Market value, book value and earnings: is bank efficiency a missing link?

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Abstract

Purpose – This paper examines whether earnings and its components are relevant and sufficient to bridge the gap between banks’ market and book values, and also considers if bank efficiency is “value relevant” for banks valuation.

Design/methodology/approach – This paper follows the value relevance literature methodology which tests for the difference between book and market values using a variety of indicators including net income and its components as well as bank efficiency (derived using DEA) and risk indicators. The regression models are estimated using OLS, random and fixed effects approaches for a sample of listed Jordanian banks between 1993 and 2004.

Findings – The main findings of this paper are twofold. First, it is found that earnings (and its components) are value relevant and explain the gap between market and book values. Secondly, cost efficiency, as an economic performance measure, provides incremental information, not contained directly in banks financial statements, to the market. Overall it is found that the components of net income are more important than aggregate net income in explaining bank value. Furthermore, bank operational efficiency adds incremental information in explaining the gap between market and book value. These results support the view that stock prices aggregate signals received by the market as well as from firm’s accounting systems.

Practical implications – The study shows that bank efficiency indicators (along with more traditional accounting measures) help explain market values.

Originality/value – This is one of only a limited number of studies that link bank efficiency to market valuation. It is the first, we believe, to do this for banks operating in an emerging economy.

Keywords Banking, Market value, Jordan

Paper type Research paper

1. Introduction

Valuation approaches differ according to the field of application, goals and methodologies used. For example, accountants take value to mean book value, whereas economists are concerned about fair value (intrinsic value). On the other hand, stakeholders evaluate the services which they receive based on the utility provided by these services and concentrate on the market value that proceeds from actual financial transformation or sale of instruments.

Recently, banks have faced greater levels of competition and this has created excess capacity in traditional lines of business and forced them to become more market-oriented. The degree of bank complexity has increased further as they have moved away from being traditional intermediaries to more market-oriented institutions, providing a wider range of non-banking products and services[1]. As a result of such changes, banks nowadays rely more heavily on intangible or hidden assets in their operations. Therefore, as argued by Ang and Clark (1997), the conventional wisdom that banks book values should closely approximate their market values is becoming increasingly invalid.
Accordingly, book and market values will differ and the former cannot adequately reflect the enterprise’s internal value. The difference between market value, current stock price and intrinsic value is an indication of the expected rewards for investing in a security (Kothari, 2001). If the stock fails to rise in value commensurate with stockholders’ expectations, current investors may seek to unload their shares and the bank will have difficulty in raising new capital to support its future growth.

Since earnings are considered the primary profitability indicator, capital market-based researchers in accounting have developed and tested a variety models in order to explain the observed relation between earnings and other accounting information, firm fundamentals and market value. They test the accounting information value relevance and the ability of financial information, particularly earnings, to explain the divergence that can occur between market and book values.

In some cases, stock market valuation studies have discovered that variation in stock prices does not reflect the variation in earnings (Kothari, 2001)[2], or the explanatory power of earnings levels and changes for market returns has significantly decreased over time (Francis and Schipper, 1999). An increasing gap between market and book values of equity in most countries is a significant signal of the loss of relevance of accounting information and may signify that other kinds of information are needed in order to explain actual value. Therefore, the previous literature (e.g. Amir and Lev, 1996; Ittner and Larcker, 1998; Trueeman et al., 2000; Liedtka, 2002; and Liang an Yao, 2005) typically indicates that the value relevance of financial accounting information to investors is largely insufficient for security valuation and a combination of financial and non-financial information better explain stock prices. Some, e.g. Kane and Unal (1990), demonstrate that whenever the economic market values of bank assets and liabilities differ from their accounting and book value, the firm has substantial hidden assets.

For banks to succeed and survive, they have to efficiently produce their outputs from inputs. Producing more outputs than competitors from the same amount of inputs, or consuming fewer inputs from the same amount of outputs is a sign of relative efficiency (Adenso-Diaz and Gascon, 1997). Therefore, bank efficiency can be used to proxy for firms’ competitive advantage which affects the firm’s current profitability and its future potential. Banks relative success in utilizing inputs efficiently (we argue) has important information value since relative performance also provides information on the banks competitive advantage. Firms which can operate efficiently can exploit their competitive advantage and produce sustainable profits for a longer period of time leading to greater market share at the expense of other firms (McWilliams and Smart, 1993). While a substantial body of literature has emerged on bank efficiency (see for example Berger, 2007), this strand of the literature has not often been analysed from shareholders point of view, and only a few studies (e.g. Eisenbeis et al., 1999; Chu and Lim, 1998; and Beccalli et al., 2006, Fiordelisi, 2007) have attempted to bring together the issue of bank efficiency and (stock) market performance.

This study seeks to advance the literature that examines the issue of bank valuation in two ways: First, it examines the information content of earnings and its components as applied to commercial banks in emerging markets[3]. Secondly, instead of only focusing on earnings or its components as a proxy for bank market value, this study also aims to explore whether efficiency is a primary determinant of bank market value[4]. As a consequence, we examine the question as to whether the choices made by management in the cost minimisation process explain bank market valuation.
Overall, our results support the view that bank efficiency is an important variable that helps to explain the gap between market and book values. Additionally, earnings components are also statistically significant in providing information to investors in term of explaining bank market valuation. This study is important not only because it is one of a handful of studies that explicitly evaluate the relationship between bank efficiency and stock prices, but also (as far as we are aware) it is the first to examine such relationships for emerging market banks. This paper provides insights for policy-makers as to the importance of operational efficiency in influencing shareholder wealth maximisation in banking. Although, effective bank regulation and policy making, should aim to ensure stability, another dimension that should be taken into consideration is the relationship between bank valuation and efficiency, particularly in emerging markets. According to Beck et al. (2000), policy makers should not assess banking policies only along the metric of stability. They also should examine which policies encourage banks to operate efficiently and to make sound capital allocation decisions.

In term of the paper’s format, the following sectionalized approach is adopted. Section 2 will summarize the relevant literature, followed by section 3 illustrates the empirical methodology used in this study. Section 4 analyses the results of the study. Finally, section 5 concludes.

2. Empirical studies on valuation and efficiency: a literature review
This paper examines whether banks’ efficiency explains the difference between market and book values of equity by providing signaling information to market participants that bank efficiency can improve future bank profits. Two strands of the literature relate to this area of study. First, the market-based accounting literature (value relevance literature), and secondly, banking efficiency studies. A summary of this literature will be provided in the following sections.

2.1 The value relevance literature
The impact of financial statement information on capital markets indicators referred to as the value relevance studies (in the area of market-based accounting) is a well documented area of research (Kothari, 2001), and the number of these studies is large. The main focus of the value relevance studies is to identify accounting items, and other variables that influence market prices or returns. Information is considered “value relevant” if stock price movements are associated with the release of such information. The value relevance is usually interpreted by the size of the coefficient of determination (adjusted $R^2$) from regressions of stock price or returns on accounting and other information (e.g. Collins et al., 1997; and Dontoh et al., 2004).

Many of the previous studies have argued that earnings, as a key accounting number, provide information content in stock returns (see Ball and Brown, 1968; and Beaver, 1968)[5]. These studies set the foundation for future research by being the first to show that changes in earnings, as a summary performance measure, correlate with unexpected changes in stock prices[6]. However, Kormendi and Lipe (1987), Collins and Kothari (1989); and Sloan (1996); and Baber et al. (1999) among others distinguish between two types of earnings, transitory vs persistent, and investigate the value relevance of these types of earnings[7]. These studies found that both earnings and earnings changes are value relevant with greater weight to persistent earnings than those that are perceived as transitory (Collins and Kothari, 1989).

The link between book and market values and company valuation has received increase academic attention since the work of Ohlson (1995) who considered both
earnings and book value as major determinants in equity valuation. The model provides a theoretical framework for identifying those tasks which are necessary to value firms via fundamental approach. The essence of the model is that book value and earnings are relevant valuation attributes, not merely signals about other attributes. Book value represents a stock measure of value, while earnings (a flow variable) measures increments to book value. The model also allows for any value relevant information other than book value, earnings.

Given that security price changes primarily reflect revisions in expectations of current and future profitability, studies attempt to explain the differences in the relation between market value and earnings by providing evidence of a list of firm-specific (profitability ratios, liquidity ratios and sales), or/and industry-specific (market structure) determinants.

Although earnings can play a critical role in the valuation process, if markets perceive a decline in the reliability of earnings figures they may look to other descriptive information as a base for valuation. Investors and researchers consider earnings components more informative than aggregate earnings for explaining market values as they are more relevant for evaluating the firm’s ability to generate future earnings and for assessing earnings persistence (Giner and Reverte, 1999; Chen and Wang, 2004).

Lipe (1986) analyses whether six commonly reported earnings components (gross profits, general and administrative expenses, depreciation expense, interest expense, income taxes and other items) provide additional information not included in earnings to explain market returns. He provides evidence consistent with the fact that the decomposition of earnings providing a statistically significant amount of information that would be lost if only earnings were reported and the stock market recognizes differences in the time-series properties of the components of annual earnings. Ohlson and Penman (1992) discover that stock returns react differently over short time horizons to earnings components (gross margin, operating expense, depreciation and amortization, taxes, extraordinary items and all other items) however, reactions are similar over longer horizons.

In fact, despite the aforementioned evidence which support the view that accounting information, such as book value earnings and earnings components are value relevant, a body of literature has emerged that has created the widespread impression that accounting information has lost its value relevance. Francis and Schipper (1999) and Brown et al. (1999) document a decline in the value relevance of earnings over time. In particular, these studies claim that financial statements are less relevant in assessing the fundamental value of high technology service-oriented firms (Dontoh et al., 2007). It has also been stated that the value relevance of accounting information is becoming increasingly questionable in the new economic era (knowledge economy) with higher levels of innovation and rapid technological developments in which investments in human resources, information technology and research and development have become essential in order to strengthen firm’s competitive success (Quinn et al., 1996).

Kane and Unal (1990) develop a model to investigate the structural and temporal variation in the market valuation of banking firms. In their model, they try to capture the hidden reserves of US banking firms. According to Kane and Unal hidden capital (un-booked capital) exists whenever the accounting measure of a firm’s net worth diverges from its economic value. Such un-booked capital has on-balance-sheet and off-balance-sheet sources. They argued that the accounting or book value of a bank’s capital represents a biased estimate of the market value of stockholders equity.
An increasing body of literature (see for example Bao and Bao, 1998; Liedtka, 2002; and Hassel et al., 2005) also focuses on examining the value relevance of non-accounting (emerging) performance measures, such as economic value added (EVA) or balanced scorecards, and whether these measures can substitute for traditional financial measures, such as net income and cash flows, in explaining equity market prices. These studies conclude that emerging financial measures can add incremental information not included in the comprehensive (traditional) financial measures.

Amir and Lev (1996) indicate that there are complementarities between financial and non-financial information. They argue that if we were to only use financial indicators in the traditional way, this might result in biased inferences. For a company that focuses its core value on intangible assets, non-financial indicators that are related to the company’s value are even more important than traditional financial indicators (Liang and Yao, 2005). Trueman et al. (2000) find that the additions of non-financial indicators on the basis of net income provide significant incremental explanatory power in terms of the valuation of internet firms. Using Ohlson (1995) model, they provide evidence that financial information has very limited use for valuation of internet companies.

The relationship between the market and book values of equity in banks has attracted various researchers. Beaver et al. (1989) focus on the banking industry. They examine whether cross sectional differences in market to book ratios for bank equities are captured by supplemental disclosures with respect to default risk (non-performing loans) and interest rate risk (loan maturity) using a sample of 149 US banks in 1983. They found that non-performing loans and loan maturity variables contribute in a statistically significant manner to an explanation of cross-sectional variation in market to book values. Nelson (1996) examined the relationship between bank market and book values and the reported fair value of assets and liabilities. He proposed that after controlling for future profitability, the fair value of securities is the only value that has explanatory power incremental to book value. Additionally, a small number of studies have attempted to provide an explanation for the gap between book and market values in banking.

Ittner and Larcker (1998) and Lambert (1998) note that customer satisfaction and stock prices are significantly positively correlated. However, customer satisfaction cannot completely reflect the accounting book value of the bank. Dermine and Hillion (1992), examine the relationship between the market value of equity and book value of assets and liabilities for French banks over the years 1971-1981. They found that assets and liabilities subject to taxation are priced at a lower value and that demand deposits appear to provide rent. Baele et al. (2007), find some evidence of the relationship between diversification and market returns. They show that higher levels of diversification seem to be associated with slightly higher market returns.

In this context, Ang and Clark (1997) argued that the level of bank efficiency (scale and scope efficiency) and the new trend in banking activities (the growth of non-interest income) must be reflected in the market value of bank shares. Many of these new activities do not appear on the balance sheet but affect cash flows. Ang and Clark (1997) provide evidence that the response of banks to changing technological (including increased efficiency), competitive and regulatory environment increases their market value.

Although firm valuation is one of the core features of corporate finance and has attracted extensive coverage in the literature, we argue that a bank’s business exhibits peculiarities that deserve special treatment. From our perspective we suggest that
efficiency is important and can be treated as an unrecognized asset (hidden asset) as defined in the accounting literature. While efficiency is equivalent to an intangible asset in banking, it is a firm-specific performance measure that can be simply calculated using publicly available information or alternatively, can be estimated using more sophisticated non-parametric or parametric techniques. The following section will provide an overview of the bank efficiency literature and explain how this is to be linked to valuation.

2.2 Bank efficiency and valuation

Efficiency is viewed from both the industrial organization and strategic management literatures as the product of firm-specific factors such as management skill, innovation, cost control and market share as the determinants of current firm performance and its stability (McWilliams and Smart, 1993). Although, the concept of efficiency has typically been ignored in accounting valuation studies, it has been explored extensively in the banking literature.

Afriat (1988) defines efficiency as the relation between ends and means; he suggests that efficiency can be measured as the “extent to which they are matched” (Cebenoyan, 2003). Banks have focussed on improving their productivity and efficiency in order to create value for their shareholders[8]. Usually, banks focus on identifying the potential for achieving cost savings even by selecting the optimal firm size (scale economies) and product mix (scope economies), or by maximising operational or productive efficiency (Goddard et al., 2007). In operational or productive efficiency two components can be identified: technical efficiency (TE) and allocative efficiency (AE). Therefore, TE demonstrates the ability of a bank to obtain maximum outputs from a given set of inputs or of minimising inputs for a given target of outputs, this component focuses only on physical quantities and technical relationships. If information on prices is available and a behavioural assumption (such as profit maximisation or cost minimisation) can be appropriately made, AE can be introduced. AE in input selection refers to the selection of that mix of inputs which produces a given quantity of outputs at the minimum cost. In formal terms, AE refers to the ability of using the input in optimal proportions, given their respective prices and production technology.

There is a large body of literature dedicated to describing approaches to measuring the efficiency of financial institutions. Publications targeted for practitioners’ audience frequently focus a well-known accounting ratio such as the cost-income ratio (CIR) (Davidson, 1997). This measure has intuitive appeal and is thus simply called the “efficiency ratio”. According to the Cocheo (2000), this ratio is generally considered an important benchmark. Yet, the limitations of CIR have been discussed in numerous articles such as that by Osborne (1995), who found no clear correlation between the CIRs and return on equity for a sample of US banks.

There has been a growing interest in estimating operating efficiency in various banking markets. Traditionally, bank efficiency studies have focused on how well banks utilize cost advantages resulting from scale and scope production (e.g. Humphrey, 1987; Molyneux et al., 1996; Berger et al., 1993 and Altunbas et al., 2001)[9]. However, attention has increasingly switched to estimation of X-efficiency using different methodologies. Two main methodologies are usually applied to estimate bank efficiency: parametric and non-parametric approaches. The former identifies a specific form for the production function, whereas the latter does not specify any such form[10].

While a number of bank efficiency studies have examined efficiency measures (e.g. Berger and Mester 1997; Maudos and Pastor, 2003; Glass and Mckillop, 2000 and Bos
and Schmiedel, 2007) very few have examined the link to market value. Lou (2003) examined marketability efficiency (activities generating more market value) in addition to profit efficiency for a sample of 245 large banks using the non-parametric DEA approach. He found that 14 per cent of banks in the sample obtained higher level of profit performance but lower levels of marketability performance. In a recent study, Fiordelisi (2007) creates a new measure of efficiency namely “shareholder value efficiency”. He used the parametric stochastic frontier analysis to estimate his new efficiency measure. According to Fiordelisi, more efficient banks are those which produce the maximum possible EVA. Based on his sample of selected European banks (from France, Germany, Italy and the UK), he found that this measure of efficiency can explain value creation in banking better than cost and profit efficiency.

Additionally, Chu and Lim (1998) evaluate the cost and profit efficiencies of banks listed in Singapore over the period 1992-1996. They find a significant relation between profit efficiency rather than cost efficiency and the percentage change in bank share prices. Adenso-Diaz and Gascon (1997) linked various measures of bank efficiency (production costs, systemic risk, specific risk and the size of branch network distributions) with the stock performance; they found that the most influential variable in determining stock performance was the specific risk of banks. However, the other efficiency measures seem to have only a limited effect on bank stock performance.

Eisenbeis et al. (1999) studied the information content of cost X-efficiency estimates using both stochastic and linear programming frontier techniques for a sample of US bank holding companies from 1986 to 1991. First, they found that the non-parametric inefficiency scores were two to three times larger than those estimated using the parametric stochastic frontier approach. However, the patterns of the efficiency measures across banks and time were similar and highly rank correlated. Overall they found that the stochastic frontier measures of bank inefficiency were more closely related to bank stock returns. Beccalli et al. (2006), in contrast, arrived at different conclusions concerning the most appropriate efficiency estimation technique when examining the relationship between bank efficiency and stock performance. Beccalli et al. (2006) found that cost efficient banks do better than less cost efficient banks in terms of market returns when using both parametric and non-parametric techniques to examine the relationship between efficiency scores and stock returns for a cross-country sample of European banks. They also suggest that the DEA efficiency measures better explain bank stock market performance compared to the parametric (stochastic frontier) estimates.

While the previous literature addresses the important relationship between market performance and bank efficiency, none of these studies (to the best of our knowledge) directly analyse the issue of banks’ market valuation by examining the gap between market and book values, or explore this relation in emerging markets. Subsequently, this study contributes to the above mentioned literature by attempting to connect two branches of the literature (namely accounting and banking studies). This study, therefore also aims to contribute to the established value relevance literature by using the relative performance measure, bank efficiency and to examine how this measure may relate to the gap that occurs between market and book values across banks.

3. Empirical methodology

3.1 Linking bank value to financial and economic performance measures

In this paper we argue that internal value drivers may enhance bank market value. Internal value drivers are indicated by using two types of information. First, financial
information can be used by analysts by extracting performance measurement variables presented in financial statements, particularly net income, and its components. Secondly, because of the existence of differences in the value creation activities that are directly connected with management efficiency, we also plan to include cost efficiency as a bank-specific performance measure estimated using the non-parametric DEA methodology. Thus, we aim to examine whether the efficiency of banks helps in explaining the difference between market and book values. Finally, we also include risk measures which are expected to affect bank value. Bank market and book values, as well as financial and economic performance, may also be influenced by two specific risk indicators, credit and insolvency risks. These types of risks may influence market value[11]. The effect of credit risk on bank market value is obvious, a downside credit risk positively affect bank’s market value. The main reason for this expected relationship is that the higher the credit risks the more the required rate of return by investors (discount rate used to calculate the present value of expected future cash flows). Banks are assumed to accurately forecast their credit losses, and reflect their forecasting by seeking protection against loan-losses through their choice of appropriate provision for such losses. Therefore, in this study we proxy bank credit risk using annual loan-loss provisions ratio (LLP) (measured as LLP to total loans); this ratio is assumed to provide an indication of credit risk. This ratio has two possible effects on market value. The market may interpret LLPs as signals of bank managers’ private information about expected future earnings, and by increasing LLPs will be able to withstand a “hit to earnings” through absorbing future potential losses (Beaver et al., 1989). Therefore, investors interpret components of unexpected provisions as “good news” (Elliot et al., 1991 and Beaver and Engel, 1996). On the other hand, an increase in the banks’ LLP can also be viewed as bad news, especially if it is not accompanied by other, more timely indicators of loan default, because LLP will then serve as the primary source of information on loan default (Ahmed et al., 1999).

Finally, we also consider insolvency risk measured by the Z score, a metric for bank insolvency risk developed by Boyed et al. (1993). The Z score is a statistic indicating the solvency for each bank \( j \) in every year \( t \) that can be calculated as follows:

\[
Z = \frac{\sum_{j=1}^{12} \left( \pi_j / A_j \right) + \sum_{j=1}^{12} \left( E_j / A_j \right)}{S_r}
\]

where \( \pi_j \) is the estimated market value that can be calculated as follows:

\[
\pi_j = c_j p_j - c_{j-1} p_{j-1},
\]

where \( c_j \) is the number of outstanding shares adjusted for stock splits, and \( p_j \) is the share price of the last business day of month \( j \). \( E_j \) is the market value of total equity (e.g. share prices multiplied by number of shares outstanding); \( A_j \) is the market value of total assets:

\[
A_j = E_j + L,
\]

\( L \) is the book value of total debt at the end of each fiscal year. And \( S_r \) is the estimated standard deviation (SD) of \( \pi_j / A_j \). The Z score is negatively associated with insolvency risk, where \( Z \) is the number of SDs below the mean by which profits must fall in order to eliminate equity. Boyed et al. (1993) defines the downside risk as being negative.
values of the Z score (see Yasuda et al., 2004). Therefore, we assume that Z has a positive effect on market value. In other words, the higher the value of the Z-score the lower the insolvency risk and the higher the expected market value.

3.2 Empirical models, testable hypotheses and data
The empirical foundation of this study is based on relating bank's stock prices to the underlying financial information disclosed in the financial statements and to other non-financial (economic) information. Particularly, we adopt Ohlson's (1995) model which links firm market value with both of financial and non-financial information. This model has been used in various value relevance studies (e.g. Callen and Morel, 2001; Biddle et al., 1997; Myers, 1999; Trueman et al., 2000 and Dechow et al., 1999). In particular, we use Trueman's et al. (2000) methodology which tests for the difference between book and market values using both net income, net income components as well as other information (bank efficiency measures and risk indicators).

The first empirical regression model that is shown in the following equation:

\[ MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \varepsilon_{jt} \]  \hspace{1cm} (1)

where MV\(_{jt}\) is market value (proxied by stock prices) calculated for each bank \(j\) three months after fiscal year end period \(t\) to account for any delay in the release of accounting information[12]. BV\(_{jt}\) is bank \(j\)'s book value of common equity at the end of the year \(t\), and NI\(_{jt}\) is the net income available to bank \(j\)'s common stockholders at the end of year \(t\). Two additional arguments can be used to support our specification. First, although Ohlson's (1995) valuation model relies on forecasts of future earnings, not the current reported earnings, the current earnings can be thought of as the realization of previously forecasted earnings (Gornik-Tomaszewki and Jermakowicz, 2001). Second, the use of current end-of-period book value instead of the lagged book value allows us to analyse the gap between market and book value.

Consequently, the above model (Equation (4)) will be used to test the first hypothesis that can be stated in its alternative form as follows:

**H1.** Net income has value relevance in explaining the difference between bank market and book values.

In order to directly address the noted assertion that net income plays only a small role, at best, in the valuation of bank stocks (Bao and Bao, 1998; Riahi-Belkaiui, 1993; Liang and Yao, 2005 and Wang et al., 2005), we test whether net income components are able to provide different explanations in the market to book value relationship:

\[ MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHER_{jt} + \varepsilon_{jt} \]  \hspace{1cm} (2)

where OI\(_{jt}\) is the total operating income (interest and non-interest income) of bank \(j\) in quarter \(t\), OEXP\(_{jt}\) is the expenses related directly to the banks product delivery including total interest expenses of bank \(j\) in year \(t\), and OTHER\(_{jt}\) are expenses other than interest and non-interest expenses of bank \(j\) in year \(t\) (including depreciation and amortization administrative expenses, and research and development expenses).

The second tested hypothesis in its alternative form is as follows:

**H2.** Net income components add information beyond aggregate net income, in which they can improve the explanation of the difference between banks market and book value.
In addition, we seek to examine whether bank efficiency adds information in explaining market value:

\[ MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 \text{Eff}_{jt} + \varepsilon_{jt} \]  

where \( \text{Eff}_{jt} \) is the cost efficiency for bank \( j \) at year \( t \) estimated using the DEA methodology, or the accounting CIR[13, 14].

Thus, the third alternative hypothesis can be expressed as follows:

**H3.** Banks’ cost efficiency has value relevance; it can provide a significant incremental information content to the net income model.

Additionally, other information indicators, important in bank valuation, as additional independent variables along with the financial data obtained from financial statements have been included in our models. We assess the relevance of bank efficiency as non-financial information. Two risk measures will also be added to the aggregate model to control for the effects of efficiency on the relationship between market and book value as follows, the following equations are expressed as follows:

\[
\begin{align*}
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 \text{LLPR}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Z_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 \text{Eff}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 \text{LLPR}_{jt} + \alpha_4 \text{Eff}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \alpha_3 Z_{jt} + \alpha_4 \text{Eff}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \beta_1 \text{LLPR}_{jt} + \beta_2 Z_{jt} + \beta_3 \text{Eff}_{jt} + \varepsilon_{jt}
\end{align*}
\]

From Equations (4)–(9) we can test the following hypotheses in their alternative form as:

**H4.** Banks’ efficiency has value relevance after considering for credit and insolvency risk in the net income model.

Furthermore the efficiency measure and other control variables are added to the net income components model as follows:

\[
\begin{align*}
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \beta_1 \text{LLPR}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \beta_2 Z_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \alpha_5 \text{Eff}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \beta_1 \text{LLPR}_{jt} \\
&\quad + \beta_2 \text{Eff}_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \alpha_5 \text{Eff}_{jt} \\
&\quad + \alpha_6 Z_{jt} + \varepsilon_{jt} \\
MV_{jt} &= \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OI_{jt} + \alpha_3 \text{OEXP}_{jt} + \alpha_4 \text{OTHER}_{jt} + \alpha_5 \text{LLPR}_{jt} + \alpha_6 Z_{jt} \\
&\quad + \alpha_6 \text{Eff}_{jt} + \varepsilon_{jt}
\end{align*}
\]

where LLPR\(_{jt}\) is our measure of bank credit risk namely, as the ratio of LLPs to gross
loans for bank \( j \) in year \( t \); \( Z \) is a score that refers to a metric for insolvency risk developed by Boyed et al. (1993), (see section 4.2 for the calculations and expected effect of the variables).

From Equations (10)-(15) the following alternative hypotheses can be derived as follows:

\[ H_5 \] Banks’ efficiency has value relevance after considering for credit and insolvency risk in the income components model.

\[ H_6 \] The complete model (with efficiency) provides improved explanatory power compared to the model with earnings or earnings components alone.

To control for heteroscedasticity in the above mentioned models, all variables are deflated by the end of year book values[15]. Furthermore, to examine the incremental or marginal contribution of the efficiency variable to explaining bank value, we employ the \( F \)-test (Gujarati, 2003)[16]. Considering that pooled time series cross-sectional data requires various stochastic specifications, we control in all regressions for fixed firm and time effects. Lagrange multiplier (LM) as well as Hausman tests will be applied for choosing the preferred model.

The sample used in this study comprises 15 listed commercial banks that operate in Jordan. The banks in the sample consist of all publicly traded banks which had market data during the time period under study. All of the 15 banks have December 31 as their financial year end. The data sample selected in the research was collected for each year during the 1993-2004 periods. The data used in the empirical models have been acquired from the annual financial statement of the banks in the sample and the Amman Stock Exchange (ASE) Data Base[17, 18]. The non-parametric DEA model will be applied to calculate the Input oriented cost efficiency scores of sampling banks using variable return to scale. To estimate the cost efficiency, three inputs (banks deposits, labour and capital) and three outputs (total loans, securities and all other earning assets, and off balance sheet items) have been chosen. Because homogeneity of operations is essential in efficiency analysis, our study excludes foreign owned banks, which constitutes a small portion of the sector. In addition, foreign banks stocks are not listed on the ASE.

4. Results

4.1 Descriptive statistics

The first set of the results pertains to the estimation of the bank cost efficiency scores. Table I shows the average cost efficiency scores calculated based on the DEA approach. The table also presents the accounting efficiency measure (CIR calculated as total cost to total income). Over the sample period 1993-2004, average banks’ cost efficiency scores range between 61.9 and 83.3 per cent with an average value of 73.5 per cent.

On average, Jordanian banks can save nearly 26.5 per cent (1-73.5 per cent) of their total costs compared to the best practice banks without decreasing their outputs. This result suggests that the same level of outputs could be produced with approximately 74 per cent of current inputs if the banks under study were operating at their most efficient level. The SD of the DEA cost efficiency scores varies from year to year during the study period. This result suggests that Jordanian banks witnessed an efficiency gap within their operations. On the other hand, the average CIR calculated during our sample period had a higher SD, 31.3 per cent. Average CIRs fell in the range between 51 and 76 per cent. The lowest deviation was achieved in 2004 consistent with the DEA score.
Table II presents the descriptive statistics for the variables included in the models. The market value per share variable tends to exceed the book value per share widely during the sample period. The average market value stands at 10.395 Jordanian dinar (JD) compares with 2.365 JD for the book value per share. By comparison, we can say that the SD of the market value (29.56) is noticeably more than the SD of the book value (3). This gap between the two values suggests that the classical accounting bank valuation model should include other relevant variables which may help explain the gap and provide a better explanation of bank market value. Consistent with our results (Table II), the accounting CIR witnesses a higher SD equal to 31 per cent. The different levels of SD values between the NI and the OI may indicate the income smoothing of net income streams practiced by Jordanian banks, who may have been motivated to do this in order to reduce their risk and cost of capital (Liu et al., 1997).

4.2 Empirical results
In this section, we estimate the models outlined in section 4. For each model, OLS, fixed, and random effects estimates have been derived, and the most appropriate pooling procedure is documented based on LM and Hausman tests. Tables III-V present the estimated coefficients and standard errors of the valuation models.

4.2.1 Net income and net income components models. The regression results of models 1 and 2 are presented in Table III. Net income and book values are included in model 1 as independent variables, whereas in model 2 net income is replaced by the three components of income (operating income, operating expenses and other expenses). The results indicate that the net income coefficient (1.49) is statistically significant at the 5 per cent level; suggesting that market value is significantly associated with net income. This means that aggregate net income contributes to

<table>
<thead>
<tr>
<th>Year</th>
<th>Average cost efficiency scores</th>
<th>SD</th>
<th>CIR</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>0.746</td>
<td>0.237</td>
<td>0.589</td>
<td>0.219</td>
</tr>
<tr>
<td>1994</td>
<td>0.733</td>
<td>0.229</td>
<td>0.759</td>
<td>0.591</td>
</tr>
<tr>
<td>1995</td>
<td>0.773</td>
<td>0.203</td>
<td>0.715</td>
<td>0.356</td>
</tr>
<tr>
<td>1996</td>
<td>0.619</td>
<td>0.211</td>
<td>0.652</td>
<td>0.251</td>
</tr>
<tr>
<td>1997</td>
<td>0.688</td>
<td>0.191</td>
<td>0.640</td>
<td>0.272</td>
</tr>
<tr>
<td>1998</td>
<td>0.685</td>
<td>0.210</td>
<td>0.675</td>
<td>0.279</td>
</tr>
<tr>
<td>1999</td>
<td>0.714</td>
<td>0.227</td>
<td>0.662</td>
<td>0.350</td>
</tr>
<tr>
<td>2000</td>
<td>0.789</td>
<td>0.161</td>
<td>0.671</td>
<td>0.280</td>
</tr>
<tr>
<td>2001</td>
<td>0.754</td>
<td>0.165</td>
<td>0.548</td>
<td>0.168</td>
</tr>
<tr>
<td>2002</td>
<td>0.763</td>
<td>0.161</td>
<td>0.588</td>
<td>0.209</td>
</tr>
<tr>
<td>2003</td>
<td>0.721</td>
<td>0.185</td>
<td>0.611</td>
<td>0.391</td>
</tr>
<tr>
<td>2004</td>
<td>0.833</td>
<td>0.261</td>
<td>0.510</td>
<td>0.206</td>
</tr>
<tr>
<td>Average 1993-2004</td>
<td>0.735</td>
<td>0.204</td>
<td>0.636</td>
<td>0.313</td>
</tr>
</tbody>
</table>

Notes: aCost efficiency scores are calculated by the cross sectional DEA input oriented methodology, using the DEAP 2.1 computer programme. bCIRs are calculated as all operating costs including interest and non-interest income as well as other expenses divided by all operating income including interest and non-interest income and other income. cSixteen banks were included to estimate the best practice frontier on a yearly bases. We include banks of similar type of operations, and no unusual DEA efficiency scores have been detected.

Table I. Average cost efficiency scores for all banks in the sample
explaining the difference between market and book values. The explanatory power of this model is 13.82 per cent as indicated by the adjusted $R^2$ value.

However, when net income is decomposed into its components (model 2), the overall explanatory power of the model increases substantially. The explanatory power of this model is higher compared with the aggregate net income model, as indicated by the adjusted $R^2$ value of 21.14 per cent (compared to 13.82 per cent). This increase in explanatory power exists because aggregate net income “comprises various accounting items and mixes too much information together” (Liang and Yao, 2005).

Regarding the coefficients of the net income components, although operating income and operating expenses have positive coefficients (2.2 and 0.02, respectively); only the operating income coefficient seems to be significant in the valuation of Jordanian banks at the 1 per cent significance level. On the other hand, operating expenses do not provide any important signaling for market valuation. This might be because investors believe that this type of information is already incorporated in the net income value. The other operating expenses coefficient looks relatively high (3.9) and suggests that this variable is relatively important in providing information to the market about the future earnings of banks. Although, other operating expenses (including administrative expenses, research and development expenses and marketing expenses) would be expected to influence market values, it appears that investors in Jordanian banks assume that these expenses reduce value. This could be because investors believe less attention is being paid by managers to core business areas[19, 20].

Given estimates from the first and second models we cannot reject the first two alternative hypotheses and as such net income appears to provide investors in the ASE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>10.3950</td>
<td>29.5578</td>
<td>0.320</td>
<td>177.72</td>
</tr>
<tr>
<td>BV</td>
<td>2.3649</td>
<td>3.0029</td>
<td>-1.7990</td>
<td>16.3640</td>
</tr>
<tr>
<td>C/I %</td>
<td>62.96</td>
<td>31.00</td>
<td>17.81</td>
<td>257.14</td>
</tr>
<tr>
<td>Eff %</td>
<td>73.50</td>
<td>19.45</td>
<td>8.54</td>
<td>1.000</td>
</tr>
<tr>
<td>OI</td>
<td>2.0084</td>
<td>2.5661</td>
<td>0.1116</td>
<td>16.0881</td>
</tr>
<tr>
<td>OEX</td>
<td>1.2161</td>
<td>1.8382</td>
<td>0.0211</td>
<td>11.9423</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.7923</td>
<td>0.7952</td>
<td>0.0095</td>
<td>4.3286</td>
</tr>
<tr>
<td>NI</td>
<td>0.2377</td>
<td>0.4256</td>
<td>-0.4534</td>
<td>2.4467</td>
</tr>
<tr>
<td>LLPR</td>
<td>0.0153</td>
<td>0.1740</td>
<td>0.0005</td>
<td>0.1463</td>
</tr>
<tr>
<td>Z</td>
<td>146.825</td>
<td>0.7848</td>
<td>8.6670</td>
<td>354.02</td>
</tr>
</tbody>
</table>

**Notes:** (1) Variables are defined as follows: MV is the market value per share; BV is the book value per share; C/I % is the CIR; Eff % is the relative cost efficiency score; OI is the operating income per share generated by the bank during the year; OEX is the operating expenses per share generated by the bank during the year; OTHER is the other expenses per share generated by the bank during the year; LLPR is the LLP ratio; $Z$ score index value calculated as $Z = \left( \sum_{j=1}^{12} \pi_j/A_j + \sum_{j=1}^{12} (E_j/A_j) \right) / S_r$, where $\pi_j$ is the estimated market value of total profits that can be calculated as follows: $\pi_j = c_j p_j - c_{j-1} p_{j-1}$; where $c_j$ is the number of outstanding shares adjusted for stock splits, and $p_j$ is the share price of the last business day of month $j$. $E_j$ is the market value of total equity (e.g. share prices multiplied by number of shares outstanding); $A_j$ is the market value of total assets: $A_j = E_j + L$, and $L$ is the book value of total debt at the end of each fiscal year. And $S_r$ is the estimated SD of $\pi_j/A_j$. (2) The net income and net income components are calculated as a per share numbers to avoid small coefficient values.
Market value, book value and earnings

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### Table III
Regression results for the difference between market and book values based on net income and net income components

<table>
<thead>
<tr>
<th>Model</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV</td>
<td>0.7500*</td>
<td>0.4793</td>
</tr>
<tr>
<td></td>
<td>0.3654</td>
<td>0.4148</td>
</tr>
<tr>
<td>NI/BV</td>
<td>1.4915*</td>
<td>0.6623</td>
</tr>
<tr>
<td>OI</td>
<td>2.233**</td>
<td>0.6992</td>
</tr>
<tr>
<td>OEXP</td>
<td>0.0233</td>
<td>0.0780</td>
</tr>
<tr>
<td>OTHER</td>
<td>-3.9212**</td>
<td>0.8784</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.218</td>
<td>0.294</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.1382</td>
<td>0.2114</td>
</tr>
<tr>
<td>LM</td>
<td>7.33</td>
<td>10.50</td>
</tr>
<tr>
<td>($p$-value)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>HT</td>
<td>4.46</td>
<td>9.33</td>
</tr>
<tr>
<td>($p$-value)</td>
<td>(0.09)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Estimation</td>
<td>FE</td>
<td>FE</td>
</tr>
</tbody>
</table>

**Notes:** In each model the dependent variable is the market book value. See Table II for variable definition. In each model the first value is the estimated coefficient, and the second is the standard errors. *, **, *** indicate significance at the 5, 1 and 10 per cent levels, respectively. LM is the Lagranger multiplier, this test originally created by Breusch and Pagan (1980) based on OLS residuals. This test is used in this study to compare between pooled regression and random effect model based on maximum likelihood estimation under the null hypothesis the efficient estimators is pooled least square. FE is the fixed effects model; RE is the random effects model. The $F$-statistic and adjusted $R^2$ for the valuation models assume the fixed effects in the pooled data. The $F$-statistic tests the hypothesis that all of the slope coefficients (excluding the intercept) in a regression are zero. HT is Hausman test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than random effect. Values between brackets are $p$-values.

Model 1: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 NI_{jt} + \varepsilon_{jt}$
Model 2: $MV_{jt} = \alpha_0 + \alpha_1 BV_{jt} + \alpha_2 OP_{jt} + \alpha_3 OEXP_{jt} + \alpha_4 OTHER_{jt} + \varepsilon_{jt}$

some prediction ability of bank stock prices as it does explain differences between bank market and book values. However, if investors only place emphasis on bottom-line net income they will ignore other valuable information incorporated in the components of net income which can further improve the predictive ability about future earnings.

This result is consistent with Giner and Reverte (1999) who note that accounting earnings are not the only potentially relevant data that accounting systems produce. In addition, this result is in-line with many studies relating to the earnings disaggregation literature, e.g. Lipe (1986). Hence, earnings components convey information and appear complementary to that provided by aggregate earnings because such information enables investors to evaluate contributions made by individual earnings components to the firm’s overall market value.

4.2.2 Net income, efficiency and other variables. As argued by Kohlbeck (2004), the value relevance of net income does not mean that accounting information is the only information that can be used to value securities, investors and analysts may use other information sources. In the case of Jordan, the result of using “other information” is
tested through models 3-8 and presented in Table IV. Model 3 in Table IV examines how our measure of credit-risk (LLPs) contributes to explaining bank market value. We can see that at the 5 per cent confidence interval that credit risk has a positive and significant influence on bank market values.

Put simple, Jordanian banks that take on more credit risk appear to have higher market value – investors therefore being compensated for more risk behaviour. However, the incremental influence is not large as LLPs only increase the explanatory power of the model (Model 1 compared with Model 3) by around 1 per cent. On the other hand, the coefficient of insolvency risk estimated using the \( Z \)-score index is negative (\(-0.006\)) and significantly affects market value at the 1 per cent level. This result is quite surprising, because one would expect that the more the insolvency risk (indicated by lower values of our estimated \( Z \)-score) the less the market price. Two reasons may be given to explain

<table>
<thead>
<tr>
<th>Model</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV</td>
<td>0.4223*</td>
<td>0.9109**</td>
<td>0.1123**</td>
<td>-1.4328**</td>
<td>-0.5113</td>
<td>-0.6733</td>
</tr>
<tr>
<td></td>
<td>0.2110</td>
<td>0.2784</td>
<td>0.0288</td>
<td>0.5493</td>
<td>0.5724</td>
<td>0.5560</td>
</tr>
<tr>
<td>NI</td>
<td>3.1787**</td>
<td>2.1317**</td>
<td>1.9814**</td>
<td>2.495**</td>
<td>1.8698**</td>
<td>3.2950**</td>
</tr>
<tr>
<td></td>
<td>0.7150</td>
<td>0.6229</td>
<td>0.5576</td>
<td>0.7392</td>
<td>0.6291</td>
<td>0.7323</td>
</tr>
<tr>
<td></td>
<td>3.928</td>
<td>4.0956</td>
<td>3.958</td>
<td>0.2110</td>
<td>0.2784</td>
<td>0.0288</td>
</tr>
<tr>
<td>Z</td>
<td>-0.00589**</td>
<td>-0.00589**</td>
<td>-0.00589**</td>
<td>0.00168</td>
<td>0.00168</td>
<td>0.00168</td>
</tr>
<tr>
<td></td>
<td>0.89026**</td>
<td>0.89026**</td>
<td>0.89026**</td>
<td>0.00168</td>
<td>0.00168</td>
<td>0.00168</td>
</tr>
<tr>
<td>Eff</td>
<td>0.2164</td>
<td>0.5397</td>
<td>0.5315</td>
<td>0.5315</td>
<td>0.5175</td>
<td>0.5175</td>
</tr>
<tr>
<td></td>
<td>0.2164</td>
<td>0.5397</td>
<td>0.5315</td>
<td>0.5315</td>
<td>0.5175</td>
<td>0.5175</td>
</tr>
<tr>
<td>( F )</td>
<td>2.76</td>
<td>3.24</td>
<td>2.86</td>
<td>2.76</td>
<td>3.09</td>
<td>3.33</td>
</tr>
<tr>
<td>( p )-Value</td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0003)</td>
<td>(0.0003)</td>
<td>(0.0001)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.232</td>
<td>0.2619</td>
<td>0.2487</td>
<td>0.2436</td>
<td>0.2654</td>
<td>0.292</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.1479</td>
<td>0.1800</td>
<td>0.1600</td>
<td>0.1550</td>
<td>0.1790</td>
<td>0.204</td>
</tr>
<tr>
<td>LM</td>
<td>1.57</td>
<td>3.86</td>
<td>0.08</td>
<td>0.43</td>
<td>0.27</td>
<td>0.09</td>
</tr>
<tr>
<td>( p )-Value</td>
<td>(0.2104)</td>
<td>(0.0495)</td>
<td>(0.7728)</td>
<td>(0.5116)</td>
<td>(0.6005)</td>
<td>(0.7689)</td>
</tr>
<tr>
<td>HT</td>
<td>6.14</td>
<td>5.97</td>
<td>6.89</td>
<td>5.28</td>
<td>10.32</td>
<td>7.65</td>
</tr>
<tr>
<td>( p )-Value</td>
<td>(0.1051)</td>
<td>(0.1129)</td>
<td>(0.0755)</td>
<td>(0.2602)</td>
<td>(0.0353)</td>
<td>(17.69)</td>
</tr>
</tbody>
</table>

| Estimation method | OLS | RE | OLS | OLS | OLS | OLS |

Notes: In all models the dependent variable is the market book value. In each model the first value is the estimated coefficient, and the second is the SEs. *, **, *** indicate significance at the 5, 10 and 10 per cent levels, respectively. LM is the Lagrange multiplier, this test originally created by Breusch and Pagan (1980) based on OLS residuals. This test is used in this study to compare between pooled regression and random effect model based on maximum likelihood estimation under the null hypothesis the efficient estimators is pooled least square. FE is the fixed effect model; RE is the random effect model and OLS is the ordinary least square model. For comparison reason, the \( F \)-statistic and adjusted \( R^2 \) for the valuation models assume the fixed effects in the pooled data. HT is Hausman test to choose between a fixed or random effects specification. The null hypothesis is that both the fixed and random specifications are consistent and the alternative hypothesis is that fixed effect is better estimator than random effect. Values between brackets are \( p \)-values.

Table IV.
Regression results for the difference between market and book values based on net income, efficiency and other variables.
this negative relationship between the Z-score and market prices. The first reason is that
the ability of investors in emerging markets to assess the insolvency risk of banks is
questionable. The second explanation is that although banks' shareholders have much to
lose if a bank becomes insolvent, speculators still can earn short-term capital gains from
investing in insolvent bank stocks which may raise the market value of such stocks
irrespective of their performance. Based on this result reported in Table IV, we can
conclude that under the net income model, the Z-score provides an additional 2.2 per cent
(based on adjusted $R^2$ values reported in Tables III and IV) of explanatory power while
the percentage for the incremental explanatory power of LLPs provides additional
explanation close to only 1 per cent.

Column 5 in Table IV presents the results of the relationship between the cost
efficiency measures and market value. The evidence here is consistent with our claim
that bank cost efficiency significantly affects bank market value and helps partly explain
the gap between market and book values. When the DEA efficiency scores are used as
explanatory variables, the coefficient of the efficiency scores (0.89) positively and
significantly affects banks market value at the 5 per cent significance level. In addition, it
provides around 2.3 per cent incremental information to the net income model (model 1).
This result is in-line with previous studies that indicate that stocks of efficient banks
tend to perform better than their inefficient counterparts (Beccalli et al., 2006; Kirkwood
and Nahim, 2006). The implications of these results are that more efficient banks with
superior management shelter banks from unexpected profit shocks (see Baele et al.,
2007). Accordingly, investors would demand less compensation for such behaviour.
Improvements in bank cost efficiency appear to be reflected in banks market value.
Senior managers and investors (as well as regulators) should note that improvements in
bank efficiency feed through the improvements in the valuation process.

Based on the results of models 6-8 in Table IV, the importance of efficiency exists
even when each type of risk (LLP ratio and Z-score) are included in our models. The
explanatory power reaches its highest level when all variables are included together, as
expected, and the adjusted $R^2$ equals 20.4 per cent. This is followed by the model which
includes jointly the Z-scores and efficiency scores (both deflated by book value in
model 7), that have an adjusted $R^2$ equals to 17.9 per cent. These results indicate that
the two variables contribute to explaining the differences between book and market
values. Overall, efficient banks are more capable in attaining a minimum operating cost
and these banks are likely to benefit from improvements in market value. From the
former results we can accept the two alternative hypotheses three and four that
efficiency measures are important in explaining the gap between market and book
values and this is still the case after controlling for risk. We can conclude that if only
aggregate financial performance measurement (net income) is considered, the
explanatory power of the valuation model decreases.

4.2.3 Net income components, efficiency and other variables. The regression results
of the net income components models are presented in Table V. It can be observed from
models 9 and 10 that the relationship between LLP ratio and market value are not
statistically significant when net income has been disaggregated into its components.
However, the Z-score significantly affects market value at the 1 per cent significance level.

More importantly, the test results for the incremental information content of the
efficiency scores over the net income components are illustrated in Table V (model 11).
The coefficient of efficiency scores (0.90) has a significant relationship with the market
value at the 1 per cent significance level. Net income components are significantly
related to market value. Looking at model 11 in Table V we can observe that adding the
bank cost efficiency measure to the valuation model improves the explanatory power of the models slightly by around 2 per cent. Additionally, inferences regarding the efficiency scores seem to remain significant after considering the additional risk variables (in models 12, 13 and 14).

In essence, our efficiency measure is value relevant with respect to bank market value in both the aggregate net income and the income components models. This
conclusion supports the fifth alternative hypothesis. While this paper does not specifically address whether efficiency scores should be recognized or disclosed in financial statements, the result supports the call for greater emphasis on bank efficiency measures as a driver of bank value.

Furthermore, we examine whether the unconstrained valuation models which include the efficiency scores are superior to each of the two constrained valuation models (net income or net income components). The incremental information of the cost efficiency measures in the net income model (model 5, Table IV) is tested using the $F$-test in Equation (19). The results of this test rejects the null hypothesis that the unconstrained efficiency model is not superior ($F = 6.64 \sim F_{1,170}^{0.05}$). Likewise, the $F$-test rejects the same null hypothesis for model 11 in Table V where the efficiency has been included in the net income components model ($F = 5.21 \sim F_{1,170}^{0.05}$). Therefore, this conclusion supports the sixth alternative hypothesis[21].

5. Conclusions
In this paper, several hypotheses have been proposed and tested concerning the value relevance of earnings, earnings components, efficiency and risk. This study contributes to the extant valuation literature in two respects: first; instead of focusing on earnings as an aggregate number in interpreting the gap between market and book values we examine the value relevance of earnings components in bank valuation. Secondly, we analyse the gap between banks’ market and book values using variables developed in the economics literature based on production theory (banks’ relative cost efficiency).

This study is important, because it is one of the few studies that explicitly evaluate banking efficiency from a shareholders’ perspective. In addition, it contributes to the literature that analyses the relationship between bank cost efficiency and stock performance in the banking literature. This paper follows the approach adopted by Trueman et al. (2000) (based on Ohlson, 1995) to evaluate the relation between earnings, earnings components and market value.

The cost-to-income has been traditionally used in the literature to indicate bank cost efficiency. However, researchers have demonstrated that cost efficiency measures derived from parametric and non-parametric approaches have advantages over traditional accounting indicators (see Berger and Humphrey, 1997). This study advances the literature by incorporating DEA bank efficiency measures to test whether cost efficient banks are more able to create value for shareholders.

The main findings of this paper are as follows: First, it is found that earnings and its components are value relevant and explain the gap between market and book values. Secondly, cost efficiency, as an economic performance measure, provides incremental information, not contained directly in banks financial statements, to the market. These results support the argument of Dutta and Reichelstein (2005) that stock prices aggregate signals received by the market and firm’s accounting systems and each of these signals reflect management’s unobservable efforts. Our findings regarding the positive relationship between bank efficiency and market value seem to be in concordance with recent results reported in the literature, (e.g. Beccalli et al., 2006 and Eisenbeis et al., 1999).

The value relevance of banks’ efficiency has an important implication for regulators and policy makers because it is important for regulators, especially in emerging markets, to create an environment that enhances the efficiency and stability in the banking system. Using bank efficiency as a performance evaluation measure may improve
banking systems overall efficiency and stability. In addition, valuations derived from market prices can also be more accurate and timely than those derived from standard accounting sources and as such further investigation into the determinants of banks' market prices can be helpful in assessing the risk of bank failure.

Notes

1. Banks have focused on growing non-interest income activities such as insurance and assets management.


3. Information content of a variable means how much this variable was able to capture or summarize information that affects share values and empirically has a statistical effect on banks' market value.

4. While some studies (e.g. Beccalli et al., 2006), examined whether bank efficiency can determine the bank market return (performance), however, this study analysed whether bank's efficiency can bridge the gap between market and book values, and then considered to be value relevant in bank valuation.

5. Ball and Brown (1968) were the first to report drift in stock returns after earnings announcements and Beaver (1968) reported increase in volume of trade following announcements.


7. Persistence of earnings is indicated by levels and earnings changes.

8. Although productivity and efficiency are used in the literature interchangeably, a difference between the two concepts exists. As defined by Lovell (1993), the productivity of a production unit is expressed as the ratio of its outputs to its inputs and it is determined by the production technology. On the other hand, the efficiency of production is only a determinant of productivity, which can be defined as the comparison between observed and optimal values of a firm's inputs and outputs.

9. Where scale efficiency measures whether a bank is providing the most cost efficient level of output, scope efficiency measures whether a bank is producing the most cost efficient combination of outputs (Isik and Hassan, 2003).

10. Berger and Humphrey (1997) summarize over 120 studies dealing with cost and profit efficiency in banking. These studies are divided between those using parametric and non-parametric techniques: 69 studies applied non-parametric techniques and 60 adopted parametric approaches.

11. Credit risk is the probability that bank borrowers will fail to meet their obligations in accordance with the agreed terms. This type of risk is considered the major risk faced by commercial banks, because revenues associated with lending activities is the main source of bank income, hence, previous studies have typically focus on credit risk measurement in banking (e.g. Lucas and Klaassen, 2006; Galluccio and Roncoroni, 2006), and the relationship between this risk and other risks (e.g. Zheng, 2006; Jobst et al., 2006).

12. Share prices have been chosen in this study rather than stock returns because they are more consistent with the main purpose of the study. In this study, we investigate the relevance of efficiency by addressing this main question: Are bank efficiency associated with the capital market’s pricing of bank’s share? Examining the information content of a specific variable using share prices in Ohlson's 1995 model has been employed before by Barth et al. (1992), Collins et al. (1997), Dechow et al. (1999), Giner and Reverte (1999), Trueman et al. (2000), Ittner and Larcker (1998) and Liang and Yau (2005). Share prices after three months have been taken in this study for two reasons. First, we followed
some value relevance studies (e.g. Trueman et al., 2000; Liang and Yao, 2005). Second, Jordanian firms should announce their information within the first three months of the following year. According to the Jordanian law 1 April is the deadline for all listed banks or other corporations to submit their financial information. Therefore, we believed that longer time period may mix other type of information and though confuse our results.

13. CIR is computed as the ratio of operating costs over operating income.

14. Cost efficiency rather than profit efficiency has been included in this study for two purposes. First, we believe that bank managers have more control over their costs than profits. Second, the ability of banks to generate profits is clearly indicated to a major degree in earnings and its components that are already included in our model.

15. A number of deflators have been used before, as proxies for scale, in valuation models such as: sales, number of shares, opening market value, for further discussion on deflation and scaling see Akbar and Stark (2003).

16. F-test for nested models are chosen here rather than the non-nested models tests such as Voung (1989) and the J-test by Davidson and MacKinnon (1981) because in this study, the competing models are nested where in each time the first model becomes part of the second model.

17. The reason for the lack of empirical analysis on banks in emerging markets and Arab countries in particular relates to the availability of data. Most of the time, such data are considered confidential and typically proprietary. However, as the Jordanian economy opens up, the ASE became a rich database and covers all of the national listed banks.

18. This study uses annual data because accounting information that is required is only available on a yearly base (not quarterly as in the USA and some other developed markets).

19. Administrative and sales expenses are expenses which are associated with developments of financial products to meet customer demand. In order to implement the banks’ future plans and vision, banks need to spend more on research and development and employ researchers with specialized financial knowledge in order to develop products that meet the particular demands of individuals.

20. This variable is included as other operating expenses in aggregate terms instead of more detailed expenses because of the lack of comprehensive data for all banks in the sample, especially in the early years.

21. These results were cross-checked substituting a simple CIR instead of the DEA efficiency measures. We find similar results and these are available from the authors on request.

References


**Further reading**


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