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# Cash flow, earnings, and dividends: A comparison between different valuation methods for Brazilian companies

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## Abstract

This paper compares three valuation models – discounted dividends, discounted cash flow, and residual earnings – using financial and accounting data from Brazilian companies, during the period of 1995 to 2004. These approaches should be theoretically equivalent when the respective companies' payoffs are predicted to infinity, but in practice they require predictions over finite horizons. So, the objective of the present study is to assess how these three models perform in finite horizon analysis and in a different financial and economic context. The conclusion was that, among the three models, the cash flow approach presented the best accuracy and explanatory power, having the current stock price as the parameter of comparison. It also had the largest number of valuations considered acceptable. This conclusion diverges from that obtained by some studies performed in other countries like the U.S. (Francis et al., 2000, Penman and Sougiannis, 1998, and Courteau et al., 2000).

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## 1. Introduction

Valuation is one of the most demanded research topics in capital markets (Kothari, 2001) and has been applied in many purposes - estimation of the shares prices in IPOs, benchmarking between assets in the same industry, evaluation of the value creation due to managers, etc. (Fernández, 2001). Conceptually, it refers to the expected payoffs and the use of financial information to develop forecasts (Penman, 2001). The importance of this subject is direct, since the value of an investment is based on its future payoffs.

Three valuation approaches - cash flows, residual earnings, and dividends - are conducted with Brazilian data and their results compared in this study. The research approach follows Penman and Sougiannis (1998) and Francis *et al.* (2000), which methodologies are aligned with the current state of the international literature. The premise adopted is that the three models should produce the same result when the payoffs are predicted to infinity. However, for practical purposes, the analysis requires predictions over finite horizons. The need to restrain the explicit forecasting window creates distortions in the results, according to the valuation approach (Penman, 2001, and Courteau *et al.*, 2000). Once identified, the discrepancy among approaches enables to investigate the accuracy and the statistical incremental power of each model to explain the current stock prices.

The remainder of the study is organized as follows. Next section presents an outline of the three valuation approaches. In section 3 the testable propositions are developed. In section 4 the data used as input for each model, the specification of research procedures, and the results are described. Section 5 concludes and shows some recommendations for future research.

## 2. Literature Review

### *2.1 The Dividend Discount Model (DD)*

Financial theory describes the company value in terms of expected future dividends (Penman and Sougiannis, 1998) and presents the Dividend Discount (DD) as theoretically correct valuation model (Plenborg, 2002), given by:

$$p_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t\left(\tilde{d}_{t+\tau}\right) \quad (1)$$

where $p_t$ is the company market value in time $t$; $\tilde{d}_{t+\tau}$ is assumed to represent the net dividends in time $t+\tau$; $R$ is the discount rate $r$ plus 1; $E_t$ is the expectation's operator based on the information available at time $t$.

The practical implementation - over finite horizons - of the DD model is problematic (Penman and Sougiannis, 1998). Miller and Modigliani (1961) dividend irrelevancy proposition determines that a company price is not related to the frequency and timing of dividend payments. Ang and Liu (1998) also attest that other variables should have preference over dividends for valuation purposes, once they are arbitrarily determined by managers, the process of estimation is inaccurate for short samples and their focus are on distribution and not on creation of wealth.

### *2.2 Discounted Cash Flow (DCF)*

The Discounted Cash Flow model (DCF) discounts the estimated future cash flows of an asset to their present value with a rate that synthesizes the cost of all sources of financing (debts, equity, etc.). Despite of the existence of several estimates of cash flow, in this study was applied the concept of free cash flow - (cash flow available to all suppliers of capital).

The equation uses a comprehensive approach, similar to Copeland *et al.* (2000) and Damodaran (1999):

$$V_t^{FCF} = \sum \frac{FCF}{(1+r_{WACC})} + EC_t - D_t \tag{2}$$

$$FCF = (SALES_t - OPEXP_t - DEPEXP_t)(1 - \psi) + DEPEXP_t - \Delta WC_t - CAPEXP_t \tag{2a}$$

$$r_{WACC} = \%_D (1-\psi) r_D + \%_{PS}\, r_{PS} \tag{2b}$$

where: $V_t^{FCF}$ is the company value; $SALES_t$ is the sales revenues; $OPEXP_t$ are the operating expenses; $DEPEXP_t$ is the depreciation expenses; $\Delta WC_t$ is the change in working capital; $CAPEXP_t$ is the capital expenditures; $EC_t$ is the excess cash; $D_t$ is the market value of debt; $r_{WACC}$ is the weighted average cost of capital; $\%_D$ is the debt percentage in the capital structure; $\%_{PS}$ is the equity percentage in the capital structure; $r_{PS}$ is the equity cost of capital; $r_D$ is the cost of debt and $\psi$ is the corporate tax rate.

### *2.3 Valuation using Residual Earnings (RE)*

The model expresses the value of a company as the sum of its equity and the discounted present value of its residual earnings. Therefore,

$$p_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t\left(x_{t+\tau}^a\right) \tag{3}$$

where $b_t$ represents the equity book value in time *t*; $x_{t+\tau}^a$ denotes the residual earnings in time $t+\tau$. The "residual" earning is interpreted as the accounting income minus the interest due to use of equity capital:

$$x_t^a = x_t - r(b_{t-1}) \tag{4}$$

where *r* is the discount rate and $x_t$ is the accounting income $(t-1,\, t)$.

To derive the RE model from the DD model, two premises are needed (Lo and Lys, 2000). The first refers to the adoption of an accounting system that satisfies the Clean Surplus Relation (CSR). Essentially, CSR implies that all variations of equity pass by the income statement, given by:

$$b_t = b_{t-1} + x_t - d_t \tag{5}$$

The second premise to derive the RE model from the DD model is regularity condition, which imposes that the equity book value grows at a rate smaller than *R*.

$$R^{-\tau} E_t\left(b_{t+\tau}\right) \xrightarrow{\tau\to\infty} 0$$

## 3. Testable Propositions

Considering the existing belief – that the cash flow method is the dominant one – the alternative application of all three models in the same data set allows the verification of the following hypotheses:

*Hypothesis 1: the cash flow method presents better accuracy and explanatory power than the other alternatives.*

The accuracy identification of the models allows the analyses of observed errors in the explicit forecasting horizon. A relevant issue is to identify if the estimation error variation is influenced by increases or decreases of the forecasting window. In other words, since the estimates produce a bias, one would expect that, the larger the explicit forecasting horizon, the larger the error. This argument is reinforced by the fact that the present study uses perfect forecast of the terminal value. Specifically, the *ex-ante* terminal value forecast was established by *ex-post* data. Therefore, all models considered as terminal value the observed market price for the last explicit forecasting period. This terminal value perfect forecast allows focusing in the explicit forecasting horizon, where the model is effectively applied.

*Hypothesis 2: the increase in the explicit forecasting horizon increases the valuation error estimates, independently of which method is used.*

The estimation errors vary according with the modeling approach adopted. A model can present a high or a low bias, but what is his ability of producing reasonable estimates? To define a reasonable estimate, an error parameter of 15% can be determined. Along these lines, if the estimate fluctuates 15% around the real stock price, the estimate can be classified as adequate. In the present study, an adequate estimate is defined as situated within the central tendency. Again, focusing on the cash flow for the reasons already presented, one would expect that this model yields the largest number (in relative terms) of observations situated near the central tendency comparatively to the other models considered. This intuition defines the third hypothesis:

*Hypothesis 3: the cash flow approach is the one that presents, relatively to the others, the largest number of estimations within the central tendency*;

The final supposition is that all valuation models considered in this work have incremental power in explaining the market price of companies. The incremental power, in this case, is defined as the positive variation in the correlation coefficient (adjusted-$R^2$), given by the difference between the adjusted $R^2$ calculated in the regression that has the estimates of all models as independent variables and the $R^2$ calculated in the regression that has only the estimates of two valuation models. This difference gives the incremental power for the model left out of the second regression (Dechow, 1994). The fourth hypothesis, therefore, can be expressed as:

*Hypothesis 4: all valuation models, whatever the approach used, present an incremental power in explaining companies' stock prices*.

## 4. Data and Results

### *4.1 Data*

The analyses conducted in this study use accounting historical values and stock prices (in an annual basis) of firms listed on the Sao Paulo Stock Exchange (Bovespa). The data was extracted for the period of 1995 to 2004 from *Economatica* data basis, removing financial companies from the sample. Additionally, the outliers located in the upper and lower extremes (2.5%) of the market share price sample distribution were discarded. Other factors that influenced the amount of observations were missing observations and liquidated companies. These procedures resulted in a sample of 1,900 observations/year, on average.

The accounting historical data are used to perform estimates for the explicit forecasting horizon, according to the fundamentals of each model (dividends, cash flows, and residual earnings). All valuations, independent of the considered model, were performed for the last day of the year in analysis. The last closing price of shares prices were used with two purposes: as parameter for benchmarking and as terminal value.

It was utilized *ex-post* data as proxies of terminal value for all models. In this sense, the terminal value is defined as the firm market value , measured by stock closing price in the last day of 2004. This procedure, together with the efficient market hypothesis, corresponds to a “perfect forecast” of the terminal value, since all relevant information have already been incorporated in the stock price for the period exceeding the explicit forecasting horizon (terminal value). The variable *TV* represents the terminal value in the valuation equations (see Table 1).

In order to better handle the issue of survivorship bias, the selection of companies in terms of missing observations or liquidation of the firm was performed dynamically. For each forecasting horizon, it was required the availability of the stock price for each year.

### *4.2 Results*

The hypothesis 1 is based on the premise that the cash flow model is the dominant one. This hypothesis depends on the performance of the models, measured by its accuracy and its explanatory power. Three steps were conducted: (i) identification of the existing bias between the calculated and observed values, in order to determine the models accuracy; (ii) execution of three regressions, in order to verify the explanatory power of each model; (iii) comparison of the correlation coefficients (adjusted-$R^2$) of each model. The regressions were performed according to the following specification:

$$\hat{p}_{it} = \alpha + \beta\left(X_{it}\right) + \varepsilon_{it} \qquad (6)$$

where $\hat{p}_{it}$ is the estimated market price; $X_{it}$ is the value of company *i* that can be estimated either by net dividends (*Div*), cash flow (*CF*), or residual earnings (*RE*) methodologies, in period *t*. Subscript *t* can assume the following values: 1996, 1997, 1998, 1999, 2000, 2001, 2002, and 2003. It was performed 24 regressions (8 years for each of the 3 models).

Table 1 presents the estimated normalized values from equation (6). It can be seen the occurrence of negative values in each model, particularly for the cash flow (approximately 30%) and residual earnings (approximately 20%). The negative valuations can occur due to several reasons and it is not the focus of this study. However, possible causes can be negative net dividends, low terminal values, negative cash flows, excessive leverage, negative equity, and negative net income (net losses). The negative valuations were excluded from the analyses, following previous studies (Francis *et al.*, 2000).

Table 2 shows the bias identified in each model by $\left(V^{Mod} - P\right)/P$, where $V^{Mod}$ is the value estimated by each model and *P* is the observed value of the variable (the benchmark value). It can be noted that the dividends and the residual earnings models have the tendency to overestimate the firm values, while the cash flow does the opposite. In absolute terms (disregarding the sign bias) the cash flow presented the best accuracy[1] among the models, confirming the first half of hypothesis 1.

The second half of the hypothesis was verified by the results of univariate regressions between observed and estimated values. To perform this step, the ordinary least squares (OLS) method was employed. Table 3 presents the regressions coefficients (slopes), correlation coefficients (adjusted-$R^2$), the relative force of the dividends and residual earnings models against the one of the cash flow model, and the number of observations included. Missing values for dependent or the independent variables were excluded in regressions. All coefficients are significant at 1% level.

The models explanatory power can be compared by a relative power statistic, calculated as $R^2(.)/R^2CF$, where $R^2(.)$ denotes the dividends or residual earnings correlation coefficient and $R^2CF$ represents the cash flow correlation coefficient. If this statistic is larger

[1] The performance was calculated by the average of the median forecasted errors, in absolute terms.

than one, the cash flow underperforms the other methods, and vice versa. The results obtained indicate that the referred statistic is 75% of the time bellow one in relation to dividends and 50% of the time bellow one in relation to residual earnings. However, in this last case, on average, the statistic is also bellow one, what gives superiority to the cash flow method. These results allow the acceptance of the second part of hypothesis 1. Adding to the results presented earlier, hypothesis 1 can be fully accepted (in terms of accuracy and explanatory power).

Hypothesis 2 is built in the premise that increasing the explicit forecasting horizon it increases the valuation estimation errors, for all models. Tables 2 and 3 can be used to verify this hypothesis. It can be observed in Table 2 that the estimation errors do not tend to increase (decrease) systematically with an increase (decrease) in the forecasting horizon. However, it can be seen that as the forecasting horizon decreases, the number of positive bias increases for dividends model, decreases for the cash flow model, and it has no clear trend for the residual earnings model.

Another factor implies that changes in the explicit forecasting horizon do not generate a clear trend in terms of the sign and size of forecasting errors is the univariate correlation coefficient presented in Table 3. Taking dividends as an example, the $R^2$ obtained for year 1996 was of 0.2606 and for year 2003 was of 0.9529, indicating that there was an improvement in the coefficient as the explicit forecasting horizon decreased. However, it can be observed that the $R^2$ obtained for 1997 and 2002 was of 0.9529 and 0.6483, respectively, denying the existence of any kind of trend. In conclusion, the hypothesis 2 can not be supported be the evidence found.

The third hypothesis refers to the ability of models to yield good stock prices estimates. With this purpose it was necessary to define a new measure and a parameter. The measure selected was the central tendency that captures the estimates located within a specific interval (parameter). In this study it was defined an interval of plus or minus 15% of actual stock price as parameter for the central tendency, in accordance with previous studies (Francis *et al.*, 2000). Table 4 summarizes the results obtained.

For the discounted dividends model the smallest number of estimates (in relative terms) within the central tendency was identified for 1998 (1.27%) and the largest for 2003 (17.32%). Furthermore, for the cash flow model the smallest number of estimates was observed for 1998 (5.63%) and the largest for 2003 (26.15%). Moreover, for the residual earnings model the smallest and largest numbers were observed for 1997 (3.06%) and 2003 (16.56%), respectively. Hence, the results encountered allow the acceptance of hypothesis 3.

The last hypothesis claims that all models have incremental explanatory power. In order to verify this hypothesis, 32 new regressions were carried out, according with the following specifications:

$$P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(CF_{it}) + \beta_2(RE_{it}) + \varepsilon_{it} \quad (7)$$

$$P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(CF_{it}) + \varepsilon_{it} \quad (8)$$

$$P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(RE_{it}) + \varepsilon_{it} \quad (9)$$

$$P_{it} = \alpha + \beta_0(CF_{it}) + \beta_1(RE_{it}) + \varepsilon_{it} \quad (10)$$

Where $P_{it}$ is the price of company *i* for year *t*, being *t* the period of 1996 to 2003. *DIV* corresponds to the estimate of the dividends model for company *i* for year *t*; *CF* corresponds to the estimate of the cash flow model for company *i* for year *t*; *RE* corresponds to the estimate of the residual earnings model for company *i* for year *t*; $\alpha$ is the intercept; $\beta_{(.)}$ are the regression coefficients (slopes); and $\varepsilon$ is the error term.

Equation (7) specifies a multivariate regression of stock prices with the estimations of all models, simultaneously. In contrast, equations (8) to (10) specify multivariate regressions of stock prices with only two of the models (two at a time), simultaneously. The incremental power was then identified as the difference between the adjusted correlation coefficients of the regression with three independent variables (equation 7) and the one of the regressions with two independent variables - equations (8) to (10). For instance, the difference between the coefficients the regressions using equations (7) and (8), (7) and (9), (7) and (10) yields the incremental power of the residual earnings model, cash flow model, and dividends model, respectively. The results presented in Table 5 permit rejection of the hypothesis 4.

## 5. Conclusions

In order to determine the best performance model (for a finite horizon of forecasting) four hypotheses were established and tested. The first one poses that the discounted cash flow valuation method presents better accuracy and explanatory power than the dividends and residual earnings valuation methods. As this method produced the smallest average difference between the calculated and observed firm values (defined here as accuracy), and also produced the best explanatory power, determined by a statistic based on R-square coefficients ratio, this hypothesis was accepted.

The second hypothesis states that an increase in the explicit forecasting horizon increases the valuations estimates error. The results encountered did not support this statement.

The third hypothesis claims that the discounted cash flow is the valuation method with a largest number of estimates within the central tendency, which reflects the models ability to produce good company value estimates, considering a departure (above or bellow) from the observed value not higher than 15%. For all periods studied, the cash flow was the method that achieved better results, allowing the acceptance of the hypothesis 3.

The last hypothesis asserts that all valuation models should have an incremental power to explain the firms market prices. In order to verify that $R^2$-adjusted for multivariate regressions involving estimates of the three models (simultaneously) was compared with the $R^2$-adjusted of regressions involving just two of the models at a time (also simultaneously). The difference between the $R^2$-adjusted is considered to be the incremental contribution of the model left out of the second regression (the one with only two models). The results do not confirm the hypothesis 4.

One of the main contributions of this study consists in the documentation[2] of several diverging results encountered in the application of theoretically equivalents valuation approaches for Brazilian companies. Its findings, however, refer to the period of 1995-2004, and, therefore, should be used with caution for different periods or companies not include in the sample (as financial companies).

Within the limitations of the present study, the evidences found reveal the discounted cash flow as the superior method for the valuation of Brazilian companies, in relation to the discounted dividends and residual earnings models. However, the majority of the recent studies (as in Francis *et al.*, 2000, Penman and Sougiannis, 1998, and Courteau *et al.*, 2000) points out to the dominance of the residual earnings model for companies of other countries, particularly for the U.S. environment. Even though the analysis of the causes of this divergence is not the focus of this study, some specific circumstances in the Brazilian capital markets and corporate reporting system, such as poor investor protection and legal enforcement (Anderson, 1999, Durnev and Kim, 2005, and Chong and Lopez-de-Silanes, 2007), corporate governance (Rabelo and Vasconcelos, 2002), liquidity (Sanvicente and Minardi, 1998, and Machado and Medeiros, 2011), ownership concentration (Silva and Leal,

[2] It was not found in the literature review another study comparing the three models discussed in the present work for a robust sample of Brazilian companies.

2005), lack of transparency in the disclosure of accounting numbers (Lopes and Galdi, 2006) and strong tax influence (Coelho, Galdi and Lopes, 2010, and Dal-Ri Murcia, F. et al, 2008) might be part of the explanation.

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**Table 1 – Valuations Results**[a]

Equations used:

$$p_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t\left(\tilde{d}_{t+\tau}\right) + TV \quad \text{for Dividends}$$

$$p_t = \sum \frac{FCF}{(1+r_{WACC})} + EC_t - D_t + TV \quad \text{for Cash Flow}$$

$$p_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t\left(x_{t+\tau}^{a}\right) + TV \quad \text{for Residual Earnings}$$

| *Year* | *Mean* | *Median* | *SD* | *Positive Valuations* | *Negative Valuations* | *Total* |
|---|---|---|---|---|---|---|
| **Dividends** | | | | | | |
| 1996 | 1.4397 | 0.0056 | 8.7310 | 139 | 31 | 170 |
| 1997 | 2.7298 | 0.0062 | 15.1492 | 142 | 26 | 168 |
| 1998 | 3.4147 | 0.0063 | 17.8712 | 158 | 21 | 179 |
| 1999 | 3.7519 | 0.0072 | 18.5622 | 162 | 15 | 177 |
| 2000 | 4.2966 | 0.0064 | 20.4675 | 160 | 8 | 168 |
| 2001 | 4.0751 | 0.0058 | 22.9708 | 177 | 7 | 184 |
| 2002 | 4.4873 | 0.0097 | 25.4381 | 181 | 0 | 181 |
| 2003 | 6.1056 | 0.0107 | 32.0961 | 179 | 1 | 180 |
| **Cash Flow** | | | | | | |
| 1996 | 0.3259 | 0.0461 | 2.6144 | 88 | 24 | 112 |
| 1997 | 2.6002 | 0.0939 | 17.4740 | 97 | 21 | 118 |
| 1998 | 3.0365 | 0.0635 | 20.5767 | 108 | 31 | 139 |
| 1999 | 1.7011 | 0.0493 | 26.7045 | 108 | 37 | 145 |
| 2000 | 3.6152 | 0.0509 | 30.8513 | 116 | 32 | 148 |
| 2001 | 3.3040 | 0.0202 | 35.4110 | 129 | 39 | 168 |
| 2002 | 2.6872 | 0.0370 | 43.4417 | 135 | 42 | 177 |
| 2003 | 4.2104 | 0.0351 | 43.4042 | 138 | 43 | 181 |
| **Residual Earnings** | | | | | | |
| 1996 | 0.6367 | 0.0602 | 5.8065 | 90 | 21 | 111 |
| 1997 | 3.1623 | 0.0777 | 18.3579 | 98 | 19 | 117 |
| 1998 | 4.8928 | 0.0733 | 23.4760 | 113 | 24 | 137 |
| 1999 | 5.6949 | 0.0779 | 24.9959 | 121 | 22 | 143 |
| 2000 | 6.8418 | 0.0975 | 27.7768 | 124 | 22 | 146 |
| 2001 | 6.5072 | 0.0715 | 30.4169 | 145 | 22 | 167 |
| 2002 | 7.1464 | 0.0825 | 32.4934 | 158 | 18 | 176 |
| 2003 | 9.8247 | 0.0829 | 41.3604 | 163 | 17 | 180 |

[a] Values are in domestic currency (Reais – R$) and are normalized by the last day of each year closing price for each company before estimating the moments. Outliers are not included.

**Table 2 – Estimated Bias (Sample Forecasting Bias)[a]**

| *Year* | *Mean* | *Median* | *Positive Bias[b]* | *Negative Bias[b]* | *Observations* | *% Positive* |
|---|---|---|---|---|---|---|
| **Dividends** | | | | | | |
| 1996 | 1.7388 | 0.0570 | 66 | 65 | 131 | 50.38% |
| 1997 | 4.4310 | 0.9270 | 77 | 47 | 124 | 62.10% |
| 1998 | 12.3804 | 2.1507 | 93 | 40 | 133 | 69.92% |
| 1999 | 2.1072 | 0.5070 | 85 | 61 | 146 | 58.22% |
| 2000 | 2.4104 | 0.7757 | 95 | 40 | 135 | 70.37% |
| 2001 | 1.8081 | 0.6403 | 99 | 56 | 155 | 63.87% |
| 2002 | 2.4438 | 1.2725 | 125 | 28 | 153 | 81.70% |
| 2003 | 0.6484 | 0.3245 | 122 | 39 | 161 | 75.78% |
| **Cash Flow** | | | | | | |
| 1996 | 36.51% | -0.6072 | 10 | 42 | 52 | 19.23% |
| 1997 | 50.00% | -0.2451 | 23 | 40 | 63 | 36.51% |
| 1998 | 19.51% | 0.0350 | 32 | 32 | 64 | 50.00% |
| 1999 | 22.50% | -0.4154 | 16 | 66 | 82 | 19.51% |
| 2000 | 19.59% | -0.4101 | 18 | 62 | 80 | 22.50% |
| 2001 | 14.44% | -0.4419 | 19 | 78 | 97 | 19.59% |
| 2002 | 11.20% | -0.3718 | 13 | 77 | 90 | 14.44% |
| 2003 | 19.23% | -0.2724 | 14 | 111 | 125 | 11.20% |
| **Residual Earnings** | | | | | | |
| 1996 | 2.4420 | 0.7539 | 59 | 27 | 86 | 68.60% |
| 1997 | 6.0853 | 2.7996 | 66 | 21 | 87 | 75.86% |
| 1998 | 16.3657 | 3.9744 | 83 | 13 | 96 | 86.46% |
| 1999 | 1.7761 | 0.7777 | 79 | 30 | 109 | 72.48% |
| 2000 | 1.9711 | 1.1651 | 89 | 20 | 109 | 81.65% |
| 2001 | 1.7052 | 0.8419 | 91 | 37 | 128 | 71.09% |
| 2002 | 2.4872 | 1.1515 | 117 | 20 | 137 | 85.40% |
| 2003 | 0.4621 | 0.3245 | 114 | 36 | 150 | 76.00% |

[a] The data was obtained from *Economatica*.
[b] The bias was calculated as: $\left(V^{Mod} - P\right)/P$, where $V^{Mod}$ is the estimate given by the model and $P$ is the observed value of the variable.

**Table 3 – Regression Results of Observed vs. Estimated Stock Prices[a,b]**

$$\hat{p}_{it} = \alpha + \beta(X_{it}) + \varepsilon_{it}$$

| | ***1996*** | | | ***1997*** | | |
|---|---|---|---|---|---|---|
| | *DIV* | *CF* | *RE* | *DIV* | *CF* | *RE* |
| OLS Coeff. | 0.4571 | 0.6014 | 0.4313 | 0.2520 | 0.2419 | 0.2518 |
| OLS $R^2$ | 0.2606 | 0.6058 | 0.5553 | 0.7461 | 0.7723 | 0.7732 |
| $R^2(.)/R^2CF$ [c] | 0.4302 | | 0.9167 | 0.9662 | | 1.0012 |
| Observations | 131 | 85 | 86 | 124 | 86 | 87 |
| | **1998** | | | **1999** | | |
| | *DIV* | *CF* | *RE* | *DIV* | *CF* | *RE* |
| OLS Coeff. | 0.1032 | 0.1143 | 0.1047 | 0.5131 | 0.5888 | 0.5154 |
| OLS $R^2$ | 0.3795 | 0.5176 | 0.5099 | 0.7944 | 0.8086 | 0.8190 |
| $R^2(.)/R^2CF$ [c] | 0.7333 | | 0.9852 | 0.9825 | | 1.0130 |
| Observations | 133 | 92 | 96 | 146 | 102 | 109 |
| | **2000** | | | **2001** | | |
| | *DIV* | *CF* | *RE* | *DIV* | *CF* | *RE* |
| OLS Coeff. | 0.3348 | 0.3605 | 0.3354 | 0.3802 | 0.4472 | 0.3849 |
| OLS $R^2$ | 0.5394 | 0.5632 | 0.5855 | 0.8187 | 0.8158 | 0.8333 |
| $R^2(.)/R^2CF$ [c] | 0.9577 | | 1.0395 | 1.0036 | | 1.0215 |
| Observations | 135 | 103 | 109 | 155 | 111 | 128 |
| | **2002** | | | **2003** | | |
| | *DIV* | *CF* | *RE* | *DIV* | *CF* | *RE* |
| OLS Coeff. | 0.2843 | 1.2326 | 0.2845 | 0.6498 | 1.4878 | 0.5857 |
| OLS $R^2$ | 0.6483 | 0.8734 | 0.6489 | 0.9529 | 0.9263 | 0.9243 |
| $R^2(.)/R^2CF$ [c] | 0.7422 | | 0.7429 | 1.0288 | | 0.9979 |
| Observations | 153 | 121 | 137 | 161 | 129 | 150 |

[a] Data obtained from *Economatica*.
[b] The regression specification is given by Equation 6.
[c] The coefficient of relative power measures is given comparing dividends and residual earning with cash flows. A coefficient larger than 1 indicates that the cash flow has less explanatory power for the stock price than the other models.

**Table 4 – Central Tendency[a]**

| *Year* | *Number* | *%* | *Price up to +15%* | *Price up to -15%* |
|---|---|---|---|---|
| **Dividends** | | | | |
| 1996 | 10 | 7.19% | 5 | 5 |
| 1997 | 3 | 2.11% | 1 | 2 |
| 1998 | 2 | 1.27% | 1 | 1 |
| 1999 | 10 | 6.17% | 4 | 6 |
| 2000 | 9 | 5.63% | 5 | 4 |
| 2001 | 13 | 7.34% | 4 | 9 |
| 2002 | 20 | 11.05% | 9 | 11 |
| 2003 | 31 | 17.32% | 18 | 13 |
| **Cash Flow** | | | | |
| 1996 | 5 | 9.62% | 2 | 8 |
| 1997 | 6 | 8.96% | 2 | 4 |
| 1998 | 4 | 5.63% | 2 | 3 |
| 1999 | 10 | 11.63% | 6 | 3 |
| 2000 | 12 | 13.48% | 2 | 3 |
| 2001 | 10 | 9.35% | 4 | 4 |
| 2002 | 15 | 15.46% | 7 | 9 |
| 2003 | 34 | 26.15% | 9 | 19 |
| **Residual Earnings** | | | | |
| 1996 | 6 | 6.67% | 2 | 4 |
| 1997 | 3 | 3.06% | 0 | 3 |
| 1998 | 5 | 4.42% | 1 | 4 |
| 1999 | 10 | 8.26% | 3 | 7 |
| 2000 | 10 | 8.06% | 4 | 6 |
| 2001 | 9 | 6.21% | 4 | 5 |
| 2002 | 17 | 10.76% | 8 | 9 |
| 2003 | 27 | 16.56% | 15 | 12 |

[a] The central tendency was defined as the ability to produce reasonable estimates, defined as being within an interval of plus or minus 15% of the observed value. The percentage (%) is the relative number of observations within the central tendency in relation to the sample.

**Table 5 – Valuation Models Incremental Power[a]**

Group Estimate: $P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(CF_{it}) + \beta_2(RE_{it}) + \varepsilon_{it}$

Residual Earnings Increment: $P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(CF_{it}) + \varepsilon_{it}$

Cash Flow Increment: $P_{it} = \alpha + \beta_0(DIV_{it}) + \beta_1(RE_{it}) + \varepsilon_{it}$

Dividends Increment: $P_{it} = \alpha + \beta_0(CF_{it}) + \beta_1(RE_{it}) + \varepsilon_{it}$

| | ***1996*** | | | ***1997*** | | |
|---|---|---|---|---|---|---|
| | *DD* | *CF* | *RE* | *DD* | *CF* | *RE* |
| OLS Coeff. | -1.0498** | 0.7483* | 0.9480** | -1.7281*** | 0.4987SNS | 1.4514*** |
| *t* statistic | -1.9979 | 3.7381 | 2.3745 | -1.6468 | 1.2862 | 1.7312 |
| Model $R^2$ | 0.6252 | | | 0.7714 | | |
| Incremental $R^2$ | 0.0155 | 0.0557 | 0.0188 | 0.0051 | 0.0000 | 0.0050 |
| Observations | 76 | | | 77 | | |
| | **1998** | | | **1999** | | |
| | *DD* | *CF* | *RE* | *DD* | *CF* | *RE* |
| OLS Coeff. | 0.2673*** | 0.0090SNS | -0.1639SNS | -0.5358SNS | 0.5715* | 0.5484SNS |
| *t* statistic | 1.8923 | 0.1013 | -1.1356 | -1.3139 | 2.5117 | 1.4911 |
| Model $R^2$ | 0.5205 | | | 0.8064 | | |
| Incremental $R^2$ | 0.5056 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| Observations | 86 | | | 96 | | |
| | **2000** | | | **2001** | | |
| | *DD* | *CF* | *RE* | *DD* | *CF* | *RE* |
| OLS Coeff. | 0.2877SNS | -0.4875*** | 0.4916SNS | -0.3968*** | 0.1062SNS | 0.6922* |
| *t* statistic | 0.5271 | -1.5297 | 0.8236 | -1.6142 | 1.0656 | 2.6425 |
| Model $R^2$ | 0.5782 | | | 0.8323 | | |
| Incremental $R^2$ | 0.0000 | 0.0001 | 0.0000 | 0.0026 | 0.0000 | 0.0077 |
| Observations | 95 | | | 105 | | |
| | **2002** | | | **2003** | | |
| | *DD* | *CF* | *RE* | *DD* | *CF* | *RE* |
| OLS Coeff. | 0.111SNS | 0.6677* | -0.3897SNS | 2.3289* | -0.0702SNS | -1.5081* |
| *t* statistic | 0.1903 | 4.5429 | -0.6387 | 3.4768 | -0.4535 | -2.8099 |
| Model $R^2$ | 0.6905 | | | 0.9756 | | |
| Incremental $R^2$ | 0.0000 | 0.0468 | 0.0000 | 0.0022 | 0.0000 | 0.0013 |
| Observations | 117 | | | 124 | | |

[a] The increment was defined as the difference between the coefficient of the group regression and the increment regression. The underwritten have the following meaning: * Significant at 1%; ** Significant at 5%; *** Significant at 10%; and *SNS* Statistically Not Significant.