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Accounting Rate of Return and Prediction of Cash Flow per Share (At Aggregate Level of Data)

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ABSTRACT

In the present paper, accounting rate of return (ARR) and its effect on estimating cash flow per ordinary share (CFPS) is examined. The main purpose of the research is to determine the relationship between ARR and CFPS movements.

In order to test the hypothesis of the research, Butler, Holland and Tippett(1994) model was used. Also ordinary least squares regression(OLS) method to a sample of 42 firms in Tehran Stock Exchange (TSE) for the period from 1994 to 2009 based on time series and cross-sectional data at aggregate level was used. The results of examining time series and cross-sectional for ARR and CFPS movements, indicate that ARR follows a mean-reverting process at aggregate level, and there is a significant relationship between ARR and CFPS movements. The relationship is reversed.

KEYWORDS: Accounting rate of return, Cash flows per ordinary share, Time series, Cross-sectional, Mean-reverting process

1. INTRODUCTION

Cash flow is a vital and important resource in a business unit. Making a balance between present cash flow and cash needs is a very important factor of economic health in a business unit and continuous activity of the unit. In most of the financial decision makings, evaluation models of securities, evaluation methods of capital plans and some of the traditional and modern analysis in financial management of cash flow have pivotal role. So, from internal view, ability of forecasting future activity's results, especially cash flow, makes it possible to administer the affairs in the most efficient manner and results in making optimal operational decisions, investing and financing. In other hand, most of the external users' decisions are based on future cash flow information. Investors are interested in stock of business enterprises which have abundant cash flow and avoid investing in business enterprises which lack cash flow. Also, Lenders and creditors care about cash flow of business enterprises. Cash flow input and output and business unit accessibility to it, is a base for most decision makings and major groups of financial information users judge according to that [1].

The importance of forecasting cash flow in theoretical framework of financial reporting is confirmed. In the Statement of Financial Accounting Concepts No. 1,FASB is stated:" Financial reporting should provide information to help present and potential investors and creditors and other users in assessing the amounts, timing, and uncertainty of prospective cash receipts from dividends or interest and the proceeds from the sale, redemption, or maturity of securities or loans. The prospects for those cash receipts are affected by an enterprise's ability to generate enough cash to meet its obligations when due and its other cash operating needs, to reinvest in operations, and to pay cash dividends and may also be affected by perceptions of investors and creditors generally about that ability, which affect market prices of the enterprise's securities" [2].

The aim of the present paper is investigating time series and cross-sectional dynamics of accounting rate of return and also prediction of cash flow per ordinary share using aggregated data level.

2. LITERATURE SURVEY

Research into relationships between accruals, earnings, stock prices and dividends has pawned a considerable literature. Beaver, for example, stated that ‘the prediction of earnings are part of a larger analytical process in which the ultimate concern is the prediction and valuation of the dividend stream. Earnings are an important informational source about future dividend-paying ability’. Therefore, we briefly discuss whether relationships coexist between profitability and cash flow, which may shed light on share price, future dividend streams and firm valuation. In this light, the related financial variables (ARR and CFPS) are discussed and tested, and several inferences are drawn [3].

Previous research has usually employed models using adjusted historical cost information as a basis on which to predict future accrual earnings and balance sheet changes. Results obtained from applying such techniques when using past, individual, decile and aggregated data generally indicate that earnings changes are

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unpredictable and follow a random walk with drift parameter. Previous analysis was largely motivated by concerns about whether time series earnings can be characterized as a pure random walk, a random walk with drift pattern or some other process, and whether time series profit portrays moving average or indeed mean-reverting properties, thereby implying a normal or long-term earnings expectation [3].

Dechow et al. (1998) employed firm-specific time-series regressions of future operating cash flows on current cash flows and aggregate earnings during the 1963–1992 test period. Since most of their data occurred prior to the inception of SFAS No. 95, they employed an algorithm to construct a proxy for the annual CFO series. They model the accrual process and formulated regression models that capture the role of accruals in predicting future CFO. They found that aggregate earnings were consistently useful in forecasting future cash flows beyond the information contained in cash flows. Dechow et al. (1998), however, did not compare the predictive performance of their time-series regression models with cross-sectionally estimated models [4].

Barth, Cram, and Nelson (2001) extended the Dechow et al. (1998) framework by disaggregating earnings into cash flows and six major accrual components (e.g., change in accounts receivable, change in accounts payable, change in inventory, depreciation, amortization, and other accruals). They estimated cross-sectional regressions of future operating cash flows on the current values of the earnings components over the 1987–1996 period finding that prediction models that employ disaggregated earnings provide superior descriptive fit (e.g., adjusted R2) compared to models that employ aggregate earnings or current cash flows. Unlike Dechow et al. (1998), Barth et al. used annual CFO data reported under SFAS No. 95 and estimated their models cross-sectionally [5].

Kim and Kross (2005) adopted the regression models of Dechow et al. and the cross-sectional approach of Barth et al. to examine the predictive power of CFO models over a 28-year period. In addition to using descriptive goodness-of-fit criteria similar to Barth et al. (e.g., adjusted R2), they also assessed predictive performance using an “out-of-sample” holdout period. Their primary finding pertaining to predictive performance was that “out-of-sample” predictions of CFO were generally increasing in forecasted accuracy across time. Kim and Kross, however, did not estimate the cash-flow prediction models on a time-series basis like Dechow et al. or disaggregate earnings into its components like Barth et al [6].

Cheng and Hollie (2008), and Yoder (2007) examined annual CFO prediction models. Cheng and Hollie extended Barth et al.'s annual CFO prediction model by decomposing CFO into its core and non-core subcomponents. They find that these subcomponents are differentially useful in predicting future CFO values. Yoder (2007) extended the Barth et al. annual CFO prediction model by including cash-flow implications of growth in future sales [7, 8].

Gary and Iqbal (2009) investigate the time series and cross-sectional behaviour of the Accounting Rate of Return (ARR) and test whether ARR is a good predictor of the Cash Flow Per Share (CFPS). Time series results indicate that ARR follows a mean-reverting process at individual and aggregate levels, and that it is a poor predictor of CFPS. Cross-sectional results for ARR and CFPS suggest random processes without substantial drift patterns [3].

Lorek and Willinger (2010) refine the analysis of annual cash-flow prediction models originally developed and tested by Dechow et al. (1998), Barth et al. (2001) and Kim and Kross (2005) using cash flow from operations data reported in accordance with FASB Standard No. 95 for a constant sample of 1111 firms. They estimated annual cash-flow prediction models both cross-sectionally and on a time-series basis to assess whether restricting firm specific parameter estimation in the cross-sectional approach adversely affects predictive performance. They provide new evidence that significantly greater enhancement to predictive performance is obtained when cash-flow prediction models are estimated on a time-series basis versus cross-sectionally. They find that the relative accuracy of cash-flow predictions is unaffected by whether the aforementioned prediction models employ cash flows or net earnings as independent variables. Finally, They also provide evidence that the predictive ability of cash flows is highly sensitive to firm size. That is, relatively larger firms provide significantly more accurate cash-flow predictions than those of smaller firms across cash-flow prediction models [9].

3. HYPOTHESIS

1- Hypothesis

In essence, the emerging literature on capital market allocation, which has employed periodic (as opposed to permanent) earnings and balance sheet figures (absolute values) as predictive variables to forecast profit changes, is less comprehensive than the literature using ratio instruments such as ARR and CFPS, because these latter constructs control for corporate size [3].

So the relationship between profitability and cash flows was examined as according hypothesis.

H_1: There is a significance relation between accounting rate of return and cash flow per ordinary share movements.

Variables:

1-Indipendent variable: accounting rate of return, which is calculated as follow:

$$ARR=\frac{\text{net profit}}{\text{average shareholders' equity}}$$

2-Depended variable: cash flow per ordinary share movements, which is calculated as follow:

$\Delta CFPS_t = CFPS_{t+1} - CFPS_t$

CFPS is calculated as follow:

$$CFPS=\frac{\text{net profit + amortization + depreciation}}{\text{number of outstanding ordinary shares}}$$

Statistical population and sample:

Statistical population of the research is the companies admitted in Tehran Stock Exchange (TSE) from 1994 to 2009 for 16 years, which were active in this period.

The statistical population is restricted to following conditions:

1. The sample shouldn't be of financing, investment and insurance company.
2. Sample companies should have fiscal year ending to calendar year (29th Esfand).
3. Data of the research variable should be available for the mentioned companies.
4. In the research period there is no change in fiscal year.

Considering conditions which mentioned above finally 42 companies were elected.

4. RESEARCH METHODOLOGY

The research methodology is inductive, in which past data and econometric tests based on time series first differences and cross-sectionals are used. In order to test research hypothesis, Butler, Holland and Tippett (1994) model and also ordinary least squares regressions(OLS) method was used.

In the research two methods of OLS are applied. The first method is applied for evaluating ARR (model 1) and the second one is applied to test whether ARR is a good predictor of CFPS (model 2). Both models are applied on time series and cross-sectional bases for individual stocks and aggregated data.

Accounting Rate of Return

(1) $\Delta ARR_t = \alpha+\beta ARR_t+\varepsilon_t$

Where: $\Delta ARR_t = ARR_t + 1 - ARR_t$ is the change in ARR over the years of available information (derived from corporate annual reports); α (the drift term) and β (the slope coefficient) are the linear parameters to be estimated; ε_t is the stochastic error term; and $Cov(ARR_t, \varepsilon_t) = 0$. ;$\alpha + \beta ARR_t$ is deterministic, while εt is the stochastic component of equation (1). Butler et al. observed that for ARR to be generated by a pure random walk process, β would have to be zero, while α measures drift per unit of time. Butler et al. also showed that if ARR is generated by a mean-reverting process, β will have to be negative, and $-\alpha/\beta$ is the long-term average or normal ARR. They further stated that $1/\beta$ can be characterized as a measure of the speed with which ARR is pulled back to its long-term mean [3].

Cash Flow Per Share

(2) $\Delta CFPS_t = \alpha + \beta ARR_t + \varepsilon_t$

Where: $\Delta CFPS_t = CFPS_{t+1} - CFPS_t$ is the change in CFPS over the years of available information; α (the drift term) and β (the slope coefficient) are the linear parameters estimated; ε_t is the stochastic error term at time t; and $Cov(ARR_t, \varepsilon_t) = 0$; $\alpha + \beta ARR_t$ is deterministic, while εt is the stochastic component of equation (2).

5. HYPOTHESIS TEST AND EMPIRICAL RESULTS

Descriptive statistics of research variables:

Descriptive statistics of research variables is shown in table 1. Notice that since some of data is abnormal, Box-Cox transformation was applied to normalize it.

Table 1: Descriptive statistics of research variables after normalizing

Variables	Max	Min	Mean	Standard Deviation
ARR	8.455	-2.300	0.802	0.840
ΔARR	2.541	0.007	1.235	0.374
ΔCFPS	8,235.8	647.6	4,153.2	998.1

Hypothesis Test process

Research Hypothesis test should be applied based on times series and cross-sectional methods. The following are different modes of the test :

A) A Test based on times series: A-1) On model 1 A-2) On model 2

B) A Test based on cross-sectional: B-1) On model 1 B-2) On model 2

A-1) A Test based on times series on model 1

Time series analysis result for ARR, employing model 1 at aggregated level, are presented in table 2.

(1) $\Delta ARR_t = \alpha + \beta ARR_t + \varepsilon_t$

Table 2: Accounting Rate of Return: Time Series Analysis

α	t(α)	β	t(β)	β sig	- α/β	R^2	K-S sig	D-W	Breusch -Pagan
0.364	[B] 10.906	-0.558	[B]-18.042	< 0.001	0.626	0.373	[B] 0.945	1.788	[A] 6.575

[A] significant at the 1% level.
[B] significant at the 5% level.

As we see estimated parameters for α , β, R^2, probability of β, probability of Kolmogorov-Smironov(K-S)statistic, also t, Durbin-Watson and Breusch-Pagan statistics for the first model are reported.

According to t-statistics value and related probability value in table 2, probability value is less than 0.001, so the fitted model is significant at 5% level to test the hypothesis.

Requirement of regression model:

K-S probability statistic value is 0.945 that is greater than 0.05. So normality of residual is confirmed at confidence level of 95%.

Durbin-Watson statistic, according to the estimated results is 1.788. If the value placed between 1.5 and 2.5, we can accept the non-existence of autocorrelation between model's errors. So the independence of errors in estimated regression model is confirmed.

Breusch-Pagan statistic value is 6.575 that significant at 1% level. So there isn't heteroscedasticity in model's errors.

As for the confirmation of the above, we can ensure the results of the fitted model.

Determination coefficient value is 0.373 i.e. 37 percent of dependant variable (ΔARR) can be described by independent variable (ARR). Independent variable coefficient value in estimated model is -0.558, and it means that each unit increase in independent variable (ARR) leads to 0.558 unit decrease in the dependent variable.

So the results of survey time series for ARR indicate that estimated model follows a mean-reverting process at aggregate level (β<0), also - α/β value, that indicate the long-term average or normal ARR is 0.626.

A-1) A Test based on times series on model 2.

Time series analysis result for CFPS, employing model 2 at aggregated level, are presented in table 3.

(2) $\Delta CFPS_t = \alpha + \beta ARR_t + \varepsilon_t$

Table 3: Cash Flow Per Ordinary Share: Time Series Analysis

α	t(α)	β	t(β)	β sig	R^2	K-S sig	D-W	Breusch -Pagan
162.580	1.316	-388.976	[B] -3.427	< 0.001	0.043	[B] 0.173	1.702	[A] 6.416

[A] significant at the 1% level.
[B] significant at the 5% level.

According to t-statistics value and related probability value in table 3, probability value is less than 0.001, so the fitted model is significant to test the hypothesis.

Requirements of regression model:

K-S probability statistic value is 0.173. So normality of residual is confirmed at confidence level of 95%.

Durbin-Watson statistic value is 1.702. So the independence of errors in estimated regression model is confirmed.

Breusch-Pagan statistic value is 6.416 that is significant at 1% level. So there isn't heteroscedasticity in model's errors.

Expressing the hypothesis statistically:

H_0: There isn't a significance relation between accounting rate of return and cash flow per ordinary share movements.

H_1: There is a significance relation between accounting rate of return and cash flow per ordinary share movements.

The probability of null hypothesis ($H_0 : \beta = 0$) is less than 0.001, that smaller than 0.05, so this hypothesis is rejected at confidence level of 95%. Thus there is a significant relationship between two variables and the research hypothesis is accepted by this method.

Determination coefficient value is 0.043 ,i.e., about 5 percent of dependant variable (ΔCFPS) can be described by independent variable (ARR). Independent variable coefficient value in estimated model is -388.976, and it means that each unit increase in independent variable (ARR) lead to about 389 unit decrease in the dependent variable.

B-1) A Test based on cross-sectional on model 1

Cross-sectional analysis results for ARR, employing model 1 at aggregated level, are presented in table 4.

(1) $\Delta ARR_t = \alpha+\beta ARR_t+\varepsilon_t$

Table 4: Accounting Rate of Return: Cross-Sectional Analysis

α	t(α)	β	t(β)	β sig	- α/β	R^2	K-S sig	D-W	Breusch -Pagan
0.329	[B] 10.090	-0.517	[B]-17.480	< 0.001	0.637	0.343	[B] 0.174	1.914	[B] 0.083

[A] significant at the 1% level.
[B] significant at the 5% level.

According to t-statistics value and related probability value in table 4, probability value is less than 0.001, so the fitted model is significant to test the hypothesis.

Requirement of regression model:

K-S probability statistic value is 0.174. So normality of residual is confirmed at confidence level of 95%.

Durbin-Watson statistic value is 1.914. So the independence of errors in estimated regression model is confirmed.

Breusch-Pagan statistic value is 0.083 that significant at 5% level. So there isn't heteroscedasticity in model's errors.

Determination coefficient value is 0.343 i.e. 35 percent of dependant variable (ΔARR) can be described by independent variable (ARR). Independent variable coefficient value in estimated model is -0.517, and it means that each unit increase in independent variable (ARR) lead to 0.517 unit decrease in the dependent variable.

So the results of survey cross-sectional for ARR indicate that estimated model follows a mean-reverting process at aggregate level ($\beta<0$), also - α/β value, that indicator the long-term average or normal ARR is 0.637.

B-1) A Test based on cross-sectional on model 2

Cross-sectional analysis result for CFPS, employing model 2 at aggregated level, are presented in table 5.

(2) $\Delta CFPS_t = \alpha+\beta ARR_t+\varepsilon_t$

Table 5: Cash Flow Per Ordinary Share: Cross-Sectional Analysis

α	t(α)	β	t(β)	β sig	R^2	K-S sig	D-W	Breusch -Pagan
118.980	1.014	-327.154	[B] -3.077	0.002	0.042	[B] 0.628	1.789	[A] 5.556

[A] significant at the 1% level.
[B] significant at the 5% level.

According to t-statistics value and related probability value in table 5, probability value is 0.002, so the fitted model is significant to test the hypothesis.

Requirements of regression model:

K-S probability statistic value is 0.628, that is greater than 0.05. So normality of residual is confirmed at confidence level of 95%.

Durbin-Watson statistic value is 1.789. So the independence of errors in estimated regression model is confirmed.

Breusch-Pagan statistic value is 5.556 that significant at 1% level. So there isn't heteroscedasticity in model's errors.

The probability value of null hypothesis ($H_0 : \beta = 0$) is 0.002, that smaller than 0.05, so this hypothesis is rejected at confidence level of 95%. Thus there is a significant relationship between two variables and the research hypothesis is accepted by this method too.

R^2 is 0.042 which means that 5% of CFPS movements can be described by ARR. Independent variable coefficient value in estimated model is -327.154, and it means that each unit increase in ARR lead to about 327 unit decrease in the CFPS movements.

6- Conclusion

The rationale for inclusion of CFPS in the present paper is that a company's ability to transact its ordinary business and take advantage of other investment opportunities is largely dependent upon having sufficient cash flow relative to equity investment, given an optimal capital structure. The ability to conduct ordinary business operations and take advantage of other investment opportunities is reflected in the results of corporate performance evaluation. An empirical analysis of changes in CFPS is hypothesized to directly affect company performance and contribute to the predictive information set available to facilitate forecasting profitability and cash flow changes.

This research investigates relationship between ARR and CFPS first differences for both time series and cross-sectional among corporations, utilizing the straightforward OLS statistical method.

The distinguishing feature of this paper is that it introduces tests and discusses the predictability of CFPS. The ARR time series results were characterized by mean reversion, a stationary and predictive process, thereby confirming to ARR findings of Butler et al. (1994), Freeman et al. (1982) and Gary & Iqbal (2009).

The overall results of this research show that ARR is a good predictor of CFPS movements in the time series an cross-sectional models, so sub-optimal policy and resource allocation outcomes can therefore emerge if ARR is used as a substitute for CFPS movements. But the findings of Gary & Iqbal (2009) show that ARR is largely a poor predictor of CFPS movements in time series models, also cross-sectional results of their research for ARR and CFPS suggest random processes without substantial drift patterns.

Also Lorek and Willinger (2010) in the other research entitled “Time series versus cross-sectionally derived predictions of future cash flows” find that the relative accuracy of cash-flow predictions is unaffected by whether the aforementioned prediction models employ cash flows or net earnings as independent variables. Finally, they also provide evidence that the predictive ability of cash flows is highly sensitive to firm size. That is, relatively larger firms provide significantly more accurate cash-flow predictions than those of smaller firms across cash-flow prediction models.

Some suggestions for future research:

1- Using the methodology of this research to predict other items of interest to users of financial statements, such as stock prices, stock returns, risk and ... .

2-Investigating the time series behavior of CFPS and determining whether past CFPS information is useful for predicting future CFPS changes.

3- Analyzing internal rate of return (IRR) of companies and its usage in forecasting CFPS.

4- Predicting cash flow with considering firm size factor and considering its impact on prediction.

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