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Σχολή Κοινωνικών Επιστημών  
Τμήμα Οικονομικών Επιστημών  
Μεταπτυχιακό Δίπλωμα Ειδίκευσης:  
«Οικονομική Θεωρία και Πολιτική»

Μεταπτυχιακή διατριβή με θέμα:

**“The effect of management buyouts on  
productivity growth: Empirical evidence from  
the Greek banking sector.”**

Όνοματεπώνυμο φοιτήτριας: Καρυπίδου Μαγδαληνή

A.M.: 74

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Ρέθυμνο, 2008-2009

# The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

## **Acknowledgements**

The student would like to thank the Associate Professor of the Department of Economics of the University of Crete, Vangelis Tzouvelekas for his cooperation, his support and his helpful comments during the preparation of this paper and the Lecturer of the Department of Economics of the University of Crete, Margarita Genius for her contribution in finding the data. She would also like to thank Konstantinos Chatzimichael for his helpful contribution as well as Eleftheria Gavana and Tonia Zaimaki for their neat comments. Last but not least, she would like to express her gratitude to her family and friends for their moral support and their patience during all this period.

# The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

## **Abstract**

Over the last decade, the frequency of management buyouts (MBOs) in Greece has dramatically increased. The critical issue that arises concerning MBOs is whether they enhance economic efficiency or not. In this study, we use detailed data on output, capital, materials and employment and we assess the total factor productivity (TFP) of 42 banks that take an active role in the Greek financial market, before and after MBOs. The results, based on the period 1997-2007, indicate whether MBO banks are less productive than comparable banks before the transfer of ownership and whether they experience a substantial increase in their efficiency after a buyout. The evidence suggests that MBOs may be a useful mechanism for reducing agency costs, enhancing economic efficiency and improving the performance of the financial firm.

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## I. Introduction

It is reasonable to say that the policies applied by the financial system as well as the rate of development of the credit system influence significantly the distribution and the cost of financing and capital among the different sectors of the economy. That is why the financial and banking system is the necessary instrument for all governments wishing to apply their monetary policies. Banks are the central points of financial and credit systems as they have the ability to modify the money supply of the economy, to influence the purchasing power, and to integrate the economic process of production, distribution and consumption.

During the last years the banking sector has been characterized by continuous organizational, institutional and technological changes. These changes in laws and regulations, fostered by the unification process in the European market, have increased competition and integration for the banking market of different countries.

Since 1993, the Greek banking system is undergoing a period of rapid changes. These changes include the interest rate liberalization, the annulment of various credit rules, the deregulation of capital movements and the free entrance of banking institutions into the European Union (Noulas, 1999). This situation, in addition to further liberalization leads to an increased competition in both price and quality levels of the offered services by the banking sector. Market liberalization, technological improvements and the entrance of non-banking institutions for the provision of banking services in the form of non-intermediation were the main reasons for the increase of competition between banks (Staikouras and Steliarou, 1999).

Among all these changes, one of the most significant is the capacity of the credit institutions and specialized financial institutions to offer new products, such as leasing, factoring, forfeiting and venture capital. Banks also were allowed to use financial derivatives, such as futures, options and swaps, for hedging against potential risks. Furthermore, financial liberalization in the 1990s has allowed the entrance of new private banks and led to an increase in the number of branches.

In this new environment of continuous changes, the Greek commercial banks should be adapted and develop new strategies in order to satisfy depositor demands and increase their security and profitability. As a result, management buyouts (MBOs) have increased in both size and number in recent years. In an MBO, senior managers

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purchase a controlling interest in a firm's common stock, typically using funds borrowed against the firm's physical assets or cash flows as collateral to finance the acquisition (Harris, Siegel and Wright, 2005). In other words, a management buyout is a form of acquisition where a company's existing managers acquire a large part or all of the company and in this way they can gain independence and autonomy, a chance to influence the strategy and future direction of the company and the prospect of a capital gain.

MBOs vary in size, scope and complexity and are typically characterized by a large amount of debt, the transfer of assets to a new company and the concentration of equity held by incumbent managers and financial institutions (Thompson et al., 1992). Theory predicts an improvement in firm-level performance via the reunification of ownership with peak tier management, debt bonding, and improved monitoring of managerial performance by the principal financing institution having board representation (Amess, 2003).

Jensen (1986, 1988) argues that buyouts combine several powerful incentives that increase efficiency and value. Large debt-service payments force managers to find ways to generate cash and prevent them from wasting resources. Furthermore, larger equity stakes give managers an incentive to find ways to pay off the debt while increasing value. Finally, the buyout specialist, who structures the transaction, monitors and controls the management team. According to this reduced-agency-cost or new-incentive hypothesis, the new incentives lead to increases in operating income and operating margins as well as reductions in wasteful capital expenditures.

Shleifer and Summers (1988) suggest that buyouts and takeovers transfer wealth to investors by laying off employees or reducing their wages. This employee-wealth-transfer hypothesis argues that operating income increases after the buyout at the expense of employee layoffs and wage reductions.

Lowenstein (1985) argues that managers have information about the company that is not available to other bidders. For example, at the time of the buyout announcement, managers may know that cash flows will be higher than the market expects. Because they have private information, managers can buy the company for less than a similarly informed bidder would be willing to pay, and informed shareholders would be willing to accept. This information-advantage or under pricing hypothesis also predicts that operating income is unusually high after the buyout.

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But the critical policy issue concerning MBOs is whether they enhance economic efficiency or not. There are many proposed theories of ownership change, each with different implications of how mergers and acquisitions affect economic performance. In the neoclassical tradition, J. E. Meade (1968) argued that corporate takeovers promote economic natural selection. Efficient firms survive, that is they remain autonomous, while inefficient companies are taken over. H. Manne (1965) suggested that ownership change provides a way of getting rid of ineffective managers while M. Jensen (1988) asserted that mergers increase the efficiency of resource allocation and provide a framework for ensuring that management will act to maximize shareholder wealth.

In contrast, D. C. Mueller (1969) contended that corporate leaders pursue a policy of growth rather than maximization of profit or stock-holder wealth. Executive compensation is often based on revenue increases, and because of imperfections in capital markets, large firms are less likely to be taken over. Consistent with this notion of management empire building, R. Roll (1986) argued that the net effect of mergers is to reduce stockholder wealth because acquiring firms systematically overestimate the value of their targets. He attributed this myopic behavior to the hubris of top-level executives.

Lichtenberg and Siegel (1990) asserted that it is more desirable to assess the total factor productivity (TFP) of plants before and after MBOs. What they found is that MBO plants had higher TFP than representative establishments in the same industry before they changed owners. However, they also reported that MBO plants experienced significant improvements in TFP after the MBO. More importantly, the authors also found that this enhancement in economic performance could not be attributed to reductions in R&D, wages, capital investment or layoffs of blue-collar personnel.

This paper analyzes a sample of 29 management buyouts completed between 1996 and 2007 in Greece. We use detailed data on output, capital, materials and employment and we assess the TFP of 42 banks that take an active role in the Greek financial market, before and after MBOs, in order to examine whether these MBOs have a positive effect on the economic performance of the banks or not.

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The outline of this paper is as follows. The next section analyzes the attempts of some researchers to measure the productivity and efficiency of the banking industry. Section III analyzes some of the problems in specifying inputs and outputs for the banking sector and presents the solution adopted in this paper. Then data sources and the definition of the variables used in the empirical model are discussed. The empirical model based on a translog input distance function and the estimation procedure are described in Section V. The empirical results of efficiency analysis are presented in Section VI and Section VII is devoted to the concluding remarks.

### II. The efficiency of the banking system

The efficiency of the banking system has been one of the major issues in the new monetary and financial environment. The efficiency and the competitiveness of financial institutions cannot be easily measured since their products and services are of intangible nature. Many researchers have attempted to measure productivity and efficiency of the banking industry using outputs, costs, efficiency and performance.

The scale and scope economies of banking have been one of the issues related to the competitiveness and efficiency of banks studied extensively. Murray and White (1983), recognized the multi-product nature of financial intermediaries and used translog cost function to evaluate the scale and scope economies of credit unions in Canada. They find that large multi-product credit unions are more cost-efficient than small single-product credit unions. Gilligan et al. (1984) also use the translog cost function to examine scale and scope economies in U.S. banking firms.

In addition, there are different bank performance measures that can be employed. Revell (1980) uses interest margin as a performance measure for U.S. commercial banks. He defines interest margin as the difference of interest income and expense divided by total assets. Arshadi and Lawrence (1987) measure bank performance using normal correlation analysis. They consider factors related to profitability, pricing of bank services and loan market share. Size also affects the efficiency of banks. Short (1979) indicates that scale economies appear in small banks and not in large ones. More recent research (Miller and Noulas, 1997) shows that the



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levels of size for the existence of scale economies are higher due to economic development and market liberalization.

In this new competitive environment, large banks have been proved to survive whereas small banks are considered to be able to survive if they are focused on specialized activities (Peterson and Rajan, 1995). The efficiency and technical progress of German cooperative banks were examined by Lang and Welzel (1996). All banks proved to enjoy productivity, which is higher in small banks according to this sample.

The technical efficiency of large banks was examined by Miller and Noulas (1996). Larger and more profitable banks have higher levels of technical efficiency and at the same time are more likely to operate under decreasing returns to scale. The performance of the new U.S. commercial banks was examined by DeYung and Hasan (1998). The profit efficiency of the new banks improves rapidly during the first years of operation but on average it takes about nine years to reach established bank levels. Small banks lend a larger proportion of their assets to small businesses than large banks do.

The present study uses an input distance function to measure the technical efficiency of the Greek banking system. In the section that follows we analyze the approach utilized in order to specify the inputs and outputs used in our empirical model.

### III. Specification of outputs and inputs

A definition of banking activity is necessary in order to analyze the efficiency of the banking sector. Economists are divided over the conceptual issue of the correct definitions of outputs and inputs in the banking industry. According to the relevant literature, we can identify five different approaches for the correct definitions of outputs and inputs: a) the production approach (PA), b) the intermediation approach (IA), c) the asset approach (AA), d) the user cost approach (UCA) and e) the value added approach (VAA) (Favero and Papi, 1995).

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The production approach and the intermediation approach are the most widely used in the international literature. The production approach (Sherman and Gold, 1985; Ferrier and Lovell, 1990; Berger et al., 1997; Prior, 2003) defines banks as producers of deposit accounts and loan services. Outputs are measured by the number of accounts serviced or transactions processed, while inputs include capital and labor, but do not include interest costs.

According to the intermediation approach (Rangan et al., 1988; Aly et al., 1990; Berger and Humphrey, 1991; Fried et al., 1993; Berger et al., 1997; Mester, 1997; Young et al., 1998; Kumbhakar and Tsionas, 2002; Drake and Hall, 2003;), banks are viewed as intermediators which transform and transfer financial resources from units in surplus to units in deficit. This approach is particularly appropriate for banks where most activities consist of turning large deposits and funds purchased from other financial institutions into loans and financial investments. Some researchers argue that this approach fails to give the appropriate importance to deposits, since banks produce both earning assets and deposits, incurring production and interest costs (Rangan et al., 1988; Aly et al., 1990; Berger and Humphrey, 1991).

A variant of the intermediation approach is the so-called asset approach which focuses on recent developments in the theory of intermediation (Elyasiant and Mehdian, 1990; 1992; Favero and Papi, 1995; Shaffer, 1993; Drake, 2001). Outputs are strictly defined by assets and mainly by the production of loans, in which banks have advantages over other financial institutions. The main disadvantage of the intermediation approach and the asset approach is that they do not take into account most of the services provided by banks.

The final two approaches mentioned above, are not connected with macroeconomic functions carried out by banks. More specifically, according to the user cost approach, the net contribution to bank revenue determines the nature of inputs and outputs. According to this approach, the method of classifying outputs and inputs is the following: outputs are those with negative user costs, or generate more revenue than expenditure for the firm and inputs are those with positive user costs. There are two main criticisms concerning the user cost approach: the difficulties in collecting accurate data and the practice of subsidization, which implies low reliability of prices and available revenues.

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Finally, in the value added approach, the specification of inputs or outputs is based on the share of value added (Drake, 1992; McAllister and McManus, 1993; Vivas, 1997; Glass et al., 1998, Schure et al., 2004; Fries and Taci, 2005). Items of the balance sheet with a substantial share of value added are considered as important outputs.

In general, the user cost approach has been less frequently used for the reasons mentioned above. The production approach has been applied to the evaluation of relative efficiency of single branches within a particular firm. In this case, it is easier to measure output in physical units, because data are more readily available and all branches adopt the same technology (Favero and Papi, 1995). The value added approach has been implemented to measure changes in banking technology over time (Berger and Humphrey, 1992). In cross-section bank studies, the intermediation approach and the asset approach have been more widely used (Favero and Papi, 1995). The table that follows, reports a summary of the various outputs and inputs definitions used in some specific studies.

Table 1

| <b>Authors</b>          | <b>Inputs</b>  | <b>Outputs</b>  | <b>Approach</b> |
|-------------------------|--|---|-----------------|
| Sherman and Gold (1985) | Labor<br>Capital (rent paid for each branch)<br>Cost of supplies   | Number of transactions  | PA              |
| Rangan et al. (1988)    | Labor (employees)<br>Capital<br>Purchased funds  | Loans<br>Deposits (demand and time)   | IA              |
| Aly et al. (1990)       | Labor (employees)<br>Capital<br>Loanable funds   | Loans (real estate, consumer, other)<br>Demand deposits   | IA              |
| Charnes et al. (1990)   | Total operating expense<br>Total non-interest expense<br>Provision for loan losses<br>Actual loan losses | Total operating income<br>Total interest income<br>Total non-interest income<br>Total net loans |                 |

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| <b>Authors</b>             | <b>Inputs</b>   | <b>Outputs</b>   | <b>Approach</b> |
|----------------------------|---|--|-----------------|
| Berger and Humphrey (1991) | Labor<br>Purchased funds<br>Capital   | Deposits (demand, retail, savings)<br>Loans (real estate, installment)                 | IA              |
| Ferrier and Lovell (1990)  | Labor (employees)<br>Expenditures on materials<br>Occupancy costs and expenditure on furniture and equipments | Number of deposit accounts (demand, time)<br>Number of loans (real estate, instalment) | PA              |
| Olivei (1992)              | Labor (employees)<br>Non-interest expense<br>Depreciations (fixed assets and premises)<br>Interest expenses   | Loans<br>Deposits<br>Non-interest income   | VAA             |
| Yue (1992)                 | Interest expenses<br>Non-interest expenses<br>Deposits  | Interest income<br>Non-interest income<br>Total loans                                  | IA              |
| Resti (1993)               | Capital (number of branches)<br>Labor (employees)<br>Purchased funds  | Loans<br>Deposits (current and saving)<br>Net loans to other banks                     | VAA             |
| English et al. (1993)      | Deposits<br>Labor<br>Purchased funds  | Loans<br>Investments   | AA              |
| Berg et al. (1993)         | Labor (man-hours per year)<br>Capital   | Loans<br>Deposits<br>Services (number of branches)                                     | VAA             |

Source: Favero, C.A., and L. Papi. "Technical efficiency and scale efficiency in the Italian banking sector: a non-parametric approach." *Applied Economics* 27:4 (1995):385-395.

As we already mentioned, there is no simple solution to the problem of output and input specification and reasonable arguments can be made for all approaches (Berger and Humphrey, 1992; Colwell and Davis, 1992). However, the following general comments can be made. Firstly, the measures of output used in the most studies do not take quality into account. In particular, neglecting the risk factor, especially for the loans, is a significant drawback (Favero and Papi, 1995). What's

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more, all studies have used balance-sheet data and thus, off-balance sheet activities, which for many banks often exceed the on-balance sheet activities, are ignored. Finally, until very recently (McAlister and McManus, 1993), no study has considered the role of financial capital as input.

Our approach to tackling the classification problem is to develop complete user costs of balance sheet items for each financial firm. An input is defined as a good with positive user cost, and an output is one with a negative user cost. Despite the fact that the user cost approach is not frequently used, in this paper we adopt it as the derivation of user costs not only permits asset input-output classification and develops appropriate prices on inputs and outputs, but also allows the examination of key monetary policy such as reserve requirements, interest rates and regulations such as deposit rate and loan rate ceilings. Furthermore, the user costs are the prices which when multiplied by the quantity in deposit or loan balances, yield net revenues or expenditures from financial goods.

In our empirical model, the inputs used are labor, materials, capital, non-deposit liabilities, borrowed money, cash and demand deposits. As outputs we use loans to customers, loans to other banks and investments.

Table 2

| <b>Inputs</b>                           | <b>Outputs</b>       |
|---|----------------------|
| Labor                                   | Loans to customers   |
| Materials                               | Loans to other banks |
| Capital                                 | Investments          |
| Non-deposit liabilities-borrowed money- |                      |
| Cash-Demand deposits                    |                      |

#### IV. Data description

The sample used in this study consists of yearly data from the Balance Sheet Accounts of 42 banks that take an active role in the Greek financial market over the period 1996-2007 obtained from ICAP. Data on MBOs were provided by the Hellenic Bank Association (HBA) and by the Consolidated Balance Sheet Accounts of each bank. Data on different interest rates, on inflation and taxes were taken by the Bank of Greece and the General Secretariat of National Statistical Service of Greece. As we already mentioned above, the specification of inputs and outputs is based to the user cost approach. We use the “sign test” for all our variables and we consider three outputs and four inputs in the examined model as shown in Table 2. What we will do next is define each of our variables and explain how we came to the conclusion to consider some of them as inputs and some of them as outputs.

##### i. Labor

Labor services include salary and fringe benefits for the employees for each bank and year. Average compensation is obtained by dividing total compensation for the employees by the number of workers. Hence (Hancock, 1991),

$$(1) \quad W_t(PE) = \frac{\Sigma(SPE_t + FBPE_t)}{NPE_t}$$

where  $SPE_t$  is the salaries of the employees at time t,

$FBPE_t$  is the fringe benefits of the employees at time t and

$NPE_t$  is the number of the employees at time t

Let  $EXL_t$  denote labor compensation at time t, or

$$(2) \quad EXL_t = W_t(PE) * NPE_t$$

In this way we compute the labor which is considered as an input in (11).

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### ii. Materials

The data for material services include expenditures on stationery, printing and supplies, telephone, publicity and advertising, postage, freight and delivery. The total expenditure on materials at time  $t$  is obtained by the Balance Sheet Accounts of the banks and is also considered as an input in (11).

### iii. Capital

Information regarding physical capital is obtained by the Balance Sheet Accounts. On the balance sheet, capital is listed at book value less accumulated depreciation. The user cost of capital in period  $t$  is constructed in the framework of Jorgenson and Griliches (1967). It is derived as though all firms lease their capital goods from a 'leasing' firm. Competition presumably forces the 'leasing' firm to earn the going rate of return, or nominal discounting rate  $R$ , on its leasing activities. The purchase cost of one unit of the capital good less the rental received during the period is equal to the discounted depreciated value of the capital good in the rental period (Hancock, 1991). In symbols we have,

$$(3) \quad P_t - U_t = \frac{\{(1-d)P_{t+1}\}}{(1+R)}$$

Rewriting (3) we obtain:

$$(4) \quad U_t = \frac{\{RP_t + dP_{t+1} - (P_{t+1} - P_t)\}}{(1+R)}$$

where  $t = 1996, 1997, \dots, 2007$

$P_t$  is the purchase price of capital in period  $t$ ,

$P_{t+1}$  is its expected purchase price in period  $t+1$ ,

$d$  is its one-period combined economic depreciation and obsolescence rate computed as the total amount of depreciations in year  $t$  divided by net tangible fixed assets in year  $t-1$  (Konings, Cayseele and Warzynski, 2005) and

$R$  is the nominal discounting rate.

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We use (4) and we compute the user cost of capital for each bank and year. The results show that the user cost is always positive and thus capital is an input in (11).

### iv. Non-deposit liabilities

Total liabilities represent the sum of deposits, in the form of demand and time categories, and non-deposit liabilities. The two main categories of non-deposit liabilities are liabilities from securities and other liabilities. The second category includes all the financial obligations that are not elsewhere classified.

The user cost of non-deposit liabilities is computed according to (5), is positive for each bank and year and thus, non-deposit liabilities are considered as an input.

$$(5) \quad U_{BPF} = -1 + \left\{ \frac{1 + (BPFINT/BPF)}{(1+R)} \right\} \quad (\text{Hancock, 1991})$$

where  $BPFINT$  represents the interest paid by the bank for borrowed, purchased and other funds and

$BPF$  is the total balance outstanding.

On these liabilities there are no reserve requirements.

### v. Cash

The user cost of cash, an asset on the balance sheet of the financial firm, is constructed according to the following equation (Hancock, 1991):

$$(6) \quad \begin{aligned} U_i/P &= \frac{R - h_i}{1 + R} \\ &= 1 - \frac{(1 + r_i + c_i + s_i - \delta_i)}{(1 + R)}, \quad i = 1, \dots, N_1 \end{aligned}$$

where  $h_i = r_i + c_i + s_i - \delta_i$  is the one-period holding revenue per dollar for asset  $i$  for  $i = 1, \dots, N_1$ .



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The holding of cash during the Hicksian period does not yield revenue to the firm, but has an opportunity cost. Consequently, the real user cost of cash is (Hancock, 1991):

$$(7) \quad U_{cash} = 1 - 1/(1 + R)$$

where  $R$  is the discounting rate.

This user cost is applicable to excess reserves. Nearly all financial firms must keep some minimum portion of assets in cash. These reserve requirements are generally based upon the types of deposit liabilities on the balance sheet of the financial firm. Since  $U_{cash} > 0$  for each bank and year, this category represents an input.

vi. Demand deposits

Transactions accounts include all deposits on which the account holder is permitted to make withdrawals by negotiable or transferable instruments, payment orders of withdrawal, telephone and preauthorized transfers, for the purpose of making payments to third persons or others. Included in the demand deposits are also all types of checking accounts including those on which the bank may be paying interest (Hancock, 1991).

The user cost of demand deposits is calculated as follows:

$$(8) \quad U_{DD} = \frac{-1 + \{1 + (INT/DD) + (FDIC/DD) + R * RESREQ - (SERVICE/DD)\}}{(1 + R)}$$

where  $DD$  is total demand deposits,

$INT/DD$  is the interest rate payable by the financial institution,

$FDIC/DD$  is the insurance premium rate,

$RESREQ$  is the marginal reserve requirement and

$SERVICE/DD$  is the service and handling charge rate which is calculated by dividing the income from demand deposits by total demand deposits.

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The user cost for this category is positive for each bank in all years of the sample, hence demand deposits are an input from the financial firm viewpoint.

### vii. Loans

In this category two types of loans are included: loans to customers and loans to other banks. Loans to customers include real estate mortgages loans, namely loans made and serviced, loans sold but serviced and loans purchased but not serviced, and installment loans which consist of direct consumer loans, indirect consumer loans, check credit, commercial and equipment loans. Furthermore, credit card loans, agricultural loans and aggregate loans are considered as loans to customers.

The real user cost for loans,  $U_{CAO}$ , is calculated (Hancock, 1991):

$$(9) \quad U_{CAO} = 1 - \left\{ \frac{1 + (INCCAO/CAO) - (LOSSCAO/CAO)}{(1+R)} \right\}$$

where  $INCCAO/CAO$  denotes the interest rate earned on each type of loan,

$LOSSCAO/CAO$  is the default rate proxy that is approximated by the yearly net losses from loans divided by the total loan volume in euros and

$R$  is the discounting rate.

Since  $U_{CAO} < 0$ , loans to customers as well as loans to other banks are considered as outputs in (11).

### viii. Investments

Investments include securities, tax exempt securities and in general everything that is contained in the investment portfolio of the financial firm. The real user cost of investments is calculated in the following manner (Hancock, 1991):

$$(10) \quad U_{INV} = 1 - \left\{ \frac{1 + (INCINV/INV) + (TAX/INV) + (GAINS/INV)}{(1+R)} \right\}$$

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where  $INV$  is the total investment volume in euros,  
 $INCINV$  is interest and other income received,  
 $INCINV/INV$  is the interest rate,  
 $TAX/INV$  denotes tax savings on tax-exempt securities in rate form,  
 $GAINS/INV$  is the capital gains rate and  
 $R$  is the discounting rate.

The user cost for investments is always negative for each bank and year. This indicates that investments are an output from the viewpoint of the financial firm. With Table 3, which is a summary of the statistics of all our variables, we conclude the description of the procedure for constructing the data and we continue to our empirical model.

Table 3 Summary Statistics of the Variables

| Variable  | Mean          | Min         | Max            | SD             |
|---|---------------|-------------|----------------|----------------|
| <b>Outputs</b>  |               |             |                |                |
| Loans to customers  | 3,655,383,557 | 19,483      | 39,568,570,000 | 6,897,180,461  |
| Loans to other banks  | 809,021,522   | 45,598      | 15,581,590,273 | 1,684,274,608  |
| Investments   | 1,149,491,410 | 0           | 21,584,650,598 | 3,164,108,610  |
| <b>Inputs</b>   |               |             |                |                |
| Labor   | 78,674,361.27 | 101,104.04  | 871,263,424.8  | 149,934,778.7  |
| Materials   | 38,780,641.4  | 265,836.7   | 318,779,842.3  | 62,035,327.71  |
| Capital   | 134,520,525   | 54,062      | 1,605,091,843  | 236,679,610.8  |
| Non-deposit liabilities-borrowed money-Cash-Demand deposits | 5,999,038,715 | 1,000,739.3 | 59,340,336,024 | 11,411,800,679 |

## V. Empirical model and estimation procedure

In order to keep the representation of production technology as flexible as possible within the parametric approach, the translog form is chosen to approximate the input distance function:

$$(11) \quad \ln D^I(y, x; t) = a_0 + \sum_{k=1}^3 a_k \ln y_{kit} + \sum_{j=1}^4 \beta_j \ln x_{jit} + \gamma_1 t + \gamma_2 t^2$$

The regularity conditions associated with the input distance function require homogeneity of degree one in input quantities, which imply the following restrictions on the parameters of (11):

$$(12) \quad \sum_{j=1}^4 \beta_j = 1$$

The homogeneity restriction may also be imposed by dividing all input quantities on the right-hand side of (11) by the quantity of that input used as a *numeraire*.

$$(13) \quad \ln(D^I/x_{1it}) = a_0 + \sum_{k=1}^3 a_k \ln y_{kit} + \sum_{j=1}^3 \beta_j \ln(x_{jit}/x_{1it}) + \gamma_1 t + \gamma_2 t^2$$

Given linear homogeneity, (13) may be written as:

$$(14) \quad -\ln x_{1it} = \phi(\cdot) - \ln D_{it}^I$$

in order to obtain an estimable form of the input distance function. Because there are no observations for  $\ln D_{it}^I$  and given that  $\ln D_{it}^I \leq 0$ , it can be assumed that  $\ln D_{it}^I = u_{it}$  (Coelli and Perelman, 1999), where  $u_{it}$  is a one-sided, nonnegative (non symmetric) error term representing the stochastic shortfall of the  $i^{th}$  bank output from its

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production frontier due to the existence of technical inefficiency. For the non symmetric error term there have been proposed different distributions (normal distribution, Pearson distribution etc). If we denote as  $\varepsilon_{it}$  a symmetric and normally distributed error term (i.e. statistical noise), representing a combination of those factors that cannot be controlled and omitted explanatory variables, then the stochastic input distance function model can be written as follows:

$$(15) \quad -\ln x_{1it} = \phi(\cdot) - u_{it} + \varepsilon_{it}$$

It is also assumed that  $u_{it}$  and  $\varepsilon_{it}$  are distributed independently of each other (Battese and Coelli, 1992).

$$(16) \quad \varepsilon_{it} \sim N(0, \sigma_{\varepsilon}^2)$$

$$(17) \quad u_{it} = \exp\{-\eta(t-T)\} u_i \quad \text{and}$$

$$(18) \quad u_{it} \sim N(\mu, \sigma_u^2)$$

The resulting model is estimated through a computer program named Frontier 3.1 developed by Coelli (1992). This program has been written to provide maximum likelihood estimates of the parameters of stochastic frontier production and cost function. More precisely, it is used the Battese and Coelli (1992) specification that is responding with the best way to the available data and the specific characteristics of the present research work.

The program provides the maximum likelihood estimates of the model as well as those for individual bank technical efficiency over time using the following predictor (Kumbhakar and Lovell, 2000):

$$(19) \quad TE_i = E\left[\exp\{-u_{it}\} \mid \varepsilon_{it} - u_{it}\right]$$

$$(20) \quad TE = \left\{ \frac{1 - \Phi\left\{ \sigma_* - \frac{\tilde{\mu}_i}{\sigma_*} \right\}}{1 - \Phi\left( -\frac{\tilde{\mu}_i}{\sigma_*} \right)} \right\} \exp\left\{ -\tilde{\mu}_i + \frac{1}{2}\sigma_*^2 \right\}$$

The empirical results of efficiency analysis are presented in the section that follows (see Table 4). To analyze the impact of MBOs on the productivity of Greek banks we estimate the following equation:

$$(21) \quad TE_i = \delta_0 + \delta_1 D^{MBO} + \delta_2 Emp$$

where  $D^{MBO}$  is a dummy that equals 1 if the financial firm was involved in a MBO during 1996-2007 (either as an acquirer or a vendor) and 0 if not. The empirical results are shown in Table 7.

## VI. Empirical results

The parameter estimates of the translog input distance function are presented in Table 3. According to the estimated parameters, the translog input distance function is found, at the point of approximation, to be nonincreasing in outputs and nondecreasing in inputs. Also, at the point of approximation, the Hessian matrix of the second-order partial derivatives with respect to inputs is found to be negative definite and the corresponding Hessian matrix with respect to outputs to be positive definite. These indicate respectively the concavity and convexity of the underlying input distance function with respect to inputs and outputs. The value of the adjusted R-squared indicates a satisfactory fit of the translog specification.

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Table 4. Parameter Estimates of the Translog Input Distance Function

| <b>Coefficient</b>          | <b>Estimate</b> | <b>StdError</b> |
|-----------------------------|-----------------|-----------------|
| Loans to customers          | -.2819661       | .0192694        |
| Loans to banks              | -.0987479       | .0179507        |
| Investments                 | -.0725681       | .0112347        |
| Capital                     | .261503         |                 |
| Labor                       | .2017953        | .0545444        |
| Materials                   | .1456035        | .0285293        |
| Liabilities-Demand deposits | .3910982        | .0360238        |
| Time                        | -.2888959       | .2150322        |
| Time-squared                | .0196845        | .1046391        |
| Constant                    | 2.997601        | .2310272        |
| $\mu$                       | .6054054        | .8406099        |
| $\eta$                      | .0053575        | .0056163        |
| $\gamma$                    | .9707163        | .0167977        |

The estimated variance of the one-sided error term is found to be  $\sigma_u^2 = 0.354$  and that of the statistical noise  $\sigma_\varepsilon^2 = 0.051$ . The presence of technical inefficiency is related to the statistical significance of  $\sigma_u^2$ . Thus, a significant part of output variability is explained by the existing differences in the degree of technical efficiency. Furthermore, the estimate of the time coefficient is negative (-0.289) which means that there is technological progress over time.

The estimated mean technical efficiency was found to be 75.36% during the period 1996-2007 (see Table 5). Thus, on average, a 24.64% decrease in total cost could have been achieved during this period, without altering the total volume of outputs, production technology and input usage.

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Table 5. Frequency Distribution of Technical Efficiency Estimates

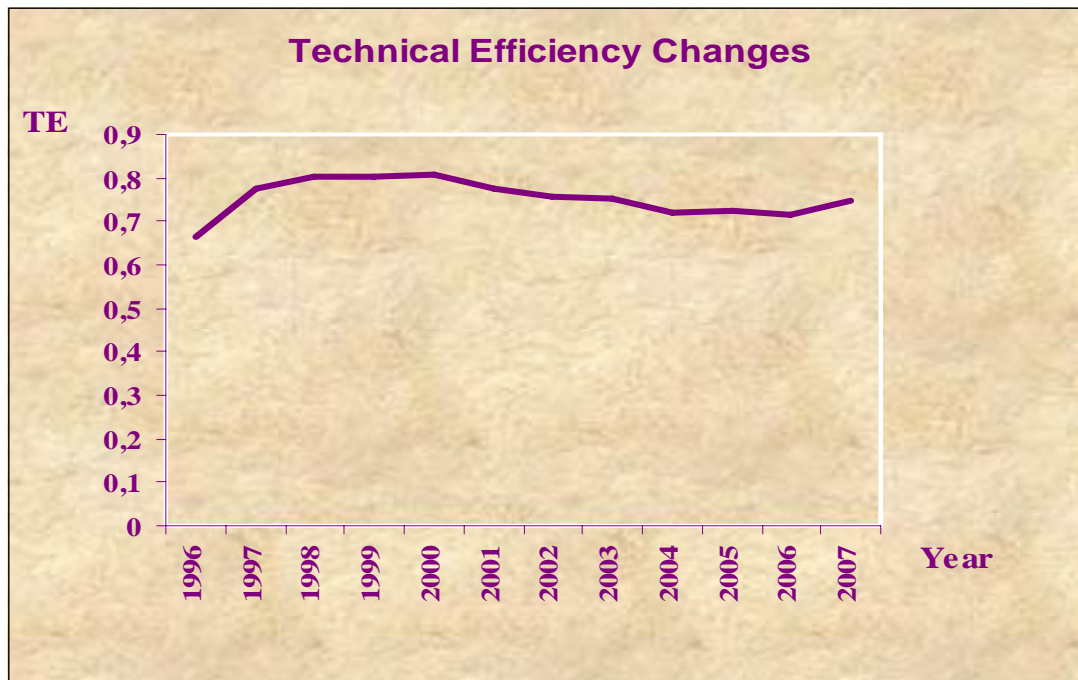
|              | 1996          | 1997          | 1998          | 1999          | 2000          | 2001          | 2002          | 2003          | 2004          | 2005          | 2006          | 2007          |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>0.1</b>   | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| <b>0.2</b>   | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| <b>0.3</b>   | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| <b>0.4</b>   | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 1             | 1             | 1             | 1             | 1             |
| <b>0.5</b>   | 0             | 1             | 2             | 2             | 2             | 3             | 3             | 3             | 5             | 5             | 6             | 2             |
| <b>0.6</b>   | 1             | 2             | 2             | 2             | 2             | 4             | 5             | 5             | 7             | 7             | 7             | 6             |
| <b>0.7</b>   | 0             | 0             | 0             | 0             | 0             | 0             | 3             | 4             | 5             | 5             | 6             | 4             |
| <b>0.8</b>   | 1             | 2             | 3             | 4             | 4             | 4             | 4             | 3             | 3             | 4             | 4             | 1             |
| <b>0.9</b>   | 0             | 4             | 7             | 7             | 7             | 8             | 9             | 9             | 9             | 9             | 9             | 9             |
| <b>1</b>     | 0             | 3             | 6             | 7             | 8             | 8             | 8             | 9             | 9             | 9             | 9             | 7             |
| <b>Total</b> | 2             | 12            | 20            | 22            | 23            | 27            | 32            | 34            | 39            | 40            | 42            | 30            |
| <b>Mean</b>  | <b>0.6659</b> | <b>0.7766</b> | <b>0.8010</b> | <b>0.8022</b> | <b>0.8065</b> | <b>0.7769</b> | <b>0.7571</b> | <b>0.7504</b> | <b>0.7211</b> | <b>0.7244</b> | <b>0.7150</b> | <b>0.7456</b> |

The vast majority of the banks in the sample have consistently achieved scores of technical efficiency greater than 50%. Moreover, there are no banks with technical efficiency scores below 30%. During the period under consideration, technical efficiency is time-invariant, which means that it tends to remain stable over time (see Table 6). What we can see is that technical efficiency tends to increase but not significantly over the period 1996-2000. Specifically, mean input-oriented technical efficiency increased from 66.59% in 1996 to 74.56% in 2007 (see Table 5), implying that the contribution of technical efficiency to output growth would be positive. During the period 1996-2000, the annual rate of increase in technical efficiency was estimated to be 0.051%.



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Table 6. Intertemporal Variation of Mean Technical Efficiency Estimates



As we already mentioned above, we estimate (21) and the results are shown in Table 7 that follows:

Table 7.

| <b>Coefficient</b>      | <b>Estimate</b> | <b>Standard error</b> |
|-------------------------|-----------------|-----------------------|
| <b>MBO</b>              | 1.3521          | (0.3672)              |
| <b>Employment level</b> | 0.4134          | (0.0511)              |
| <b>R<sup>2</sup></b>    | 0.2326          |                       |

Our results suggest that MBOs have positive effects on efficiency and thus they may be a useful mechanism for enhancing the economic efficiency of the financial firm. Our findings are consistent with recent theoretical and empirical evidence (Jovanovic and Rousseau, 2002) suggesting that takeovers shift a firm's resources to more efficient uses and to better managers.

## VII. Concluding remarks

The deregulation process has put the Greek banks in the position to engage in all those activities performed by universal bank which represents the standard model in the rest of the European Union. The objective of this paper was to produce econometric measures of efficiency for the Greek banking industry and to investigate the effects of management buyouts on productivity, using a large database that includes all banks that take an active role in the Greek banking system, both privately and publicly owned.

We conclude that buyouts have positive impact on technical efficiency despite the fact that this result is not very clear in the existing literature concerning the banking industry (Cuesta and Orea, 2002). In other words, MBOs proved to be beneficial for the merger participants as the results indicate that the ownership change is a mechanism for correcting lapses of efficiency, reducing agency costs and enhancing economic efficiency (Harris, Siegel and Wright, 2005). Furthermore, our results are consistent with the matching theory of plant turnover (Lichtenberg and Siegel, 1987) which implies that a change in ownership will result in an increase in productivity.

The analysis reveals that productivity is significantly higher in the first three years after the buyout but we cannot prove that the buyout was the only cause of the productivity gain. Amess (2003) find that MBO firms have superior performance up to four years after the transaction, Lichtenberg and Siegel (1990) find that performance gains exist for up to three years post-buyout whereas Wright et al. (1998) report that they occur from the third year to the fifth year after the MBO transaction. The results of this study are generally consistent with the MBO governance structure providing improved managerial incentives leading to improvements in technical efficiency (Amess, 2003). More generally, our findings are consistent with most merger theories, including the managerial-discipline and managerial-synergy theories (McGuckin and Nguyen, 1995).

Yet, the results, as shown in Tables 5 and 6, indicate that MBOs have a merely transitory impact on firm-level technical efficiency. Despite the fact that the efficiency tends to increase three years after the buyout, we can observe that it

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declines in later years. This is not consistent with both Jensen's (1989) or Rappaport's (1990) view of MBOs and their longevity.

There are several possible explanations that can explain these findings. First of all, MBOs and their organizational changes create a shock-therapy initially leading to efficiency improvements that declines in later years due to managers and employees becoming accustomed to the new structure (Lichtenberg and Siegel, 1990). Second, the incentive effects of debt-bonding decline as the MBO team reduce leverage over time (Amess, 2003). Third, the ownership structure and high leverage put constraints on managerial behavior to the extent that the benefits of the organizational structure no longer outweigh the costs (Amess, 2003).

We should also notice that the efficiency gains associated with an MBO may begin prior to the transaction. One possible explanation for this situation is that vendors prepare themselves and the financial firm for the buyout in order to make the transaction an attractive proposition. Another explanation is that the agreement between acquirers and vendors could be made prior to the public announcement and therefore, managers start behaving like residual claimants and seek to improve firm efficiency before the announcement of the MBO (Amess, 2003).

In addition, according to the Balance Sheet Accounts of all banks that took part in MBOs during 1996-2007, the later experience increases in their operating income (before depreciation). The operating income equals net sales less cost of goods sold and selling, general, and administrative expenses before depreciation, depletion and amortization are deducted (Kaplan, 1989). In other words, operating income measures the cash generated from the buyout firm operations before depreciation, interest or taxes.

The results also suggest that bank mergers not only generate savings by reducing the number of new branches, redundant personnel and related operating costs but they can also achieve substantial savings by adopting best practice operating methods (Sherman and Rupert, 2004). Finally, we should keep in mind that it is true that increasing efficiency directly benefits the MBO financial firm by reducing its expected costs, but it can indirectly harm it by increasing the severity of competition (Thomas, 2004).

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Although not conclusive, the evidence presented in this study broadly supports the hypothesis that management buyouts experience post-buyout operating improvements and value increases. Moreover, the operating improvements and value increases appear to be generated by improved incentives rather than wealth transfers from employees or superior managerial information.

An extension to our analysis would be to examine separately the effects of MBOs on the productivity growth of the acquirer and on the productivity growth of the vendor. We could also investigate the productivity impact of different types of MBOs. For instance, private financial firms could have lower agency costs than public firms and therefore, we could see whether differences exist between the TFP effects of public-to-private and private-to-private MBOs. Finally, there is the phenomenon of the reverse buyout (Degeorge and Zeckhauser, 1993), which occurs when an MBO goes public again. It might be interesting to analyze TFP before and after reverse MBOs.

## VIII. References

- Aly, H.Y., Grabowski, R., Pasurka, C., and N. Rangan. "Technical scale and allocative efficiencies in US banking: an empirical investigation." *The Review of Economics and Statistics* (1990):211-218.
- Amess, K. "The effect of management buyouts on firm-level technical inefficiency: Evidence from a panel of UK machinery and equipment manufacturers." *The Journal of Industrial Economics* Vol. LI, No.1 (2003):35-44.
- Arshadi, N., and E.C. Lawrence. "An empirical investigation of new bank performance." *Journal of Banking and Finance* 11 (1987):33-48.
- Battese, G.E., and T.J. Coelli. "Frontier production functions, technical efficiency and panel data: with application to paddy farmers in India." *Journal of Productivity Analysis* 3 (1992):153-169.
- Berger, A.N., and D.B. Humphrey. "The dominance of inefficiencies over scale and product mix economies in banking." *Journal of Monetary Economics* 28 (1991):117-148.
- Berger, A.N., and D.B. Humphrey. "Measurement and efficiency issues in commercial banking." In Z. Griliches, eds. *Output Measurement in the Service Sector*. The University of Chicago Press, Chicago, 1992.
- Berger, A., Leusner, J., and J. Mingo. "The efficiency of bank branches." *Journal of Monetary Economics* 40 (1997):141-162.
- Coelli, T., and S. Perelman. "A comparison of parametric and non-parametric distance functions: with application to European railways." *European Journal of Operational Research* 117 (1999):326-339.
- Cuesta, R.A., and L.Orea. "Mergers and technical efficiency in Spanish savings banks: A stochastic distance function approach." *Journal of Banking and Finance* 26 (2002):2231-2247.
- DeGeorge, F., and R. Zeckhauser. "The Reverse LBO Decision and Firm Performance: Theory and Evidence." *Journal of Finance* 48 (1993):1323-1348.
- DeYung, and I. Hasan. "The performance of de novo commercial banks: A profit efficiency approach." *Journal of Banking and Finance* 22/5 (1998):565-587.

The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

- Drake, L. "Economics of scale and scope in UK building societies: an application of the translog multiproduct cost function." *Applied Financial Economics* 2 (1992):211-219.
- Drake, L. "Efficiency and productivity change in UK banking." *Applied Financial Economics* 11 (2001):557-571.
- Drake, L., and M. Hall. "Efficiency in Japanese banking: An empirical analysis." *Journal of Banking and Finance* 27 (2003):891-917.
- Elyasiani, E., and S.M. Mehdian. "Productive efficiency performance of minority and nonminority-owned banks: a nonparametric approach." *Journal of Banking and Finance* 16 (1992):933-948.
- Favero, C.A., and L. Papi. "Technical efficiency and scale efficiency in the Italian banking sector: a non-parametric approach." *Applied Economics* 27:4 (1995):385-395.
- Ferrier, G.D., and C.A.K. Lovell. "Measuring cost efficiency in banking: econometric and linear programming evidence." *Journal of Econometrics* 46 (1990):229-245.
- Fried, H., Lovell, C.A.K., and P.V. Eeckaut. "Evaluating the performance of US Credit Unions." *Journal of Banking and Finance* 17 (1993):251-265.
- Fries, S., and A. Taci. "Cost efficiency of banks in transition: Evidence from 289 banks in 15 post-communist countries." *Journal of Banking and Finance* 29 (2005):55-81.
- Gilligan, T., Smirlock, M., and W. Marshall. "Scale and scope economics in the multi-product banking firm." *Journal of Monetary Economics* 13 (1984):393-405.
- Glass, J., McKillop, D.G., and Y. Morikawa. "Intermediation and Value-Added Models for estimating Cost Economies in large Japanese banks 1977-93." *Applied Financial Economics* 8 (1998):185-661.
- Hancock, D. *A theory of production for the financial firm: Innovations in Financial Markets and Institutions*. Massachusetts: Kluwer Academic Publishers, 1991.
- Harris, R., Siegel, D.S., and M. Wright. "Assessing the impact of management buyouts on economic efficiency: Plant-level evidence from the United Kingdom." *The Review of Economics and Statistics* 87(1) (2005):148-153.
- Jensen, M. "Agency costs of free cash flow, corporate finance and takeovers." *American Economic Review* 76 (1986):323-329.

The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

- Jensen, M. "Takeovers: Their causes and consequences." *Journal of Economic Perspectives* 2 (1988): 21-48.
- Jensen, M.C. "The Takeover Controversy: Analysis and Evidence." In J.C. Coffee, J.L. Lowenstein, and S. Ackerman, eds., *Knights, Raiders, and Targets: The Impact of the Hostile Takeover*. Oxford University Press, 1988.
- Jensen, M.C. "Eclipse of the Public Corporation." *Harvard Business Review* 5 (1989):61-75.
- Jorgenson, D.W., and Z. Griliches. "The Explanation of Productivity Change." *Review of Economic Studies* 34 (1967):249-283.
- Jovanovic, B., and P. Rousseau. "Mergers as Reallocation." National Bureau of Economic Research working paper no. 9279 (2002).
- Kaplan, S. "The effects of management buyouts on operating performance and value." *Journal of Financial Economics* 24 (1989):217-254.
- Karagiannis, G., Midmore, P., and V. Tzouvelekas. "Parametric Decomposition of Output Growth Using a Stochastic Input Distance Function." *American Journal of Agricultural Economics* 86 (4) (2004): 1044-1057.
- Konings, J., Cayseele, P.V., and F. Warzynski. "The effects of privatization and competitive pressure on firms' price-cost margins: Micro evidence from emerging economies." *The Review of Economics and Statistics* 87(1) (2005); 124-134.
- Kumbhakar, S.C., and C.A.K. Lovell. *Stochastic Frontier Analysis*. Cambridge: Cambridge University Press, 2000.
- Kumbhakar, S.C., and E. Tsionas. "Measuring technical and allocative inefficiency in the translog cost system: a Bayesian approach." *Proceedings of the conference "Current Developments in Productivity and Efficiency Measurement"*. University of Georgia, October 25-26, 2002.
- Lang, G., and P. Welzel. "Efficiency and technical progress in banking empirical results for a panel of German cooperative banks." *Journal of Banking and Finance* 20/6 (1996):1003-1023.
- Lichtenberg, F.R., Siegel, D., Jorgenson, D., and E. Mansfield. "Productivity and Changes in Ownership of Manufacturing Plants." *Brookings Papers on Economic Activity* 3 (1987):643-683.

The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

- Lichtenberg, F.R., and D.Siegel. "The Effect of Leveraged Buyouts on Productivity and Related Aspects of Firm Behavior." *Journal of Financial Economics* 27 (1990): 165-194.
- Lowenstein, L. "Management buyouts." *Columbia Law Review* 85 (1985):730-784.
- Manne, H.G. "Mergers and the Market for Corporate Control." *Journal of political Economy* 73 (1965):110-120.
- McAllister, P., and D. McManus. "Resolving the scale efficiency puzzle in banking." *Journal of Banking and Finance* 20 (1993):389-405.
- McGuckin, H., and S.V. Nguyen. "On Productivity and Plant Ownership Change: New Evidence from the Longitudinal Research Database." *The RAND Journal of Economics* 26 (2) (1995):257-276.
- Meade, J.E. "Is the New Industrial State Inevitable?" *Economic Journal* 78 (1968):372-392.
- Mester, L. "Measuring efficiency at US banks: Accounting for heterogeneity is important." *European Journal of Operational Research* 98 (1997):230-242.
- Miller, S., and A. Noulas. "The technical efficiency of large banks production." *Journal of Banking and Finance* 20/3 (1996):495-509.
- Miller, S., and A. Noulas. "Portfolio mix and large-bank profitability in the USA." *Applied Economics* 29 (1997):505-512.
- Mueller, D.C. "A Theory of Conglomerate Mergers." *Quarterly Journal of Economics* 83 (1969): 643-659.
- Murray, J.D., and R.W. White. "Economies of scales and economics of scope in multiproduct financial institutions: A study of British Columbia credit unions." *Journal of Finance* 38 (1983):887-902.
- Noulas, A. "Profitability and efficiency of the Greek banks (1993-1998)." *Bull. Union Greek Banks* 4 (1999): 53-60.
- Peterson, M., and R. Rajan. "The effects of credit market competition on lending relationships." *Quarterly Journal of Economics* 60 (1995):407-444.
- Prior, D. "Long- and short-run non-parametric cost frontier efficiency: An application to Spanish saving banks." *Journal of Banking and finance* 27 (2003):655-671.
- Rangan, N., Grabowsky, R., Aly, H.Y., and C. Pasurka. "The technical efficiency of US banks." *Economics Letters* 28 (1988):169-175.



The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

- Rappaport, A. "The Staying Power of the Public Corporation." *Harvard Business Review* 1 (1990):96-104.
- Revell, J. "Costs and margins in banking: An international survey." Paris, OECD.
- Roll, R. "The Hubris Hypothesis of Corporate Takeovers." *Journal of Business* 59 (1986): 197-216.
- Schure, P., Wagenvoort, R., and D. O'Brien. "The efficiency and the conduct of European banks: Developments after 1992." *Review of Financial Economics* 13 (2004):371-396.
- Shaffer, Sh. "Can megamergers improve bank efficiency?" *Journal of Productivity Analysis* 17 (1993):423-436.
- Sherman, H.D., and F. Gold. "Bank branch operating efficiency: evaluation with data envelopment analysis." *Journal of Banking and Finance* 9 (1985): 297-315.
- Sherman, H.D., and T.J. Rupert. "Do bank mergers have hidden or foregone value? Realized and unrealized operating synergies in one bank merger." *European Journal of Operational Research* (2004).
- Shleifer, A., and L. Summers. "Breach of trust in hostile takeovers." In A. Auerbach, ed. *Corporate Takeovers: Causes and consequences*. University of Chicago Press, Chicago, IL, 1988.
- Shleifer, A., and R. Vishny. "Management buyouts as a response to market pressure." In A. Auerbach, ed. *Mergers and acquisitions*. University of Chicago Press, Chicago, IL, 1988.
- Short, B. "The relation between commercial bank profit rates and banking concentration in Canada, Western Europe and Japan." *Journal of Banking and Finance* 3 (1979):209-219.
- Staikouras, C., and M. Steliarou. "Determinants of profitability for the Greek banking institutes." *Issue of the Union of Greek Banks* (1999):61-66.
- Thomas, C.J. "The competitive effects of mergers between asymmetric firms." *International Journal of Industrial Organization* 22 (2004):679-692.
- Thomson, S., Wright, M. and Robbie, K. "Management Equity Ownership, Debt, and Performance: Some Evidence from UK Management Buyouts." *Scottish Journal of Political Economy* 39 (1992):413-430.
- Vivas, A.L. "Profit efficiency for Spanish savings banks." *European Journal of Operational Research* 98 (1997):381-394.

The effect of management buyouts on productivity growth: Empirical evidence from the Greek banking sector

Worthington, A.C. "Efficiency in Pre-Merger and Post-Merger Non-Bank Financial Institutions." *Managerial and Decision Economics* 22 (2001):439-452.

Wright, M., Wilson, N., and K. Robbie. "The Longer-Term Effects of Management Buyouts." *Journal of Entrepreneurial and Small Business Finance* 5 (1998):213-234.

Young, R., Hasan, I., and B. Kirchhoff. "The impact of out-of-state entry on the cost efficiency of local commercial banks." *Journal of Economics and Business* 50 (1998):191-203.