of the technical efficiency of companies across different types of owners and ownership concentration allows us to make a first glance into the ability of different owners to deal with the corporate governance problem. Knowledge of the relation between the degree a company adheres to sound corporate governance practices and technical efficiency may also produce

conclusions that are valuable for corporate behavior, as well as, government regulation of corporate sector.

A considerable attention has been paid to the link between ownership structures and firm performance in the world (e.g. Demsetz et al. 1985, NCEO, 2002) including transition countries (e.g. Demsetz et al. 1985, Frydman et al. 1997, Xu et al. 1997, Kuznetsov et al. 2001). Much less research was done for the Ukrainian economy. Mostly research in this field for the Ukrainian economy was concerned with the relative efficiency of state firms (e. g. Grygorenko, 2001, Melnychenko, 2002) and only two studies address the issue of companies' performance across ownership structures (Andreyeva, 2000, Repei, 2000). However the later two works produced contradictive evaluations of the effects of insider and outsider ownership on performance indicators. This indicates a necessity to further explore this issue in order to establish more clear evidence on ownership structures effects.

Corporate governance is usually analyzed in a framework of its relation to market value of a firm (e.g. McKinsey, 2002, Black, 2001). However, due to the high rigidity of Ukrainian stock market it is not possible to determine the market value. Instead, I suggest to evaluate the link between the degrees to which a company follows sound corporate governance practices and a company's technical efficiency. Technical efficiency is useful in this context, since it represents a single

aggregate measure of utilization of input factors to produce desired outputs relative to the revealed best-practice frontier. Such analysis allows us to look at the root of the corporate governance problem – specifically, an inefficient usage of resources – usually not easily observable by outsider like investor, shareholder, government etc. Applying the theory of value creation (Copeland, 2000) we can argue that corporate value and corporate efficiency should go together. Therefore investigating the association between corporate governance and efficiency can in some extent even predict the link between corporate governance and corporate value in situation when corporate value is not observable as it is in the case of Ukraine. To my knowledge such research has not been done for the Ukrainian economy before, so this is a first attempt to investigate corporate governance as a determinant of a company's efficiency.

Essentially there are four major approaches to address the issue of firm's performance: average production or cost function models (e.g. through OLS), total factor productivity (TFP) indices, data envelopment analysis and stochastic frontiers. First two methods assume that all firms are technically efficient and are most often applied to aggregate time-series data to estimate the measures of technical change or/and TFP. The other two methods are often applied to cross-section data and provide measures of relative efficiency within that data. Hence, these latter approaches do not assume that all firms are technically efficient (Coelli et al. 2002).

In my paper I suggest using DEA methodology (Charnes et al. 1981, Fare et al. 1994) to evaluate the technical efficiency of the firm. DEA has several attractive features in this context. It places no constraint on the functional form of the production relationship. This method concentrates on revealed best-practice frontiers, rather than on central-tendency properties of frontiers, as it is in case of regression estimation of production function. In the second stage I examine the determinants of firm's technical efficiency, in particular the association between different ownership structures, corporate governance and technical efficiency.

In contrast to the previous studies, the latest data on Ukrainian joint-stock companies listed on the main Ukrainian stock, PFTS, specifically for the years 2000-2001 is used.

Chapter 2

THEORETICAL FRAMEWORK

In this chapter I provide a theoretical framework on the link between structure of ownership, corporate governance and corporate performance. First, we look at the essence of corporate governance. Then we try to define the place and importance of ownership structures in corporate business and governance. And finally, we look at the theoretical evidence on the impact of different ownership structures and corporate governance on the efficiency of enterprise.

Investors/shareholders will only want to give money to an enterprise if they are confident that their funds will be used efficiently and that they will receive a competitive return from their investments. This confidence can be established in its turn through three main mechanisms: high transparency of company's activity (following international principles of information disclosure), effective and independent supervisory boards, and proper treatment of shareholders including minority shareholders. An interested reader can look at Higg's Report (Higgs, 2003), Sarbanes Oxley Act (2002) for the latest news on corporate governance practices and standards.

Corporate governance allows to decrease the risk of loosing investments, by means of legal protection of investor/shareholder rights and creating such mechanisms of company management that allow investor or shareholder to be assured that the management uses his (her) investments efficiently and that they will bring him the expected earnings. According to the OECD definition, corporate governance is the system by which business corporations are directed and controlled. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation, such as, the board, managers, shareholders and other stakeholders, and spells out the rules and procedures for making decisions on corporate affairs. By doing this, it also provides the structure, through which the company objectives are set, and the means of attaining those objectives and monitoring performance (OECD, 1999).

Ownership structures are of major importance in corporate governance because they affect the incentives of managers and thereby the efficiency of the firm. The ownership structure is defined by the distribution of equity with regard to votes and capital but also by the identity of the equity owners. A classic reference is Jensen and Meckling (1976). These economists tried to develop a theory of the ownership structure of the firm by integrating elements from the theory of agency, the theory of property rights and the theory of finance.

Ownership structure can be distinguished by the level of concentration of ownership rights as well as by the identity of the owner. In general ownership structure may include inside as well as outside owners. Inside owners are managers and employees, and outside owners are individuals, organizations and state. Owners may also be distinguished as foreign and native ones (Figure 1).

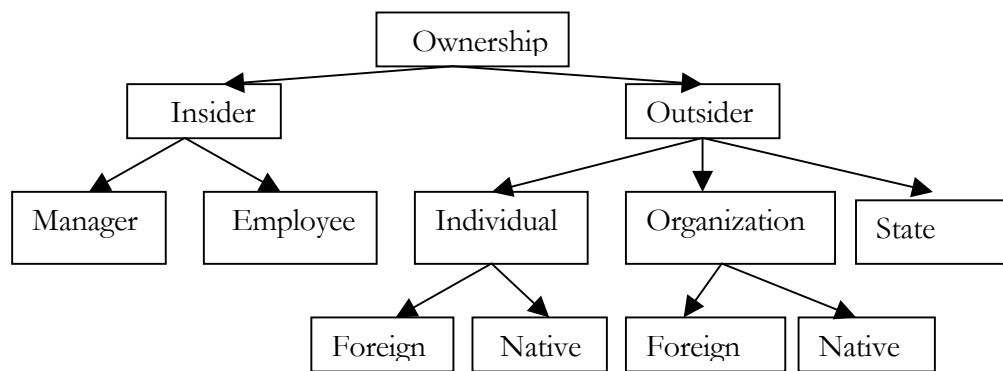


Figure 1. Ownership structure (adopted from Repei, 2000).

There is clear evidence that the structure of company ownership can significantly influence the financial performance of the company through, for example, its impact on incentive mechanism, decision-making procedures as well as performance-monitoring system. However the theoretical and empirical evidence on the effect of ownership structure on company's efficiency is very controversial. To see this controversy further I summarize the theoretical evidence on the effects of different ownership structures in terms of types of owners and the level of ownership concentration on the corporate performance.

Concentrated ownership. Ownership by large investor prevails in the world (Shleifer and Vishny, 1986). A reasonable explanation to this is the weakness of the legal system protecting investor rights around the world. In comparison with small investors large investors need less right to protect their interests. Large owners can be more effective in monitoring and controlling the management therefore contributing to the performance. However, on the other side, concentrated ownership also has its costs, which are basically represented by possibility of expropriation by large investors of other investors and stakeholders of the firm (Shleifer and Vishny, 1997). Another cost of concentrated ownership is that large owners bear an excessive risk from decreased diversification (Demsetz and Lehn, 1985; Fama and Jensen, 1983). Some recent studies point out that high concentration of ownership may lead to excessive monitoring of managers. Therefore decreasing managerial initiative to make firm- specific investments (Demsetz, 1997; Burkart, Gromb, and Panunzi, 1996).

Manager Ownership. By Jensen and Meckling (1976), more equity ownership by the manager contributes to the better alignment of monetary incentives between the manager and other owners, so that it may increase performance. On the other side more equity ownership may decrease the performance because managers can be so powerful that they do not consider other stakeholders interests. Large managerial ownership contributes to entrenchment of managers, which can be specifically costly when they have low qualification or prefer to live

an easy life (Morck, Shleifer, and Vishny, 1988; Stultz, 1988). Stultz (1988) also presents a formal model that predicts a “roof” shaped relation between managerial ownership and firm performance.

Employee Ownership. The relationship between employee ownership and corporate performance in public companies is ambiguous. From one side the ownership in enterprise stimulates employees to work as efficient as possible, since they gain from the prosperity of enterprise. The main result concluded by The National Center for Employee Ownership (NCEO) (2002) is that when ownership and participative management are combined, substantial gains result. Ownership alone and participation alone, however, have no result. But from the other side, the employees may be powerful enough to influence their level of pay in the enterprise, therefore extracting short-term gain from the firm’s activity. This would, in turn, worsen the long-term efficiency of enterprise.

Individual Ownership. Individual investors usually create strong controlling mechanism, since their holding in corporation is not diversified (Shleifer and Vishny, 1986). Its effects on company performance are similar to those described for concentrated ownership.

Organization Ownership. Organizations, firms and institutions enhance efficiency of enterprises the most, due to their ability to better analyze

information, provide new technologies and capital, and create more well thought out corporate governance system. However the efficiency may be decreased due to the fact that the controlling organization may have different goals from that of profit maximization.

State Ownership. It is well documented that state companies usually under perform in comparison with those of other forms of ownership. Andrei Shleifer (1998) has made an excellent review on the efficiency of state ownership. Shleifer argues that the main reason for state ownership to be inefficient is the lack of incentives for government employees to maximize efficiency with regard to both cost reduction and quality innovation.

Foreign and Domestic Ownership. The management can use different techniques against foreign investors, including declaring some of their shares illegal, losing voting records, and so on. The domestic investors have more ways on their own to protect their rights, including better connections to other shareholders, to courts and even to the physical forces (Shleifer et al. 1997; Asland and Boone, 2002)

Chapter 3

PREVIOUS EMPIRICAL EVIDENCE

There is a heavy discussion on the effects of ownership structures on company performance in the world. Much of empirical research was done to determine the influence of different kinds of owners and concentration of ownership rights on the performance of a firm. Basically, four major approaches that are used for the analysis of ownership-performance issue can be distinguished in the literature. They are the least-squares econometric production models, total factor productivity (TFP) indices, data envelopment analysis (DEA) and stochastic frontier analysis (SFA).

The paper by Kuznetsov and Muravyev (2001) gives a comprehensive review of different regression approaches involving production function estimation that were undertaken by different economists to the analysis of ownership-performance. Kuznetsov et al. (2001) using regression estimations found in their work that ownership concentration positively affects labor productivity, has negative impact on Tobin's Q and the relationship between ownership concentration and profitability follows an U-shaped pattern with a turning point of concentration at about 57% for the group of blue chips of Russian stock

market. They also documented a relatively weak association between ownership by different groups of owners and firm performance.

Yudaeva et al. (2000) examine productivity differences between foreign-owned and domestic Russian firms estimating the log-linear production function. They use value added as an output of the firm and firm's fixed assets that were used in industrial production as a proxy for the capital. Foreign firms were found to be more productive than domestic ones.

Frydman et al. (1997) analyze the effects of ownership on performance applying regression analysis to the sample of firms in the Czech Republic, Hungary and Poland. As measures of performance they use the annualized rates of growth of the following four measures: revenues, employment, revenue per employee, and labor and material costs per unit of revenues. Their findings provide strong evidence that private ownership dramatically improves corporate performance during the post-communist transition. Their results also demonstrate that outsider-owned firms perform better than insider-owned firms on most performance measures. While managerial ownership effects on performance are ambiguous, employee ownership appears to have detrimental effect on performance. Authors also find that impact of foreign owners on performance measure is not stronger than that of major domestic outsider.

Walsh et al. (2000) using survey data for the set of traditional manufacturing firms in four Central Eastern Europe countries, and extending the approach taken in Frydman et al. (1997), examine the effects of insider and outsider ownership on various measure of firm performance. They find that, within the firms that produced previously for CMEA market, the best ones were selected to outside privatization and outperformed insider/state owned firms. Outside privatization was resisted in EU oriented firms and ownership was found to have no effect on performance. The paper provides that inside ownership is not a bad thing, but rather an outcome of market forces and political constraints that ensures the long-term success of the reform process.

Xu et al. investigate the ownership effects on the performance of publicly listed companies in China. They employ three accounting ratios to measure firm's performance: the market-to-book value ratio (MBR), ROE, and ROA. Results from their empirical analysis show a positive and significant correlation between ownership concentration and profitability. They also find that the labor productivity tends to decline as the proportion of state share increases.

The measures of performance used by Weiss et al. (2001) are the operating profits per unit of labor and operating profits per unit of capital. The main finding of their research is that when foreigners become the major shareholders

of Czech firms the performance of those firms improves. Concentrated ownership did not have any beneficial effects.

Brown et al. (2000) also touch the issue of ownership effects on performance of companies. They argue that in the context of transition such performance indicators as accounting measures of profits and revenues, Tobin's Q, profitability, price-cost margins are highly questionable due to problems of both measurability and appropriateness. They suggest estimating the technical efficiency using the disembodied total factor productivity (TFP). As a proxy for capital they use a productive capital stock: plant and equipment used in production. Authors' main finding is that private ownership outperforms the state one.

Zheng et al. (1998) used DEA methodology to evaluate technical efficiency across state (SOE), collective (COE) and township-village (TVE) Chinese enterprises. The authors also use limited dependent variable models to analyze the determinants of technical efficiency. In their paper they found that relatively large TVEs surpassed SOEs significantly; urban COEs are less efficient than SOEs.

Another study in this field was conducted by Ng et al. (1999). These economists employ DEA to examine the efficiency measure of manufacturing enterprises in

Shanghai by types of ownership and training provision provided by enterprises. This study estimate the productive efficiency of a group of firms which can be decomposed into reallocative, allocative and technical efficiency multi-output multi-input production. They found that wholly foreign owned enterprises outperform others. The more serious inefficiency in reallocative aspect was found in the case of state-owned enterprises.

Lauterbach et al. (1999) applied DEA to examine the effect of ownership structure on performance for 280 Israeli firms and found that owner-manager firms are less efficient in generating net income than firms managed by a professional (non-owner) manager, and that the family firms run by their owners perform the worst. The authors conclude that the modern form of business organization, the open corporation with a disperse ownership and non-owner manager, promotes firm performance.

Barbetta, Turati and Zago (2001) examine the impact of ownership structure on hospital efficiency in Italy. They adopt both parametric (Corrected OLS to estimate translog output distance function) and non-parametric (DEA) approaches. Their findings give some indication that public owned hospitals are more efficient than non-for-profit ones. This result is robust to the different approaches.

Gumbau-Albert et al. (1998) analyze the factors explaining the technical efficiency of Spanish industrial sectors using stochastic frontier analysis (SFA). Specifically, they assume the Cobb-Douglas type of the production function supposing that the level of production (value added) depends on the quantity of labor and capital. Having estimated the efficiency scores authors then estimate the determinants of the efficiency. They found that the highest levels of the efficiency are associated with sectors with least share of the public capital. However, it is shown that this “two-stage” SFA methodology produces biased estimates of the effects (Reifschneider, 1991; Coelli, 2002). The problem is that in the first stage the inefficiency effects are assumed to be independently and identically distributed to predict the values of the technical inefficiency effects, however in the second stage it is suggest that the inefficiency scores are determined by a function of a number of firm-specific factors.

The paper by Khatri et al. (2002) measures corporate sector performance and empirically examines the role of corporate governance. A stochastic frontier with inefficiency effects is fitted to a panel dataset of the largest non-financial companies listed on the Malaysian Kuala Lumpur Stock Exchange. The high significance and explanatory power of the ownership concentration variables provides evidence of a robust and positive relationship between the system of cross-shareholdings, ownership concentration and the inefficiency in the Malaysian corporate sector.

Despite much of research in this field was done in the world there is very little analysis done for the economy of Ukraine. Repei (2000) did the most relevant research for the Ukrainian JSC in this field. He investigated the performance indicators, such as wages, sales and sales changes across different ownership structures with regression analysis and found that private organization outsiders with high concentration of ownership rights run companies most efficiently.

Andreyeva (2000) examined the impact of outsider and insider ownership concentration on annualized rate of growth of labor productivity in Ukrainian enterprises and concluded that concentrated ownership leads to better company performance and companies with insider concentrated ownership outperform all others. Drawing from panel data on Ukrainian firms for 1996-2000, Andreyeva (2003) estimates a production function using random effects and instrumental variable estimators. She finds a positive effect of concentrated ownership on firm performance. There is also an indication that privatized companies with dominant outside shareholders are the most efficient.

Other research done in this field is by Grygorenko (2001) and Melnychenko (2002) who studied performance of privatized versus state owned enterprises and the impact of state corporate rights management on the efficiency of Ukrainian JSC respectively. Both authors used regression analysis and inferred that

privatization positively influences labor productivity and profitability of enterprises (Grygorenko, 2001) and that increase of state corporate control over an enterprise results in substantial losses of efficiency (Melnychenko, 2002).

Concluding the available literature on ownership-performance issue it should be noted that in the first two methods, least-squares econometric production models and TFP indices it is implicitly assumed that firms are technically and allocatively efficient. These methods are often applied to time-series data. While the other two methods, DEA and SFA are often applied to data on a sample of firms and provide measures of relative efficiency among those firms. Therefore these latter two approaches do not assume that all firms are technically and allocatively efficient (Coelli, 2002).

In the context of corporate governance issue the assumption that firms work efficiently would be incorrect. Such an assumption contradicts the essence of corporate governance problem, which implies that due to the principal-agent problem there may be a loss in efficiency. Therefore in the research I assume that not all companies are efficient but rather there are some companies that are inefficient due to some reasons and, in particular, due the problem of corporate governance. This assumption is considered to be much more reasonable especially in transition context, where a tremendous corporate governance problem exists (Stiglitz, 1999). The appropriate measure of efficiency to address

the issue of ownership and corporate governance effects on performance in the context of existence of inefficient firms is a Farrell measure of efficiency (Farrell, 1957). In this research I suggest using various techniques using DEA to analyze the Farrell measure of productive efficiency across different ownership structures and the quality of corporate governance (following Zheng et al. (1998) and Ng et al. (1999)).

In contrast to the partial measures of efficiency used in much of the existent literature (Kuznetsov et al, 2001; Frydman et al, 1997; Walsh et al, 2000) the important advantage of Farrell measure of efficiency is that it represents a single aggregated measure of overall efficiency, and not a partial measure of productivity (e.g. labor productivity). Using partial measures of efficiency can provide a misleading indication of overall productivity when considered in isolation (Farrell, 1957). For example, labor productivity can be higher in one company relative to another because the former uses more capital in the production but not because of higher efficiency.

I did not find any research that investigates the association between corporate governance and technical efficiency. Usually, previous research done on corporate governance relates the corporate governance indexes (determined by rating agencies like Standard and Poors, Deminor etc.) to corporate value instead of efficiency (e.g. McKinsey, 2002, Black, 2001). Based on two reasons, I suggest

investigating the link between corporate governance and corporate efficiency. The first reason is that Ukrainian stock market is characterized by extremely high rigidity, that is companies' shares are not freely traded in the market, and consequently the market capitalization of the company is not a good measure of corporate value. The second reason is that this way of research provides us some other useful insights and still may be used to predict the impact of corporate governance on corporate value. For instance, analysis of quality of corporate governance and technical efficiency allows us to look at the root of corporate governance problem – specifically, an inefficient usage of resources – usually not easily observable by outside person like investor, shareholder, government etc. Thus this research sheds a light on how to enhance the efficient usage of scarce resources by society. Moreover, based on the theory of value creation, companies with higher productivity are more likely to create more value than those with lower productivity (Copeland, 2000). Therefore we can argue that corporate value and corporate efficiency go together and the association between corporate governance and efficiency can predict the link between corporate governance and corporate value in a situation when corporate value is not observable as it is in the case of Ukraine.

Chapter 4

EMPIRICAL ANALYSIS

Data Description

For the empirical evidence I use a dataset of companies listed on the Ukrainian stock PFIS (Persha Fondova Torgova Systema – (translation: First Securities Trading System)) in 2000-2001. In total the sample comprises of 283 observations. Most data are from annual financial statements of enterprises and were provided by PFIS that can be considered as one of the most reliable sources. Securities and Stock Market Commission provided some additional information on the quality of corporate governance in enterprises. The sample comprises of the companies from all regions of Ukraine. It covers various business sectors, excluding finance.

All variables and their short description are reported in Table 1. Descriptive statistics of variables are provided in Tables A1, A2, A3 and A4 of Appendix A. Descriptive statistic shows that on average the annual revenue of the company in the sample consists of 325 million UAH and varies in the interval from 19.7 thousand to 5.1 billions of UAH; therefore it covers enterprises of quite a different size.

Table 1. Data Description

Input Variables	Description
LCOST	Labor cost, the annual pay to workers, UAH
MCOST	Material cost, UAH
CCOST	Capital cost, capital depreciation, UAH
MOCOST	Material plus other cost, UAH
LACOST	Labor plus other cost, UAH
BOOKV	Book value of the capital at the end of year, UAH
LABOR	Average number of workers during the year, UAH
Output Variable	
SELL	Total net sales, UAH
Ownership Variables	
FORG	The share of the largest foreign owner in company ownership.
IND	The share of the largest individual owner in company ownership.
ORG	The share of the largest home organization owner of a company.
STA	The share of the state ownership in company in 2000.
NOM	The share of nominal shareholder (unknown shareholder who is represented by financial institution).
DPRV	= 1 if concentrated ownership (existence of the strategic owner, cut off point is 50%+1 share stake in company's equity for private ownership), 0 otherwise.
DSTA	=1 if there is a state concentrated ownership (cut off point is 10 % or 50% for state ownership), 0 otherwise.
PRIV	The share of private ownership in company.
Business Sector Variables	
CC	=1 if the company belongs to construction or chemical sectors, 0 otherwise.
ET	=1 if the company belongs to engineering or transport sectors, 0 otherwise.
FS	=1 if the company belongs to food, services or light industry, 0 otherwise.
OMO	=1 if the company belongs to oil, metal, mining or other industry, 0 otherwise.
PU	=1 if the company belongs to power utilities sector, 0 otherwise.

On average the state has the largest share of ownership rights in the enterprises (17.11 %), while the largest individual, nominal and managerial owners own relatively small shares in enterprises (in the range from 2 to 4 %). Foreign and home organizations on average have relatively large shares in enterprises, 9.58% and 16.48% respectively. Mean concentration of private ownership rights is quite high (28.35 %) with maximum at 98 %. These statistics suggest an evidence of relatively high concentration of ownership rights, which is consistent with Shleifer and Vishny (1997).

I also develop a simple index of the quality of corporate governance in Ukrainian enterprises using the experience of rating agencies (e.g. Standard and Poor's, 2002) and generally accepted corporate governance principles (Higgs, 2003; Sarbanes Oxley Act, 2002; OECD, 1999). The information on indicators that is available for Ukrainian enterprises and included in corporate governance index (CGI) is presented in the Table 2. The variables COMP24 and VIO are obtained from the working databases of the Ukrainian Securities and Stock Market Commission. One database documents all complaints from individuals and organizations to Commission against the issuers of securities. And the second database consists of all check-ups made by the Commission based on the complaints against the firms and results of these check-ups.

General shareholder meeting attendance is on average 77 % with a median of 82% and there were no shareholder meeting in 22 firms for some reasons. 66 out of 283 companies in the sample have their own web site for communication with their stakeholders. 60 companies of the sample either have not published their annual financial statements or published them after 9 months after the end of the year (9 months is a period specified by Ukrainian legislature). There were at least two complaints against 40 companies in the sample and the violation of corporate governance legislature was found in 21 companies.

Table 2. Corporate Governance Index (CGI) Construction.

Variables	Description
ATTE	Add 1 to CGI if attendance of general shareholder meeting is above 60%, 0 otherwise.
WWW	Add 1 to CGI if firm has a website as a way of communication with its stakeholders, 0 otherwise.
PUBL	Add 1 to CGI if company's annual financial statements were published in the press, 0 otherwise.
COMP24	Add 1 to CGI if there were not at least two complaints to the Commission against the enterprise during last three years, 0 otherwise.
VIO	Add 1 to CGI if there was no violation of corporate governance legislature found by the Commission check-up, 0 otherwise.

Therefore the maximum value of corporate governance index is five.

Methodology

In Chapter 3 above we have addressed various approaches that researchers use to investigate the association between ownership structure, corporate governance and efficiency. The approaches can be grouped in two main groups, regression analyses that involve estimation of average production and cost function, and analyses of efficiency through evaluation of production frontier and estimation of efficiencies relative to this production frontier. The latter approach can also be accomplished either by non-parametric approach, linear programming or through parametric estimation, stochastic frontier analysis.

In this paper I use Farrell* measure of productive efficiency (Farrell, 1957). Farrell illustrated his idea using simple two-input (x_1, x_2), one output technology (y) under assumption constant returns to scale and input oriented production. Knowledge of efficient frontier, represented by SS' (to be estimated) in Figure 2, permits the measurement of technical efficiency. If a firm uses the quantities of inputs represented by point P , to produce a unit of output, the technical inefficiency of this firm is shown by the distance QP . This distance represents the amount by which all inputs can be reduced without reducing the output. The technical efficiency of a firm is measured by the ratio $TE_i = OQ/O_P$. It takes a

* It should be mentioned that technically speaking I do not use the original Farrell measure where inputs, outputs were used in physical units but a transformed Farrell measure of efficiency. Specifically, first, I aggregate the inputs and outputs into few categories and, second, since the information on the quantities of inputs and outputs, and their prices are not available I use the costs of the firm for input variables, and its

value between zero and one, with value of one indicating that firm is fully technically efficient.

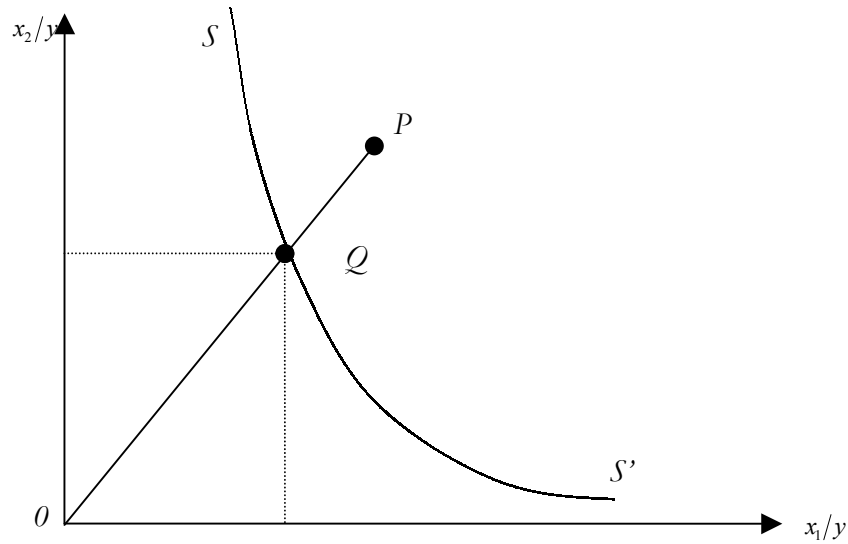


Figure 2. Technical Efficiency.

Specifically, I estimate the efficient production frontier (surface) and Farrell measure of technical efficiency of a firm by using non-parametric approach, standard input oriented* Data Envelopment Analysis (DEA)**. Adopting the Farrell measure of technical efficiency to our context I aggregate each firm's

revenue for output variable. It's shown that an industry maximal revenue is the sum of its firms' maximal revenues (Färe and Zelenyuk, 2002).

* I consider the input-oriented model to be more reasonable assumption then output-oriented due to the excessive production inputs in the countries of FSU and necessity under present conditions to minimize cost of production.

** Fare et al. (1994) present the comprehensive review of the methodology.

inputs into labor costs, material costs, capital costs, total costs; for the output variable I use total sales (Färe and Zelenyuk, 2002). As a next step, the following linear programming problem* for each firm has to be solved.

$$\begin{aligned}
 E^j(x^j, y^j) &= \text{Min } \theta \\
 \sum_{i=1}^n \lambda_i X_{ik} &\leq \theta x_k^j, k = 1 \dots s \\
 \text{s. t. } \sum_{i=1}^n \lambda_i Y_{ip} &\geq y_p^j, p = 1 \dots r \quad , \\
 \sum_i \lambda_i &= 1; \lambda_i \geq 0
 \end{aligned} \tag{1}$$

where θ is a scalar and λ is a $N \times 1$ vector of constants, n is the number of firms in the sample, s is the number of inputs X of a firm and r is the number of outputs Y it produces.

The problem has to be solved N times, once for each firm and the value of θ obtained is the technical efficiency score for the i -th firm.

To estimate the ownership effects I suggest using three different techniques. First method is an aggregation of Farrell efficiency scores (Färe and Zelenyuk, 2002). This technique allows aggregation of efficiency scores for each specific ownership

* Assumptions to the model: convexity, free disposability of inputs and outputs, and variable returns to scale.

group. Therefore it allows us to compare the differences among ownership group efficiency scores.

Second method is a Grand-Frontier DEA (Charnes et al., 1981, Coelli, 2002).

This method involves three stages:

- 1) Division of the sample into different ownership structure sub-samples and solution of DEAs for each sub-sample; therefore specific inefficiency effects within each specific ownership type are estimated.
- 2) Correction of the inputs for inefficiency observed within each sub-sample (projection of all observed data points on their sub-sample frontiers); here the firm-specific inefficiency within each sub-sample is cleaned.
- 3) Solution of a single DEA using the projected points and comparison of the sub-sample means of the efficiency scores between each other and relative to the mean of the whole sample.

This methodology allows us to eliminate the firm-specific inefficiency effects and finally get the net differences in efficiency due to the difference in ownership structure among the sub-samples of firms.

The third approach is a Two-Stage DEA of ownership structure influence on efficiency that involves DEA and statistical regression analysis. This methodology allows us to take into account the effects of multiple environments in which

company operates, specifically in our case it is an effect of different business sectors. In the first step I solve a DEA problem (1). In the second step, regression analysis is used to estimate the relationship between the efficiency scores obtained in the first step and a set of variables representing firm's ownership structure, specific industries potentially influencing the efficiency of each observation. The sign of the coefficients of the ownership and corporate governance variables indicate the direction of the effects, and standard hypothesis tests are used to assess the strength of the relationship (Coelli, 2002).

For the second step I employ the following model:

$$EFF_i = \alpha_l \sum_{l=1}^6 Ownership_{li} + \beta_k \sum_{k=1}^5 Industry_{ki} + \gamma CGI_i + u_i \quad (2)$$

where, $i=1, \dots, 283$

Ownership – shares of the largest foreign organization, individual, domestic organization, state, manager and nominal shareholders. Also dummy variables are used for concentrated ownership rights.

Industry – dummies for each of 5 specific business sector groups.

CGI – index of corporate governance quality.

DEA has several attractive features in this context. First, it places no constraint on the functional form of the production relationship, which is a very suitable

characteristic in empirical cases with relatively small size of sample. Second, it focuses on the individual observations rather than population averages, as in the case of purely regression analysis. Third, it concentrates on revealed best-practice frontiers, rather than on central-tendency properties of frontiers. And fourth, for each production unit, it produces a single aggregate measure of utilization of input factors to produce desired outputs (Zheng et al, 1998). The last property allows to calculate and compare the aggregated weighted average (Fare et al, 2002) of firm efficiency for the different groups of firms e.g. across different ownership structures.

Since the main goal of my research is to evaluate the link between the ownership structure, the quality of corporate governance and technical efficiency of enterprises I formulate the following hypotheses:

1. The increase of state ownership is associated with a decrease in efficiency of enterprise.
2. Technical efficiency increases with the increase of the share of foreign ownership in enterprise.
3. Organization as an owner enhances technical efficiency relatively more than the individual as an owner.
4. High concentration of ownership rights negatively associated with the technical efficiency of enterprises.
5. The increase in the quality of corporate governance is positively associated with the technical efficiency of enterprises.

Empirical Results

In this chapter I present the application of the methodology described in the previous chapter and the results of analysis of the effects of ownership structure and the quality of corporate governance on efficiency of the firm. Specifically, I describe the results of estimated technical efficiency of enterprises, of aggregate efficiency scores for different groups of firms distinguished by their ownership structure, of Grand-Frontier estimation and of two-stage DEA-regression analysis.

First I estimate the efficiency scores by solving the linear-programming problem (1) for each enterprise within the whole sample, without taking into account environmental variables (ownership structure, corporate governance, business sector). Specifically I use each firm's labor cost, material cost and capital cost as input variables and the total net sales as output variable, and estimate input-oriented multi-stage DEA with assumption of variable returns to scale. To control for sensitivity of the specification of the DEA model I change the structure of inputs in the model and estimate the other four alternative models. In Model 2 social and other costs are added to the material cost, in model 3 social and other costs are added to the labor cost. In model 4 all costs are aggregated into one input (total cost) and one input is used for estimation. In model 5 two

inputs are used, specifically, book value of the fixed assets at the end of the year and the annual average number of workers in the firm. The descriptive statistic of estimated efficiency scores with simple arithmetic averages for all five models are presented in Table B2 of Appendix B. However, to calculate the sample efficiency score it is necessary to weight the received efficiency scores by the amount of firm's costs (Färe et al., 2002). Table B1 of Appendix B presents the weighted efficiency score of the sample for each model. First three models produce similar results with the weighted efficiency score slightly above 0.60, which means that firms in the sample use about 60-61 % of their production capacity and thus they can decrease the production costs by about 39-40%. The other two models produce somewhat lower weighted efficiency scores, which is consistent with the fact that we use less number of inputs for estimation. However, in all models weighted efficiency score is significantly higher than the simple average one, suggesting that efficiency increases with the increase in the scales of production.

Next, the firms in the sample are divided into groups with respect to the structure of ownership. I separate firms into groups with respect to the controlling owner*; it is either foreign organization or domestic organization, or manager, or individual, or state, or nominal owner. And the rest of the firms I separate into another group of firms that have a relatively dispersed ownership rights. With

respect to the ownership structure, the distribution of the firms in the sample is presented in Table 3.

* Cut-off point is 50 %+1 share.

Table 3. Distribution of the Firms with Respect to the Largest Owner Identity

Ownership Structure	Abbreviation	Number of firms
Foreign organization	FOR	36
Domestic organization	ORG	77
Manager	MAN	17
Individual	IND	10
State	STA	81
Nominal (unknown to the public)	NOM	11
Dispersed	DISP	51
Total		283

In Table 4 the aggregated efficiencies (Fare et al., 2002) according to the ownership structure groups are presented.

Table 4. Ownership Structure Group Efficiency.

	FOR	ORG	MAN	IND	STA	NOM	DISP
Model 1	0.24	0.74	0.13	0.13	0.69	0.56	0.27
Model 2	0.23	0.78	0.19	0.18	0.65	0.48	0.23
Model 3	0.23	0.80	0.13	0.13	0.66	0.55	0.28
Model 4	0.13	0.39	0.18	0.05	0.17	0.09	0.20
Model 5	0.29	0.60	0.15	0.15	0.44	0.50	0.27
Average	0.22	0.66	0.16	0.13	0.52	0.44	0.25

Therefore, the group of firms that are controlled by domestic organization owner significantly outperforms all other groups in terms of technical efficiency in all five models, with the average efficiency score at 0.66. High performance of domestic organization owned firms is consistent with the theory and is explained by the ability of organizations to better analyze information, provide new

technologies and capital, and the most important, to create better systems of corporate governance. The next is the group of state owned firms that is characterized by 0.52 efficiency score, possibly indicating about some relative efficiency of state control over enterprises.

Foreign and dispersed ownership resulted in efficiency at 0.22 and 0.25 efficiency score respectively. Unexpectedly low efficiency of foreign ownership can be explained by the inability of foreign investors to deal with the difficulties that they meet when investing in Ukrainian economy. Among such difficulties are the bureaucracy and corruption, the ability of management to use different techniques against foreign investors and, of course, the inefficiency of investor rights legal protection in Ukraine (Shleifer and Vishny, 1997, Asland et al., 2002). This may indicate on the existence of serious corporate governance problems with investment climate in Ukraine and explain low foreign investment flows into Ukrainian economy. The relatively low efficiency of dispersed ownership is consistent with the economic situation of inefficient shareholder rights protection and ability of managers to expropriate stakeholder rights (Shleifer and Vishny, 1997).

However, managerial and individual ownership rights are characterized by even less average efficiency scores, 0.16 and 0.13 respectively. Such a low efficiency of managerial and individual ownership possibly indicates about the low ability of

individuals to successfully run companies under growing competition. Another possible reason for low efficiency of manager owned firms are the entrenchment of management with low qualification. Under uncertain economic conditions, managers and individuals may also try to extract short-term financial benefits, while neglecting the long-run prosperity of enterprise.

To examine the effect of concentration of ownership rights on efficiency I also aggregate the efficiency scores with respect to the ownership concentration, specifically to the share of the largest owner of the firm. With this purpose I use different cut-off points: 50%, 40% and 25%. As a result efficiency of group with concentrated ownership is about 0.62 and efficiency of group with non-concentrated ownership is about 0.50-0.51 if cut-off point of 40 or 50 % is used. Therefore concentrated ownership is found to improve the efficiency for about 20%. This result is consistent with previous research in this field (Repei, 2000; Andreeva, 2003) as well as with our expectation. For more details on estimation results see Table C1 of Appendix C.

In Table C2 and Table C3 of Appendix C I present the group efficiency scores for concentrated state and private ownership respectively. There is a slight indication that concentrated state ownership rights in our sample decreases technical efficiency of firms, while concentrated private ownership increases efficiency, which is consistent with our expectations.

To further explore the effects of ownership structure on technical efficiency I employ the Grand Frontier technique proposed by Charnes, Cooper and Rhodes (1981). DEA is used to eliminate the inefficiency effects specific for the firm within its ownership group and to get ownership group specific inefficiency effects. Results of Grand Frontier DEA estimation based on model 2 cost structure are presented in Table 5.

Table 5. Results of Grand Frontier Estimation.

	FOR	ORG	MAN	IND	STA	NOM	DISP
Efficiency score	0.21	0.77	0.27	0.52	0.50	0.35	0.57

In Grand Frontier estimation, the group efficiency scores of foreign organization, domestic organization and state owned firms are similar to the previous results. Somewhat higher relative efficiency is received for managerial, individual and dispersed ownership. However, for managerial ownership we still have relatively low efficiency score (0.27) that confirms our previous findings.

The important drawback of these two estimation techniques is that estimation with multiple environments is too complicated here, so we cannot account for the quality of corporate governance and specific business sector in which firm operates. Therefore, to take into consideration the effect of business sector and of quality of corporate governance on efficiency of Ukrainian enterprises the

regression analysis is used. The two-stage technique, described in previous chapter is used for this purpose and the equation (2) is estimated with ordinary least squares (OLS) and limited dependent variable (Tobit) techniques. Tobit estimation is more theoretically appropriate, since the dependent variable in our model is truncated between zero and one. As a dependent variable I use the efficiency score evaluated earlier for model 2, in which all costs are aggregated into three groups: capital, labor and material costs. As explanatory variables I use shares of the largest owners of the firm for each specific owner identity according to the description in Chapter 4. Therefore, estimated coefficients can be used to determine the marginal effects of changes in ownership share and quality of corporate governance on technical efficiency, however our purpose is to estimate the direction of influence rather than marginal effects.

The effect of state ownership and therefore the sign of its coefficient is expected to be negative with reference to hypothesis 1. The coefficient for foreign organization ownership should have positive sign according to my hypothesis 2. The coefficient for organization as owner should be greater than the coefficient for individual ownership according to the hypothesis 3. I also expect the positive sign for the coefficient of concentrated ownership with reference to the hypothesis 4. The signs for corporate governance variables are expected to be positive according to the hypothesis 5.

The OLS and Tobit estimation results for ownership identity effects with inclusion of business sector dummies are presented in Table 6.

Table 6. Owner Identity Effects.
Dependent variable is the efficiency score of Model 3

	OLS		Tobit	
	Coefficient	p-value	Coefficient	p-value
C	-	-	-	-
FORG	0.0005	0.5969	0.0006	0.5758
NOM	0.0016	0.1734	0.0018	0.1711
ORG	0.0019**	0.0351	0.0020**	0.0270
MAN	-0.0013	0.5515	-0.0013	0.5636
IND	0.0002	0.9166	0.0002	0.9113
STA	0.0021*	0.0029	0.0023*	0.0016
CC	0.1143*	0.0141	0.1095**	0.0232
ET	0.1145*	0.0128	0.1101**	0.0210
FS	0.1937*	0.0000	0.1924*	0.0000
OMO	0.2559*	0.0000	0.2590*	0.0000
PU	0.3262*	0.0000	0.3243*	0.0000
R-sq.	0.1743		0.1671	
Adj.R-sq.	0.1439		0.1333	

* - significant at 1 %, ** - significant at 5 %, *** - significant at 10 %

The results are not sensitive to the technique chosen for estimation. The coefficients and their significance values presented in Table 6 confirm the positive and significant effects of domestic organization and state ownership on technical efficiency of the enterprises in the sample. The coefficient for domestic ownership (0.0019) is significant at 5% level, while that of state ownership (0.0021) is significant at 1% level. The coefficients for the specific business sector are also highly significant implying that the technical efficiency varies across different business sectors and it is indeed necessary to account for these effects.

We can note the positive sign for the coefficient of foreign ownership, which implies a positive effect on efficiency from an increase of foreign share in enterprise ownership. The coefficient of managerial ownership is insignificant however it has a negative sign in all specifications. This provides an indication of detrimental effect of managerial ownership on efficiency, which is consistent with our previous estimation results.

Table 7. Concentrated Ownership Effects.
Dependent variable is the efficiency score of Model 3

	OLS		Tobit	
	Coefficient	p-value	Coefficient	p-value
C	0.131878*	0.0002	0.129671*	0.0005
DPRIV	0.064672**	0.0432	0.069667**	0.0375
DSTA	0.123262*	0.0048	0.135493*	0.0031
ET	0.006386	0.8858	0.007027	0.8804
FS	0.083448***	0.0592	0.086888***	0.0607
OMO	0.156742*	0.0007	0.165556*	0.0006
PU	0.223759*	0.0000	0.226768*	0.0001
R-sq.	0.158570		0.147314	
Adj.R-sq.	0.140278		0.125609	

* - significant at 1 %, ** - significant at 5 %, *** - significant at 10 %

To examine the influence of concentrated ownership on efficiency I estimate the model using dummies for concentrated state and private ownership rights with inclusion of dummies for business sector. The results of estimation are presented in Table 7. Both estimated coefficients (0.1233 and 0.0647, for state and private ownership respectively) are significant at 5% level and have positive sign, suggesting that the presence of large shareholder, either private or state, improves technical efficiency significantly.

The results of estimation of the effect of the quality of corporate governance on efficiency results in insignificant coefficients, however they always have a negative sign suggesting that firms with higher index of corporate governance are characterized with lower efficiency score (see the results of estimation in Table D1 of Appendix D). This is unexpected result, and it is not sensitive to different weights given to the indicators included in the index of corporate governance. However, this result is consistent with narrow control giving access to rents in a corrupt economy.

Available information allows estimation of the effects of different ownership structures on the index of corporate governance. The results of regression estimation are presented in Table 8. The coefficient for foreign ownership effect on corporate governance (0,0065) is significant at 5 % level, indicating that presence of foreign owner enhances the quality of corporate governance. Managerial ownership also has significant coefficient (-0,0159), however the direction of influence on efficiency is detrimental. Coefficient for state ownership has a negative sign, indicating that state as an owner decreases the quality of corporate governance.

Table 8. Corporate Governance Determinants.

Dependent variable is the index of corporate governance (CGI).

	Dependent variable: CGI			
	OLS	p-value	Tobit	p-value
C	-	-	-	-
FORG	0,0065**	0,0496	0,0084**	0,0263
NOM	0,0035	0,4042	0,0054	0,2610
ORG	-0,0002	0,9492	-0,0002	0,9432
MAN	-0,0159**	0,0258	-0,0175**	0,0287
IND	0,0028	0,6323	0,0058	0,3938
STA	-0,0011	0,6255	-0,0012	0,6404
CC	3,7423*	0,0000	3,7456*	0,0000
ET	3,9257*	0,0000	4,0281*	0,0000
FS	3,6328*	0,0000	3,6526*	0,0000
OMO	3,7207*	0,0000	3,7478*	0,0000
PU	3,5818*	0,0000	3,6174*	0,0000
R-sq.	0.061604			
Adj.R-sq.	0.027105			

* - significant at 1 %, ** - significant at 5 %, *** - significant at 10 %

These last results are consistent with theory on corporate governance and provide us with some fresh ideas. Analysing the results of my research it can be noted that a relatively low efficiency score is found for foreign organization controlled group of firms in our sample and at the same time I found that foreign ownership enhances the quality of corporate governance the most. Possibly this is why we had insignificant and negative coefficient for corporate governance effect on technical efficiency of enterprise.

Since foreign investors came from different countries, often, with an environment of much better corporate governance, we may assume that

behaviour of foreign firms in our sample is different from that of domestic firms, and that the relationship between dependent and explicative variables is different for foreign firms. Making such an assumption I exclude from my estimation 23 foreign firms and try to test my hypothesis of positive effect of corporate governance on technical efficiency for the domestically owned firms only. The results of estimation are different from previous and are presented in Table 9.

Table 9. Corporate Governance and Technical Efficiency.
Dependent variable is the efficiency estimated in Model 3.

	Dependent variable: EFFMO					
	EFFMO		LOG(EFFMO)			
	Tobit	p-value	OLS	p-value	Tobit	p-value
C	-0,0227	0,8064	-2,5632*	0,0000	-2.6506*	0.0000
FORG	0,0025	0,1419	0,0045	0,4259	0.0051	0.3901
NOM	0,0023***	0,0909	0,0033	0,4540	0.0039	0.4023
ORG	0,0023**	0,0153	0,0052***	0,1003	0.0061***	0.0636
MAN	-0,0008	0,7150	-0,0011	0,8880	-0.0010	0.8940
IND	0,0002	0,8910	0,0019	0,7605	0.0019	0.7619
STA	0,0023*	0,0017	0,0021	0,3945	0.0030	0.2390
CC			-	-	-	-
ET	0,0027	0,9558	-0,0794	0,6252	-0.0757	0.6534
FS	0,0894	0,0727	0,3188***	0,0559	0.3376**	0.0505
OMO	0,1465	0,0043	0,5066*	0,0032	0.5453*	0.0021
PU	0,2271	0,0002	0,9917*	0,0000	1.0139*	0.0000
CGI	0,0295	0,1281	0,0984	0,1285	0.1141***	0.0895
R-sq.	0.1742		0.1724		0.1707	
Adj.Rsq	0.1357		0.1371		0.1320	

* - significant at 1 %, ** - significant at 5 %, *** - significant at 10 %

Therefore, now the sign of corporate governance coefficient is positive as it was expected from the beginning. Moreover, if we introduce some more flexibility to our model, namely, taking the logarithm from the dependent variable (allowing it

to be truncated from minus infinity to zero), the coefficient for corporate governance is now significant at 10 % level. This result indicates a positive association between corporate governance and technical efficiency for domestically owned firms and is consistent with our Hypothesis 5.

Due to the lack of observations we cannot test the hypothesis on corporate governance influence on technical efficiency for foreign firms in this research.

Thus, the following conclusions can be made from the empirical examination of ownership structure and corporate governance effect on efficiency. The increase in the share of state ownership is not associated with a decline in efficiency, but rather with a rise in efficiency, possibly due to the efficient control over enterprises. Foreign firms in our sample are the least efficient, however only they have a significant positive effect on the quality of corporate governance. Domestic organization owned firms is the most efficient group in our sample, and domestic organization ownership enhances technical efficiency greater than individual ownership. Concentrated ownership rights, either private or state, positively affect technical efficiency. And the quality of corporate governance is positively associated with technical efficiency of domestically owned enterprises.

Chapter 5

SUMMARY AND CONCLUSIONS

In this paper the issue of corporate governance and ownership structure effects on Farrell measure of technical efficiency is addressed. In particular, the study aims to shed a light on corporate governance problem in Ukraine. The use of a simple technique of Data Envelopment Analysis allows us to look at the root of corporate governance problem – an inefficient usage of scarce society's recourses. The structure of corporate ownership with respect to owners' identity and concentration of ownership rights is found to have a significant impact on corporate efficiency. The paper also confirms a significant positive effect of good corporate governance practices on technical efficiency of domestic enterprises even on these early stages of Ukrainian market economy development.

Empirical examination of ownership and governance effects on efficiency shows that the increase in the share of state ownership is not associated with a decline in efficiency, but rather with a rise in efficiency for the sample of firms used. Foreign firms in our sample are found to be relatively inefficient, however only they have a significant positive effect on the quality of corporate governance.

This may imply that foreign owned firms set long-term goals for enterprise development. However, it can also indicate the inability of foreign investors to effectively run companies at present due to the high level of bureaucracy and corruption in the economy. This, in its turn is consistent with a fact that some foreign investors are leaving Ukraine now and others are not willing to invest in Ukrainian economy. Firms owned by domestic organizations are found to be the most efficient group in our sample, and domestic organization ownership enhances technical efficiency significantly greater than individual or managerial ownership. Owner managed firms have been found to be technically inefficient, giving an indication that managers expropriate rights of other stakeholders by extracting short term benefit from enterprise business.

Concentrated ownership rights, either private or state, positively affect technical efficiency. This result is consistent with the low quality of corporate governance practices and legal protection of shareholders that induces investors to take control over enterprises.

The quality of corporate governance is found to be positively associated with technical efficiency of domestically owned enterprises. This result confirms the necessity to implement and legally enforce generally accepted corporate governance principles in the country. This in its turn would enhance the technical

efficiency of the single enterprises as well as of the economy, as a whole, therefore enhancing the economic growth and prosperity.

The study, while establishing the effects of different ownership structures and corporate governance on efficiency, still leaves a room for further research in this field. Firstly, it can be beneficial to generate a larger sample of firms for future analysis and to test the estimated results for other data sets. Secondly, bootstrap analysis can be used to test the hypotheses on the significance of differences in ownership group aggregated efficiency scores.

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APPENDIX A. DESCRIPTIVE STATISTIC

Table A1. Descriptive statistic of output-input variables

	<i>SELL</i>	<i>CCOST</i>	<i>LCOST</i>	<i>MCOST</i>
Mean	325460367	15825087	23981661	180831488
Median	64276000	3270000	5803200	17319000
Std.Dev.	735536189	41362974	66877657	501150505
Minimum	19700	2400	12000	2900
Maximum	5094082000	450850900	673025500	3931230000
Observations	283	283	283	283

	<i>MOCOST</i>	<i>LACOST</i>	<i>BOOKV</i>	<i>LABOR</i>
Mean	273520397	116670570	458348198	4571
Median	32605400	17298800	101555200	1573
Std.Dev.	759564727	374708815	1052399039	12015
Minimum	25200	18200	870000	0
Maximum	7031853000	3906461000	8130168300	126052
Observations	283	283	283	283

Table A2. Descriptive statistic of ownership variables

	<i>FORG</i>	<i>NOM</i>	<i>ORG</i>	<i>MAN</i>	<i>IND</i>	<i>STA</i>
Mean	9,58	3,83	16,48	3,22	2,62	17,11
Median	0,00	0,00	9,26	0,17	0,00	0,00
Std.Dev.	17,08	12,41	20,07	7,59	8,94	27,13
Minimum	0,00	0,00	0,00	0,00	0,00	0,00
Maximum	87,08	97,90	86,37	67,00	69,00	100,00
Observations	283,00	283,00	283,00	283,00	283,00	283,00

	<i>CONC_PR</i>	<i>CONC_ST</i>	<i>CONC_PRD</i>
Mean	28,35	0,35	0,17
Median	24,90	0,00	0,00
Std.Dev.	21,37	0,48	0,38
Minimum	0,00	0,00	0,00
Maximum	97,90	1,00	1,00
Observations	283,00	283,00	283,00

Table A3. Sector distribution of the sample

Sector	Number of companies
CC	56
ET	63
FS	67
OMO	56
PU	41
Total	283

Table A4a. Descriptive statistic of corporate governance variables

	atte	www	Publ	meet	Comp24	Vio
Mean	77,23	0,23	0,79	0,92	0,14	0,07
Median	82,13	0,00	1,00	1,00	0,00	0,00
Standard Deviation	21,83	0,42	0,41	0,27	0,35	0,26
Range	100,00	1,00	1,00	1,00	1,00	1,00
Minimum	0,00	0,00	0,00	0,00	0,00	0,00
Maximum	100,00	1,00	1,00	1,00	1,00	1,00
Sum		66,00	223,00	261,00	40,00	21,00
Observations	283,00	283,00	283,00	283,00	283,00	283,00

APPENDIX B. DEA ESTIMATION RESULTS

Table B1. Summary of estimated efficiency scores: weighted averages

Model	Model Description: output-inputs	Score
Model 1	1) sales-capital, material, labor costs	0,61528
Model 2	2) sales-capital, material, other costs	0,60094
Model 3	3) sales-capital, labor, other costs	0,60349
Model 4	4) sales-total costs	0,36788
Model 5	5) sales-book-value, number of workers	0,455

Table B2. Summary of estimated efficiency scores: simple averages

	Model 1	Model 2	Model 3	Model4	Model 5
Mean	0,2587	0,286042	0,265375	0,299488	0.139385
Median	0,161	0,195	0,166	0,191	0.064
Mode	1	1	1	1	1
Std.Dev.	0,263149	0,255013	0,260647	0,266263	0.195394
Minimum	0,009	0,01	0,009	0,008	0.007
Maximum	1	1	1	1	1
Count	283	283	283	283	283

APPENDIX C. DEA AGGREGATION FOR CONCENTRATED OWNERSHIP

Table C1. Ownership Concentration and Efficiency

Cut-off point=50%			
	Concentrated	Not-concentrated	Difference
Model 1	0,6684	0,5543	0,1141
Model 2	0,6809	0,5276	0,1534
Model 3	0,6329	0,5628	0,0701
Model 5	0,5060	0,3966	0,1094
Average	0,6220	0,5103	0,1117
Number of observations	102,0000	181,0000	

Cut-off point=40%			
	Concentrated	Not-concentrated	Difference
Model 1	0,6642	0,5505	0,1136
Model 2	0,6771	0,5212	0,1559
Model 3	0,6322	0,5575	0,0746
Model 5	0,5076	0,3871	0,1204
Average	0,6202	0,5041	0,1161
Number of observations	121,0000	162,0000	

Cut-off point=25%			
	Concentrated	Not-concentrated	Difference
Model 1	0,5997	0,6603	-0,0606
Model 2	0,6083	0,6112	-0,0029
Model 3	0,5646	0,6872	-0,1226
Model 5	0,4648	0,4254	0,0394
Average	0,5593	0,5960	-0,0367
Number of observations	203,0000	80,0000	

Table C2. State Ownership Concentration

Cut-off point=50%			
	Concentrated	Not-concentrated	Difference
Model 1	0,615960027	0,611303954	0,004656073
Model 2	0,623223578	0,572961608	0,050261969
Model 3	0,589933591	0,622383231	-0,032449641
Model 5	0,483066676	0,386310978	0,096755698
Average	0,578045968	0,548239943	0,029806025
Number of observations	189	94	

Cut-off point=10%			
	Concentrated	Not-concentrated	Difference
Model 1	0,595064663	0,645075091	-0,050010427
Model 2	0,603169296	0,617779648	-0,014610352
Model 3	0,565835698	0,649064076	-0,083228378
Model 5	0,475826217	0,426573951	0,049252266
Average	0,559973969	0,584623191	-0,024649223
Number of observations	143	140	

Table C3. Private Ownership Concentration

Cut-off point=50%			
	Concentrated	Not-concentrated	Difference
Model 1	0,629928	0,626779	0,00315
Model 2	0,696766	0,618659	0,078107
Model 3	0,662808	0,610829	0,051978
Model 5	0,53503	0,456983	0,078047
Average	0,631133	0,578313	0,05282
Number of observations	49	234	

APPENDIX D. ESTIMATION RESULTS

Table D1. Corporate governance effect on efficiency.
Dependent variable is the efficiency score of Model 3

	OLS		Tobit	
	Coefficient	p-value	Coefficient	p-value
C	-	-	-	-
FORG	0.000584	0.5521	0.000647	0.5261
NOM	0.001708	0.1652	0.001796	0.1609
ORG	0.001857**	0.0355	0.002029	0.0271
MAN	-0.001423	0.5036	-0.001462	0.5087
IND	0.000208	0.9032	0.000232	0.8962
STA	0.002040*	0.0031	0.002244	0.0017
CC	0.153989***	0.0602	0.155308	0.0678
ET	0.156223***	0.0641	0.158149	0.0711
FS	0.232314*	0.0034	0.236828	0.0038
OMO	0.295356*	0.0004	0.304468	0.0003
PU	0.364241*	0.0000	0.368072	0.0000
CGI	-0.010616	0.5549	-0.012245	0.5133
R-sq.	0.175342		-	
Adj.R-sq.	0.141868		-	

* - significant at 1 %, ** - significant at 5 %, *** - significant at 10 %