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COMMUNICATIONS

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DETERMINANTS OF BANK PROFITABILITY: EVIDENCE FROM THE GREEK BANKING SECTOR

ABSTRACT: *This paper investigates the effects of bank-specific and macroeconomic determinants of bank profitability, using an empirical framework that incorporates the traditional Structure-Conduct-Performance (SCP) hypothesis. A panel data approach has been adopted and effectively applied to six Greek banks. The evidence generated suggests that for any consistent or systematic size the profitability relationship is relatively weak. Most of the bank-specific determinants were found to significantly affect bank profitability. A more ambiguous picture emerged when the macroeconomic factors were considered.*

KEY WORDS: *bank profitability; Greek banking sector; panel data*

JEL CLASSIFICATION: G21, C23, L2

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1. INTRODUCTION

Over the last two decades the Greek banking industry has undergone substantial changes. Newly introduced elements, including deregulation, technological advances and intense competition, have transformed the structure and performance of banks. The main trends have been the strong growth in lending volumes, the high sustainable interest margins and the significant expansion of Greek banks into the SE European region, mainly through acquisitions (Deloitte & Touche, 2006). These trends acted as a catalyst to the performance of banks and resulted in unprecedented levels of profitability in recent years. Inevitably, a key dimension of performance among financial institutions is profitability or, in financial jargon, the "bottom line figures". Satisfactory earnings coupled with prudent risk management preserve capital, and provide a basis for survival and future growth. Given that banks constitute the spinal cord of financial systems, the Greek banking sector provides a relevant platform on which to study the determinants of bank profitability.

The objective of this paper is to identify the crucial factors that affected the profitability of the six major Greek commercial banks over the period 2000 – 2007. The rest of the paper is organised as follows: Section 2 describes the economic environment within which Greek banks operate, while section 3 explains the methodological approach adopted and the results obtained. Finally, the conclusions are given in section 4.

2. TRENDS IN THE GREEK ECONOMY: AN OVERVIEW

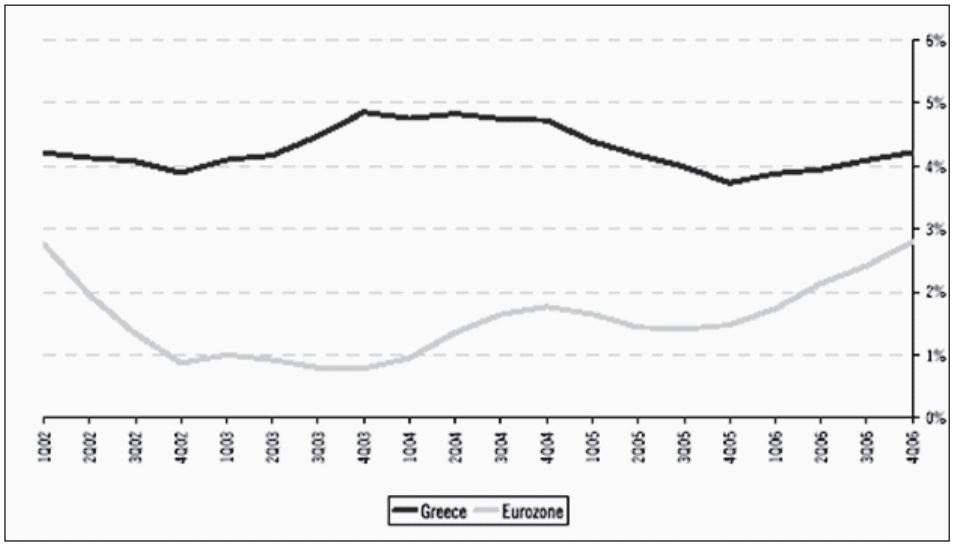
Relatively speaking, since the beginning of 2000, the Greek economy has experienced real growth higher than the European average, with private consumption remaining the principal component[1]. Driven mainly by infrastructure projects, the growth rate of GDP rose to almost 5% in the period prior to the Athens Olympics (2003 – 2004), before experiencing a sharp decline in 2005 after the games.

For 2008 it is anticipated that the GDP rate will remain at 4%, thus sustaining the positive performance of the previous years. Figure 1 presents the real GDP growth for Greece vis-à-vis the whole of the Eurozone during the period 2002 to

1 A traditional service economy, with a relatively small manufacturing sector. The service and construction sectors are the engines of growth in Greece.

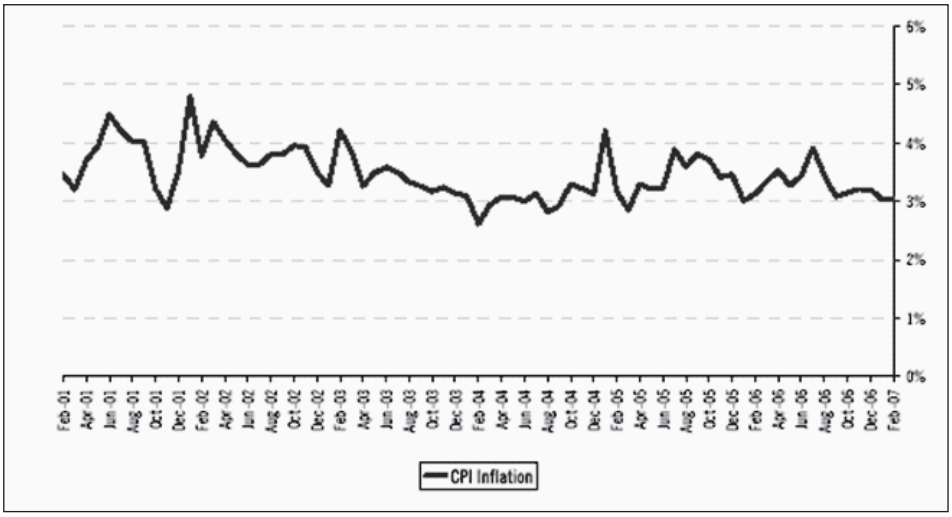
2006. Clearly, the rate of economic growth in Greece remains high, at levels well above the growth rate in the Eurozone, leading to further economic convergence. Thus in 2006, per capita GDP stood at 84.7% of the EU-15, compared to 83.3% in 2005 and 77.9% in 2000.

Figure 1. Real GDP Growth



A more detailed look reveals that the domestic economy grew by almost 4.1% in 2006, compared to 3.7% in 2005, with strong domestic demand and investment acting as the primary catalysts for growth. However, the satisfactory growth in exports was cancelled out by an increase in imports, resulting in a continued negative impact on the trade deficit. Inflation in Greece remains above the Eurozone average by approximately 1.1%, due primarily to a faster increase in domestic demand and higher labour costs per unit compared to the Euro Zone. Having reached 5% during the end of 2001 and the beginning of 2002, the average headline consumer price inflation stabilised at around 3% at the start of 2007. The national consumer price index reached 3.2% in 2006, compared to 3.4% in 2005 (see fig.2).

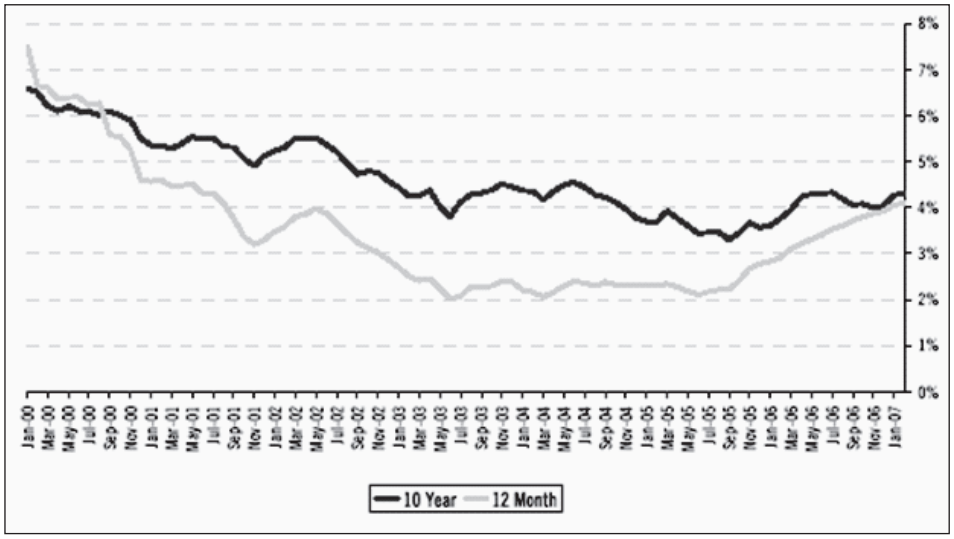
Figure 2. Inflation Rate



The acceleration in investment and the strong growth of private consumption were driven by low interest rates, the easy availability of credit and higher employment. Total investment of fixed capital increased by 9.1% in 2006 compared to a decline of -1.4% in 2005, and was equal to almost 27% of GDP in 2006 compared to 26% in 2005. Private consumption grew by 3.8%, slightly higher than in 2005, boosted by the expansion of consumer credit, improved standards of living and increased household disposable incomes.

With regard to interest rates, the Greek experience over the last decade has been one of unprecedentedly low and decreasing rates, as they converged to the Euro area and as monetary policy was relaxed by the European Central Bank. During the last few years the European Central Bank has undergone a phase of monetary policy tightening, resulting in rising interest rates in Greece, as illustrated in Figure 3 below.

Figure 3. Interest Rates, 2000 – 2007



2.1 The Greek Banking System

Historically, Greek banks were prohibited from engaging directly in financial service activities other than their traditional loan and deposit functions. The Greek banking system was subject to strict regulatory requirements, including restrictions on freely determined interest rates, the financing of various sectors of the economy, and activities in the foreign exchange market. In the late 1980s, a gradual relaxation of the regulatory environment in Greece took place due to the increasing interdependence of EU economies, increasing pressure for the opening of markets, and anticipation of EMU. Administratively determined interest rates by the Central Bank of Greece were finally abolished and Greek banks became free to negotiate interest rates with customers based on market conditions. These significant changes, together with the M&A trend and technological advances, contributed to a rapid expansion of the banking system, which is now characterized by a high degree of concentration and competitiveness (Kosmidou *et al*, 2005). In 2006, there were 46 domestic and foreign banks and other credit institutions operating in Greece.

Domestic banks can be grouped into two main categories: universal[2] banks and specialized credit institutions. A higher banking concentration ratio than in the

2 This refers to commercial and investment banks. Recently, the distinction between commercial and investment banks ceased to exist. The Bank of Greece classifies all banks operating in Greece as universal banks.

rest of the Eurozone makes Greece a *de facto* oligopoly, allowing the maintenance of high loan–deposit interest spreads (Athanasoglou et al, 2005) (see Table 1).

Table 1. Greek Banking Sector Concentration and Market Shares of Main Competitors

Banks		Assets	Market Share	Loans	Market Share	Deposits	Market Share
1	National Bank of Greece	61.3	22.7%	32.7	19.9%	44.5	25.3%
2	Eurobank	50.1	18.6%	30.1	18.3%	30.3	17.2%
3	Alpha Bank	46.7	17.3%	28.2	17.2%	20.3	11.6%
4	Piraeus Bank	27.9	10.4%	18.7	11.4%	14.6	8.3%
5	Emporiki Bank	21.8	8.1%	16.1	9.8%	16.3	9.3%
6	ATEBank	20.5	7.6%	13.6	8.3%	18.1	10.3%
Total		228.3	84.7%	139.4	84.9%	144.1	82.0%

Amounts in € millions

Source: Published Financial Statements

Clearly, six banks control more than 80% of the market, as measured in terms of assets, loans or deposits. As a result of consolidation in the industry, Greek banks now enjoy economies of scale and scope, which is reflected in their high profitability with returns on equity exceeding 20% in 2006.

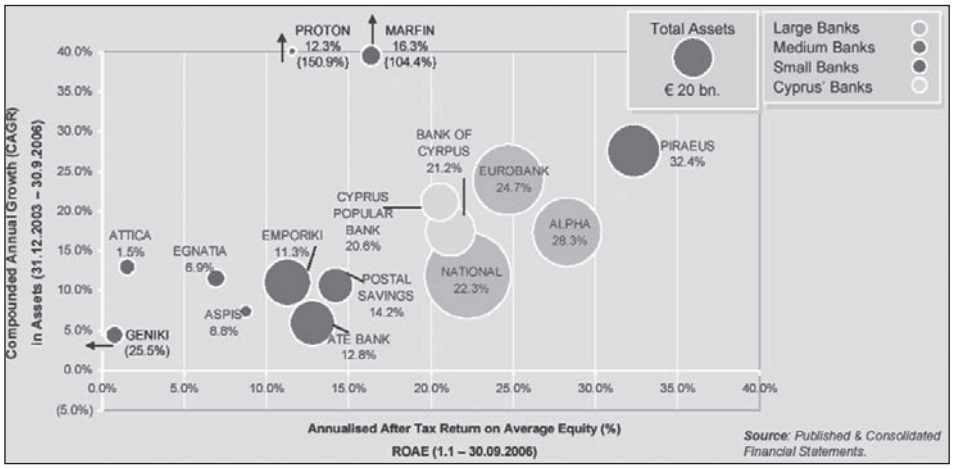
In terms of performance, the Greek banking industry has been highly profitable over the last decade, enjoying almost double-digit annual profit growth. More specifically, in the period 2003 to 2006, banking industry return on equity advanced from a general level of 15% and the return on assets increased to match the highest levels of recent years. The performance of Greek banks as measured by the return on equity ratio is illustrated in Figure 4.

This shows the bigger banks, represented by the larger circles, achieved higher returns on equity, indicating gains from economies of scale.

The strong position of the Greek banking system is further reflected by the rapid growth of credit extended to households and businesses. Total lending volume growth, though declining slightly at the start of 2007, shows an annual growth rate of approximately 18% throughout the period 2000 to 2007. From 2001, credit to households increased by 30% annually as a result of strong private demand

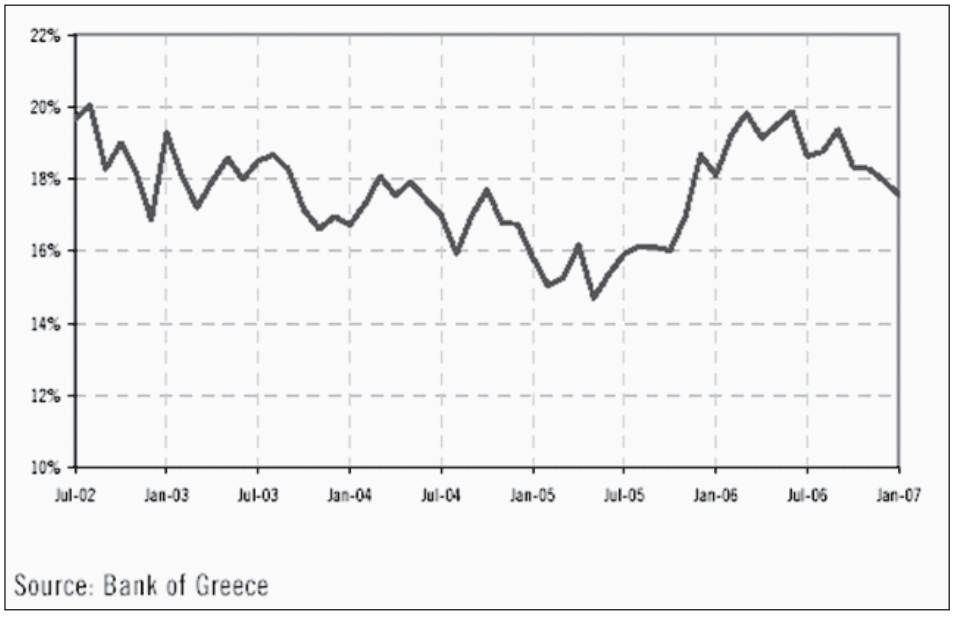
fuelled by the low Eurozone interest rates. Figure 5 illustrates this steady growth. It is evident that, despite the slight decrease in 1Q 2007, the volume of loans continues to grow at a significant rate.

Figure 4. Greek Banks' Return on Equity (ROE) (2003 – 2006)



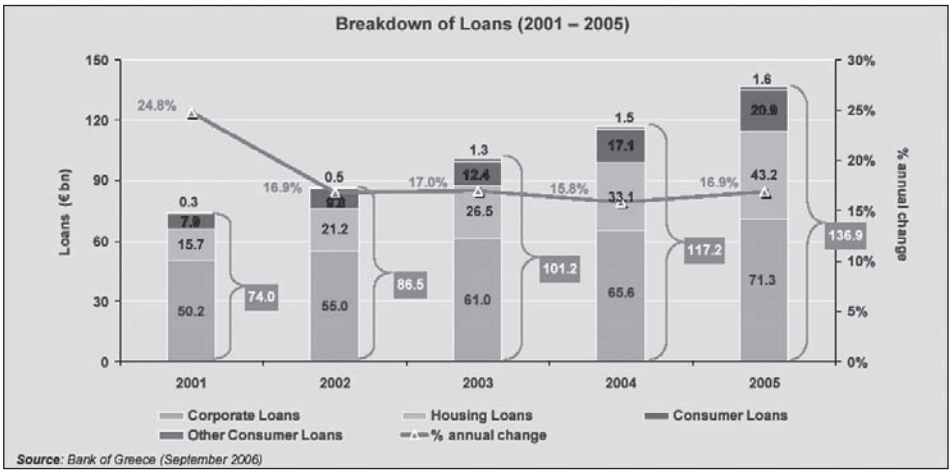
Source: Deloitte & Touche (2006)

Figure 5. Greek Banking Sector Total Lending Growth



The sector's asset mixture for 2001 – 2005 is presented in Figure 6. Household lending supported by corporate loans are responsible for the significant growth in lending during this period.

Figure 6. Evolution of Total Lending in Greece - Breakdown by Type of Loan



Source: Deloitte & Touche (2006)

Similarly, bank deposits also increased from 2003 to 2006. Funds withdrawn from other types of investments, mainly due to weak stock market performance in 2001 – 2002, were put into various types of deposit accounts. Following a sharp decline during 2006, deposit growth began to rise again at the start of 2007 (see Figure 7).

The type of deposit growth for 2001 – 2005 is presented in Figure 8. This shows an overall shift from savings accounts and repurchase agreements to time (fixed term) deposits over this period.

Traditionally, Greek banks finance their asset growth with their depositor base. Furthermore, the Greek banking industry has historically enjoyed high interest margins compared to other EU countries. This has intensified competition between the Greek banks in attracting deposits. As can be seen in Figure 9, the ratio of loans to deposits shows a steady increase, indicating that Greek banks fully utilise deposits in their growth strategies. Additionally, the increase in this ratio highlights the necessity of injecting external funds into the industry to sustain growth and finance investment.

Figure 7. Greek Banking Sector Total Deposit Growth

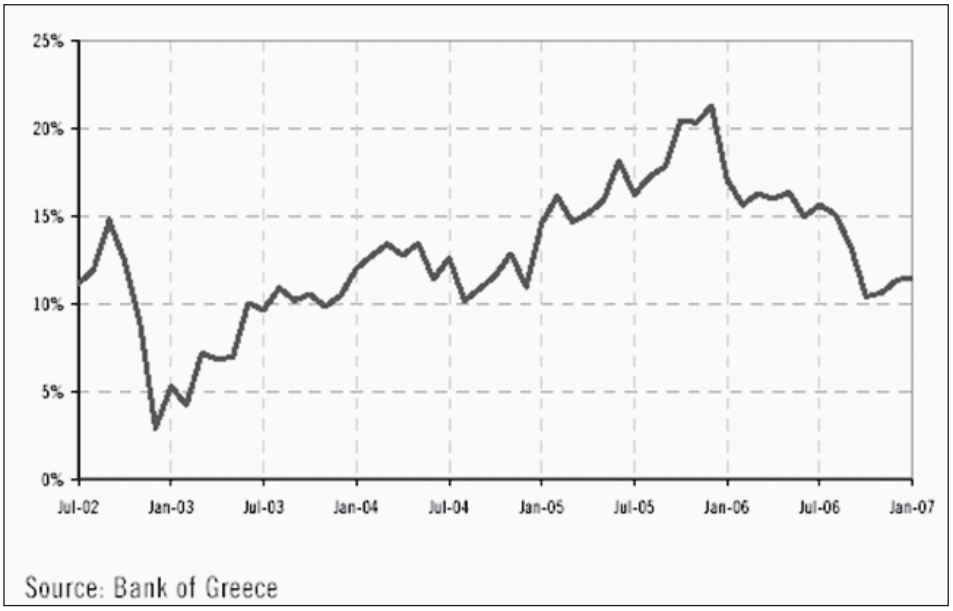
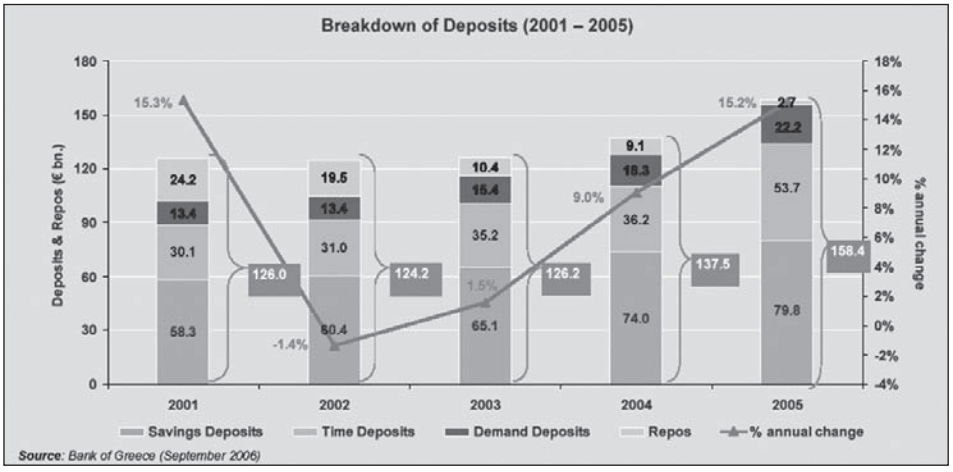


Figure 8. Evolution of Deposits in Greece and Breakdown by Type of Deposit



Source: Deloitte & Touche (2006)

Figure 9. Loan to Deposit Ratio for the Greek Banking Sector

Increased competition is reflected by the continued narrowing of the interest rate spreads between loans and deposits, from approximately 7.0% in December 2000 to an average of 4.4% in December 2006. Initial results for 2007 show further increases in terms of bank productivity and, more specifically, assets per employee compared to 2006.

In summary, the stability of the Greek banking sector has improved dramatically, with profitability and performance measures currently at significantly higher levels than at the beginning of the century.

3. EMPIRICAL INVESTIGATION

3.1 The data set

In this section a preliminary data analysis is presented together with the background information necessary to provide an insight into the banks' profitability. For the purposes of econometric modelling, quarterly balance sheet data for six major Greek banks and macroeconomic data over the period

2000 – 2007 were used. The bank variables were obtained from the published financial statements of the banks. Sources for the macroeconomic variables were the National Statistics Bureau and the European Central Bank. The period prior to 2000 was excluded since, up to the end of the 90s, almost all Greek banks enjoyed extraordinary non-recurring profits from stock exchange transactions. Furthermore, consolidation in the industry was at an early stage and bank deals had not been concluded and/or matured.

All Greek corporations listed on the Athens Stock Exchange applied IFRS[3] in accordance with EU directives in 2005. We found that the IFRS application had limited impact on equity, profits and other crucial bank variables. However, appropriate one-off data adjustments and remeasurements have been done prior to IFRS introduction to ensure comparability. It should be noted that financial statements of Greek corporations listed on the Athens Stock Exchange are audited on a semester basis, i.e. on June 30th and December 31st.

The financial sector in Greece is characterised by groups of specialised companies[4] established around a principal bank. In the context of the present study, solely bank-related data have been used, not consolidated accounts. The results of an analysis that incorporates consolidated accounts, including banks' participations in other corporations (financial and non-financial) as well as foreign operations, would form the basis of a broader study beyond the scope of the present one.

Table 1 in the appendix lists the variables used to infer bank profitability and their determinants. The notations used and the expected effect of each variable are also given. In banking literature, the profitability variable is most commonly represented by one or both of two alternative measures: the ratio of net profit to equity, ROE, and the ratio of net profit to assets, ROA (Berger and Humphrey, 1997; Ganesan, 2001; Altunbas and Ibanez, 2004; De Young and Rice, 2004; Fries and Taci, 2004; Athanasoglou et al, 2006). Each ratio looks at a slightly different aspect of bank profitability.

In principle, ROA reflects the ability of a bank's management to generate profits from the bank's assets, although it may be misleading due to off-balance-sheet activities. Thus, ROA is primarily an indicator of managerial efficiency. ROE indicates the return to shareholders on their equity. Thus, it is a measure of the

3 International Financial Reporting Standards.

4 Greek banks seeking to provide multiple services to clients establish several subsidiaries, each specializing in a single type of transaction, e.g. leasing, insurance, etc.

rate of return flowing to shareholders. As such it approximates the net benefit that the shareholders received from investing their capital in the financial institution. Moreover, ROE equals ROA times the total assets-to-equity ratio. The latter is often referred to as the bank's equity multiplier and measures financial leverage. Essentially the ROE – ROA relationship clearly illustrates the fundamental trade-off banks face between risk and return, whereas the equity multiplier reflects the leverage or financing policies, i.e. the sources (debt or equity) chosen to fund the bank. Banks with lower leverage, and thus higher equity, generally report higher ROA, but lower ROE. Athanassoglou, (2005) argues that an analysis based on ROE disregards the risks associated with leverage, often a consequence of regulation. On the other hand, Gottard et al (2004b) employ ROE as an appropriate profitability measure, arguing that for many European banks the off-balance-sheet business[5] makes a significant contribution to total profit. The earnings generated from these activities are excluded from the denominator of ROA. In our analysis ROE has been used as the key ratio for the evaluation of bank profitability, akin to the approach followed by Gottard et al (2004b).

Moving on to the explanatory side of the equation, we initially consider the credit risk variable, which can have a major impact on bank performance and profitability. Credit risk is broadly defined as the risk of financial loss relating to the failure of a borrower to honour their contractual obligations. Principally, it arises through lending but also from various other activities where banks are exposed to the risk of counter party default, such as trading and capital markets. Furthermore, a domestic bank is subject to the risk that its counter parties may have borrowed unsustainably large amounts from other banks[6].

The credit decisions of Greek banks are based primarily on the customers' potential sources of repayment, including an assessment of operating cash flows. Currently, credit analysis is conducted through the use of decision support models. The level of non-performing loans for the banks under review is approximately 5% of each bank's total loan portfolio as at December 31, 2006. This figure is significantly higher than for most other banks operating in the EU. Key factors that have contributed to the high level of non-performing loans were the recession in the Greek economy, which affected many borrowers in the 1990s,

5 Off-balance-sheet business includes loan commitments, letters of credit, derivatives and the creation of marketable securities through asset securitization. Their use by Greek banks increased rapidly at the end of the 1990s and they now constitute a significant portion of business.

6 The database that monitors defaulting customers in Greece reports defaults but not aggregate amounts of non-defaulted loans outstanding to a debtor.

and government influence over lending policies, including regulations requiring lending to specific sectors of the economy and policies that required the banks to extend credit to troubled companies considered to be of national interest.

One of the most widely used indirect measures of credit risk is the ratio of provisions or allowance for loan losses to total net loans[7] (Mansur et al, 1993). As this ratio rises, exposure to credit risk increases along with the possibility of bank failure. The ratio reveals the extent to which a bank is preparing for loan losses by building up its loan–loss reserves (allowance for loan losses) through annual charges against current income.

When establishing additional variables that affect profitability we also considered bank capital. By capital we mean the long-term funds contributed to a bank, primarily by its owners, consisting of common and preferred equity, reserves and retained earnings. Capital reflects a bank's ability to absorb unexpected losses. As such, the strength and quality of capital will influence a bank's relative profitability. The capital reserves of the banks under review vary significantly. In this study, the ratio of equity to assets (EQ/AS) has been used to approximate the capital variable when adopting ROA as the profitability measure. Similar proxies are used in the existing literature, suggesting a positive relationship between capital and profits (Athanasoglou et al, 2006).

Generally speaking, increasing size has a positive effect on profitability (Kaufman, 1992). However, banks that become extremely large experience negative size-effects due to bureaucratic and other reasons. Hence, the size-profitability relationship should be non-linear (Eichengreen and Gibson, 2001). In our study the logarithm of bank assets has been used in order to accommodate this non-linear relationship.

Typically Greek banks exhibit highly leveraged balance sheets. The degree of leverage is determined by the banks' core business and the regulatory framework. In this context the proxy EQ/AS is also used a measure of the banks' indebtedness.

Liquidity risk concerns the ability of a bank to anticipate changes in funding sources. This could have serious consequences on a bank's capacity to meet its

7 The allowance for loan losses is based upon estimates of probable losses inherent in a bank's loan portfolio. The amount of the allowance set aside for loan losses is based upon management's ongoing assessments of the probable estimated losses inherent in the loan portfolio.

obligations when they fall due. Effective liquidity management seeks to ensure that, even under adverse conditions, a bank will have access to the funds necessary to fulfil customer needs, maturing liabilities and capital requirements for operational purposes. Intuitively, one would expect a positive relationship between the profitability and liquidity of a bank (Bourke, 1989). The principal source of liquidity in the Greek banking industry is the large deposit base and, to a lesser extent, interbank borrowings. In recent years, almost all major Greek banks have exhibited excess liquidity as funds withdrawn from the stock exchange were channelled into various types of deposits accounts. Conforming with previous studies, the ratio of loans to deposits serves as a proxy for liquidity.

Cost efficiency variables have also been considered, e.g. operating expenses, which comprise salaries and other employee benefits[8]. Expenses management, i.e. the total cost of a bank (net of interest payments), can be separated into operating costs and other expenses (including taxes, depreciation etc.). Only operating expenses can be viewed as the outcome of bank management. In our context, efficiency is represented by the ratio of cost/income.

Greek banks have experienced intense competition due to deregulation, the lowering of barriers for new entrants and globalisation. Operating within this framework, banks have to allocate personnel effectively and centralise back office operations. The aim is to reduce the labour force or at least keep it constant while increasing overall output, resulting in increased productivity. To examine the effect of productivity on bank profitability, the ratio of net assets over the number of employees has been calculated.

As for the macroeconomic environment where the banks under review operate, the catalyst for their respective profitability ratio is perceived to be the inflation rate, which in this case is proxied by CPI.

Economic growth should enhance bank profits through increased demand for household and business loans. Such loans generate good returns to commercial banks, resulting in higher profits. Another equally important reason why profits increase with economic growth is that fewer loan defaults occur during periods of strong growth. Interest rate movements are assumed to correlate with Greek

8 Over the period under review the ratio of operating expenses to total assets exhibits a downward trend. Administrative costs include various types of bank expenses associated with bank operations, such as the adoption of new information technology, depreciation, legal fees, marketing expenses, or non-recurring costs related to restructuring. Provisions for lending losses are not included in operating expenses.

banks' profits. In general, banks rely heavily on short-term deposits as a source of funds. The interest paid on the deposits varies in accordance with the interest rates set by the European Central Bank, which in turn are closely linked to inflationary expectations (Bourke, 1989; Molyneux and Thornton, 1992). Finally, additional macroeconomic indicators believed to affect profitability, such as private consumption and capital investment, were also considered.

3.2 Econometric methodology

Panel data analysis was adopted for conducting our econometric modeling. The term panel data refers to the pooling of observations of separate units (countries, banks, groups of people etc.) on the same set of variables over several time periods (Baltagi, 2001)[9].

In our model we use a data-set which consists of *N* cross-sectional units, denoted $i = 1.\ldots,N$, observed at each of *T* time periods, denoted $t = 1.\ldots..T$. We have a total of *TN* observations and y is a $(TN\times1)$ vector of endogenous variables and X is a $(TN\times k)$ matrix of exogenous variables, which does not include a column of units for the constant term. In our study we use quarterly data for five banks (National Bank of Greece, Alpha Bank, Piraeus Bank, Eurobank, Emporiki Bank and ATE Bank) from 2000:01 to 2007:01.

The generalized regression model provides our basic framework:

$$y_{it} = \alpha_i + \beta_i' x_{it} + \varepsilon_{it},$$

where $\varepsilon_{it} \sim i.i.d.\ (0\ .\sigma_i^2)$, where α_i is a scalar. and β_i is a $(k \times 1)$ vector of slope coefficients. The underlying assumptions are: similar variances among banks. i.e. $\sigma_i^2 = \sigma_\varepsilon^2\ \forall$i and zero covariances among banks. i.e. $Cov\ (\varepsilon_{it}\ .\ \varepsilon_{js}) = 0$ for $i \neq j$.We distinguish three cases of the generalized regression model:

9 Prior to describing our model it is important to stipulate the reasons why panel data analysis can be beneficial, as well as distinguishing between the models used in panel data analysis. Among the main advantages of panel data, compared to other types of data, is that the approach allows the testing and adjustment of the assumptions that are implicit in cross-sectional analysis (Maddala, 2001). A number of econometricians state that the use of panel data analysis can be very beneficial in a number of ways, including: (i) panel data suggest that individual countries etc. are heterogeneous; (ii) panel data give more information, more variability, less collinearity among other variables, more degrees of freedom and more efficiency; (iv) panel data can capture and measure effects that are not detectable in cross-section time-series analysis, as well as provide a platform on which to test more complicated behavioural models. (Hsiao, 1986; Klevmarken, 1989).

(a) The pooled model. When both α and β are common between banks we get the pooled model:

$$y = \iota\alpha + X\beta + \varepsilon$$

where ι is a *(TN × 1)* column vector of ones. In this case the Generalized Least Squares (GLS) estimator reduces to pooled Ordinary Least Squares (OLS).

(b) The fixed effects model(or least squares dummy variables model). This is based on the notion that differences across different banks can be captured in differences in the constant term:

$$y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it}$$

The fixed model is a reasonable approach when we can be confident that the differences between banks can be viewed as parametric shifts of the regression function.

Under the assumption that the error terms (ε_{it}) are independently normally distributed over *i* and *t* with mean zero and variance σ^2_{ε} the F- statistic(s) can be used to test the linear restrictions postulated by the pooled model and the fixed effects model.

(c) The random effects model. When the sampled cross sectional units are drawn from a large population, it may be more appropriate to use the random effects (or variance components) model. In this case the individual constant terms are randomly distributed across cross sectional units. The general equation of the model is:

$$y_{it} = \alpha + \beta' x_{it} + \mu_i + \varepsilon_{it}$$

where $E(\mu_i = 0)$, $E(\mu_i^2) = \sigma_{\mu}^2$, $E(\mu_i \mu_j) = 0$ *for* $i \neq j$, *and* $E(\varepsilon_{it} \mu_j) = 0$, *for all i, t, and j.* Thus μ_i is a random disturbance that characterizes the *ith* observation and is constant through time. It can be regarded as a set of factors specific to bank *i* that are not included in the regression model. The random effects model can be estimated by Generalized Least Squares (GLS).

3.3 Model specification

In testing the relationship between bank profitability, and bank-specific industry-related and macroeconomic determinants, the following model serves as the basis for our investigation:

$$\Pi_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \varepsilon_{it} \; \Pi_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \varepsilon_{it} \qquad (1)$$

$$\varepsilon_{it} = v_i + u_{it}$$

where Π_{it} denotes profitability, X_{it} comprises all bank-specific variables such as size, liquidity, efficiency and credit risk, and H_{it} consists of macroeconomic determinants such as inflation, interest rates, GDP, private consumption and investment; ε_t is the disturbance term, v_i captures the unobserved bank-specific effect while u_{it} is the idiosyncratic error. This is a one-way error component regression model, where $v_i \sim$ IIN $(0, \sigma^2)$ and independent of $u_{it} \sim$ IIN $(0, \sigma^2)$[10].

In addition, two- and three-stage least squares (3SLS) estimators have been considered, in an attempt to identify any potential bias in the parameters caused by endogeneity (Altunbas and Molyneux, 1994). As the generated estimates are rather similar to the Fixed Effects ones we have not reported them. Furthermore, bank and time-specific dummies were also introduced into the model seeking to capture potential cross-bank and time-effects. In view of the above, equation (1) assumes the following form:

$$\Pi_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \beta D + \varepsilon_{it} \; \Pi_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \beta D + \varepsilon_{it} \qquad (2)$$

$$\varepsilon_{it} = v_i + \xi_t + u_{it} \; \varepsilon_{it} = v_i + \xi_t + u_{it}$$

where D stands for the bank-specific dummy variables and ξ_t accounts for the nobservable time effects.

The underlying hypotheses are tested separately as well as jointly (see appendix). On the basis of the Lagrange Multiplier (LM) tests, the only valid dummy variables

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10 The procedure used is to minimize the Schwarz *(S.I.C)* and Akaike *(A.I.C)* Information Criteria. The S.I.C and A.I.C are defined by: $\text{S.I.C} = -\frac{k \ln T}{T} + \ln\left(\frac{uu}{T}\right)$ and $\text{A.I.C} = -\frac{}{T} + \ln\left(\frac{uu}{T}\right)$. For example, for two models based on the same series we would choose the specification with the lowest value of the A.I.C and the S.I.C. It should be noted that the S.I.C penalizes more any loss in the degrees of freedom, compared to the A.I.C.

are the individual ones, in so far as the time-effects ones are insignificant. The resulting estimated equation is expressed as follows:

$$\prod_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \beta D + \varepsilon_{it} \prod_{it} = a_0 + a_1 X_{it} + a_2 H_{it} + \beta D + \varepsilon_{it} \qquad (3)$$

$$\varepsilon_{it} = v_i + u_{it}$$

Table 2: Estimations Results: Dependent variables are *ROE / ROA*

	Regressions	
Variables	**(1) R^2=0.836**	**(2) R^2=0.827**
c	-2.56*(1.85)*	-1.274*(-1.95)*
CR	-1.453*(-2.56)**	-0.992*(-0.750)*
CTI	-1.04*(-267)**	-0.062*(-9.868)**
Ln(AS)	0.104*(2.11)**	0.013*(2.76)**
AS/TP	-0.012*(-1.76)*	-0.002*(-2.49)**
LO/DEP	-0.135*(-2.63)**	-0.005*(-2.71)**
PC	-0.09(-1.69)	-0.021*(-0.86)*
INF	1.03*(1.34)*	0.781(0.845)
GROWTH	2.89 *(0.67)*	1.45(0.879)
EQ/AS	0.056(2.89)*	0.021*(3.09)**
DNB	1.02(2.12)*	0.87(2.37)
DAB	-0.67(-1.51)	-0.59(-1.16)
DPB	0.92(1.87)	0.75(1.06)
DEUB	1.27(1.92)	1.21(1.59)
DEB	-0.86(-0.98)	-1.12(-1.38)
	SIC = -2.38	*SIC* = -2.45
	AIC = - 2.22	*AIC* = - 2.28
	Hausman-test (χ^2): 16.012(0.000)	Hausman-test (χ^2): 18.967(0.000)

Note: In regression (1) ROE is the dependent variable whereas in regression (2) ROA serves as the dependent variable; t-statistics are given in parentheses; (*) indicates significance at the 5% level of the test; *SIC and AIC* stand for the Schwarz and Akaike Information Criteria respectively; since the *Hausman test* cannot accept the orthogonality of the individual effects and the regressors (at any reasonable size of the test), the fixed effects model is preferred to the random effects model (see appendix); DNB, DAB, DPB, DEUB and DEB are the dummies for the respective banks.

3.4 Interpretation of results

As can be discerned from the preceding empirical results, the fixed effects estimates will be our reference point.

The model seems to fit the panel data reasonably well, having fairly stable coefficients. The relatively high R^2 suggests that variations in the dependent variable profitability, as measured by ROE, are explained satisfactorily by variations in the selected variables[11].

The estimated parameters display the anticipated signs and all pass the t-test at the 1% significance level except for inflation and private consumption. The inflation rate appears to have a positive but slight effect on bank profitability. This could be ascribed to the ability of management to adequately, though not fully, forecast future inflation, which in turn implies an appropriate adjustment of interest rates to achieve higher profits (Athanassoglou et al, 2005). Alternatively, it may a consequence of the false inflationary expectations of bank customers, implying that extraordinary profits could be gained from asymmetric information. This positive relationship between profitability and inflation may also be influenced by the fact that interest rates on deposits usually decrease at a faster rate than those on loans[12].

Private consumption also exhibits a positive but not significant relationship with bank profits. Inevitably, the profitability of commercial banks is sensitive to economic conditions. During times of economic growth, such as the period in our analysis, demand for bank loans increases. Since loans generate higher returns than other banking products, expected cash flows should be higher. Despite the fact that banks' loan portfolios have grown steadily in recent years (in line with increased demand for credit), it appears that increased competition within the Greek banking sector has played a key role in compressing net interest margins.

Other macroeconomic variables investigated, such as GDP, were found to be highly insignificant. In the literature the underlying relationship is ambiguous,

11 The estimations based on ROA produce inferior results, as suggested by both the coefficients estimates and the specification tests.

12 It is worth noting that similar estimates (not given here) were obtained when using interest rates as measured by the 10-year government bond instead of inflation in the regression model, which is consistent with the existing literature (Molyneux and Thornton, 1992; Bourke, 1989).

with a few studies suggesting bank profits are correlated with the business cycle as measured by GDP (Demirguc-Kunt and Huizinga, 2000; Bikker and Hu, 2000).

As for the bank-specific variables, the coefficient of the size variable as measured by the logarithm of banks' assets is positive and highly significant, reflecting the advantages of being a large company in the financial services sector. The estimated coefficient shows that the effect of bank size on profitability is positive, a fact that is in line with the economies of scale theory. Standard and Poor's (2006) industry survey indicates that larger companies, which typically offer many different products, are able to leverage their distribution systems to get most products to more people in the most efficient way. Furthermore large banks are generally able to secure financing for their operations at a lower cost than their smaller competitors. The results obtained are consistent with the vast majority of previous studies (see for instance, Akhaiven et al, 1997, Carbo et al, 2002, Smirlock, 1985, Goddard et al, 2004, Molyneux and Thornton, 1992). The relative market power hypothesis[13] asserts that only banks with large market shares and well-differentiated products are able to exercise market power in pricing those products to earn above average profits. Moreover, in a highly concentrated banking sector, large players benefit from economies of scale or scope and other size-related advantages[14] (Goddard et al, 2004).

As expected, the value of the credit risk coefficient is negatively and significantly related to bank profitability. It appears that Greek banks implement risk-averse strategies in their attempt to maximize profits, mainly through systematic controls and monitoring of credit risk. The banks under scrutiny, as well as the whole banking sector in Greece, have significantly higher level of non-performing loans than most other banks in the EU. Furthermore, non-performing loans tend to remain on the banks' balance sheets longer than is the case in other European countries. Advanced risk management techniques, strict lending policies reinforced by reliable monitoring systems and non-performing loan restructuring appear to have had a direct impact on reducing the banks' provisions for loan defaults which in turn boosts profitability. The related literature indicates that the effect of credit risk on profitability is clearly negative (Miller and Noulas, 1997; Athanassoglou et al, 2005). The sign of the coefficient indicates that the higher the credit risk assumed by a bank, the higher the accumulation of defaulted loans. In

13 Theory related to the traditional structure conduct hypothesis (SCP).

14 The Greek banking marketplace is highly concentrated compared to the Eurozone, with the five largest banks enjoying a 75% market share.

turn, the higher the level of loans in default, the greater the negative impact on bank profitability.

Bank productivity as measured by the ratio of assets over personnel has a negative and significant effect on profitability. This is a striking result that departs from our expectations since most US and Western European studies suggest a positive relationship. Assuming that the ratio used provides an accurate reflection of productivity, a predominantly negative empirical relationship between profitability and productivity is surprising. Greek banks display a steadily increasing trend in asset growth coupled with an accelerating reduction in staff numbers through the implementation of voluntary retirement schemes, the underlying idea being to further reduce operating costs. A possible explanation may be that Greek banks have not yet reached the optimum number of employees for the assets under management, thus the voluntary retirement schemes should be continued.

The next calculated parameter is efficiency as measured by the cost to income ratio. Results suggest a negative and highly significant effect on profitability. This implies that efficient cost management is a prerequisite for improving the profitability of the Greek banking system. Typically the most competitive financial institutions have low efficiency ratios meaning that they have low expenses for a given level of output. However, it is important to acknowledge that revenues are not generated without associated costs, although Greek banks generally strive to keep the growth rate of operating expenses below that of revenues. Our results are in line with other banking studies (Bourke, 1989; Molyneaux and Thornton, 1992; Vennet, 2002; Athanassoglou et al, 2006; Bodla and Verma, 2006).

With respect to bank liquidity, as measured by the ratio of loans over deposits, a negative and significant relationship with profitability is confirmed (Molyneaux and Thornton, 1992). The estimated coefficient corresponding to this particular proxy suggests that an increase in liquidity will cause a decline in profitability. These findings highlight the trade-off between liquidity and profitability. *Ceteris paribus*, the more resources that are tied up to meet future liquidity demands, the lower the bank's profitability. The problem of ensuring adequate liquidity while not negatively impacting performance requires skilful management.

4. CONCLUDING REMARKS

From a review of the existing literature it would be legitimate to assume that the two broad sets of variables that control bank profitability are a function of

the specific sector as a whole as well as the macroeconomic environment within which the sector operates. Macroeconomic factors such as inflation and private consumption appear to play a significant role in shaping the performance of banking institutions. Additionally, bank-specific variables, such as capital or measures of cost-efficiency, also play a critical role in determining bank profitability.

Bank profitability could be improved considerably if appropriate mechanisms to screen, monitor and forecast future levels of risk are put in place. In Greece, the methods used for approving loans and monitoring troubled loans in the past depended heavily on collateral and did not focus on the cash flow of the borrower, leading to relatively high levels of default.

The design of these mechanisms must take into account the peculiarities of the Greek macroeconomic environment as well as the specific circumstances of the banking sector. The boards and chief executives of banks may select their managers and define their organisational form and procedures but the managers' internal decisions are sometimes beyond their control. Revising the structure of banks' assets and liabilities as well as introducing cost-efficiency measures can enhance the quality of the sector, making it thus more profitable. The evidence generated in this study conforms with the bulk of the existing literature.

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APPENDIX

Table 1. Definitions Of Variables

Variable	Notation	Measure	Expected signs
Profitability	*ROA*	*Net Profit Before Taxes / Total Assets*	
Profitability	*ROE*	*Net Profit Before Taxes / Equity*	
Credit Risk	CR	Loan Loss Provisions / Total Loans	-
Size	Ln(AS)	Log Assets	+
Liquidity	LO/DEP	Loans / Deposits	?
Productivity	AS/TP	Assets / Total No of Employees or Δprofit / Δemployees	?
Efficiency	CTI	Cost / Income	-
Inflation	ln(ΔCPI)	Current Period CPI	+
Interest rates	IR	10-yr Bond yield	?
GDP (growth)	ln(ΔGDP)	GDP	+
Private Consumption	PC	Private Consumption	+
Capital	EQ/AS	Equity / Assets	+

Table 2. Descriptive Statistics

	Mean	*Maximum*	*Minimum*	*Std. dev*
ROA	0.012462	0.031753	0.004864	0.004835
ROE	0.194706	0.555308	0.079529	0.090644
CR	0.007802	0.013283	0.003184	0.001829
LOG(AS)	16.92341	17.9645	16.04293	0.631144
LO/DEP	0.788618	1.398227	0.354292	0.305916
AS	49567701	63369788	38765077	5731248
EQ	3008026	6317556	2265741	1114388
AS/TP	3186.22	6756.277	1093.335	1139.845
CTI	0.56025	0.875828	0.297092	0.091849
GDP	1.927632	3.871524	0.324102	1.043638
INF	0.820672	1.987207	-0.10588	0.538417
PC	0.016847	0.037057	-0.01919	0.016728

Table 3. Test for specific and time effects

Hypothesis	LM test [P-Value]
$D_2 = D_3 \ldots = D_k = 0$	$X^2(5) = 26.75$ [*0.000*]
$\xi_2 = \xi_3 \ldots = \xi_T = 0$	$X^2(28) = 22.66$ [*0.750*]
$D_2 = D_3 \ldots = D_{k-} \xi_2 = \xi_3 \ldots = \xi_T = 0$	$X^2(33) = 58.32$ [*0.001*]

Table 4: Estimations Results (Fixed Effects Vs. Random Effects): Dependent variables are *ROE / ROA*

Variables	(FE) R^2=0.84	(RE) R^2=0.84	(FE) R^2=0.83	(RE) R^2=0.83
c	-2.56*(1.85)*	-1.62*(1.03)*	-1.274*(-1.95)*	-1.583*(-1.73)*
CR	-1.453*(-2.56)**	-3.691*(-2.71)**	-0.992*(-0.750)*	-0.167*(-0.15)*
CTI	-1.04*(-267)**	-0.934*(-1.86)*	-0.062*(-9.868)**	-0.130*(-8.653)**
Ln(AS)	0.104*(2.11)**	0.967*(2.37)**	0.013*(2.76)**	0.056*(2.05)**
AS/TP	-0.012*(-1.76)*	-0.009*(-1.39)*	-0.002*(-2.49)**	-0.011*(-1.99)**
LO/DEP	-0.135*(-2.63)**	-0.0735*(-2.02)**	-0.005*(-2.71)**	-0.016*(-2.39)**
PC	-0.09(-1.69)	-0.101(1.43)	-0.021*(-0.86)*	-0.020*(-1.32)*
INF	1.03*(1.34)*	0.871*(1.62)*	0.781(0.845)	0.925*(0.63)*
GROWTH	2.89 *(0.67)*	1.563*(0.94)*	1.45(0.879)	1.05(0.75)
EQ/AS	0.056(2.89)*	0.132(2.64)*	0.021*(3.09)**	0.026*(3.15)**
DNB	1.02(2.12)*	1.35(2.76)*	0.87(2.37)	1.01(2.71)
DAB	0.67(1.51)	0.92(1.75)	0.59(1.16)	0.74(1038)
DPB	0.92(1.87)	0.79(1.04)	0.75(1.06)	1.12(0.84)
DEUB	1.27(1.92)	0.93(1.48)	1.21(1.59)	0.96(1.25)
DEB	-0.86(-0.98)	-1.03(-1.25)	-1.12(-1.38)	-0.79(-1.11)
	SIC = -2.38	*SIC* = -2.42	*SIC* = -2.45	*SIC* = -2.48
	AIC = - 2.22	*AIC* = - 2.27	*AIC* = - 2.28	*AIC* = - 2.34
	Hausman-test (χ^2): 16.012(0.00)		Hausman-test (χ^2): 18.967(0.000)	

Note: (FE) and (RE) stand for Fixed Effects and Random Effects respectively.