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Structure, Competitiveness and Efficiency Aspects of Jordanian Banking Industry

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ABSTRACT

Development in the Jordanian banking industry has been rapid, and the level of competition has increased in recent years. In the light of this development, it is important to investigate competitive conditions through testing the structure-performance relationship in the Jordanian banking industry. Mainly, two competing hypotheses are employed in the literature to explain the positive correlation between profitability and concentration: the Structure-Conduct-Performance Hypothesis (SCP) and the Efficient-Structure Hypothesis. The two hypotheses have radically contrasting implications for merger and antitrust policy.

This paper considers different degrees of market power and their relation with efficiency. X-efficiency is estimated here using stochastic frontier approach under the assumption that the inefficiency components of error terms follow half-normal distribution. Although little support is found for both the Structure-Conduct-Performance hypothesis (SCP) and X-efficiency version of the efficient-structure hypothesis, none of the two competing hypotheses could explain the positive relation between market structure and profitability in Jordan. Only size factor has a statistically significant and positive effect on bank performance, indicating that Jordanian banks operate at significant economies of scale.

Keywords: Structure-performance hypothesis, Jordanian banking, X-efficiency, Concentration, Profitability.

1. INTRODUCTION

Towards the end of 1980s, the banking system in Jordan was tightly regulated and protected from foreign competition by keeping relatively high levels of government controls over the banking system. Consequently, banks operated within an environment characterized by controlled interest rates, directed credit programs, high reserve requirements, constraints on foreign exchange, in addition to entry barriers. While those financial and regulatory policies were aimed at providing stability to the financial system and protecting banks from failure, they had their negative effects on the banking system's competitiveness and efficiency, which led in turn to a market that is more concentrated.

In contrast, the 1990s period has witnessed a major trend toward liberalization of the financial market in Jordan. After the economic crisis in 1988 and the following failure of some banks starting from 1989, the government implemented a structural adjustment program that encompassed many financial liberalization and deregulation measures. In principal, most measures aimed at developing an efficient and competitive financial system. To that extent, reforms eliminated interest rate controls, liberalized most of foreign exchange operations, and eased entry of new financial institutions.

In the recent years, banks and other financial institutions in Jordan operate under conditions of free price and more competition than they did before. Many competitors have entered the industry, and new ones are expected to enter as globalization has caused the Jordanian authorities to keep more relaxed constraints on new foreign entrance. In addition, technological progress, especially phone-based and inter-banking communications, has enabled many larger banks and financial institutions to extend their services outside national market, and therefore provided competitive

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products at a lower price. In the light of these developments, banks' efficiency and performance are becoming important for the institution not only to survive but also to develop.

Furthermore, an important argument often raised concerns the policy issue of which type of banking structure best serves the public in terms of both cost and availability of banking services. Some economists argue that encouraging merger and acquisition policy will help banks in improving their performance, and thus give them more competitive advantages. Contrary to this view, others argue that application of antitrust policy will play a potentially beneficial role in improving bank performance.

The purpose of the present paper is to examine the structure-performance relationship within the Jordanian banking industry. Accordingly, it is of great interest to investigate this relationship to address three main issues. First, does market structure matter in the Jordanian banking market? Second, which aspects of market structure are essentially relevant, and, therefore, which types of regulation or regulatory reform (merger versus antitrust policy) have the greatest impact? Finally, what aspects of bank performance are most sensitive to differences in market structure?

Answering these questions is of great importance since the recent liberalization and globalization will result in allowing foreign banks to open branches in Jordan. Moreover, many bankers argue that Jordanian authorities should adopt the merger policy in order to help improve bank performance and protect banks from failure. If the market-power hypothesis is supported for Jordanian banking, then regulators may have to be more cautious in approving mergers, while antitrust law may play a potentially beneficial role. Alternatively, if the efficient-structure hypothesis is supported, the antitrust measures may be of a reverse effect, while mergers should be encouraged.

The paper is organized as follows. Section 2: Background and Literature Review, it presents and evaluates the main characteristics of the banking system in Jordan, and explores a theoretical background concerning the structure-performance relationship in banking. Section 3: Methodology and Data Description, it outlines the structural tests employed in this study, a description of the variables and the methods used to measure them is outlined. In addition, the stochastic frontier approach utilized to estimate efficiency in Jordanian banking is discussed. Section 4: Empirical Results, it provides a brief description of the regression techniques used, and a detailed discussion of the regression results. Section 5: Conclusion, it provides an overview of the results of the study, limitations and suggestion for future researches.

2. Background and Literature Review

In this part, we present a brief historical overview of the banking system in Jordan. We review the literature from two competing hypotheses that are employed in to explain the relationship between market structure variables and bank performance indicators.

2.1. Background in the Banking System in Jordan

Over the last two decades, the banking sector has been expanding very rapidly in Jordan. In the 1960s and 1970s, the banking sector was characterized by mainly small-sized banks serving primarily the requirements of the local market.[1] The only financial links with the outside world were through foreign-owned banks, and no local banks had internationalized their operations to any significant extent. Today, the financial scene has been completely transformed: a substantial increase in the size and number of the local banks, a rapid expansion of branch networks and a huge widening in the range of financial services provided by the domestic banks.

By the end of 2002, the Jordanian-banking system comprised of 21 banks. Fourteen were national commercial banks, five were branches of foreign banks and two were Islamic banks.[2] In addition, there were five specialized credit institutions, three of which were governmentally owned and two jointly owned by the public and private sectors. The branch network is well spread, which covers most of the country with 471 branches. The number of Jordanian banks' branches operating abroad, including representative offices, became 149 by the end of 2002, 50 branches and 2 representative offices of which spread across the Palestinian territories.

Table (2.1) shows the main financial indicators that represent the key activities of Jordanian banks as a percentage of GDP for the 1992-2002 periods. The table summarizes the importance of banking sector to the economic development process, and shows a continuous growth in the relative importance of the financial indicators through the period.

Table 2.1.: Main Financial Indicators of the Jordanian Banking Sector As a Percentage of GDP 1992-2002

Year	*Total Assets*	*Total Deposits*	*Total credit*	*Total Equity*
1992	*178.43*	*134.26*	*62.72*	*9.85*
1993	*174.86*	*128.01*	*71.04*	*12.77*
1994	*177.25*	*126.95*	*76.49*	*13.72*
1995	*184.84*	*126.90*	*81.25*	*15.39*
1996	*188.02*	*127.12*	*83.22*	*16.37*
1997	*195.71*	*129.16*	*80.47*	*21.18*
1998	*201.93*	*131.49*	*82.73*	*22.81*
1999	*218.24*	*141.74*	*84.38*	*24.87*
2000	*218.40*	*139.09*	*76.89*	*23.30*
2001	*226.08*	*139.31*	*79.04*	*22.94*
2002	*229.42*	*142.13*	*77.84*	*23.44*

Source: Central Bank of Jordan, annual reports.

The implementation of the Economic Adjustment Program (EAP) at the end of the 1980s in response to the economic crisis of 1988 has had a great impact on the banking sector by triggering the forces of competition via easing the regulatory restrictions, which previously limited market forces. However, as a part of the EAP, the Jordanian government embarked on an intensive process of liberalizing the banking sector. First, interest rate ceilings, which were applied in Jordan on deposit and loan rates during the 1980s, were completely deregulated on February 1990. Second, privileges that were previously granted to some institutions like The Housing Bank were also gradually eliminated.[3] Third, restrictions on bank's foreign exchange operation were almost pertained. Finally, ownership and foreign banks constraints have substantially diminished. Moreover, banks were given more flexibility in managing their liquidity and were allowed to extend developmental loans to the export sector without prior approval by the Central Bank.

Consequently, the impact of this process was seen obvious on the increase of competition level in the market in many forms i.e., new entrance, branch expansion, variety of services and price reduction. At the same time, various re-regulation measures have been set to maintain the soundness of the system including the raising of the minimum paid up capital from JD 5 million to JD 20 million,[4] liberalizing of foreign exchange during the 1990s, and amending the interest rate ceilings until eliminating all ceilings.

According to the report of the US Commercial Service – Jordan (2001), Jordanian banks rely heavily on traditional banking activities, namely, the extension of direct credit facilities, as a main source of income. Credit facilities offered by banks include loans, discounted bill and overdraft. The corporate bond market remains underdeveloped, and continues to be over-shadowed by the traditional direct lending. However, some banks have started adopting modern banking practices such as automated check clearing and the use of magnetic check processors, unified reporting forms and electronic data-transmission networks. The Central Bank of Jordan has adopted policies aimed at stimulating the local capital market, particularly where long-term project finance is required. A number of banks have established mutual funds. In addition to long-term instruments, e-banking, securitization, short-selling and treasury stocks are being introduced in some banks.

2.2. Literature Review

The structure-performance relationship has received considerable attention in the banking literature, and many attempts have sought to explain the relationship between elements of market structure, such as concentration and market share, and indicators of bank performance, such as profitability and prices. Mainly, two competing hypotheses are employed in the literature to explain the relationship between market structure and bank performance: the Market-Power Hypotheses and the Efficient-Structure Hypotheses.

The Market-Power Hypotheses: It states that market power is the main variable that causes performance to change. Concentrated markets often require market

imperfections that may result from collusion, facilitated by high concentration, or by entry and exit barriers (often present in banking because of strict regulations).[5] Under these imperfections, banks operate in a market that deviates from perfect competition, which enables them to exercise influence on prices of loans and deposits. Thus, these banks achieve higher profits at the expense of their customers through conducting price setting. The market-power hypotheses include two sub hypotheses: the Structure-Conduct-Performance (SCP) hypothesis and the Relative Market-Power (RMP) hypothesis.

The Structure- Conduct- Performance (SCP) Hypothesis simply asserts that fewer firms in a market (that is, a concentrated structure) will generally lead firm to conduct prices by imposing higher prices and reducing output, and therefore become of less competitive performance by achieving higher ratio of price to cost and thereby higher profits at the expense of consumer welfare[6]. In essence, this hypothesis proposes that market concentration lowers the cost of collusion between firms and results in higher than normal profits for all market participants. The conclusion is that if the degree of concentration of a market exerts a direct influence on the degree of competition between firms, then the more concentrated market will lower the degree of competition.

The Relative-Market-Power (RMP) Hypothesis proposes that efficient firms increase in size and market share because of their ability to generate higher profits, which usually leads to higher market concentration. Thus, in this hypothesis, firm efficiency is adopted as the explanation for the relationship between market structure and firm performance.

Many researchers argue that the literature that distinguishes the SCP and efficiency hypotheses suffers several defects, and the methodologies used to test the relationship between efficiency, concentration and performance have still been inconsistent.[7] This is because of the fact that the early studies tend to assume that market share is a proxy of efficiency rather than a measure market-power hypothesis. Thus, Berger (1995) and Berger and Hannan (1997) use market share as an element of market structure, basing on that firms with large market shares and well-differentiated products are able to exercise market power in setting prices to earn supernormal profits.

A third additional hypothesis is used in the literature known as "Quiet Life" Hypothesis.[8] Berger and Hannan (1997) embody other version of this hypothesis mainly to explain the possible absence of the structure-performance relationship. This version asserts that firms with more market power, through either market share or concentration, may take part of gains from noncompetitive pricing not as profits, but as a more relaxed environment in which less effort is put into minimizing cost. That is, management becomes less focused on efficiency, since setting prices at levels that are more favorable can increase earnings.[9]

The Efficient-Structure Hypotheses: According to the Efficient-Structure Hypotheses, efficiency of individual firm causes both a higher profitability and more concentration and market share. Thus, the conclusion is that by controlling for efficiency, the link between profits and market structure variables becomes insignificant and thereby the positive profit-structure relationship is spurious. Two efficient-structure hypotheses are employed in the literature.

First, *X-efficiency version of the efficient-structure hypotheses* assets that firms have the ability to realize lower cost and thereby higher profits as they enjoy superior management and production technology. Firms that enjoy higher X-efficiency levels are assumed to increase their market shares, in addition to higher profits, which may result in a higher level of concentration. X-efficiency includes both technical efficiency (when a bank maximizes the output from the given level of input) and allocative efficiency (when a bank chooses mix of outputs that maximizing the revenue).

Second, *Efficient-Structure Scale Efficiency (ESS) Hypothesis* indicates whether firms are operating at the minimum of its long-run average cost curve (at the optimal economies of scale). Scale inefficiency in firm's operation may be resulted when a deviation form this level of production exist. In banking, the earlier studies of scale efficiency suggest that the average cost curve has a relatively flat U-shape, that is, medium sized banks are somewhat more scale efficient than either very large or very small banks (Humphrey, 1991).

Pervious Studies: The structure-performance relationship has been extensively examined in banking and other industries. Most studies have been on U.S. and European banking industries, and few have been on Arab Countries and Jordan.[10] At least five approaches have been employed in the literature to examine this relationship.[11]

The first and early approach is set in motion with the work of Schweiger and McGee (1961). This approach consists of regressing the profits or prices as dependent variables on market concentration. Gilbert (1984) summarizes 56 studies, and finds that only 27 studies suggest that concentration significantly and positively affect performance. Molyneux, Gardener, and Altunbas (1996) state that "the lack of consistent results has led some researchers to argue that the literature on SCP contains too many inconsistencies to establish a satisfactory SCP relationship in banking". The increased criticism of the traditional SCP paradigm combined with the widespread frustration from the SCP explanation of the structure-performance relationship results in a new approach raised by Demsetz (1973).

The second approach based on the Demsetz's argument that the positive relationship between profits and concentration may reflect differential efficiency of the largest and smaller firms, rather than attributing to more effective collusion in the more concentrated markets (Gilbert, 1984). This approach tests the structure-performance relationship by regressing profits, as a dependent variable, on market shares in addition to concentration. The findings are generally positive, where the coefficient of market share is statistically significant, and the coefficient of concentration is statistically insignificant.[12] These findings propose that the relationship between concentration and firm performance found in the previous studies is spurious and probably due to a correlation between profits and the omitted market share variable.

Berger and Hannan (1997) assert that two arguments consider this finding. Some economists, such as Smirlock (1985), Evanoff and Fortier (1988), and Al-Karasneh, Cadle and Ford (1997), argue that this finding supports the efficient-structure hypothesis, because profitability and market share are related to differential efficiency. Alternatively, other economists, such as Ravenscraft (1980), Mueller (1983), and Shepherd (1986), argue that this finding supports the relative-market-power hypothesis, since market share may capture market power derived from product differentiation.

The third approach attempts to provide a cleaner test by using price data instead of profit data to avoid the defects of profitability measure. Berger and Hannan (1989), and Hannan (1991) use some relatively precise survey information on the prices of individual bank deposit and loan. They regress these prices on the market structure variables. They find evidence to support market-power hypotheses. Berger and Hannan (1997) argue that the use of exact prices paid or received is more accurate indicators for market power than are profits. However, this approach still has its own defects, since a measure of efficiency has not been directly included into the test, which may have an effect on both performance and market structure variables.

The fourth approach examines the structure-performance relationship by including direct measures of efficiency into the model. Berger (1995) tests the market-power and efficient-market hypotheses by regressing profits against concentration, market share, X-efficiency and scale-efficiency. Additionally, concentration and market share are regressed on the efficiency variables to test the necessary condition of efficient-structure hypothesis that efficiency positively affects market structure and creates higher concentration and market share. The findings provide some support for the X-efficiency version of efficient-structure hypothesis and some support for market share indicating that the profit-concentration relationship is a spurious one, created by correlations with other variables, such as market share.

The fifth approach attempts to take advantages of the literature and overcome the limitations associated with the four previous approaches. This comprehensive approach is introduced by the work of Berger and Hannan (1997) through reproducing the four approaches and adding three more innovations. First, they include direct measures of efficiency in the regressions of survey price data against the market structure variables in addition to profit data. Second, they directly compare the results of using both profits and prices data that apply to the same banks for the same period. Finally, they examine the reverse causation by testing the direct effects of market structure variables on the efficiency variables. This allows for testing the "quite life" effects, which predict the reverse causality in the fourth approach.

The findings are mixed depending on the performance measures used. The results of regression of price data provide support for the traditional structure-conduct-performance hypothesis SCP. In addition, the finding of a negative relationship between concentration and X-efficiency provide support for the "quite life" hypothesis, and therefore support the market-power hypothesis. At the same time, the significantly positive concentration-profitability relationship is not hold. The relative-market-power hypothesis is not consistent with the price data and

only the effect of market share on profits is positive and partially significant. The efficient-structure hypotheses are also contradicted by much of the performance variables. X-efficiency and scale-efficiency are positively related to profitability, and not supported by the price data. In contrast, Goldberg and Rai (1996) find evidence that supports the X-efficiency version of the efficient-structure hypothesis with price data. The relative-structure hypothesis is found to have a positive and significant effect on both measures of performance, while the traditional SCP is not held for both price and profit data.

3. Methodology and Data Description

This study applies a version of the model developed by Berger and Hannan (1997) to analyze the structure-performance relationship in the Jordanian banking. This model introduces a comprehensive approach that considers different degrees of market power and their relation with efficiency. Thus, this approach resolves the conflict that arises between the traditional Structure-Conduct-Performance hypothesis (SCP) and the Efficient-Structure hypotheses (EFS) by specifying two efficiency explanations of the positive relationship between profits and either concentration or market share. In this study, X-efficiency (ESX) version of Efficient-Structure Hypothesis is incorporated to account for efficiency, in addition to the Traditional Structure-Conduct-Performance (SCP) Hypothesis and Relative Market Power (RMP) Hypothesis.[13]

3.1. Methodology

In order to use these hypotheses to determine how different institutional structures as well as operational input and output efficiencies influence a bank performance in the banking industry, the following performance equation is specified:

$$P_i = f\ (X\text{-}EFF_i\ ,\ CONC_m\ ,\ MS_i\ ,\ Z_i) + e_i \qquad (1)$$

where P_i is a measure of performance of bank i, which can be captured by several measures such as Return On Asset (ROA), Return On Equity (ROE) or Net Interest Margin (NIM). $X\text{-}EFF_i$ is a measure of each bank's X-efficiency and it captures its ability to produce a given bundle of output at minimum cost through superior management or production technology. CONC is a measure of concentration in the market. MS is the market share of bank i in the market. Z is a set of control variables for each bank that includes the ratio of total wages and salaries to total number of employees for individual bank (WAGE), the bank size, which will be measured as the Log of Total Assets (LTA), and the ratio of total liabilities to total assets (RISK). Finally, e_i is the error term.

Taking into consideration the efficient-structure hypothesis, efficiency is expected to affect profits, prices, and then market structure variables (concentration and market share). Hence, this efficiency variable (X-EFF) may have positive effects on profits, which are measured by ROA or ROE, indicating that the expected sign of the coefficient of X-EFF is positive (> 0). On the other hand, if NIM is used as price measure, the expected sign of the efficiency indicator should be negative (< 0). It is expected that banks that are more efficient may offer prices that are more favorable (loan and deposit rates) to customers. Continuously, the expected signs of concentration (CONC) and Market Share (MS) are expected to be zero reflecting that market structure has no direct effect on profits or prices, while efficiency leads to higher market shares and concentration.

Using the model that incorporates efficiency directly, the same assumptions considered by Berger and Hannan (1997) and by Goldberg and Rai (1996) are applied. First, prices are set competitively. Second, efficiency is a function of strictly lower costs and banks are operating at efficient scale levels. Finally, market structure variables, either CONC or MS, have no relationship with profits and prices, conditional on efficiency.

Besides its influence on profitability and possibly on prices, efficiency is also expected to have an impact on the market structure variables: market shares and concentration. The unconditional relationship between market structure and efficiency is deemed an essential condition for the efficient-structure hypotheses to be held. Hence, two equations are also specified to ensure for the essential condition.[14]

$$MS_i = f\left(X - EFF_i, Z_i\right) + e_i \qquad (2)$$

$$CONC_i = f\left(X - EFF_i, Z_i\right) + e_i \qquad (3)$$

Under the efficient-structure hypothesis, firms that are more efficient will increase market shares, as in (2), and thereby will be more often in concentrated market, as in (3). Consequently, the coefficient of efficiency measure (X-EFF) will be positive in both equations (2) and (3).

Fundamentally, if the more efficient firms are profitable, according to equation (1), and simultaneously have larger market shares and concentration according to equations (2) and (3), then the efficient-structure hypothesis is strictly valid.

In contrast, the market-power hypotheses claim that there is a direct causal relation from market structure to performance, even after controlling for other variables. Therefore, the Structure-Conduct-Performance (SCP) hypothesis and the Relative-Market-Power (RMP) hypothesis are expected to have positive effects on both profits and prices, indicate positive signs for the CONC and MS. The efficiency measure still has effects on profits and prices, but these effects are expected to be smaller than those under the efficient-structure hypothesis are, and dominated by the market power effects (Berger and Hannan, 1997).

In addition to these relations, the strictest version of the market-power hypotheses asserts that there is no causal relation from efficiency to market structure. Thus, a causal relationship from market structure to efficiency might exist. In fact, these reverse causal relationships can be tested to support the market-power hypothesis, although it is not usually considered as a part of the market-power hypotheses:

$$X-EFF_i = f\left(CONC_m, MS_i, Z_i\right)+e_i \qquad (4)$$

Equation (4) is specified to embody a version of the Hicks' (1935) "quiet life" hypothesis.[15] This inefficiency raised from "quiet life" effect refers not to non-competitive pricing, but to a more relaxed environment in which less effort is placed to minimize costs. Accordingly, market structure variables are expected to have negative sign coefficients. The "quiet life" hypothesis might give explanation why the profit-structure relationship is so weak in many banking sectors, and why prices are robustly related to concentration more than profits are. This explanation is emanated since the negative effect of the "quiet life" hypothesis, if it holds, tends to offset the positive profit-structure relationship, because profits from pricing are partially offset by cost increases from the poorer efficiency (Berger and Hannan, 1997).

In summary, equation (1) incorporates the hypothesized relationship among the performance, market structure, and efficiency by specifying all three hypotheses with performance. Under the efficient-structure hypothesis, the efficiency variable is expected to have a positive effect on profits and a negative one on prices, while the market structure variables are predicted to have zero sign coefficients. Under the market-power hypothesis, the market structure variables have a positive effect on both profits and prices with the same effect of efficiency variable, but under market-power hypothesis domination.

Equations (2) and (3) provide necessary conditions for the efficient-structure hypothesis to hold. The unconditional relationship between market structure and efficiency establishes that efficiency variable will have positive effect on market structure variables. Equation (4) is quite different from equations (2) and (3), since they provide the reverse causal relationship between market structure and efficiency, which indicates a negative effect of market structure variables on efficiency.

3.2. Data and Variables Description

The data used in this study comprise a representative sample of the banks operating in Jordan. The sample consists of thirteen banks' data that represent the local operations only (data outside Jordan are exclusive) over the periods of 1992-2002. The sample represents around 91% of the banking sector in Jordan according to total deposit. A description of the variables is given below, while a brief description is provided in appendix A. Appendix B provides a list of the names of banks included in the sample.

Measurement of Bank Performance: Three measures of performance are used in this study. First, Net Interest Margin (NIM), defined as the total interest received minus total interest paid divided by total assets. Second, Return On Assets (ROA), defined as the ratio of net income before tax to the total assets. Finally, Return On Equity (ROE), defined as the ratio of net income before tax to the total equity. ROA and ROE include the ability of the firm to generate fees through services, while NIM is used since it captures the pricing ability of banks for services, both deposits and loans. That is, if banks have the ability to price deposits and loans non-competitively, then net interest margin will be higher, reflecting the ability of the banks to charge lower deposit rates and higher loan rates.[16] Thus, ROA and ROE serve as profitability measures, while NIM provides as proxy for price measure.

Table 3.1. The descriptive statistics of the variables: return on assets (ROA), return on equity (ROE), net interest margin (NIM), three-bank concentration ratio (CR3), the Herfindahl index (HERF), market share (MS), X-efficiency (X-EFF), total assets in log (LTA), price of wages (WAGE), total liabilities/total asset (RISK). The sample includes 139 observations of 11 cross sections for the period from 1992 to 2002.

	Mean	*Median*	*Maximum*	*Minimum*	*Std. Dev.*	*Jarque-Bera*
ROA	*0.0058*	*0.0090*	*0.0280*	*-0.0740*	*0.0141*	*1131.18*
ROE	*0.0892*	*0.1072*	*0.4492*	*-0.8783*	*0.1648*	*498.57*
NIM	*0.0205*	*0.0219*	*0.0383*	*-0.0035*	*0.0086*	*4.35*
CR3	*0.6107*	*0.6024*	*0.7057*	*0.5527*	*0.0383*	*35.45*
HERF	*0.1800*	*0.1732*	*0.2357*	*0.1588*	*0.0215*	*61.44*
MS	*0.0749*	*0.0356*	*0.4018*	*0.0045*	*0.0932*	*215.00*
X-EFF	*0.8815*	*0.8888*	*0.8999*	*0.8006*	*0.0201*	*137.05*
LTA	*19.641*	*19.519*	*22.114*	*17.083*	*1.0967*	*1.01*
WAGE	*8042.4*	*7603.8*	*18017*	*2986.9*	*2915.8*	*26.49*
RISK	*0.9294*	*0.9200*	*1.4274*	*0.7592*	*0.0766*	*1642.20*

Table 3.2.: Correlation Matrix

	ROA	*ROE*	*NIM*	*CR3*	*HERF*	*MS*	*X-EFF*	*LTA*	*WAGE*	*RISK*
ROA	*1.000*									
ROE	*0.732*	*1.000*								
NIM	*0.316*	*0.137*	*1.000*							
CR3	*-0.092*	*-0.098*	*-0.000*	*1.000*						
HERF	*-0.084*	*-0.082*	*-0.034*	*0.959*	*1.000*					
MS	*0.208*	*0.425*	*0.033*	*0.034*	*0.039*	*1.000*				
X-EFF	*0.092*	*-0.166*	*0.208*	*-0.043*	*-0.055*	*-0.354*	*1.000*			
LTA	*0.387*	*0.514*	*0.236*	*-0.045*	*-0.062*	*0.817*	*-0.188*	*1.000*		
WAGE	*0.083*	*0.038*	*0.241*	*-0.136*	*-0.170*	*0.068*	*0.102*	*0.407*	*1.000*	
RISK	*-0.230*	*0.057*	*-0.118*	*-0.015*	*0.013*	*0.092*	*-0.155*	*0.077*	*-0.137*	*1.000*

Measurement of Concentration: Two popular measures of concentration are employed in this study. First, the three-bank concentration (CR3) ratio is defined as the ratio of the total deposits of the three largest banks to the total deposits of the entire banks in the market. Second, the Herfindahl Index (HERF), often called the "full information" measure, is calculated by summing the squared market shares of deposits of all the banks in the market.

Measurement of Efficiency: In this study, X-efficiency is only incorporated in the test of the structure-performance relationship by employing the Stochastic cost Frontier Analysis (SFA) developed by Aigner et al. (1977).[17] This approach is less flexible comparing with other approaches (because of the assumptions that must be maintained about the form of the frontier and error terms). However, it is usually selected because "it allows for statistical noise resulting from events outside the firm's control, such as luck and weather", and because it is "allowing for some types of specification error and for omitted variables uncorrelated with the included repressors" (Bauer, 1990).

The basic model uses a parametric representation assuming a two-part composed error term. One part represents random error, v_i, and the other part represents inefficiency component, u_i. Hence, the stochastic cost function is specified as:

$$\ln TC = f(y_i, p_i) + \varepsilon_i$$

where TC is observed total cost, y_i is a vector of outputs, p_i is a vector of input prices, and

$$\varepsilon_i = u_i + v_i$$

where v_i is statistical noise that is assumed to follow

normal distribution $N(0,\sigma_v^2)$. u_i is one-sided inefficiency measure, which is assumed to be independently distributed as half-normal $|N(0,\sigma_u^2)|$. u_i represents the individual bank's deviations from the efficient cost frontier and serves as a proxy for both technical and allocative efficiency. In order to estimate the efficient cost model, the following Cobb-Douglas function form for the cost frontier, with two outputs and three inputs with prices, is specified as: [18]

$$\ln TC = \alpha_0 + \sum_{i=1}^{2} \alpha_i \ln(y_i) + \sum_{j=1}^{3} \beta_j \ln(p_j) + \varepsilon$$

where TC is total operating and interest costs. y is output for i = 1, 2 representing respectively loans, as the primary output (y_1), defined as the sum of all loan account intermediated by banks less non-performing loans, and all other earning assets, as the secondary output (y_2), includes total securities, equity investment, and bank own produced deposits and other investments. p is input for j = 1,2,3, where p_1 is the price of borrowed funds, estimated as interest on deposits, debts and borrowing funds plus provisions and commission paid divided by all deposits plus other interest-bearing liabilities and borrowed funds; p_2 is the price of labor, defined as the ratio of personnel expenses to the number of bank employees; p_3 is the price of physical capital, calculated by dividing operating expenses, depreciation and occupancy expenses by fixed assets.

The method of maximum-likelihood is used to estimate the parameters of the stochastic Cobb-Douglas cost function by using the computer program FRONTIER 4.1 developed by Coelli (1996). This program follows three steps. The first step includes obtaining the Ordinary Least Squares (OLS) estimates of the cost function. All estimated parameters (α and β) with exception of the intercept (α_0) are unbiased. The second step involves evaluating the log-likelihood function for a number of values of λ between zero and one. During this step, the β and α parameters (excepting α_0) set to the OLS values and the values of α_0 and σ^2 are adjusted according to the corrected ordinary least squares formula. Finally, the largest log-likelihood values selected in the second step are used as starting values in iterative procedure to obtain the final maximum likelihood estimates.[19]

Control Variables: Three control variables will be included in the model, which were found in most previous studies. The bank size, which will be measured as the Log of Total Assets (LTA), controls for cost differences related to bank size (control for scale-efficiency) and for the greater ability of large banks to diversify. The cost differences would expect to have positive relationship with profitability and prices if there are significant economies of scale, while the ability of diversification have negative coefficient when diversification leads to lower risk and thereby lower the required return.

The ratio of total wages and salaries to the total number of employees for individual bank (WAGE) is expected to affect performance negatively with respect to the efficient-structure hypothesis since efficient banks are predicted to operate at lower costs. If the market-power hypothesis holds, the same argument can also be applied because banks may be able to behave monopolistically in concentrated markets.

The ratio of total liabilities to total assets, (RISK), or the risk measure indicates the level of capital in the bank and may affect the performance negatively or positively. This is because higher RISK ratios reflect higher financial leverage and lower capital, which might result in raising borrowing costs, and therefore leading to less interest margin and profits. Simultaneously, greater leverage indicates aggressive asset/liability management, which results in greater interest margin and profits.

Descriptive Statistics for Variables: Table (3.1) reports some descriptive statistics for the variables incorporated in this study. It appears that ROA for Jordanian banks varies form 2.8% to -7.4% with average of 0.5%, and ROE reaches its maximum value at 44% and minimum value at -87%. On the other hand, NIM varies from 3.8% to -0.3%, indicating that NIM fluctuates less than ROA and ROE. The concentration ratio averages to 61% with CR3 and 18% with HERF. The largest bank in Jordan reaches 40% market share of total market deposits and the smallest bank has only 4.5% market share. Efficiency in Jordanian banks is within the acceptable range since the minimum level of inefficiency does not pass 20% in the less efficient bank. Moreover, only size variable is normally distributed according to the Jarque-Bera normality test.

Table (3.2) outlines the correlation matrix among the variables. The chief object is measuring the strength or degree of linear relationship between two variables. This matrix helps to account for some econometric problems, especially multicollinearity among independent variables. In general, most variables have low pair-wise correlation coefficients, indicating that the multicollinearity problem might not appear among the variables.

4. Empirical Results

This section provides the detailed results of this study. A brief description of the regression techniques used to estimate equations 1-4 is outlined firstly. The Jordanian banking market is discussed by examining the concentration, competition, and efficiency levels. A detailed discussion of the regression results is provided next.

4.1. Regression Techniques

The panel data analysis is implied in this study to estimate equations 1-4 using three alternative models. First, the Pooled Least Squares (OLS) model, which fundamentally depends on minimizing the sum of squared residuals, is based on the assumption that both intercept and coefficient are constant over time and cross section, and statistical noise captures disturbances over time and cross-section.

Second, the Fixed Effect model - also referred to as the "Least Squares with Dummy Variables" (LSDV) model - estimates the intercept as coefficient of dummy variables. This model allows intercept to vary for each cross-section and thus account for the individual effect. Finally, the Random Effect model, which is also known as the variance components model, treats the intercepts as random variables rather than fixed constants. The intercepts are assumed to be independent from the error term and also mutually independent. It is important to note that having panel data has many advantages; mainly it allows testing and relaxing the assumptions that are implicit in cross-sectional analysis.[20].

4.2. Concentration and Efficiency in the Jordanian Banking Market

Concentration levels in the Jordanian banking market are outlined in Table (4.1) The Table provides information on total banks deposits, and presents the two common concentration measures: three-bank concentration ratio (CR3) and the Herfindahl index (HERF).[21] It could be inferred from the CR3 ratio that the three leading banks, which control over 60 percent (on average) of the market deposits on the given period, dominate the banking system in Jordan. Simultaneously, the Herfindahl index is found to range between 16% and 24% where the highest value was in 1999. This might suggest that the Jordanian banking was highly concentrated in 1999. The Table shows also that the two concentration ratios declined after year 1999, which could be attributed to the increase in the level of competition among Jordanian banks in the following years.

This result might be attributed to that the banking sector in Jordan has traditionally been characterized by relatively high level of government controls where regulatory authorities maintained a protected banking environment that inhibited competition. However, market conditions in banking have undergone extensive changes over the last decade. On the demand side, customer preferences have changed substantially, becoming more sophisticated and price conscious. On the supply side, the globalization of financial markets has been accompanied by governmental deregulation, financial innovation and automation. Both factors cause an increase in the level of competition, and force banks to reduce profit margin and be more concerned about cost minimization.

Table 4.1.: Concentration in Jordanian Banking Market

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total deposits[22]	5097	5461	6251	6823	7289	8056	8685	8096	10811	11662	12092
Three largest banks' Deposits[23]	3266	3305	3623	4242	4548	5006	5233	5713	6342	6873	6684
CR3	0.64	0.59	0.58	0.62	0.62	0.62	0.60	0.71	0.59	0.59	0.55
HERF	0.2	0.17	0.17	0.19	0.19	0.18	0.17	0.24	0.16	0.16	0.16

Source: banks' annual reports and author's own estimation.

Table 4.2.: Cost Efficiency in Jordanian Banks 1992-2002 (in percentage)

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
88	89	88	88	88	88	87	89	88	90	89

Source: author's own estimation.

Table 4.3.: $P_i = f\ (CONC_m, MS_i, Z_i) + e_i$

Regression results of return on assets (ROA), return on equity (ROE) and net interest margin (NIM) on three-bank concentration ratio (CR3), market share (MS) and other control variables (WAGE and RISK) without control for efficiency.

	ROA			ROE			NIM		
	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect
Constant	0.068 (1.71)*		0.105 (4.11)***	0.306 (0.95)		0.625 (2.22)**	0.020 (1.33)		0.060 (4.52)***
CR3	-0.037 (-0.94)	-0.042 (-1.14)	-0.042 (-1.59)	-0.488 (-0.96)	-0.56 (-1.25)	-0.572 (-1.99)*	0.006 (0.37)	0.011 (1.15)	0.005 (0.44)
MS	0.035 (3.64)***	-0.012 (-0.19)	0.036 (1.84)*	0.757 (6.72)***	0.274 (0.31)	0.758 (3.15)***	0.002 (0.39)	-0.070 (-1.59)	-0.010 (-0.50)
WAGE	9.19E-08 (0.27)	-7.09E-07 (-2.27)**	-3.91E-07 (-0.96)	-2.48E-07 (-0.05)	-1.26E-05 (-3.40)***	-9.08E-06 (-2.05)**	6.86E-07 (3.05)***	6.83E-07 (2.91)***	6.16E-07 (3.09)***
RISK	-0.046 (-1.18)	-0.119 (-2.27)**	-0.078 (-4.18)***	0.032 (0.25)	-0.373 (-1.08)	-0.179 (-0.85)	-0.010 (-0.91)	-0.056 (-4.91)***	-0.051 (-4.91)***
R^2	0.11	0.44	0.32	0.19	0.51	0.42	0.06	0.66	0.61
Adjusted R^2	0.09	0.36	0.30	0.16	0.44	0.41	0.03	0.61	0.60

Note: significant differences are remarked by (*), (**) and (***) for 10%, 5 % and 1% significance levels respectively, T-values are reported in parentheses.

Table 4.4: Equation (1): $P_i = f\ (X\text{-}EFF_i, CONC_m, MS_i, Z_i) + e_i$

Regression results of return on assets (ROA), return on equity (ROE) and net interest margin (NIM) on three-bank concentration ratio (CR3), market share (MS), X-efficiency (X-EFF), total assets (LTA), and other control variables (WAGE and RISK).

	ROA			ROE			NIM		
	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect
Constant	-0.203 (-3.32)***		-0.199 (-3.00)***	-1.233 (-1.86)*		-0.791 (-0.91)	-0.127 (-2.84)***		-0.081 (-1.59)
CR3	-0.028 (-0.777)	-0.050 (-1.28)	-0.030 (-1.18)	-0.414 (-0.87)	-0.650 (-1.36)	-0.495 (-1.70)*	0.010 (0.61)	0.017 (1.77)*	0.011 (0.95)
MS	-0.076 (-4.14)***	0.082 (0.84)	-0.067 (-2.54)**	-0.417 (-1.74)*	1.09 (0.91)	-0.016 (-0.04)	-0.034 (-2.21)**	-0.120 (-2.43)**	-0.068 (-2.33)**
X-EFF	0.057 (1.08)	0.121 (2.33)**	0.073 (1.30)	0.646 (1.09)	0.113 (0.21)	-0.188 (-0.29)	0.072 (1.94)*	0.003 (0.12)	0.013 (0.48)
LTA	0.012 (5.35)***	-0.006 (-1.03)	0.011 (4.95)***	0.121 (4.40)***	-0.096 (-1.28)	0.081 (2.36)**	0.004 (2.91)***	0.003 (1.91)*	0.006 (2.89)***
WAGE	-1.63E-06 (-4.90)***	-2.12E-07 (-0.32)	-1.65E-06 (-3.45)***	-1.61E-06 (-3.93)***	-2.75E-07 (-0.35)	-1.73E-05 (-2.90)***	1.20E-08 (0.04)	1.56E-08 (0.03)	-7.90E-08 (-0.25)
RISK	-0.054 (-1.59)	-0.125 (-2.40)**	-0.058 (-3.88)***	-0.078 (-0.50)	-0.536 (-1.43)	-0.120 (-0.59)	-0.011 (-1.29)	-0.045 (-3.97)***	-0.041 (-3.90)***
R^2	0.32	0.46	0.34	0.32	0.52	0.42	0.17	0.67	0.64
Adjusted R^2	0.29	0.38	0.31	0.29	0.44	0.40	0.13	0.62	0.63

Note: significant differences are remarked by (*), (**) and (***) for 10%, 5 % and 1% significance levels respectively, T-values are reported in parentheses.

Table 4.5: Equations (2) & (3): ($MSi = f(X\text{-}EFF_i, Z_i) + e_i$) & ($CONCm = f(X\text{-}EFF_i, Z_i) + e_i$)
Regression results of three-bank concentration ratio (CR3), the Herfindahl index (HERF) and market share (MS) on the X-efficiency (X-EFF), total assets (LTA) and other control variables (WAGE and RISK).

	CR3			HERF			MS		
	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect
Constant	0.694 (3.70)***		0.616 (21.17)***	0.232 (2.12)**		0.180 (168.83)***	-0.66 (-2.85)***		-0.421 (-3.73)***
X-EFF	-0.063 (-0.37)	-0.102 (-0.51)	-0.004 (-0.16)	-0.043 (-0.43)	-0.057 (-0.51)	-0.0001 (-0.11)	-0.743 (-3.57)***	-0.15 (-2.31)**	-0.164 (-2.83)***
LTA	0.0003 (0.10)	0.003 (0.26)	-0.0005 (-1.60)	-3.02E-06 (-0.001)	-0.05E-06 (-0.70)	-2.00E-05 (-1.62)	0.077 (13.02)***	0.24 (5.25)***	0.031 (6.59)***
WAGE	-1.88E-06 (-1.41)	-3.29E-07 (-1.75)*	9.56E-06 (0.49)	-1.25E-06 (-1.43)*	-1.25E-06 (-1.34)	4.90E-09 (0.69)	-9.32E-06 (-4.52)***	-1.59E-06 (-2.30)**	-2.32E-09 (-3.38)***
RISK	-0.020 (-0.57)	-0.074 (-1.12)	0.008 (1.80)*	-0.004 (-0.23)	-0.023 (-0.62)	0.0003 (1.86)*	-0.052 (-1.71)*	0.044 (2.15)**	0.053 (2.25)**
R^2	0.02	0.03	-0.05	0.03	0.04	-0.05	0.77	0.98	0.98
Adjusted R^2	-0.007	-0.08	-0.08	0.001	-0.07	-0.08	0.76	0.98	0.98

Note: significant differences are remarked by (*), (**) and (***) for %10, %5 and %1 significance levels respectively, T-value are reported in parentheses.

Table 4.6: Equation (4): $X\text{-}EFF_i = f(CONC_m, MS_i, Z_i) + e_i$
Regression results of X-efficiency (X-EFF) on three-bank concentration ratio (CR3), the Herfindahl index (HERF), market share (MS) and other control variables (WAGE and RISK).

	X-EFF (with CR3)			X-EFF (with HERF)		
	Common	Fixed effect	Random effect	Common	Fixed effect	Random effect
Constant	0.913 (26.69)***		0.923 (24.26)***	0.911 (35.84)***		0.92 (7.67)***
CR3	-0.009 (-0.22)	0.023 (0.57)	-0.008 (-0.22)			
HERF				-0.020 (-0.26)	0.041 (0.56)	-0.016 (-0.23)
MS	-0.075 (-4.38)***	-0.37 (-2.69)**	-0.088 (-2.68)***	-0.075 (-4.38)***	-0.37 (-2.69)**	-0.088 (-2.68)***
WAGE	7.53E-07 (1.33)	1.21E-06 (01.82)*	7.98E-07 (1.33)	7.44E-07 (1.31)	1.21E-0 (1.82)*	7.92E-07 (1.32)
RISK	-0.028 (-1.34)	-0.044 (-1.28)	-0.039 (-1.38)	-0.028 (-1.34)	-0.045 (-1.32)	-0.039 (-1.37)
R^2	0.15	0.37	0.30	0.17	0.37	0.30
Adjusted R^2	0.12	0.28	0.28	0.14	0.28	0.28

Note: significant differences are remarked by (*), (**) and (***) for 10%, 5 % and 1% significance levels respectively, T-values are reported in parentheses.

After 1988, Jordanian authority has taken serious deregulating steps to promote competition in the market, aiming at increasing both the efficiency and soundness of the banking sector. The process of deregulation has an important implication in that it removes or reduces collusive and/or restrictive practices, and promoting competition among banks.

Table (4.2) provides efficiency (X-Efficiency) estimates for banks in Jordan for the period over 1992-2002. [24] The Jordanian banks' efficiency average 88% and has slightly varied from 87% to 90%. The level of inefficiency is moderately within the range of 10-15% for

the 130 studies surveyed by Berger and Humphrey (1997), and less than the level of inefficiency found in European studies. In this regard, based on a sample of 12 European countries, Carbo et al. (2000) identified that the mean cost inefficiency is around 22% for the period spans over 1989 -1996.

4.3. The Results

In the first stage of the empirical test, the regression analysis is implemented by using the second and third approaches employed in the previous literature, where performance measures (profits and prices) are regressed on the market structure variables without controls for bank efficiency. These analyses provide a comparison with previous literature, i.e., Al-Karasneh, Cadle and Ford (1997), as well as to determine the effects of adding the efficiency variable.[25]

Table (4.3) reports the results of the regression on profitability measures (ROA and ROE) and the price variable (NIM).[26] Considering first the regression on the profitability measures, the concentration coefficients (CR3) are not significant, and thus provide no support for the SCP hypothesis. In contrast, the coefficients of market share (MS) are positive in both profitability regressions, although the fixed effect analysis registers no consistency with the prediction of the Relative-Market-Power (RMP) hypothesis. These results are qualitatively consistent with the findings of Al-Karasneh, Cadle and Ford (1997), in which they find that higher market share, but not higher market concentration, is associated with high profit.

Focusing next on the price regression by using NIM as a dependent variable, neither concentration (CR3) nor Market Share (MS) is found to have the predicted statistically significant and positive effect on the NIM. Hence, the predictions of the market-power hypotheses are not observed in the case of price regression. Up to now, the results are mixed. While the relative-market-power hypothesis appears to be supported by profit-concentration relationship, the traditional SCP hypothesis is not supported by either profit or price-concentration regression.

The second stage of the empirical test accounts for efficiency by adding X-efficiency and the log of total assets (to control for scale efficiency) to the profitability and price regressions. The use of direct measure of efficiency reproduces the fourth approach in the literature.

The results of profitability and price regressions after control for efficiency are shown in table (4.4). The Market Share (MS) variable is considered here as reflecting only market power, since the efficiency variable is included in the test. The regression results of ROA and ROE show that neither concentration (CR3) nor Market Share (MS) provides evidence to support the market-power hypotheses, although MS has statistically significant and negative influence on ROA. Thus, the traditional SCP hypothesis is not supported by the profit regressions with and without controls for efficiency. X-efficiency shows a relatively mixed picture. Only fixed effect analysis registers a statistically significant and positive effect of X-efficiency on ROA. This X-EFF result can be to some extent as a support for the X-efficiency version of the Efficient-Structure hypothesis (ESX).

The regression results of NIM with efficiency included show that the fixed effect analysis provides a positive and significant coefficient of concentration (CR3), which can be attributed to and support for the traditional SCP hypothesis. The coefficients of Market Share (MS) are again statistically significant and negative, which do not support the Relative-Market-Power (RMP) hypothesis. These negative coefficients of market share are quite surprising and suggest that banks with large market shares do not exercise relative market power by changing deposit and loan rates and therefore gain high profits. The coefficient of X-efficiency (X-EFF) is only statistically significant in the case of employing the common OLS analysis, but the positive coefficient does not consist with the predicted X-efficiency version of efficient-structure hypothesis.

The only variable to influence all bank performance variables is the size variable (LTA). The positive and statistically significant coefficients of size variable on ROA, ROE and NIM suggest that banks work at significant economies of scale, which may be considered as evidence supporting scale-efficiency version of Efficient-Structure hypothesis (EFS).

Table (4.5) reports the results of regressions test for the necessary condition of the efficient-market hypothesis that efficiency influences market structure positively. Under this hypothesis, greater efficiency should result in higher market share and therefore higher concentration in the market. The X-EFF results do not provide the necessary condition of X-efficiency version of efficient-structure hypothesis. When concentration variables (CR3

or HERF) are the dependent variables, the coefficients of X-EFF are negative and statistically insignificant. In the Market Share (MS) regression, the coefficients of X-EFF are negative and statistically significant. Since X-EFF is not found to be positively related with both profits - except with ROA with fixed effect analysis - and market structure variables, the quiet-life hypothesis can be reasonably considered as creator of the bias in these results. Alternatively, the coefficients of size variable are only positive and statistically significant in the Market Share (MS) regression. These results may provide the necessary condition for the scale-efficiency version of efficient-structure hypothesis.

Table (4.6) presents regression results of equation (4) that tests Hicks' (1935) "quiet life" hypothesis. X-efficiency appears as the dependent variable, and market structure variables are specified as explanatory variables with WAGE and RISK as control variables. The expected signs of market structure variables are negative if the market-power hypotheses are to be supported. This indicates that banks with larger market power are less diligent in controlling costs. The coefficients of concentration measures (CR3 and HERF) are positive (except for fixed effect model) and statistically insignificant; while the coefficients of Market Share (MS) are negative and statistically significant. This result provides evidence that "quiet life" effect exists, and consists with the joint hypothesis that MS proxies market power that causes firms to be less incentive to minimize costs.

5. Conclusion

The purpose of this study is to reexamine the structure-performance relationship for Jordanian banks. Unlike the conventional test applied by AL-Karasneh, Cadle and Ford (1997) in the Jordanian banking market, the model developed by Berger and Hannan (1997) is used. This comprehensive approach considers different degrees of market power and their relation with efficiency. A direct measure of efficiency is utilized to the test, after estimating X-efficiency for individual banks using the stochastic frontier approach.

Several conclusions emerge from this investigation. First, the traditional Structure-Conduct-Performance (SCP) hypothesis is not consistent with the data. The positive and marginally significant coefficient of concentration measures, either CR3 or HERF, is only found in NIM regression with fixed effect model. This provides a weakly support for the SCP hypothesis. In all profitability regressions, the coefficients of concentration variables are either insignificant or they are significant with the sign opposite to that predicted by the hypothesis. These findings are for the most part consistent with the findings of Al-Karasneh, Cadle and Ford (1997), although they do not include efficiency in their tests.

Second, the Relative-Market-Power (RMP) hypothesis is completely not supported by the profit or price data, although the profitability regressions without incorporating direct measure of efficiency generally provide evidence consistent with the hypothesis. Most of the market share coefficients are negative and statistically significant. On the contrary, the finding of negative relationship between market share and efficiency supports the "quiet life" hypothesis, which can be considered as a supplementary support for the relative-market-power hypothesis. This difference in results suggest that banks with large market shares do not exercise relative market power in pricing differentiated products and thus gain supernormal profits, in addition to that they are less diligent in controlling costs. This result contradicts the result obtained by Al-Karasneh, Cadle and Ford (1997).

Third, the regression results testing the validity of the efficient-structure hypothesis are not robust and are sensitive to the measure of performance used. The only positive effect of X-efficiency on performance is found in ROA regression, although two of three regression analyses are statistically insignificant. This efficiency measure is not associated with prices that are more favorable for consumers as might be expected. This finding is consistent with the fact that efficiency variable is not positively related to the market structure variables, a necessary condition for the hypothesis. Thus, it seems that more efficient banks do not tend to obtain greater market shares or operate in a more concentrated market.

Finally, only the size variable, which is incorporated in the regression to control for economies to scale effect (scale-efficiency), is consistent with the data. This indicates that size factor can be considered as the most important variable that affects bank performance in Jordan, and therefore banks are operating at significant economies of scale.

Consequently, the analysis results provide a weakly support for the traditional Structure-Conduct-Performance (SCP) hypothesis when only NIM is used. The Relative-Market-Power (RMP) hypothesis is

generally not supported by the data; although the "quiet life" tests provide support for the hypothesis. The Efficient-Structure (EFS) hypothesis also cannot be considered as the explanation for the structure-performance relationship for two reasons. First, the only case consisting with the prediction of the hypothesis is realized in ROA regression. Second, the efficiency measure is not consistently and positively related to the market structure variables. The only factor that obviously and positively affects bank performance is the bank size, indicating that banks are operating at the significant economies of scale. This suggests that scale-efficiency must be directly incorporated in future researches employed on the Jordanian banking industry along these lines.

The major limitation encountered in this study is related to the sample size, which only consists of thirteen banks operating in Jordan. This limitation bounds the use of the appropriate cost functional form to estimate the frontier: either the translog functional form that is the most widely used in the bank efficiency literature or the Fourier Flexible functional form that appears as a preferred alternative. Thus, a source of bias may be presented due to the use of Cobb-Douglas functional form.

Another bound related to this limitation, and therefore to the use of Cobb-Douglas cost function, is the difficulty of estimating scale-efficiency using this simple form of cost function, which may result in less consistent results in this study. This limitation can be overcome by using inter-country data, such as bank data of the Arab Middle Eastern countries. However, as mentioned earlier, the intention behind this study is to initiate empirical work that may contribute positively to Jordan and open the door for further studies of the structure-performance relationship in the Arab region.

FOOTNOTES

(1) Except Arab Bank, this has been operating in some Arab countries, such as Lebanon and Egypt, and foreign counties, such as Switzerland and U.K.

(2) Before 2002, five national commercial banks were classified as investment banks.

(3) The Housing Bank was a specialized credit institution until 1997, after which it became a fully commercial bank.

(4) On August 2003, the CBJ has issued new measures to local banks to double their paid up capital to JD 40 million by the end of 2007.

(5) According to the collusion hypothesis, if a small number of banks dominate a banking sector, then it is easier (less costly) for the banks to collude (implicitly or explicitly) than if the number of banks is large.

(6) The original formulation of this hypothesis is by Mason (1939) and Bain (1951).

(7) For example, Berger (1995), Berger and Hannan (1997), and Goldberg and Rai (1996).

(8) This hypothesis was developed by Hicks' (1935) who states that "the best of all monopoly profits is a quiet life".

(9) Berger and Hannan (1997) argue that the "quiet life" hypothesis is not necessary a part of market-power hypotheses, but it is sometimes included. Other economists (for example, Punt and Rooij 1999) consider this hypothesis as a special case of the market-power hypotheses.

(10) Al-Karasneh, Cadle and Ford (1997) study was carried out on Jordan, and Mohieldin (2001) on Egypt.

(11) Berger and Hannan (1997) propose and discuss four approaches.

(12) Lloyd-William *et al*. (1994), and Molyneux and Forbes (1995) find that the regression results support the traditional SCP paradigm and reject the competing efficiency hypothesis.

(13) Scale-efficiency is not included because of a technical problem related to the sample size. For this reason, the log of total assets is incorporated to control for scale-efficiency (see Allen and Hagin (1989).

(14) Berger and Hannan (1997) specify equation (3) with error term multiplicative rather additive, follows the fact that concentration variables are simple deterministic functions of the market shares in equation (2). Therefore, if CONC were the Herfindahl

index, then CONC would be the sum of squared shares of all banks, i.e $\sum(f(X-EFF_i, Z_i)+e_i)^2$. In this study, this specification is ignored, like Goldberg and Rai (1996), because the regression results using either CR3 or HERF are similar, making the specification of the error term irrelevant.

(15) Berger and Hannan (1997) specify two equations, one incorporates X-efficiency as a dependent variable and the other incorporates scale-efficiency as a dependent variable.

(16) For more details see Goldberg and Rai (1996).

(17) Goldberg and Rai (1996) apply this approach on the banking industry in Europe. While Berger and Hannan (1997), and Berger (1995) use distribution-free approach to disentangle efficiency from error term.

(18) Neither the translog functional form that is the most widely used in the bank efficiency literature nor the Fourier Flexible functional from that appears as a preferred alternative are implied because of technical problem related to sample size.

(19) The likelihood function for this system utilizes the parameterization of Aigner *et al*. (1977) who assume that $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and it captures total risk exposure, and $\lambda = \sigma_u / \sigma_v$, which captures the inefficiency ratio relative to random component.

(20) These assumptions related to the multicollinearity and heteroscedasticity.

(21) Total deposits are employed as a proxy for bank output.

(22) Total deposits include individual, financial institutions deposits and cash margins.

(23) The three-largest banks are the Arab Bank, the Housing Bank and the Jordan National Bank.

(24) See section 3.2 for the operational definition and measurement of cost efficiency (x-efficiency).

(25) In contrast to Al-Karasneh, Cadle and Ford (1997) who use total assets after scaled by 0.000 and the interaction between MS and CR as control variables, those variables are not incorporated in these regressions since size factor is used to control for scale efficiency and the correlation between market share and concentration measures is very small. Simultaneously, price measure is used as dependent variables in addition to profit measures.

(26) Tables (4.3 and 4.4) report only the regression results of the three-bank concentration ratio (CR3) since the regressions of the Herfindahl index give the same results of CR3 regressions. Therefore, the regression results of the Herfindahl index are not reported.

Appendix A

Detailed Description of the Variables*

Symbol	Variable	Definition
ROA	Return on assets	Ratio of before-tax net income to total assets
ROE	Return on equity	Ratio of before-tax net income to total equity
NIM	Net interest margin	Ratio of total interest received from earning assets less total interest paid on deposits and debt.
CR3	Three-bank concentration ratio	Ratio of the total deposits of the three largest banks to the total deposits of the entire banks in the market.
HERF	The Herfindahl index	Sum of squared market share of deposits of all banks in the

* All variables have been calculated using the annual reports of Jordanian banks.

		market.
MS	Market share	Ratio of individual bank's total deposits to the total deposits of all banks in the market.
X-EFF	X-efficiency	Measure of bank's closeness to the efficient cost frontier and serve as a proxy for both technical and allocative efficiency.
Y_1	Loans, as the primary output	Sum of all loan account intermediated by banks less non-performing loans.
Y_2	Other earning assets, as the secondary output	Includes total securities, equity investment, and bank own produced deposits and other investments.
P_1	Price of borrowed funds	Estimated as interest on deposits, debts and borrowing funds plus provisions and commission paid divided by all deposits plus other interest-bearing liabilities and borrowed funds.
P_2	Price of labor	Ratio of personnel expenses to the number of bank employees.
P_3	Price of physical capital	Calculated by dividing operating expenses, depreciation and occupancy expenses by fixed assets.
LTA	Log of total assets	Calculated by taking the natural logarithm of total assets. It control for economy to scale (scale efficiency).
WAGE	Wage per employee	Ratio of total wages and salaries to the number of employees.
RISK	Total liabilities / total assets	Ratio of total liabilities to total assets. It indicates that less capital and greater leverage that could result in increased borrowing costs.

Appendix B

List of Banks in the Study Sample

1. Arab Bank (Jordan Branches)
2. The Housing Bank for Finance and Trade
3. Bank of Jordan
4. Arab Banking Corporation (Jordan)
5. Jordan Kuwait Bank
6. Jordan National Bank
7. Union Bank for Trade and Investment
8. Cairo Amman Bank
9. Jordan Investment and Finance Bank
10. Arab Jordan Investment Bank
11. Middle East Investment Bank
12. Jordan Gulf Bank
13. Philadelphia Bank

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المنافسة لدى البنوك الأردنية من منظور هيكل السوق والكفاءة

*خالد الزعبي ومحمد بلول**

ملخـص

شهد القطاع المصرفي الأردني في السنوات الأخيرة تطورات سريعة ومتلاحقة, أبرزها زيادة حدة المنافسة بين البنوك وارتفاع وتيرتها بشكل ساهم جليا في إعادة صياغة مفردات العمل المصرفي. من هنا, برزت أهمية دراسة ظروف المنافسة بين المصارف الأردنية وتحليل معطياتها من خلال فحص وتبيان العلاقة بين هيكل السوق المصرفي ومؤشرات الأداء لدى البنوك العاملة في السوق الأردني. بشكل عام يتميز السوق المصرفي الأردني بارتفاع درجة التركز فيه قياسا بالقطاعات الاقتصادية الأخرى, وقد دأب كثير من الأبحاث والدراسات في هذا المجال على تفسير العلاقة الايجابية بين درجة التركز وربحية المصارف من خلال فرضيتين لهما تطبيقات مختلفة: الأولى, الفرضية التقليدية المعروفة في مجال أبحاث الاقتصاد الصناعي باسم ((Structure-Conduct-Performance Hypothesis (SCP) وتقوم أساسا على مفهوم التواطؤ بين المنشآت الاحتكارية في السوق ذي التركز العالي للحصول على عوائد أعلى من المعدلات الطبيعية. أما الفرضية الثانية فتعتمد على تفسير الأداء المتميز للمصارف في السوق ذي التركز العالي باعتبارات الكفاءة في إدارة التكاليف, وتعرف هذه الفرضية باسم((The Efficient-Structure Hypothesis (ES).

استخدمت هذه الدراسة لاختبار العلاقة بين الأداء وهيكل السوق المصرفي الأردني نموذجا، وتقوم في جوهرها على دراسة مستويات مختلفة لهيكل السوق وعلاقتها بكفاءة المنشآت العاملة فيه من خلال استعمال مقاييس مباشرة للكفاءة, ووظف لهذا العرض أسلوب إحصائي يعرف باسم (Stochastic Frontier Approach) لقياس مستوى الكفاءة لدى البنوك الأردنية قياسا كميا. أظهرت نتائج هذه الدراسة أن الفرضيتين المشار اليهما أعلاه لم تتمكنا من تفسير العلاقة بين أداء البنوك الأردنية وهيكل السوق المصرفي, وان العامل الوحيد الذي اظهر دلالة إحصائية كافية وتأثيرا إيجابيا على أداء البنوك هو عامل الحجم (Size Factor) وليس هيكل السوق ومستوى الكفاءة المحققة, مما يشير إلى أن البنوك الأردنية تعمل ضمن مستويات مقبولة من وفورات الحجم (Economies of Scale).

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[1] Except Arab Bank, this has been operating in some Arab countries, such as Lebanon and Egypt, and foreign counties, such as Switzerland and U.K.
[2] Before 2002, five national commercial banks were classified as investment banks.
[3] The Housing Bank was a specialized credit institution until 1997, after which it became a fully commercial bank.
[4] On august 2003, the CBJ has issued new measures to local banks to double their paid up capital to JD 40 million by the end of 2007.
[5] According to the collusion hypothesis, if a small number of banks dominate a banking sector, then it is easier (less costly) for the banks to collude (implicitly or explicitly) than if the number of banks is large.
[6] The original formulation of this hypothesis is by Mason (1939) and Bain (1951).
[7] For example, Berger (1995), Berger and Hannan (1997), and Goldberg and Rai (1996).
[8] This hypothesis was developed by Hicks' (1935) who states that "the best of all monopoly profits is a quiet life".
[9] Berger and Hannan (1997) argue that the "quiet life" hypothesis is not necessary a part of market-power hypotheses, but it is sometimes included. Other economists (for example, Punt and Rooij 1999) consider this hypothesis as a special case of the market-power hypotheses.

[10] AL-Karasneh, Cadle and Ford (1997) was carried out on Jordan, and Mohieldin (2001) on Egypt.
[11] Berger and Hannan (1997) propose and discuss four approaches.
[12] Lloyd-William *et al* (1994), and Molyneux and Forbes (1995) find that the regression results support the traditional SCP paradigm and reject the competing efficiency hypothesis.
[13] Scale-efficiency is not included because of technical problem related to sample size. For this reason, the log of total assets is incorporated to control for scale-efficiency (see Allen and Hagin (1989)).
[14] Berger and Hannan (1997) specify equation (3) with error term multiplicative rather additive, follows the fact that concentration variables are simple deterministic functions of the market shares in equation (2). Therefore, if CONC were the Herfindahl index, then CONC would be the sum of squared shares of all banks, i.e. $\sum (f(X - EFF_i, Z_i) + e_i)^2$. In this study, this specification is ignored, like Goldberg and Rai (1996), because the regression results using either CR3 or HERF are similar, making the specification of the error term irrelevant.
[15] Berger and Hannan (1997) specify two equations, one incorporates X-efficiency as dependent variable and the other incorporates scale-efficiency as dependent variable.
[16] For more details see Goldberg and Rai (1996)
[17] Goldberg and Rai (1996) apply this approach on the banking industry in Europe. While Berger and Hannan (1997), and Berger (1995) use distribution-free approach to disentangle efficiency from error term.
[18] Neither the translog functional form that is the most widely used in the bank efficiency literature nor the Fourier Flexible functional from that appears as a preferred alternative are implied because of technical problem related to sample size.
[19] The likelihood function for this system utilizes the parameterization of Aigner *et al*. (1977) who assume that $\sigma^2 = \sigma_u^2 + \sigma_v^2$ and it captures total risk exposure, and $\lambda = \sigma_u / \sigma_v$, which captures the inefficiency ratio relative to random component.
[20] These assumptions related to the multicollinearity and heteroscedasticity.
[21] Total deposits are employed as a proxy for bank output.
[22] Total deposits include individual, financial institutions deposits and cash margins.
[23] The three-largest banks are the Arab Bank, the Housing Bank and the Jordan National Bank.
[24] See section 3.2 for the operational definition and measurement of cost efficiency (x-efficiency).
[25] In contrast to AL-Karasneh, Cadle and Ford (1997) who use total assets after scaled by 0.000 and the interaction between MS and CR as control variables, those variables are not incorporated in these regressions since size factor is used to control for scale efficiency and the correlation between market share and concentration measures is very small. Simultaneously, price measure is used as dependent variables in addition to profit measures.
[26] Table 4.3 and 4.4 report only the regression results of the three-bank concentration ratio (CR3) since the regressions of the Herfindahl index give the same results of CR3 regressions. Therefore, the regression results of the Herfindahl index are not reported.