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Bank Efficiency Change and Stock Market Returns Relationship: Evidence from Jordanian Banking System

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Abstract:

The study aims to investigate the relationship between bank efficiency change and the stock market returns. The analysis framework is divided into two stages; the first stage measures the bank efficiency change over time by employing Malmquist index using the Data Envelopment Analysis (DEA) technique. While the second stage examines the effect of the efficiency change on the stock market returns using panel data analysis. Within the efficient market hypothesis (EMH), the stock market prices should reflect all publicly available information, which should contain the bank's operation performance and growth in the marketplace. The findings refer to that the Jordanian banking system seems to have volatile patterns in the Total Factor Productivity (TFP) and the Technological Change (TC) during the study period. The outcomes indicate to the existence of a significant positive relationship between the bank's stock market returns and the Book-to-Market Ratio (BTM), the Bank's Size (LTA), the TFP and the TC.

Keywords: Bank Efficiency, Stock Market Returns, Data Envelopment Analysis, Total Factor Productivity, Malmquist Index, Technical Efficiency Change, Technological Change.

علاقة التغيير في كفاءة المصارف وعوائد القيمة السوقية للاسهم:
دراسة ميدانية على النظام المصرفي الأردني

المستخلص:

تهدف الدراسة إلى معرفة العلاقة بين تغير كفاءة المصارف وعوائد القيمة السوقية للاسهم. ينقسم إطار التحليل إلى مرحلتين؛ تقيس المرحلة الأولى تغير كفاءة المصرف بمرور الوقت من خلال استخدام مؤشر Malmquist باستخدام تقنية تحليل البيانات (DEA). بينما تدرس المرحلة الثانية تأثير تغيير الكفاءة على القيمة السوقية للاسهم باستخدام تحليل حزمة البيانات Panel Data. ضمن فرضية السوق الفعالة (EMH)، يجب أن تعكس القيمة السوقية للاسهم جميع المعلومات المتاحة للجمهور، والتي يجب أن تحتوي على أداء عمليات المصرف والنمو في السوق. تشير النتائج إلى أن النظام المصرفي الأردني يبدو أن لديه أنماط متقلبة في الإنتاجية الكلية (TFP) والتغير التكنولوجي (TC) خلال فترة الدراسة. تشير النتائج إلى وجود علاقة إيجابية مهمة بين عوائد القيمة السوقية للاسهم للمصرف ونسبة القيمة الدفترية إلى القيمة السوقية (BTM)، وحجم المصرف (LTA)، و TFP و TC.

1. Introduction

The banking system is a vital sector of any economy considered any country, particularly in emerging countries, that for its services to the public and private sectors, whether individuals or institutions. Where the roles of the banking sector, is a mediator of the movement of the funds from savers to borrowers, as well as other multiple banking services, such as counseling, advice and rationalize investment and expenditure of its clients, for example. Due to the presence of several shocks in the global economy (such as financial crises, changes in exchange rate and oil prices, as well as the political instability and civil wars, especially in the Arabic region) are disproportionately affected the economic activities, including banking sector.

Given the importance of the banking industry in moving the economic wheel and development, in addition to reach the well-being of the economy and economic stability, as well as to provide better services, the banking system operate under a competitive environment to get a best level of efficiency in the usage of the resources available to meet the wishes of customers.

The evaluation of the financial institutions is a key factor in the service industry, one of the evaluation method's is measuring the efficiency score for the decision making unit (DMU). For that measuring banking sector's efficiency has been widely considered in the financial literature, using parametric and non-parametric techniques (Hall, 2001). Consequently, the main duty in evaluating the performance of banking system is to distinguish between those DMUs that by some standard perform well and those that perform weakly (Berger, & Humphrey, 1997).

Traditionally, the banking efficiency has been examined by the financial ratios. Recently, the focus has been moved to the operation efficiency (Beccalli et al., 2006) employing parametric and non-parametric methods to estimate the best practice of the bank's performance (Berger and Humphrey, 1997). The operation efficiency measures are assumed to be better indicators of the bank's performance compared to conventional financial ratios (Berger and Humphrey, 1992). One of the non-parametric techniques that widely used in the banking literature is the Data Envelopment Analysis (DEA) (Berger and Humphrey, 1997). This technique is used to measure the technical and allocative efficiency of any DMU in yearly based. To capture the change of the efficiency score over time, there is another

approach can be used for evaluating the efficiency change over time (Färe *et al.*, 1992 and 1995) employing the Total Factor Productivity (TFP), known as "Malmquist Index" utilizing the DEA technique.

Färe *et al.* (1994) under the constant return to scale (CRS) model decompose the total factor productivity of a DMU into technical efficiency change (TEC) and technological change (TC). The technical efficiency change attributed to the so-called catch-up effect, which reflects the change in the cross-sectional efficiency of an operating unit considering two time periods. While the technological change corresponds to the frontier-shift effect, which reflects the movement in the frontier from time period *t* to time period *t*+1 in terms of how much more (less) input is needed to achieve a given level of output, under efficient operation (Emrouznejad & Thanassoulis, 2010).

With changing the banking system structure and the development of the competitive environment is expected to influence the efficiency scores and productivity growth of the banking sector, which it is may affect the banks' stock market performance (Fiordelisi & Molyneux, 2010). As one of the most common factor, the stock market returns play a vitally role for the investment attractiveness indicator for investors. Bearing in mind, the stock's prices should reflect the information packages in an efficient market environment. Consequently, the evaluation of the equity holders' value through the stock market returns can be examined by the operation performance measured by TFP to give a better explanation of the stock market behavior.

In the banking literature there are many studies examining the efficiency (see, Berger & Humphrey, 1997; Tortosa-Ausina, 2002; Drake et al. 2006), productivity (see, Isik & Hassan, 2003a; Isik & Hassan, 2003b) and stock market performance (see, Choi et al., 1992; Baele et al., 2007, Gandhi et al., 2015) separately, but a few of these studies (see, Guzmán & Reverte, 2008; Fiordelisi & Molyneux, 2010) pay their attention toward the relationship of these factors together, especially in emerging markets, which motivate us to investigate this phenomenon in Jordanian banking system.

The rest of this study organized as the following: section two shows a brief review of the related literature, in section three the data and methodology described, the empirical evidence sets in section four, while section five concludes this article.

2. The Literature Review:

In the economic theory under the production environment, the firms' managers try to operate in an efficient usage of the available resources, to maximize the firm's value, and therefore the stockholders wealth will be maximized. So, under competitive environment, the efficiency and productivity of the financial firms become an important issue (Isik & Hassan, 2003a). Subsequently, the stock market prices will react according to the firm's (bank's) operation position and the range of the process development. For that, the most efficient/inefficient firm will take place in/out of the stock market depending on the performance of its stock prices, in which it should be reflect the information set about the DMU.

In general, this idea come from the theory of the efficient market, since the stock prices provide precise signal for the DMUs, that is, the stock market in which the DMUs can make the investment decisions, and investors can choose among the different securities, under the assumption that the security prices at any time fully reflect all available information, which known as EMH (Fama, 1970). So, there are three types of information set that the stock prices reflect it, the historical information set (the weak form of efficient market), all publically and available information (the semi-strong form of efficient market) and the insider information (the strong form of efficient market).

Depending on that, many researchers try to examine the performance of the stock's prices by different types of information set in financial institutions, but a few of them include banks' efficiency and productivity, which play crucial role to evaluate the performance of the banking system. Since, running the banking system efficiently with progress of the productivity can be result in better allocation of the available resources, which will benefit the whole economy by leading to a superior and more appropriate innovations, enhanced the profitability, maximize the amounts intermediated, improved the quality of the services to clients, in addition to boost the stability of the banking system (Isik & Hassan, 2003a).

Hadad et al. (2011) found that the banks' efficiency scores were correlated positively with stock's prices for the listed Indonesian banks. That refer to, the stock's prices are important factor in determining of the efficiency's scores. But they did not investigate the effect of the efficiency's scores on the performance of the stock's prices. In addition, they found that the

Malmquist Index results displayed volatile productivity patterns over the study period. Which may plays an important factor for the stock's price performance.

Hadad et al. (2011) examine the monthly profit-based technical efficiency and productivity of listed Indonesian banks and their stock market performance, using two techniques of efficiency and super-efficiency applying non-parametric, Slacks-Based Model (SBM) to estimate the banks' efficiency scores, over the period of January 2003 to end-July 2007 for the listed Indonesian banks. They were then combined with the non-parametric truncated regression analysis to identify the determinants of the efficiency scores. They found that the average of the efficiency scores varied widely over the study period, with only one bank having a score in excess of unity under the super-efficiency framework. With respect to the truncated regression analysis, they found that the banks' efficiency scores were positively correlated with share prices and return on equity in all models, and with the log of total assets in the super-efficiency analysis. In addition, they found that the Malmquist Index results displayed volatile productivity patterns over the study period.

Fiordelisi & Molyneux (2010) examine the shareholder value (measured by market-adjusted returns (MAR), for listed banks and by the ratio of economic value to invested capital for non-listed banks) drivers in European banking focusing on the efficiency and productivity features of individual banks. They used DEA technique to measure cost efficiency (in all its components) and TFP (in all its components) under variable return to scale assumption, by considering on the French, German, Italian and U.K. banking systems over the period 1995-2002. They found that TFP changes best explain variations in shareholder value. They also found that technological change (frontier shift effect) seems to be the most important component of TFP affecting the stockholder value creation in European banking system.

Guzman & Reverte (2008) investigate the relationship between shareholder value (measured by stock market returns) and changes in TEC and TFP. By using nonparametric method to measure Malmquist Index for the sample of listed Spanish banks in the period 2000-2004, they found that those banks with higher TEC and TFP changes have a higher shareholder value, even after controlling for the impact of conventional measures of performance, such as return on assets (ROA).

3. The Data and Methodology

3.1. The Data

Our sample contains 12 Commercial banks of which 2 are Islamic banks for the period from 2009 to 2015 selected from Jordanian Banking System. In the banking efficiency literature, there is a longstanding disagreement over what it is the banks produce (Berger and Humphrey, 1992). To identify the mix of Inputs-Outputs, the more widely used approaches are the Intermediation approach and Production approach. More recently, the Core Profit approach is widely used to evaluate the banking efficiency (such as, Drake et al., 2006; Sufian, 2009; Hadad et al., 2011; Moradi-Motlagh & Babacan, 2015). Hence, the three outputs specified are Net Interest Income, Other Operating Income and Net Fees and Commissions. The three inputs selected are Personnel Expenses, Other Operating Expenses (excluding Personnel Expenses) and Loan Loss Provisions. The choice of the Loan Loss Provisions as an input factor is to capture the operation risk factor, since the incorporation of the operation risk (loan quality) is vitally important in studies of banking efficiency (Drake et al. 2006; Hadad, et al. 2011).

Table 1. Descriptive Statistics of the Inputs-Outputs Variables.

	Personnel Expenses	Other Operating Expenses	Loan Loss Provisions	Net Interest Income	Other Operating Income	Net Fees and Commissions
All Banks						
Mean	36,278	39,376	18,851	109,791	13,131	24,750
Standard Deviation	48,827	70,686	31,551	147,213	14,880	40,614
Minimum	2,848	3,700	85	368	1,600	0
Maximum	209,800	448,400	224,769	609,779	62,400	170,500
Conventional Banks						
Mean	40,255	44,551	20,553	122,451	14,202	28,312
Standard Deviation	52,417	76,422	34,126	156,993	16,029	43,612
Minimum	3,600	3,700	164	9,111	1,600	1,900
Maximum	209,800	448,400	224,769	609,779	62,400	170,500
Islamic Banks						
Mean	16,394	13,501	10,339	46,495	7,778	6,937
Standard Deviation	11,288	6,087	8,981	48,697	3,607	5,148
Minimum	2,848	5,139	85	368	4,400	0
Maximum	32,800	26,900	24,957	134,478	16,636	14,400

Note: All values in thousands JOD.

Table 1, shows that the conventional banks appear to be larger than the Islamic banks, that may come from the differences of the number of banks operating in Jordan. We collect the data from Bankscope databases.

3.2. Methodology

To achieve the aim of this study, we divided our work to two tasks; the first one is about measuring the Jordanian banks productivity (efficiency change) by using MI employing DEA technique, while the second one is about the investigation of the relationship between the stock market returns and the efficiency change over time measured in the first stage.

3.2.1 Measuring Efficiency Change

The widely used technique for measuring the efficiency change over time is that developed by Färe et al. (1992 and 1995) using the Malmquist Index employing DEA model. Färe et al. (1994) under the constant return to scale model decompose the TFP of a DMU into technical efficiency change (catch-up effect) and technological change (frontier-shift effect).

The standard Malmquist Index can be measured only by using radial efficiency score, under input or output orientation. Taking into account two time periods (t, t+1), considering CRS assumption and input orientation, and based on the mix of input-output (X, Y), the MI can be formulated as the following:

$$MI_i^{t+1}(x^t, y^t, x^{t+1}, y^{t+1}) = \left[\frac{D_i^t(x^{t+1}, y^{t+1})}{D_i^t(x^t, y^t)} X \frac{D_i^{t+1}(x^{t+1}, y^{t+1})}{D_i^{t+1}(x^t, y^t)}\right]^{\frac{1}{2}} \quad (1)$$

Where MI_i^{t+1} represent the TFP, D_i^t is the input distance function, i and t refer to the bank and the time, respectively. The MI could be also decomposed into two components, technical efficiency change (TEC) and technological change (TC). This decomposition can be formulated as:

$$MI_i^{t+1}(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{D_i^{t+1}(x^{t+1}, y^{t+1})}{D_i^t(x^t, y^t)} X \left[\frac{D_i^t(x^{t+1}, y^{t+1})}{D_i^{t+1}(x^{t+1}, y^{t+1})} X \frac{D_i^t(x^t, y^t)}{D_i^{t+1}(x^t, y^t)}\right]^{\frac{1}{2}} \quad (2)$$

Where the first part of LHS represents the TEC and the second part refers to the TC. To obtain these components, a sequence of models could be run by using DEA linear program. For this purpose we use A Data Envelopment Analysis Toolbox for MATLAB (Álvarez et al., 2016) package to measure the TFP for the banking system of Jordan. The value of TFP or its components (TEC, TC) greater than a unity indicates to productivity progress (growth), while a value less than a unity indicates to productivity regress (decline) from period t to t+1.

3.2.2 Panel Data Regression Model

To test the relationship between the banks' stock market returns and efficiency change, we apply the following panel data regression model:

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t} + \beta_2 LTA_{i,t} + \beta_3 EC_{i,t} + \varepsilon_{i,t} \quad (3)$$

Where $LR_{i,t}$ is the natural logarithm of the stock market returns for the bank i at time t, measured by the following equation:

$$LR_{i,t} = \log\left[P_{i,t} \Big/ P_{i,t-1}\right] \text{X } 100 \quad (4)$$

Where, P_i represents the bank's stock market price at time t and time t-1, respectively. While LR represents the dependent variable of our models, which we are trying to explain it by the independent variables. Whereas $BTM_{i,t}$ is the book value per share over the stock market price, which used as a powerful predictor of the stock returns in the literature, where the high BTM ratio refers to that the firm (bank) is underpriced, which is an attractive indicator for investors to hold that bank's stock (Fama and French, 1992), in addition, the BTM ratio expected to has a positive relationship with stock market returns (Srairi, et al., 2015). While $LTA_{i,t}$ is the natural logarithm of the bank's total assets, we include it to capture the bank's size effect on the $LR_{i,t}$.

For $EC_{i,t}$ is a k-vector of the efficiency change over time measured by Malmquist Index and its components (namely, total factor productivity change TFP for model 1, the technical efficiency change TEC for model 2 and the technological change TC for model 3) in our first stage, which we suppose to have a positive relationship with stock market returns. In general, with respect to efficient market hypothesis EMH, the stock prices reflect all publicly available information (Fama, 1970). Thus, as found by Beccalli et al (2006) the efficient banks can be better enhance their stock prices performance than the inefficient banks.

The α_i is the intercepts for the different banks, and all the banks heterogeneity are assumed to be captured by its. While the estimated slop coefficients β_i are assumed to be constant for all banks across banks and the time. Whereas, the two subscripts (i & t): *i* to denote the *i*th DMU (Bank) and *t* to denote the *t*th time period.

The explanatory variables are measured at time t and t-1, the rationale behind using one lag term is that the stock prices are assumed to capture the information set, contain efficiency change, since the annual financial reports for the accounting year t are publicly declared at the

next year (time t+1), so these information set at time t will be captured by the stock price at the time t+1 (Fiordelisi & Molyneux, 2010). To apply our models we use the EViews 9 software econometric pakage, where we choose fixed effect panel data models according to Hausmant test.

4. Empirical Evidence

In this section we measure the efficiency change using Malmquist Index for our sample, in addition to investigating the relationship between the stock market returns and the efficiency change while controlling for two independent variables (BTM & LTA) employing fixed effect panel data analysis.

4.1 Efficiency Change

To get overview for the efficiency change measured by Malmquist Index, we plot the measured value of the efficiency change by the components of TFP for each banks to get a wide view of the Jordanian banking system, where the Figure 1 shows that the TFP for the Jordanian banking system fluctuates over the study period for all banks, but these fluctuations are mostly around a unity and upwards, except few banks that vary more/less over/under unity for some years.

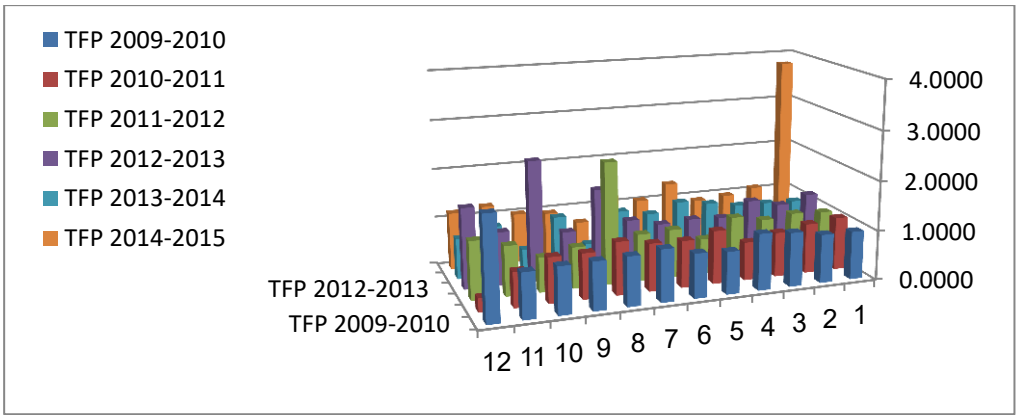

Figure 1. The Total Factor Productivity for each bank at the study period.

While Figure 2, shows that approximately all banks remain constant over the study period for the technical efficiency change TEC, which may not affect the stock prices.

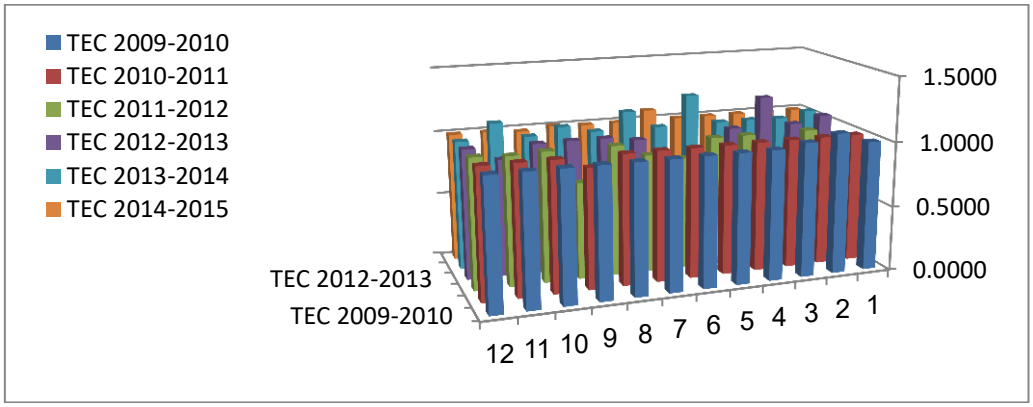

Figure 2. The Technical Efficiency Change for each bank at the study period.

Whereas, the Figure 3, shows us roughly the same result of the TFP, which means that the movements in the efficiency change over time are caused by the variation in the technological change TC, that variation we expect to affect the stock prices in same directions.

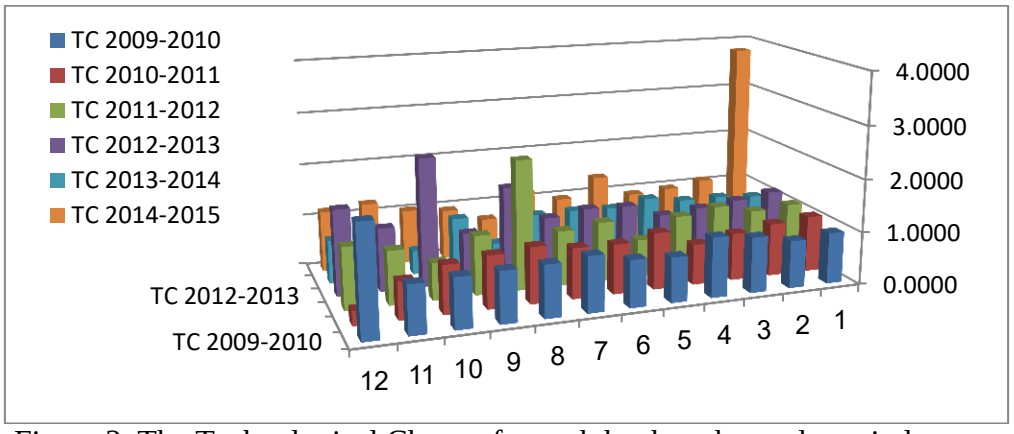

Figure 3. The Technological Change for each bank at the study period.

Since our sample contain two groups (Conventional and Islamic banks), we measure the average of the efficiency change over the time and two groups, in addition to overall average for the three scores (TFP, TEC & TC), to see if there are any differences between them. In general, we did not find any significant difference between Conventional and Islamic banks by using equality test. Table 2 illustrates that in all cases the overall average of the TFP, TEC and TC are very close to unity, with some variations according to each year, which means that the banking system in Jordan is stable.

Table 2. The Average of the Efficiency Change over time and Bank's type.

	Year	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Overall Avg.
TFP	Avg. CBs	0.9685	0.9428	1.0780	1.2278	0.8960	1.3366	1.0750
	Avg. IBs	1.5735	0.5879	1.0759	1.4158	0.8801	1.0713	1.1008
	Total Avg.	1.0694	0.8836	1.0776	1.2591	0.8934	1.2924	1.0793
TEC	Avg. CBs	1.0082	0.9921	0.9416	0.9494	1.0580	1.0083	0.9929
	Avg. IBs	1.0171	1.0000	0.9066	1.1149	1.0000	1.0000	1.0064
	Total Avg.	1.0097	0.9934	0.9358	0.9770	1.0483	1.0069	0.9952
TC	Avg. CBs	0.9612	0.9507	1.1427	1.2873	0.8427	1.3286	1.0855
	Avg. IBs	1.5556	0.5879	1.1886	1.3036	0.8801	1.0713	1.0978
	Total Avg.	1.0603	0.8902	1.1503	1.2900	0.8489	1.2857	1.0876

To be clearer around these results, we draw the efficiency change over time, to give us more information about how the two bank's type moves over time. The Figure 4 displays that the average of the TFP for the Islamic banks have a little variation from the Conventional banks in the same direction, except for the sharp decline for the period 2010 to 2011 that may come from the effect of the civil war in Syria.

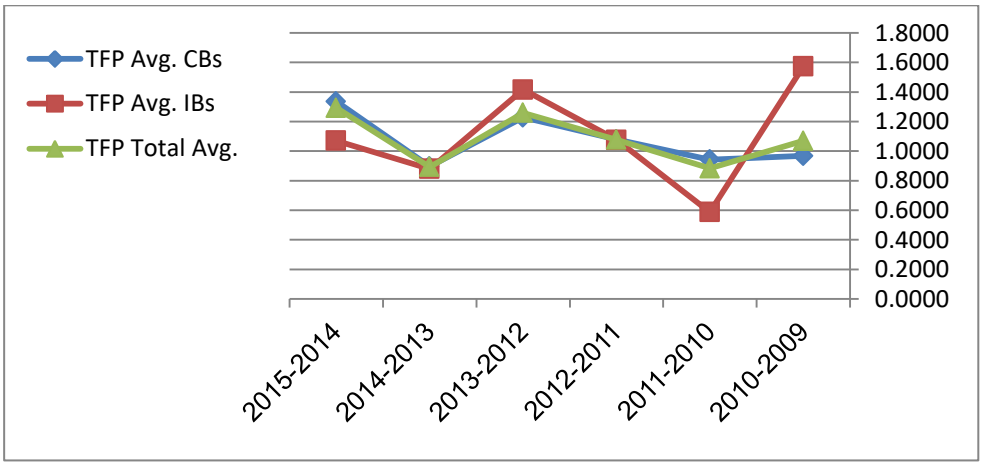

Figure 4. The Average of the Total Factor Productivity for each Bank's type at the study period.

While the average of the TEC for the Islamic banks moves beside the average of the TEC for the Conventional banks for the hall period of the study around the unity, as represented in Figure 5.

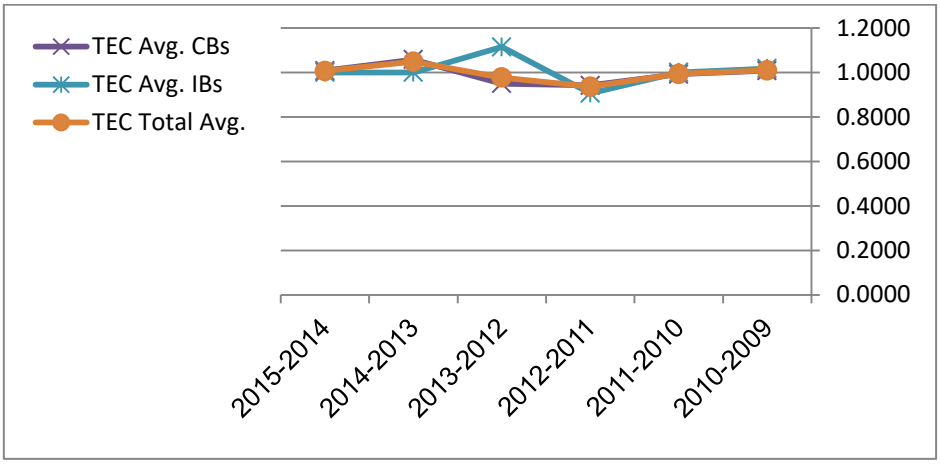

Figure 5. The Average of the Technical Efficiency Change for each Bank's type at the study period.

In despite of the stability of the TEC, the average of the TC varies from a unity up and down, for both types of banks with a sharp decline for the period 2010-2011 for the Islamic banks as shown in Figure 6, which consistent with the change of the average of the TFP displayed in Figure 4.

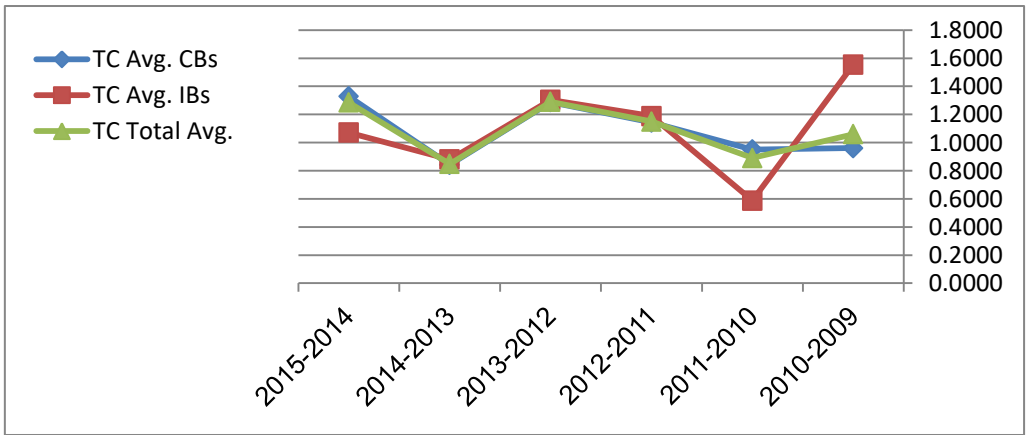

Figure 6. The Average of the Technological Change for each Bank's type at the study period.

Now we can see the full picture of the efficiency change, by looking to the Figure 7 that demonstrates the waves of the overall average of the TFP, TEC and TC, which appear clear for that high correlation between TFP and TC, those two measures move together in same direction and by nearly the same degree, while the average of the TEC seems to be constant over the period of the study.

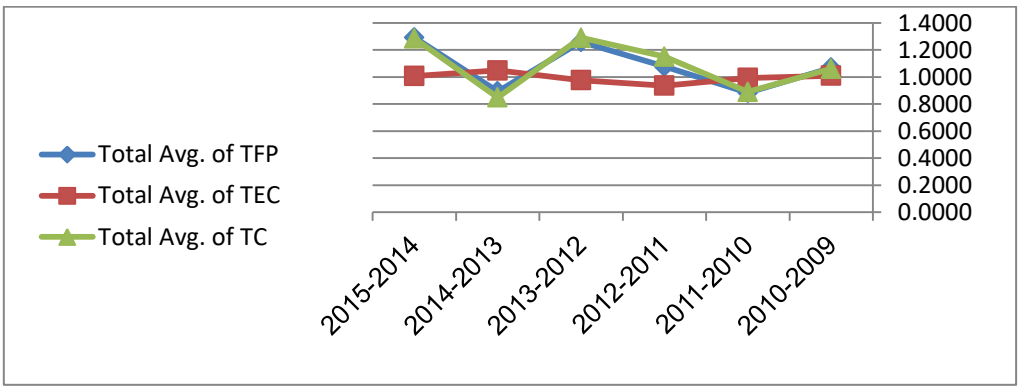

Figure 7. The Total Average of TFP, TEC, and TC.

Generally, we can conclude that for this part of our analysis, the banking system in Jordan has a volatile patterns of their productivity and the technological changes over the study's period, this variation mostly come from the frontier shift over time, which is the main cause of the productivity progress/regress, these results come in line with Hadad et al. (2011). These volatile patterns of TFP and TC may affect the performance of the stock price during the study period, which we will examine in the next subsection.

4.2 The Stock Market Returns and Efficiency Changes Relationship

The investigation of the banking efficiency change and the stock price performance has been widely examined in the banking literature separately, but there are a few studies that pay their attention for studying these factors together in general, and in emerging market such as Jordan particularly. Using fixed effect panel data model, we examine the relationship between stock market returns and the efficiency change over time, as these models written down in two terms (time t and time t-1) to capture the time delaying of the financial reports declaration.

Model 1

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t} + \beta_2 LTA_{i,t} + \beta_3 TFP_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t-1} + \beta_2 LTA_{i,t-1} + \beta_3 TFP_{i,t-1} + \varepsilon_{i,t} \quad (5.1)$$

Model 2

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t} + \beta_2 LTA_{i,t} + \beta_3 TEC_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t-1} + \beta_2 LTA_{i,t-1} + \beta_3 TEC_{i,t-1} + \varepsilon_{i,t} \quad (6.1)$$

Model 3

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t} + \beta_2 LTA_{i,t} + \beta_3 TC_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$LR_{i,t} = \alpha_i + \beta_1 BTM_{i,t-1} + \beta_2 LTA_{i,t-1} + \beta_3 TC_{i,t-1} + \varepsilon_{i,t} \quad (7.1)$$

Table 3 outlines the main results of the estimation of these models, where we can see that all the models are fit and statistically significant, taking into account the values of F-Statistics and P-Values, which appear statistically significant at 5% level for time t and at 1% for the time t-1 to the three models with value of Durbin-Watson statistic very close to 2. While by considering the estimated value of each explanatory variables, the result is more interesting, when we can see that for the book to market ratio (BTM) the estimated coefficient is statistically significant at 1% level for all the models with negative sign for the time t and positive sign in the time t-1, which means that the stock market returns fully reflect the investment attractiveness of the banks' shareholders, specially at time t-1 where the stock prices fully capture the effect of the BTM ratio.

At the same time as the BTM ratio, the LTA (The natural logarithm of the total assets) has a significant positive relationship with LR at 1% and 5% level for time t and time t-1, respectively for all models, which indicates to the importance of the size effect of each bank.

Table 3. The Panel Data Estimation of Models 1, 2 and 3

		Model 1		Model 2		Model 3	
		t	t-1	t	t-1	t	t-1
BTM	Estimated Coefficients	-25.29	42.01	-24.97	41.65	-25.33	41.13
	T-statistic	-3.31	7.74	-3.23	7.25	-3.32	7.64
	P-Value	0.002*	0.000*	0.002*	0.000*	0.002*	0.000*
LTA	Estimated Coefficients	33.57	19.22	33.28	19.97	33.59	19.90
	T-statistic	3.69	2.48	3.64	2.46	3.69	2.60
	P-Value	0.001*	0.020**	0.001*	0.018**	0.001*	0.012**
TFP	Estimated Coefficients	0.34	3.56				
	T-statistic	0.19	2.18				
	P-Value	0.852	0.034**				
TEC	Estimated Coefficients			3.24	-9.02		
	T-statistic			0.29	-1.15		
	P-Value			0.774	0.255		
TC	Estimated Coefficients					0.27	4.02
	T-statistic					0.15	2.50
	P-Value					0.881	0.016**
	R-squared	34.50%	67.78%	34.55%	65.40%	34.48%	68.72%
	Adjusted R-squared	18.40%	57.75%	18.47%	54.62%	18.38%	58.99%
	F-statistic	2.14	6.76	2.15	6.07	2.14	7.06
	P-Value	0.022**	0.000*	0.022**	0.000*	0.022**	0.000*
	Durbin-Watson stat	2.04	1.85	2.06	1.82	2.04	1.87

Note: * and ** indicate statistically significance at 1% and 5% level, respectively.

Now considering the efficiency change variables, that we try to find its relationship with the explained variable (LR), we find that for the model 1, with taking in account the total factor productivity (TFP), there is a positive relation with LR, but the estimated coefficient is significant only at time t-1 at 5% level, which means that the LR reflects the effect of the efficiency change. In addition to model 1, we can conclude a same result for the model 3, where we take the technological change TC into account, which means the TC plays an important role to explain the changes of the stock prices. While the TEC has a different sign for time t and time t-1, but their coefficient is statistically insignificant.

Finally, considering the values of R^2 and adjusted-R^2, there are a considerable incremental increase in both of them, when the first lag is taken into account for each model, which support our hypothesis for the timing of the declaration of the financial reports.

5. The Conclusions

This paper analyses the relationship between stock market returns and efficiency change in the banking system, which is widely ignored in the banking literature. To do this, firstly we measure the efficiency change over time by employing Malmquist Index using DEA technique, then link the result obtained by it with the stock market returns LR, while controlling for BTM ratio and LTA, using fixed effect panel data model. In first part of our analysis of the Jordanian banking system for the period of 2009 to 2015, we found that the TFP and TC are highly correlated with a variation around a unity during the period of the study, with an overall average more than one for the most years of the study, which refers to a productivity growth over time. Whereas, the average of the TEC is very close to a unity, which means that there is no technical efficiency change for the Jordanian banks. Since we combine our sample by two types of banks (Conventional and Islamic banks), we test the mean differences between them, but we did not find any statistical significance differences between these types in our sample.

Finally, the results of the panel data models show that the total factor productivity (efficiency change over time) and the technological changes best explain the changes in stock prices, while controlling for book to market ratio and the size of the banks, since there is a statistically significant positive relationship between them for each model at first lag, which pay our attention for the timing of the declaration of the financial reports.

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Some Basic Terminology:

Total factor productivity change (TFP): The Malmquist index measures the TFP change between two data points by calculating the ratio of the distances of each data point relative to a common technology.

Technological change (TC): is the shift of the efficient frontier between t and t+1. This is obtained as geometric mean of the shift of the frontier between two consecutive periods and, consequently, reflects improvement or deterioration in the performance of best-practice DMUs.

Technical efficiency change (TEC): measures the change in the overall technical efficiency between two consecutive periods assuming a constant technology (namely, that the efficient frontier did not change over the two periods) and, consequently, reflects the convergence towards or divergence from the best practice on part of the remaining DMUs.

Data Envelopment Analysis (DEA): is a linear programming methodology which uses data on the input and output quantities of a group of firms to construct a piece-wise linear surface over the data points.