AN INVESTIGATION OF EVA DISTORTION BY INFLATION

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Abstract
This study investigates the EVA distortion by inflation. It is argued that the Economic Value Added (EVA) can represent a reliable measure of firm performance. However, inflation distorts EVA and potentially results in inefficient investment and compensation outcomes. In this study, we investigate the relative ability of the adjusted EVA and nominal EVA to summarize firm performance as reflected in stock returns, stock prices, and operating cash flows. Following Warr (2005) using an inflation-corrected EVA metric, we measure the sensitivity of EVA to the inflation for a sample of companies listed in Tehran Stock Exchange operating in an economic environment with a high two-digit rate of inflation. The results do not show that adjusted EVA is superior to nominal EVA for firm performance evaluation on the basis of stock price. Except for Cement, Metals and Metal products, and Pharmaceutical and Chemical industrial groups we found no evidence that adjusted EVA is superior to nominal EVA for firm performance evaluation on the basis of stock price. Also, except for Metals and Metal products industrial group level, the results do not show that adjusted EVA is superior to nominal EVA for evaluating of firm performance on the basis of operating cash flows. Collectively, our results are ambiguous and do not provide strong evidence that show superiority of the adjusted EVA to the nominal EVA for evaluating of firm performance.

Keywords: Economic value added (EVA); Inflation; Inflation distortion; Performance evaluation.

JEL Classification Codes: P34; L1.

1. Introduction
FASB Statement of Financial Accounting Concepts No.1 (as amended), (FASB, 1978) “The Objectives of Financial Reporting by Business Enterprises”, states that the objective of financial reporting is providing information useful in making investment and credit decisions. The financial reporting should provide information to help present and potential investors and creditors and others to assess the amounts, timing, and uncertainty of the entity’s future cash inflows and outflows (the entity’s future cash flows). Therefore, accounting information users need the accurate and relevant information for economic decisions making, the optimal resources allocations and firm performance evaluation. For the years, conventional accounting system has provided the information and this information has an important role in the economic decisions making by financial market participants. At the other hand, with expanding the economic entities and increasing growth of business markets, the volume of information produced by accounting systems substantially increased and those of financial information users are unable to analyse this enhanced volume of financial information. Therefore, they anchor to some of the more important items of financial statements, as earnings per share. Also, managers are affected by personal motives and pressures from competitive environment and then, may issue misstatement financial reports. They through adapting the special accounting methods present the company net income illusive, and persuade investors to invest in the company based on the illusory net income (Izadinia, 2005). As well, financial ratios and criteria resulted from the accounting items are affected by adapted accounting methods therefore do not communicate accurate and relevant information to investors. Then, a metric is required to measure the true value of the company, and minimize the effects of accrual accounting and accounting techniques.

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Economic value added is one of the new criteria that investors use for evaluating firm performance and management compensation. Economic value added considers the cost of invested capital and deduct the cost of capital from company’s profit. The result will be the wealth that company provided for the stockholders in the financial period (Izadinia, 2005). In the current economic circumstances of Iran that the process of growth is slow and the capital resources are small, optimal management and use of financial resources is important. Since, economic value added is calculated with emphasis on the cost of invested capital can direct attention the managers and investors to this critical issue and cause them to reduce the cost of capital (Ghanbari, 2003).

Considering the issue that the economic value added is calculated using information produced from conventional historical cost accounts, inflation can distort information content and applications of the performance measurement criteria. Inflation can distort economic value added through three factors, i.e., the operating profit, the cost of capital, and capital base and these distortions potentially result in inefficient investment and compensation outcomes (Warr, 2005). Where as in Iran there is a high level of inflation, a two digit rate, it seems that the ability of the EVA for forecasting and performance evaluating has decreased. Therefore, it is necessary to adjust the nominal EVA for the effects of inflation to improve this measure for forecasting and performance evaluation. The adjusted EVA can improve performance evaluation of firm and management and results in improvement in determining the management compensation on the basis of accurate evaluation of performance.

The purpose of the paper is examining the effects of inflation on the EVA as a measure of performance evaluation, and providing an adjusted measure that we call the adjusted EVA. For this examining, we develop three Hypotheses and for testing each of them two competing regression models estimated. The results indicate that except to some industrial group level the adjusted EVA is not superior to the nominal EVA for evaluating firm performance as reflected in stock return, stock price, and operating cash flows.

The rest of this paper is organized as follows. Section 2 summarizes the literature on the issues surrounding the economic value added. Section 3 and 4 describes the research hypotheses and variables. Section 5 explains the research sample and methodology. Section 6 reports the major results of testing the hypotheses. Section 7 is about the summary, concluding remarks, and future research suggestions.

2. Literature Review
The EVA is not a new concept. This concept at the late 18th century developed by economists for the computation of companies net profits. In the 20th century, the EVA took an operational form and called residual income. Solomon (1965) suggested the residual income as an internal measure of evaluating firm performance and Anthony (1973) suggested that as an external measure. Modigliani and Miller in the papers that have published in years 1958-1962, stated that the economic profit is the source of wealth creation (Stern & Shiely, 2001). At the early 1990’, the Stern Stewart Institute developed an evaluation model based on the EVA and indicated its complexities. Stewart (1991) claims that the EVA explains changes in the stockholders’ wealth approximately 50% better than other accounting based measures (Biddle, Bowen, & Wallace, 1997). Stewart (1991) in his Book about EVA, "The Quest for Value", argues that as long as inflation is less than 10%, it is not required to managers make inflation adjustments. He in the argument assumes that when EVA is used as a performance measure, changes in the EVA should be considered, and the absolute level of the EVA, which may be distorted by inflation, is of no concern (Warr, 2005).

Biddle et al. (1997) compared information content of the EVA, operating cash flows, and Earnings. They found that the EVA is not superior to the net income for explaining stock returns. De Villiers (1997) examines the effects of inflation on the EVA in a modelling framework. He suggested that a major disadvantage of the EVA is that it is based on accounting profits, that a discrepancy exists between accounting profit and ‘true’ profit, and that this disaggregation is exacerbated by inflation. De Villiers (1997) argues that under conditions of inflation the EVA cannot be used to estimate actual productivity, and an “adjusted EVA procedure” is required. The adjusted EVA is calculated by firstly restating the capital base in current values, then determining the asset structure of the firm, and finally calculating the required accounting return. The final step is to multiply the required accounting return by the current value of capital, and subtracting this figure from net operating profit after tax (NOPAT).
De Villiers (1997) also suggested that the adjusted EVA has applications outside of orthodox performance analysis, especially as an alternative to inflation accounting and when estimating profitability under inflation (Worthington & West, 2001). Warr (2005) investigates inflation distortions to EVA. Using an inflation-corrected EVA metric, he measures the sensitivity of the EVA to the level of, and changes in, inflation for a large sample of US stocks. His results indicate that in a 28 years period (1975-2002), nominal EVA has significantly distorted by inflation however, during this time period, inflation ranged from 1.13 to 9.7%. He then analyze that the second half of his sample from 1990 onwards during which inflation ranged from 1.13 to 4.15% and finds that very similar results to the full sample, that indicates even in the low inflation environment of the 1990s the impact of inflation on the EVA remains significant. For the firms that rely on EVA as a measure of operation performance, failure to correct EVA for distorting effects of inflation will result in the misallocation of capital and inconsistent managerial compensation and therefore an understanding of the impact of inflation on EVA is essential.

Jalili (2002) examines the ability of EVA in comparison to operating income for providing relevant information for predicting stock returns. He finds that operating income has information content and explains the stock returns changes and in comparison the EVA has no explanation power for stock returns changes. Rezaee (2001) studies the relationship between EVA and return on stockholders’ equity for evaluating the performance of companies. His results indicate no significant relationship between EVA and return on stockholders’ equity. Anvari Rostami (2005) examines comparatively the relationship between three measures of EVA, profit before interest and tax, and operating cash flows and market values of companies listed in Tehran Stock Exchange. Their results show that the relationship between profit before interest and tax and market values is more significant than the relationship of EVA and market values. At the other hand, the relationship between EVA in comparison to operating cash flows with market values is more significant. Dastgir and Izadinia (2004) investigate the relationships between internal and external measures of wealth creation for firm performance evaluations. The research results indicate that there are significant relationships between EVA and market value and market value added measures.

Previous empirical research provides contradictory and inconclusive evidence on the relationship of EVA and firm performance in different studies and countries. At the other hand, De Villiers (1997) and Warr (2005) claim that adjusted EVA in comparison to nominal EVA is superior for firm performance evaluation. Thus, present study following De Villiers and Warr using an inflation-corrected EVA metric, measures the sensitivity of EVA to the inflation for the sample of companies listed in Tehran Stock Exchange operating in an economic environment with a high two-digit rate of inflation. The paper since relates to an emerging market, contributes to the literature of the EVA at international level and may shed more lights on the issue.

3. Hypotheses
In this research, we investigate the superiority of adjusted EVA to nominal EVA for the firm performance evaluation. For the investigation we develop three hypotheses as follow:

H1: The association between stock return and adjusted EVA is stronger than that of nominal EVA.
H2: The association between stock market value and adjusted EVA is stronger than that of nominal EVA.
H3: The association between operating cash flows and adjusted EVA is stronger than that of nominal EVA.

4. Research Variables
In this study, we take the performance as reflected in stock return, stock price, and operating cash flows. These three variables are dependent variables, and adjusted EVA and nominal EVA are independent variables. The computations of the adjusted and nominal EVA are as follows:

The Nominal Economic Value Added (nominal EVA)
The basic formula for the computation of nominal EVA is as follows:

\[ EVA_{nom,t} = NOPAT_{nom,t} - WACC_{nom,t} \times Capital_{t-1} \]
Where $EVA_{nom}$ is the nominal Economic Value Added, $NOPAT_{nom,t}$ the net operating profit after taxes, $WACC_{nom}$, the weighted average cost of capital, $Capital_{t-1}$ the invested capital by the company in the year t-1.

The Net Operating profit After Tax ($NOPAT_{nom,t}$)

$NOPAT_{nom,t} = (EBIT_t + adjustments_t)(1 - T)$. 

Where $EBIT_t$ is the earnings before interest and tax, $T$ the tax rate of company, $adjustments_t$, the adjustments related to increases in capital equivalents.

The Invested Capital ($Capital_{t-1}$)

In this study for the calculation of invested capital we use the financial approach as follows:

$Capital = Stockholders' Equity + Long Term and Short Term Debts Subjected to Interest + Capital Equivalents$

The capital equivalents are those costs that exist in the company but are not presented at the balance sheet, or are those incomes that are not presented on the income statement. In this paper, capital equivalents are: marketing and advertisement costs, employee education costs, allowances for doubtful accounts, reserves for employee retirements, inventory impairment reserve, investments impairment reserve, and accrued expenses reserve. For the calculations of profit and economic capital that are in confirmation with Stewart (1991), the ending balance of each item is added to invested capital, and their changes in the periods are added to the net operating profit after tax.

The Weighted Average Cost of Capital ($WACC_{nom,t}$)

$WACC = \left[ W_d \times K_d (1 - T) \right] + \left[ W_e \times K_e \right]$

Where $W_d$ is the weight of debt capital, $K_d$ the nominal required return on debt, $W_e$ the weight of equity capital, $K_e$ the nominal required return on equity. We use Capital Assets Pricing Model (CAPM) for estimation of equity financing costs. In the model, the rate of government bonds is used for risk free rate. For the calculation of required rate of capital market, historical data of Iranian stock market index is used. For calculating annual beta of each company we use market portfolio rate of return and company stock rate of return for a five years period that are divided to three months periods, i.e., for calculating each firm beta a 20 period of the three months is used.

The Adjusted Economic Value Added (adjusted EVA)

In this paper, the same as Warr (2005), we incorporate the depreciation adjustment, the debt adjustment, an adjusted cost of capital and the replacement book values for the inflation adjusted EVA measure (adjusted EVA):

$EVA_{adj,t} = \frac{NOPAT_t}{1 + P_{t-1}} + pD_{t-1} - DA_t - wacc_{adj,t} \times RC_{t-1}$

Where $NOPAT_t$ is the net operating income after tax adjusted for inflation, $P_t$ the inflation rate measured by the change in the GDP deflator, $wacc_{adj,t}$, the weighted average cost of capital adjusted by inflation index, $pD_{t-1}$ the gain from the depreciation of debt, $DA_t$ the depreciation adjustment to correct for historically based depreciation expense, $RC_{t-1}$ the capital base adjusted for replacement costs.
The Adjusted Weighted Average Cost of Capital (\(WACC_{ADJ,t}\))

The adjusted weighted average cost of capital is computed as follows:

\[
WACC_{ADJ,t} = \frac{WACC_{nom,t}}{1 + P_t}
\]

Where \(WACC_{nom,t}\) is the nominal weighted average cost of capital and \(P_t\) is the inflation rate measured by the change in the GDP deflator.

The Decline in the Value of Nominal Debt Caused by Inflation

For determining the effects of inflation on company debt and adjusting economic value added for these effects, we following French, Ruback, and Schwert (1983), Modigliani and Cohn (1979), and Ritter & Warr (2002), use the net debt (NETDEBT) of the firm. We compute NETDEBT as the sum of nominal liabilities less the sum of nominal assets. Modigliani and Cohn (1979) and Ritter & Warr (2002) show the correction to net income to be fairly simple. The depreciation of nominal debt is \(p_t \times NETDEBT_{t-1}\), where \(p\) is the inflation rate for the year and \(NETDEBT\) is the nominal debt of the firm less nominal assets (Warr, 2005). The nominal assets are those that have fixed values and their value decrease by inflation. In this research, nominal assets are cash, short term investments, and account receivables. Nominal debts are those that liquidate in fixed amounts of money and generally include all of the firm debts.

The Depreciation Expense Adjustments

A key assumption of EVA is that accounting depreciation is equal to economic depletion of assets. This cost is captured within NOPAT, but a significant wedge between accounting and economic depreciation can occur following a long run period of inflation, resulting in the replacement cost of the asset far exceeding the historic purchase price. Therefore, the difference between accounting depreciation and replacement cost depreciation should be subtracted from NOPAT (Warr, 2005).

We compute the depreciation adjustment, \(DA_t\), by estimation of the average age (period of operation) of the assets and then using this to gross up the depreciation expense by the amount of inflation that occurred over the life of the assets:

\[
DA_t = Depreciation\ Expense_t \left(\frac{GDP_{nom,t}}{GDP_{nom,(t-age_t)}} - 1\right)
\]

Where \(age_t\) is the average period of operation of the asset and is calculated as follows:

\[
age_t = \frac{Accumulated\ Depreciation_t}{Depreciation\ Expense_t}
\]

The Adjusted Invested Capital

The inflation affects on depreciation and resulting in, to book value of equity being understated relative to replacement cost. As book value of equity represents part of the capital base on which the required return is computed, this leads to an overstatement of EVA following a period of inflation. Replacement book value of equity is estimated by adjusting historical capital expenditures over the life of the firm’s assets for the effect of past inflation (Warr, 2005). The following is the computation of converting the nominal capital measure to replacement capital:

\[
RC_t = Capital_t - B_t + RB_t
\]

Where \(RC_t\) is the invested capital (replacement capital) adjusted for replacement cost, \(Capital_t\) the invested capital, \(B_t\) the book value of equity, \(RB_t\) the replacement book value of equity.

Consistent with Warr (2005), the first step in computing \(RB\) is to estimate the capital expenditures, \(X\), that the firm would make each year to replenish depreciated assets and to grow the asset base at a nominal rate \(G\). The book value of assets at time \(t\) will equal the sum of the previous capital expenditures that remain not fully depleted:

\[
B_t = \sum_{i=1}^{n} \frac{i}{n} X_{t-(n-i)}
\]
Where \( n \) is the estimated life of asset and is calculated as follows:

\[
n = \frac{\text{gross property plant and equipment}}{\text{Depreciation Expense}}
\]

Given nominal growth rate of assets of \( G \), we can express all capital expenditures in terms of the current capital expenditure by discounting them by \( 1+G \) per year:

\[
X_{t-(n-i)} = \frac{X_{t}}{(1+G_{t})^{n-i}}
\]

Therefore, the value of the assets at the time \( t \) is:

\[
B_{t} = \sum_{i=1}^{n} \frac{i}{n} \frac{X_{t}}{(1 + G_{t})^{n-i}}
\]

rearranging yields:

\[
X_{t} = \frac{B_{t}}{\sum_{i=1}^{n} \frac{i}{n} \frac{(1 + G_{t})^{n-i}}{(1 + G_{t})^{n-i}}}
\]

Therefore, the replacement book value of equity, except that we gross up the capital expenditures by the inflation rate each period:

\[
RB_{t} = \sum_{i=1}^{n} \frac{(i / n)X_{t}(1+\pi)^{n-i}}{(1 + G_{t})^{n-i}}
\]

Where \( \pi \) is the amount of inflation, and \( G \) is the growth rate. The computation of \( \pi \) and \( G \) is as follows:

\[
\pi = \left[ \frac{GDP_{\text{nom.}t}}{GDP_{\text{nom.}t-n}} \right]^{1/n} - 1
\]

\[
G_{t} = ROE_{t}(1 - dpr_{t})
\]

Where \( ROE_{t} \) is the return on equity, and \( dpr_{t} \) the dividend payout ratio. For firms with negative ROE, \( G \) is set to equal zero, as we assume that firms would not grow their asset base by investing projects with negative return.

5. Research Method

For the purpose of estimating the research models for hypotheses testing, a sample of companies listed in Tehran Stock Exchange (TSE) for the time period of 2001-2007 is used. We study the companies listed in TSE because of, ease of access to the data of these companies that are gathered manually. We estimate the research models with pooled data for six years, and overall 374 years-firm. Then, similarly the models are estimated for sample companies in different industrial groups level. Finally, we estimate the research models using cross-sectional data for each year (2002 to 2007).

Sample

The sample used to estimate research models consists of all production companies from 2001 to 2006 that have the following conditions: (1) the fiscal period of the company ended to March 20, (2) the company’s stock has been traded at least every three months, (3) The main area of the company operation is production, (4) the company data related to stock return and price, income statement and accompanying notes to them for the study period (four years ago for each sample company) are available. The sample companies listed in Tehran Stock Exchange for the time period of 2002-2007 is shown in the table 1.
Table 1: The Sample of Companies Listed in TSE

<table>
<thead>
<tr>
<th>Row</th>
<th>Industry</th>
<th>1380</th>
<th>1381</th>
<th>1382</th>
<th>1383</th>
<th>1384</th>
<th>1385</th>
<th>Total Sample</th>
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<td>Food</td>
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<td>8</td>
<td>8</td>
<td>8</td>
<td>48</td>
<td>12/8</td>
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<tr>
<td>2</td>
<td>Pharmaceutical &amp; Chemical</td>
<td>16</td>
<td>16</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>109</td>
<td>29/1</td>
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<tr>
<td>3</td>
<td>Cement</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>80</td>
<td>21/4</td>
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<tr>
<td>4</td>
<td>Metals &amp; Metal Products</td>
<td>5</td>
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<td>7</td>
<td>33</td>
<td>8/9</td>
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<tr>
<td>5</td>
<td>Appliances &amp; Equipments</td>
<td>7</td>
<td>7</td>
<td>7</td>
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<td>7</td>
<td>42</td>
<td>11/2</td>
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<tr>
<td>6</td>
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<td>61</td>
<td>62</td>
<td>66</td>
<td>374</td>
<td>100</td>
</tr>
</tbody>
</table>

Source of Data
For the sake of gathering the required data for the computation of research variables, we use Pars Portfolio and Rahavard Novin (Iranian Databases), and manually extract the data. In some cases that, the needed data is incomplete we use the manual archive existed in the TSE's library. We also, acquire a part of the needed data from TSE website1. The information about government bond interest rate, nominal and real GDP is extracted from Iranian Central Bank website2.

Hypotheses Testing

Testing Association of Alternate Measures of EVA with Returns (H1)
We investigate this claim that the adjusted EVA measure is a better measure of firm performance than the nominal EVA. As discussed by Harris and Muller (1999), a return model is less potentially affected by scale and heteroscedasticity problems relative to a market value model. Also, Kothari and Zimmerman (1995) argue that the inclusion of both market value and returns models potentially provide more convincing evidence (Saeedi, 2008). We estimate the models in which, return is dependent variable and the adjusted EVA and nominal EVA are as dependent variables.

\[ R_{it} = \alpha + \beta_1 EVA_{adj, it} + \epsilon_{it} \] (Model 1)

\[ R_{it} = \alpha + \beta_1 EVA_{nom, it} + \epsilon_{it} \] (Model 2)

Where \( R_{it} \) is the annual return, \( EVA_{adj, it} \) the EVA adjusted for inflation, and \( EVA_{nom, it} \) the nominal EVA.

For estimating the above models, we use data that are deflated for scale effect using beginning stock market price. Lev and Patell (1989) argues that \( R^2 \) in earnings-returns regressions is "too low" to be economically relevant. Brown, Lo, and Lys (1999) suggest that some (if not all) of the differences between the "too low" \( R^2 \) in returns regressions and the (higher) \( R^2 \) in levels regression are caused by scale effects (Saeedi, 2008).

Testing Association of Alternate Measures of EVA with Stock Market Price (H2)
Due to both econometric and theoretical problems with the returns model, Kothari and Zimmerman (1995) suggest that researchers should use additional models in their empirical analysis, such as the price model, to draw more definitive inferences Dhaliwal, Subramanyam, and Trezevant (1999). Thus, in this study, we estimate the models in which market value of stockholders' equity is dependent variable and the adjusted EVA and nominal EVA are independent variables. In the models, performance is on the basis of stock market price.

\[ PRICE_{it} = \alpha + \beta_1 EVA_{adj, it} + \epsilon_{it} \] (Model 3)

\[ PRICE_{it} = \alpha + \beta_1 EVA_{nom, it} + \epsilon_{it} \] (Model 4)

1. www.rdis.ir
2. www.cbi.ir
Brown et al. (1999) suggest that some (if not all) of differences between the "too low" $R^2$ in returns regressions and the (higher) $R^2$ in levels regression are caused by scale effects (Saeedi, 2008). Thus, for the purpose of estimation of the above models, we use the deflated data using fiscal year-end number of stocks.

**Testing Association of Alternate Measures of EVA with Future Operating Cash Flows (H3)**

Performance of firm should be reflected in future operating cash flows and income, as well as, in stock returns Dechow (1994). Thus, if the adjusted EVA is a better measure of firm performance than nominal EVA, then future operating cash flows should be more strongly associated with adjusted EVA than with nominal EVA. For the purpose of testing this prediction, we estimate cross-sectional and pooled-data regressions.

In the models of this test, the dependent variable is operating cash flows in year $t+1$ ($t=2002-2006$) for a given firm and the independent variable is alternately adjusted EVA or nominal EVA in year $t$ for the corresponding firm. We estimate the following models:

$$\text{CashFlow}_{i,t+1} = \alpha + \beta_1 \text{EVA}_{adj,i,t} + \epsilon_{i,t} \quad \text{(Model 5)}$$

$$\text{CashFlow}_{i,t+1} = \alpha + \beta_1 \text{EVA}_{nom,i,t} + \epsilon_{i,t} \quad \text{(Model 6)}$$

The above two models are not estimated for year 2007, since at the time of doing the research the required data about operating cash flows was not available from the companies.

**Non-nested model selection**

The research question addressed in this paper is that which alternate measures of the EVA (adjusted or nominal) is a "better" measure of firm performance as reflected in stock returns, stock market prices, operating cash flows prediction? Therefore, the adjusted EVA and nominal EVA are set up as competing (non-nested) models to explain stock returns, stock market prices, operating cash flows prediction. A recent development in model selection techniques is (Vuong, 1989). Vuong has provided a likelihood ratio test for model selection to test the null hypothesis that the two models are equally close to explaining the "true data generating process" against the alternative that one model is closer. In this paper, we use the Vuong’s Z-statistic for competing models selection. Note that a positive Z-statistic implies that the residuals produced by the nominal EVA regression are larger in magnitude than those from the adjusted EVA regression. Hence, a positive and significant Z-statistic indicates that the adjusted EVA is the selected model (Dechow, 1994).

**6. The Results of Hypotheses Testing**

In this section of paper we present the analyses of the research hypotheses results. The following subsections provide analyses of the results of hypotheses testing at total sample level, industrial groups level, and years level.

**Results of Testing H1**

The results of the estimation of the two models for H1 at total sample level (with pooled data for years 2001-2008), are shown in the first row of table 2. As shown in the table, p-value of coefficient of the adjusted EVA for the first model, as well as, p-value of coefficient of nominal EVA for the second model is significant. Also, F statistics of the two models are significant. The $R^2$ of the model one (0.032) and the model two (0.100) are not too different.

The Vuong's Z-statistic for these two models is not significant. The results of estimating the two models do not show that the adjusted EVA metric for firm performance evaluation (on the basis of stock returns) is superior to nominal EVA.

We also, investigate the superiority of the adjusted EVA to nominal EVA at industrial groups level, and for this purpose estimate the models for six major industrial groups. The results of estimating models at industrial groups level (table 1, rows 2-7) show that, except for auto industry, p-values of the models for industrial groups are not significant, and at auto industry Vuong’s Z-statistic does not show the superiority of adjusted EVA to nominal EVA. Collectively, the results of estimating the models at industrial groups level do not show that, the adjusted EVA for firm performance evaluation (on the basis of stock return) is superior to nominal EVA.
We also, estimate the first two of research models at six years level that, their results are shown at the last six rows of the table 2. The results of estimated models show that the models related to the adjusted EVA, for years 2002, 2003, 2007 are not significant, but those models related to nominal EVA are significant. For the year 2004, the two models are significant but the Vuong’s Z-statistic is negative and significant that does not show the superiority of adjusted EVA to nominal EVA for firm performance evaluation in this year. For the year 2005, the two models are not significant. For the year 2006, the two models are significant but the Vuong’s Z-statistic is not. Collectively, the results of estimating of the models at the years level do not show that, the adjusted EVA for firm performance evaluation (on the basis of stock return) is superior to nominal EVA.

The Results of Testing H2
In testing the second hypothesis, we investigate whether adjusted EVA reflects firm performance (on the basis of stock market price) better than nominal income. The results of estimating the two models of the hypothesis are shown in table 3. As shown in the table, the p-values of the coefficients of the two models are significant, but Vuong’s Z-statistic is not. Overall, the results of estimating the models at total sample do not show that, adjusted EVA for firm performance evaluation (on the basis of stock market price) is superior to nominal EVA.

For the sake of examining the superiority of adjusted EVA to nominal EVA at industrial groups level, we test the H2 at six different industrial groups. The results of estimating the models of H2 at six alternate industrial groups are shown at the rows of two to seven of the table 3. The results show that, except for auto industry the p-values of the coefficients of the two models are significant at all of the industrial groups level. The difference between the $R^2$ for the two models of 3 and 4, at the auto, food, and Home Appliances & Equipments industries are not significant. Also, the Vuong’s Z-statistics for these industrial groups are not significant.

The $R^2$ for model 3 (in which, independent variable is adjusted EVA) are greater than for model 4 (in which independent variable is nominal EVA) at the Cement, Metal & Metal Products, and Pharmaceutical & Chemical industrial groups. The Vuong’s Z-statistics at these three industrial groups are significant and positive, that show the superiority of adjusted EVA to nominal EVA for firm performance evaluation on the basis of stock market price.
The Results of Testing H3

In this subsection, we present the result of estimating the models of H3 (models 5 and 6) at total sample, industrial groups, and years level. The results of estimating the models at total sample are shown at the first row of the table 4. The p-values of the coefficients of the two models (5 and 6) are significant, but the Vuong’s Z-statistic is not significant. Therefore, the results of estimating the models at total sample do not show that, adjusted EVA for firm performance evaluation (on the basis of operating cash flows prediction) is superior to nominal EVA.

As shown in the rows 2-7 of table 4, the two models and their coefficients are not significant at Home Appliances & Equipments industrial group level. But, the two models are significant for the others. At the Metal & Metal Products industrial group, the $R^2$ for the model 5 (in which the independent variable is adjusted EVA) is 0.642 and greater than 0.297 that is belong to its competing model (model 6). Also, the Vuong’s Z-statistic for this industrial group is positive and significant that indicates the superiority of adjusted EVA to nominal EVA. Collectively, the results of estimating the models at the industrial groups level indicate that only at the Metal & Metal Products industrial group the adjusted EVA for firm performance evaluation (on the basis of operating cash flows prediction) is superior to nominal EVA.

The results of the estimating the models 5 and 6 at years level are shown at the ending rows of table 4. These two models are not estimated for year 2007, since at the time of doing the research the required data about operating cash flows was not available. The results indicate that, except to the model 5 at year 2004, all of the models are significant. The Vuong’s Z-statistic is significant and also positive only for year 2002 and show that the adjusted EVA for firm performance evaluation (on the basis of operating cash flows prediction) is superior to nominal EVA.

### Table 3: The Results Summary of H3

<table>
<thead>
<tr>
<th>Industry</th>
<th>Model (3) R²</th>
<th>Model (3) P-value</th>
<th>Model (4) R²</th>
<th>Model (4) P-value</th>
<th>Vuong’s Z-statistic, (P-value)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample Level</td>
<td>0/035</td>
<td>(0/000)</td>
<td>0/151</td>
<td>(0/000)</td>
<td>[-1/076], (0/281)</td>
<td>Reject</td>
</tr>
<tr>
<td>Auto</td>
<td>0/722</td>
<td>(0/070)</td>
<td>0/753</td>
<td>(0/006)</td>
<td>[0/779], (0/435)</td>
<td>Reject</td>
</tr>
<tr>
<td>Food</td>
<td>0/409</td>
<td>(0/000)</td>
<td>0/497</td>
<td>(0/000)</td>
<td>[-1/034], (0/300)</td>
<td>Reject</td>
</tr>
<tr>
<td>Home Appliances &amp; Equipments</td>
<td>0/792</td>
<td>(0/000)</td>
<td>0/790</td>
<td>(0/001)</td>
<td>[0/884], (0/376)</td>
<td>Reject</td>
</tr>
<tr>
<td>Cement</td>
<td>0/263</td>
<td>(0/000)</td>
<td>0/083</td>
<td>(0/000)</td>
<td>[2/107], (0/035)</td>
<td>Accept</td>
</tr>
<tr>
<td>Metals &amp; Metal Products</td>
<td>0/911</td>
<td>(0/000)</td>
<td>0/641</td>
<td>(0/000)</td>
<td>[2/913], (0/003)</td>
<td>Accept</td>
</tr>
<tr>
<td>Pharmaceutical &amp; Chemical</td>
<td>0/484</td>
<td>(0/000)</td>
<td>0/102</td>
<td>(0/000)</td>
<td>[7/753], (0/000)</td>
<td>Accept</td>
</tr>
<tr>
<td>Year 2002 (total sample)</td>
<td>0/370</td>
<td>(0/000)</td>
<td>0/231</td>
<td>(0/000)</td>
<td>[1/161], (0/245)</td>
<td>Reject</td>
</tr>
<tr>
<td>Year 2003 (total sample)</td>
<td>0/333</td>
<td>(0/000)</td>
<td>0/103</td>
<td>(0/079)</td>
<td>[0/614], (0/539)</td>
<td>Reject</td>
</tr>
<tr>
<td>Year 2004 (total sample)</td>
<td>0/019</td>
<td>(0/288)</td>
<td>0/501</td>
<td>(0/000)</td>
<td>[-1/705], (0/088)</td>
<td>Reject</td>
</tr>
<tr>
<td>Year 2005 (total sample)</td>
<td>0/644</td>
<td>(0/000)</td>
<td>0/752</td>
<td>(0/000)</td>
<td>[-3/901], (0/000)</td>
<td>Reject</td>
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<tr>
<td>Year 2006 (total sample)</td>
<td>0/642</td>
<td>(0/000)</td>
<td>0/718</td>
<td>(0/000)</td>
<td>[-0/616], (0/537)</td>
<td>Reject</td>
</tr>
<tr>
<td>Year 2007 (total sample)</td>
<td>0/614</td>
<td>(0/000)</td>
<td>0/772</td>
<td>(0/000)</td>
<td>[-7/537], (0/000)</td>
<td>Reject</td>
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Table 4: The Results Summary of H4

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<thead>
<tr>
<th>Industry</th>
<th>Model (5)</th>
<th></th>
<th>Model (6)</th>
<th></th>
<th>[Vuong’s statistic], (P-value)</th>
<th>Z- H3</th>
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<tr>
<td></td>
<td>$R^2$</td>
<td>P-value</td>
<td>$R^2$</td>
<td>P-value</td>
<td></td>
<td>H3 Results</td>
</tr>
<tr>
<td>Total Sample Level</td>
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<td>(0/000)</td>
<td>0/423</td>
<td>(0/000)</td>
<td>[-1/381], (0/167)</td>
<td>Reject</td>
</tr>
<tr>
<td>Auto</td>
<td>0/695</td>
<td>(0/000)</td>
<td>0/423</td>
<td>(0/000)</td>
<td>[1/205], (0/227)</td>
<td>Reject</td>
</tr>
<tr>
<td>Food</td>
<td>0/25</td>
<td>(0/001)</td>
<td>0/205</td>
<td>(0/033)</td>
<td>[1/779], (0/075)</td>
<td>Reject</td>
</tr>
<tr>
<td>Home Appliances &amp; Equipments</td>
<td>0/001</td>
<td>(0/865)</td>
<td>0/006</td>
<td>(0/633)</td>
<td>[0/127], (0/898)</td>
<td>Reject</td>
</tr>
<tr>
<td>Cement</td>
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<td>(0/000)</td>
<td>0/845</td>
<td>(0/000)</td>
<td>[1/034], (0/300)</td>
<td>Reject</td>
</tr>
<tr>
<td>Metals &amp; Metal Products</td>
<td>0/642</td>
<td>(0/000)</td>
<td>0/297</td>
<td>(0/004)</td>
<td>[2/062], (0/039)</td>
<td>Accept</td>
</tr>
<tr>
<td>Pharmaceutical &amp; Chemical</td>
<td>0/942</td>
<td>(0/000)</td>
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<td>(0/000)</td>
<td>[0/410], (0/681)</td>
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</tr>
<tr>
<td>Year 2002 (total sample)</td>
<td>0/955</td>
<td>(0/000)</td>
<td>0/006</td>
<td>(0/553)</td>
<td>[3/437], (0/000)</td>
<td>Accept</td>
</tr>
<tr>
<td>Year 2003 (total sample)</td>
<td>0/397</td>
<td>(0/000)</td>
<td>0/675</td>
<td>(0/000)</td>
<td>[-0/803], (0/421)</td>
<td>Reject</td>
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<tr>
<td>Year 2004 (total sample)</td>
<td>0/001</td>
<td>(0/897)</td>
<td>0/338</td>
<td>(0/000)</td>
<td>[-1/353], (0/175)</td>
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</tr>
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<td>Year 2005 (total sample)</td>
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<td>(0/000)</td>
<td>0/945</td>
<td>(0/000)</td>
<td>[-1/905], (0/056)</td>
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<tr>
<td>Year 2006 (total sample)</td>
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<td>(0/000)</td>
<td>0/822</td>
<td>(0/000)</td>
<td>[-0/834], (0/403)</td>
<td>Reject</td>
</tr>
</tbody>
</table>

7. Summary, Concluding Remarks, and Future Research Suggestions

The results of estimating the models for the three hypotheses do not show that at the total sample level the adjusted EVA is superior to nominal EVA for firm performance evaluation as reflected in stock return, stock market price, and operating cash flows. At the industrial groups level, the results of estimating the research models are inconsistent. The first hypothesis is rejected at the all industrial groups level. The second hypothesis is accepted at the Cement, Metal & Metal products, and Pharmaceutical & Chemical industrial groups. The third hypothesis is accepted only at the Metal & Metal products. The results of the estimation of the models at the different years level show that we can not accept hypothesis 1 and 2. The third hypothesis is accepted only for year 2002. Collectively, our results show that we can not strongly infer that for the companies listed in Tehran Stock Exchange the adjusted EVA is superior to nominal EVA for firm performance evaluation as reflected in stock return, stock market price, and operating cash flows. Therefore, in spite of the high rate of inflation in Iran the results of this study are inconsistent with Warr (2005) and De Villiers (1997).

The results of the estimating the first hypothesis models show that there is a too low relationship between the two alternate EVA metrics and stock return, and these results are consistent with Jalili (2002). The results of testing the second hypothesis indicate that the relationship between the two alternate EVA metrics and stock market prices are stronger than that of stock returns. The results of testing the third hypothesis indicate that the relationship between the adjusted and nominal EVA and operating cash flows are stronger than that of stock returns. This research study a sample selected of the production companies listed in Tehran Stock Exchange for years 2002-2007 and should be cautious for generalization of the results to all of the companies listed in TSE and other years.

We propose the following future research with respect to the research done:

1- The study of the issue that whether there is a significant difference between adjusted EVA and nominal EVA.
2- The present study investigates the level of adjusted and nominal EVA. Some of the proponents of the EVA argue that the changes of this metric better explain the changes of the firm performance (Warr, 2005). Therefore, we propose studying the adjusted and nominal EVA changes in another research using the same methodology used in this paper.

References


