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**Broker-analysts' earnings forecast bias and their trade-boosting  
incentive**

**Kim, Chansog, Ph.D.**

**City University of New York, 1994**

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**BROKER-ANALYSTS' EARNINGS FORECAST BIAS AND  
THEIR TRADE-BOOSTING INCENTIVE**

by

**CHANSOG KIM**

A dissertation submitted to the Graduate Faculty in Business in  
partial fulfillment of the requirements for the degree of Doctor of  
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**ABSTRACT****BROKER-ANALYSTS' EARNINGS FORECAST BIAS AND  
THEIR TRADE-BOOSTING INCENTIVE**

by

**Chansog Kim**

Advisor: Dr. Steven B. Lilien

There is a well documented optimism in analysts' earnings forecasts. For non-broker analysts (i.e., Value Line), evidence indicates that this optimism is due to the incentive to cultivate relations with management (the management relation incentive). Alternatively, broker-analysts (i.e., Duff & Phelps) have the additional incentive to be optimistic to stimulate stock trades (the trade-boosting incentive). For a sample of 998 matched forecasts, this research contrasts the forecast bias of these groups to test for the presence of broker-analysts' trade-boosting incentive. Results indicate that the optimistic bias for stocks with *buy* recommendations is greater for broker-analysts than for non-broker analysts. For *sell* stocks, the bias is lower for broker-analysts. These results are consistent with the existence of broker-analysts' trade-boosting incentive.

The management relation incentive also predicts that non-broker analysts' forecasts are more optimistically biased for *hold* stocks than *buy* stocks. This paper shows the opposite for broker-analysts' forecasts. These results imply that broker-analysts' trade-boosting incentive *dominates* the management relation incentive for *buy* stocks.

In the absence of the trade-boosting incentive, broker-analysts' forecasts for all stock recommendations would be less optimistic than non-broker analysts' forecasts, because broker-analysts' stock recommendations have more *buys*. In contrast, this study finds that there is no difference in total forecast bias for all recommendations between broker and non-broker analysts. These results suggest that the trade-boosting incentive provides an alternative explanation for the general optimism observed in broker-analysts' forecasts in addition to the management relation incentive and the investment banking incentive.

Finally, the investors' ability to adjust for analysts' forecast bias predicts that the regression coefficients of broker-analysts' forecast errors are smaller (larger) than those of non-broker analysts' forecast errors for *buy* (*sell*) stocks. The results do not suggest that investors adjust for analysts' forecast bias.

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## Chapter 1

### INTRODUCTION

Most studies on analysts' earnings forecasts document the existence of an optimistic bias (O'Brien [1988], Lys and Sohn [1990], Mendenhall [1991], Affleck-Graves et al. [1991]).<sup>1</sup> Early attempts to explain this forecast optimism rely on the cognitive bias theory (DeBondt and Thaler [1990] and Abarbanell and Bernard [1992]).<sup>2</sup> However, relatively little is known about the analyst incentives to include *intentional* bias in their earnings forecasts. In this paper, I partition analysts into portfolios of broker and non-broker analysts to examine the differing incentives that can lead to differing bias in their earnings forecasts.

For non-broker analysts, Francis and Philbrick [1993] document the management relation incentive of analysts to cultivate good relations with the management of the company they follow. They use Value Line and show that the analyst earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks. Their results indicate that non-broker analysts have an incentive to report more optimistic earnings

forecasts for firms with less favorable stock recommendations to improve their relationships with management.

For broker-analysts, Lin and McNichols [1993] and Dugar and Nathan [1993] use broker-analysts' research reports and suggest the incentive of broker-analysts to support the investment-banking relations (the investment-banking incentive).<sup>3</sup> Both studies show that broker-analysts whose firms serve as investment-bankers generate more optimistic earnings forecasts for investment-banking client companies than broker-analysts whose firms do not serve as investment-bankers for the same companies.

In this paper, I propose that broker-analysts have the additional incentive to stimulate trading on the stocks they recommend (the trade-boosting incentive).<sup>4</sup> That is, broker-analysts' earnings forecasts would be biased upward (downward) for *buy* (*sell*) recommendations in order to stimulate trading on the stocks they recommend.<sup>5</sup>

I find that broker-analysts' earnings forecasts are more (less) optimistically biased for *buy* (*sell*) stocks than non-broker analysts' forecasts and that there is no difference in the biasedness of broker and non-broker analysts' earnings forecasts for *hold* stocks. These results are consistent with the existence of broker-analysts' trade boosting incentive.

This paper also investigates whether the management relation incentive or the trade-boosting incentive of broker-analysts is dominant. The

management relation incentive predicts that analysts' forecasts are more optimistically biased for *hold* stocks than *buy* stocks. In contrast, I find that broker-analysts' forecasts are more optimistic for *buy* stocks than *hold* stocks. The management relation incentive also predicts that analysts' forecasts are more optimistically biased for *sell* stocks than *hold* stocks. However, this paper shows that there is no difference in broker-analysts' forecast bias between *sell* stocks and *hold* stocks. In addition, broker-analysts' forecasts for *sell* stocks are optimistically biased even in the presence of their trade-boosting incentive. These results are consistent with the dominance of broker-analysts' trade-boosting incentive over their management relation incentive for *buy* stocks, but not for *sell* stocks. These results are not surprising, because brokerage firms earn more trade commissions on the stocks with *buy* recommendations, but they rarely collect commissions from customers who do not own the stocks with *sell* recommendations.<sup>6</sup>

Broker-analysts issue more *buy* recommendations and less *sell/hold* recommendations, relative to non-broker analysts (Francis and Philbrick [1993]). Given the management relation incentive which makes *buy* stocks less optimistically biased, these results imply that in the absence of the trade-boosting incentive, broker-analysts' earnings forecasts for all stock recommendations would be less optimistically biased than non-broker analysts' forecasts. In contrast, I find that there is no difference in total bias for all

recommendations between broker and non-broker analysts' forecasts. These results suggest that the trade-boosting incentive provides an alternative explanation for the general optimism observed in broker-analysts' earnings forecasts, in addition to the management relation incentive and the investment banking incentive.

Finally, the investors' ability to adjust for analysts' forecast bias predicts that the regression coefficients of broker-analysts' forecast errors are smaller (larger) than those of non-broker analysts' forecast errors for *buy (sell)* stocks. The results do not suggest that investors adjust for analysts' forecast bias.

The incentives of broker and non-broker analysts are described in the next chapter. The hypotheses and the models are discussed in Chapter 3. Chapter 4 describes data and sample selection. The empirical results are presented in Chapter 5, followed by summary and conclusions in Chapter 6.

## Chapter 1 - Endnotes

- <sup>1</sup> "Bias" means that analysts' earnings forecasts on average deviate from actual earnings. "Optimistic (pessimistic) bias" means that analysts' earnings forecasts are biased upward (downward) compared to actual earnings.
- <sup>2</sup> The *unintentional processing bias* which attributes the forecast optimism to analysts' cognitive errors in processing information (DeBondt and Thaler [1990] and Abarbanell and Bernard [1992]) is not studied in this paper. Francis and Philbrick [1993] show that analysts' information-processing bias does not persist after controlling for their incentives. This paper focuses only on *intentional reporting bias* which attributes the forecast optimism to analysts' incentives.
- <sup>3</sup> While Lin and McNichols [1993] focus on broker-analysts' underwriting relations, Dugar and Nathan [1993] study the investment-banking relations which include, among others, advice on mergers and acquisitions, spinoffs or divestitures of divisions, and disposal of business segments as well as underwriting.
- <sup>4</sup> DeBondt and Thaler [1990] and Schipper [1991] discuss broker-analysts' incentives to make *intentionally* biased forecasts in order to stimulate trading by customers (the trade-boosting incentive). However, both studies do not conduct empirical tests on this issue. In addition, DeBondt and Thaler [1990] attribute the forecast optimism to analysts' cognitive bias in processing information rather than the trade-boosting incentive.
- <sup>5</sup> This paper focuses on incentives faced by sell-side analysts (i.e., broker-analysts). Analysts employed by money management firms, pension funds, and mutual funds are called buy-side analysts. Since buy-side analysts do not have the trade-boosting incentive and rarely issue earnings forecasts and stock recommendations, this paper uses broker-analysts' earnings forecasts and stock recommendations to study their trade-boosting incentive.

<sup>6</sup> Although brokerage firms can also provide brokerage services to investors who want short-positions, these short-sales are rare (Hardy [1992]).

## Chapter 2

### ANALYSTS' INCENTIVES

In order to study broker-analysts' trade-boosting incentive, I split analysts into two categories (i.e., broker and non-broker analysts). Non-broker analysts' environments are simpler than broker-analysts' environments, because non-brokerage firms earn neither brokerage commissions nor investment-banking service fees. Non-broker analysts forecast earnings, write research reports, and contend with the incentive to cultivate relations with management (the management relation incentive) and with the incentive to maintain a good personal reputation (the reputation incentive). Alternatively, broker-analysts perform all the tasks of non-broker analysts and face the same incentives. In addition, they select stocks and contend with incentives associated with their firm's investment-banking relations (the investment-banking incentive) and brokerage services (the trade-boosting incentive).

#### 2.1 Non-broker Analysts' Incentives

Non-broker analysts have at least two incentives: (1) the incentive to cultivate relations with management (the management relation incentive) and (2)

the incentive to maintain their good personal reputations with investors (the reputation incentive). Company management is a key source of firm-specific information for analysts and a manager can make the access to this information very difficult for out-of-favor analysts (Schipper [1991]).<sup>1</sup> Analysts are aware that a loss of access to management is costly. They try to acquire more extensive and/or more timely access to information from management by reporting more optimistic earnings forecasts.

Non-broker analysts also have the incentive to maintain a good personal reputation with investors by issuing more accurate earnings forecasts. Readers of analysts' research reports may use forecast accuracy as a quantitative measure of the quality of the overall report (Schipper [1991]).<sup>2</sup> Reporting the most accurate earnings forecasts need not be the ultimate objective analysts seek, because analysts also cultivate relations with management. Therefore, the reputation incentive serves to mitigate the optimism of analysts' earnings forecasts.

## **2.2 Broker-analysts' Incentives**

Broker-analysts' research is overhead and generates little profit (Eccles and Crane [1988]). Instead, revenue comes from providing brokerage services and investment-banking services. These revenue generating departments influence analysts' behavior (Schipper [1991]). Thus, in addition to the

management relation incentive and the reputation incentive, broker-analysts faces two additional incentives: (1) the incentive to stimulate their employers' brokerage commissions (the trade-boosting incentive) and (2) the incentive to favorably evaluate investment-banking client companies (the investment-banking incentive).

Broker-analysts work in the investor services department which also perform brokerage services (Hazen [1990]). Investor services departments generate brokerage commissions revenue on stock trades and broker-analysts' compensation is usually related to the brokerage commissions they generate.<sup>3</sup> Thus, broker-analysts face the incentive to stimulate stock trades (the trade-boosting incentive). That is, broker-analysts' earnings forecasts would be upward (downward) biased for stocks with *buy* (*sell*) recommendations and unbiased for stocks with *hold* recommendations.

Brokerage firms also provide investment-banking services including merger and divestiture advice and underwriting. Broker-analysts are aware that their employer's revenues and long-term relationships with investment-banking client companies are influenced by how favorably they evaluate client companies. Therefore, investment-banker analysts' earnings forecasts would be more optimistic for investment-banking client companies than non-investment banker analysts' forecasts for the same companies (Lin and McNichols [1993] and Dugar and Nathan [1993]).

## Chapter 2 - Endnotes

- <sup>1</sup> Analysts rank company management among top five sources of information used in making judgements and decisions (Table 4.5 in SRI International [1987]).
- <sup>2</sup> *Institutional Investor* asks about 2,000 money managers to evaluate security analysts for the selection of *All-American Research Team* on the basis of four criteria: stock-picking, earnings forecasts, written reports, and overall service. Position on the *All-American Research Team* is among three criteria for determining analyst pay (Stickel [1992]). Therefore, accuracy in earnings forecasts seems to be at least a factor in determining performance evaluation of analysts.
- <sup>3</sup> Most broker-analysts are urged to call investor clients to convince them to buy/sell the stock they recommend, and the analysts' compensation is in part based on the number of calls they make and the brokerage commissions they generate (Konrad and Greising [1989]). At most brokerage firms, the important factors affecting analysts' pay are an evaluation of analysts by the brokerage sales force, standing in the *Institutional Investor* poll, and job offers from competitors. A smaller set of brokerage firms expands the set of factors to include investment-banking business generated, trading volume in recommended stocks, and the success of buy and sell recommendations ("Heard on the Street" column of *Wall Street Journal* on October 29, 1991).

## Chapter 3

### HYPOTHESES AND MODELS

#### 3.1 Analysts' Earnings Forecast Bias

Broker and non-broker analysts are assumed to process information about earnings ( $X$ ) in an unbiased manner and report earnings forecasts ( $F(X)$ ).  $F(X)$  contains the analysts' *reporting bias* ( $\varepsilon = F(X) - X$ ). Following Francis and Philbrick (1993), a non-broker analyst is assumed to maximize the sum of 1) the reputations with investors influenced by the incentive to maintain a good personal reputation (the reputation incentive) and 2) the relations with management affected by the incentive to cultivate the management of the company he follows (the management relation incentive). Alternatively, a broker-analyst is assumed to maximize the sum of 1) the reputation, 2) the management relations, and 3) the brokerage commissions influenced by the incentive to stimulate stock trades (the trade-boosting incentive).<sup>1</sup>

Assuming that broker and non-broker analysts are risk-neutral, a non-broker analyst maximizes  $Rep(\varepsilon_{NB}) + Relm(\varepsilon_{NB})$ , where  $Rep(\varepsilon_{NB})$  is the value to a non-broker analyst of his personal reputation with investors and  $Relm(\varepsilon_{NB})$  is the value to a non-broker analyst of his relations with management.

Alternatively, a broker-analyst is assumed to maximize  $Rep(\varepsilon_{BR}) + Relm(\varepsilon_{BR}) + Com(\varepsilon_{BR})$ , where  $Rep(\varepsilon_{BR})$  and  $Relm(\varepsilon_{BR})$  are the values to a broker analyst of his personal reputation with investors and his relations with management, and  $Com(\varepsilon_{BR})$  is the value to a broker-analyst of brokerage commissions on the stocks they recommend. For broker and non-broker analysts, I assume as in Francis and Philbrick [1993] that:

Assumption (3.1):  $Rep(\varepsilon)$  is a strictly concave function of forecast bias ( $\varepsilon$ ).

Assumption (3.2):  $Relm'(\varepsilon) > 0$ .

Assumption (3.1) says that, in order to maximize  $Rep(\varepsilon)$ , broker and non-broker analysts would maximize their forecast accuracy at  $\varepsilon = 0$ . Thus, the reputation incentive leads analysts' forecasts to be unbiased. Assumption (3.2) says that, in order to maximize  $Relm(\varepsilon)$ , broker and non-broker analysts maximize the optimistic bias ( $\varepsilon > 0$ ) of their earnings forecasts. However, maximizing optimistic  $\varepsilon$  would impair their forecast accuracy (i.e.,  $Rep(\varepsilon)$ ). Therefore, the analysts' optimal solution entails a trade-off between  $Rep(\varepsilon)$  and  $Relm(\varepsilon)$ . I assume that an interior solution exists as in Francis and Philbrick [1993].

For a non-broker analyst, the optimal solution is to report  $F(X_{NB}^*) = X + \varepsilon_{NB}^*$  such that  $Relm'(\varepsilon_{NB}^*) = -Rep'(\varepsilon_{NB}^*)$ , where  $F(X_{NB}^*)$  is non-broker analyst's optimal earnings forecasts reported including the optimal bias ( $\varepsilon_{NB}^*$ ). From Assumptions (3.1) and (3.2), the optimal bias ( $\varepsilon_{NB}^*$ ) of a non-broker

analyst would be positive.<sup>2</sup> Although  $\varepsilon_{NB}^*$  is influenced by both the reputation incentive and the management relation incentive,  $\varepsilon_{NB}^*$  is called the optimal bias ( $\varepsilon_{NB}^*(MR)$ ) influenced by non-broker analysts' management relation incentive:

$$\varepsilon_{NB}^* = \varepsilon_{NB}^*(MR) \quad (3.1)$$

For a broker-analyst, the additional incentive to stimulate stock trades exists (the trade-boosting incentive). That is,  $Com(\varepsilon_{BR})$  is a positive (negative) linear function of  $\varepsilon_{BR}$  for *buy* (*sell*) stocks and unrelated with  $\varepsilon_{BR}$  for *hold* stocks:

$Com'(\varepsilon_{BR}) > 0$  for *buys*,  $Com'(\varepsilon_{BR}) = 0$  for *holds*, and

$$Com'(\varepsilon_{BR}) < 0 \text{ for } \textit{sells} \quad (3.2)$$

The optimal solution for a broker-analyst is to report  $F(X_{BR}^*) = X + \varepsilon_{BR}^*$  such that  $|Relm'(\varepsilon_{BR}^*) + Com'(\varepsilon_{BR}^*)| = |Rep'(\varepsilon_{BR}^*)|$ . Since  $Relm(\varepsilon_{BR})$  and  $Com(\varepsilon_{BR})$  are assumed to be linear functions of  $\varepsilon_{BR}$ , the optimal bias ( $\varepsilon_{BR}^*$ ) of a broker-analyst can be partitioned into two parts: (1) the optimal bias where the condition ( $Relm'(\varepsilon_1^*) = -Rep'(\varepsilon_1^*)$ ) is satisfied and (2) the optimal bias where the condition ( $|Com'(\varepsilon_2^*)| = |Rep'(\varepsilon_2^*)|$ ) is satisfied.  $\varepsilon_1^*$  is called the optimal bias ( $\varepsilon_{BR}^*(MR)$ ) of a broker-analyst influenced by his management relation incentive and  $\varepsilon_2^*$  is called the optimal bias ( $\varepsilon_{BR}^*(TB)$ ) of a broker-analyst affected by his trade-boosting incentive. The optimal bias of a broker-analyst can be written as:

$$\varepsilon_{BR}^* = \varepsilon_{BR}^*(MR) + \varepsilon_{BR}^*(TB) \quad (3.3)$$

From Assumptions (3.1) and (3.2), the optimal bias ( $\varepsilon_{BR}^*(MR)$ ) influenced by broker-analysts' management relation incentive would be positive. From Assumption (3.1) and Equation (3.2), the optimal bias ( $\varepsilon_{BR}^*(TB)$ ) influenced by broker-analysts' trade-boosting incentive would be:

$$\varepsilon_{BR}^*(TB_{Buy}) > 0, \varepsilon_{BR}^*(TB_{Hold}) = 0, \varepsilon_{BR}^*(TB_{Sell}) < 0 \quad (3.4)$$

where  $\varepsilon_{BR}^*(TB_i)$  is the optimal bias of a broker-analyst influenced by his trade-boosting incentive for  $i$  stocks ( $i = Buy, Hold, Sell$ ). That is, broker-analyst's earnings forecasts are upward (downward) biased for *buy* (*sell*) stocks and unbiased for *hold* stocks.

### 3.2 Existence of Broker-analysts' Trade-Boosting Incentive

In order to test for the presence of broker-analysts' trade-boosting incentive, I contrast the broker-analysts' forecast bias to the non-broker analysts' forecast bias by stock recommendation portfolios, because the differing incentives faced by broker and non-broker analysts can lead to differing bias in their earnings forecasts. For non-broker analysts, the optimal bias in their earnings forecasts consists of only the bias influenced by their management relation incentive (Refer to Equation (3.2)). Alternatively, broker-analysts' optimal bias ( $\varepsilon_{BR}^*$ ) consists of two parts: (1) the optimal bias ( $\varepsilon_{BR}^*(MR)$ ) affected by their management relation incentive and (2) the optimal bias ( $\varepsilon_{BR}^*(TB)$ ) influenced by their trade-boosting incentive (Refer to Equation

(3.3)). An optimal bias influenced by the management relation incentive is assumed to be indifferent for broker and non-broker analysts. From Equations (3.2), (3.3), and (3.4),

$$\varepsilon_{BR}^*(Buy) > \varepsilon_{NB}^*(Buy), \varepsilon_{BR}^*(Hold) = \varepsilon_{NB}^*(Hold), \varepsilon_{BR}^*(Sell) < \varepsilon_{NB}^*(Sell) \quad (3.5)$$

where  $\varepsilon_j^*(i)$  is the optimal bias of an analyst  $j$  for stocks with  $i$  recommendations ( $j = \text{Broker Analyst, Non-broker Analyst, } i = \text{Buy, Hold, Sell}$ ).

For *buy* stocks, broker-analysts' earnings forecasts are more optimistically biased than non-broker analysts' forecasts. For *hold* stocks, there is no difference in the biasedness of broker and non-broker analysts' forecasts. For *sell* stocks, non-broker analysts' forecasts are more optimistically biased than broker-analysts' forecasts.

$H_1$ : The existence of the trade-boosting incentive predicts that broker-analysts' earnings forecasts are more (less) optimistically biased than non-broker analysts' forecasts for *buy* (*sell*) stocks and that there is no difference in the biasedness of broker and non-broker analysts' forecasts for *hold* stocks.

### 3.3 Dominance of Broker-analysts' Trade-Boosting Incentive

The hypothesis  $H_1$  tests for the existence of broker-analysts' trade-boosting incentive. This paper also investigates the relative dominance of broker-analysts' trade-boosting incentive and their management relation incentive. Following Francis and Philbrick [1993], unfavorable stock recommendations are assumed to result in greater deterioration of analysts'

relations with management. Optimistic earnings forecasts mitigate the deterioration in the management relations caused by unfavorable stock recommendations and the manager more values an additional unit of analysts' earnings optimism for more unfavorable stock recommendations. The management relation incentive predicts that:

$$Relm'(\varepsilon) \text{ for } sells > Relm'(\varepsilon) \text{ for } holds > Relm'(\varepsilon) \text{ for } buys > 0 \quad (3.6)$$

That is, an additional unit of analysts' earnings optimism more improves relations with management for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks. From Assumptions (3.1) and (3.2) and Equation (3.6), the optimal bias ( $\varepsilon_{BR}^*(MR)$ ) of a broker-analyst influenced by his management relation incentive would be:

$$\varepsilon_{BR}^*(MR_{Sell}) > \varepsilon_{BR}^*(MR_{Hold}) > \varepsilon_{BR}^*(MR_{Buy}) > 0 \quad (3.7)$$

$\varepsilon_{BR}^*(MR_i)$  is the optimal bias of a broker-analyst influenced by his management relation incentive for stocks with  $i$  recommendations ( $i = Sell, Hold, Buy$ ).

From Equation (3.4), the trade-boosting incentive predicts that broker-analysts' earnings forecasts are optimistic for *buy* stocks and unbiased for *hold* stocks. From Equation (3.7), the management relation incentive predicts that broker-analysts' forecasts are more optimistic for *hold* stocks than *buy* stocks. If broker-analysts' trade-boosting incentive dominates their management relation incentive, the optimal bias for *buy* stocks is more optimistic than the bias for *hold* stocks (i.e.,  $\varepsilon_{BR}^*(Buy) > \varepsilon_{BR}^*(Hold)$ ).

For *sell* stocks, from Equation (3.7), the broker-analysts' optimal bias ( $\varepsilon_{BR}^*(MR_{Sell})$ ) influenced by their management relation incentive is positive. From Equation (3.4), the broker-analysts' optimal bias ( $\varepsilon_{BR}^*(TB_{Sell})$ ) influenced by their trade-boosting incentive is negative. Therefore, the directional sign of  $\varepsilon_{BR}^*(Sell)$  depends on the absolute magnitude of negative and positive optimal bias influenced by differing incentives. If the broker-analysts' trade-boosting incentive dominates their management relation incentive, the optimal forecast bias would be negative.

H<sub>2</sub>: The dominance of broker-analysts' trade-boosting incentive over their management relation incentive predicts that the broker-analysts' earnings forecasts are more optimistically biased for *buy* stocks than *hold* stocks and pessimistically biased for *sell* stocks.

### 3.4 Investors' Ability to Adjust for Analysts' Forecast Bias

Little concern is given to the investors' ability to adjust for analysts' forecast bias in previous studies. Regressing abnormal returns around actual earnings announcement dates on analysts' earnings forecast errors (i.e.,  $X - F(X)$ , where  $X$  is actual EPS and  $F(X)$  is analysts' forecasts), I examine whether investors can see through and undo the biasedness of analysts' earnings forecasts influenced by their incentives. If investors completely ignore analysts' forecast bias, there would be no difference in the magnitudes of regression coefficients between regression models with biased forecasts and regression models with bias-adjusted forecasts. If investors adjust for analysts'

forecast bias and researchers do not adjust for the bias, the regression models used by researchers would contain measurement errors in the independent variable. These measurement errors would induce the coefficients of analysts' forecast errors to be biased toward zero.

The existence of broker-analysts' trade-boosting incentive predicts that broker-analysts' earnings forecasts possess more (less) optimism for *buy (sell)* stocks than non-broker analysts' forecasts. If investors adjust for the bias, then regression models using broker-analysts' earnings forecast errors for *buy (sell)* stocks contain more (less) measurement errors than regression models using non-broker analysts' forecast errors. Consequently, the magnitudes of the coefficients in regression models using broker-analysts' forecasts errors for *buy (sell)* stocks would be smaller (larger) than those using non-broker analysts' forecasts errors.

H<sub>3</sub>: Investors' ability to adjust for analysts' forecast bias predicts that the regression coefficients of broker-analysts' forecast errors are smaller (larger) than those of non-broker analysts' forecast errors for *buy (sell)* stocks.

### Chapter 3 - Endnotes

- <sup>1</sup> This paper controls for the investment-banking incentive by sample construction. Broker-analysts also face other incentives. Analysts trade on their own personal accounts in the stocks of the company which they follow. The brokerage firm's investment portfolio may include stocks of companies analysts follow. Interested readers may read Marton [1987] for the anecdotic evidence of the conflict of interests arisen in the case that brokerage firms are also market makers. Those incentives are out of the scope of this paper. In addition, the incentives of analysts to follow a company are not studied in this paper. For the details of the analyst incentive to follow a company, see Bhushan [1989] and O'Brien and Bhushan [1990].
- <sup>2</sup> For the general optimism observed in earnings forecasts of non-broker analysts (i.e., Value Line analysts), see Mendenhall [1991], Abarbanell and Bernard [1992], and Francis and Philbrick [1993].

## Chapter 4

### SAMPLE SELECTION AND DATA DESCRIPTION

#### 4.1 Sample Selection

For non-broker analysts, I use Value Line like Francis and Philbrick [1993]. The Value Line Investment Survey provides earnings forecasts, actual earnings, timeliness ranks, and issuance dates. The timeliness rank of Value Line runs on a scale from 1 (highest) down to 5 (lowest). One hundred stocks are ranked 1; 300 stocks are ranked 2; 900 stocks are ranked 3; 300 stocks are ranked 4; and 100 stocks are ranked 5. What the timeliness rank say to investors is the following:

Rank 1 (Highest): Expect this stock to be one of the best price performers.  
Rank 2 (Above Average): Expect better-than-average price performance.  
Rank 3 (Average): Expect price performance in line with the market.  
Rank 4 (Below Average): Expect below-average price performance.  
Rank 5 (Lowest): Expect the poorest price performance relative to other stocks.

Stock recommendations are inferred from the timeliness ranks of Value Line.<sup>1</sup> A timeliness rank of 1 is defined as a *strong buy*; a timeliness rank of 2 is defined as a *buy*; a timeliness rank of 3 is defined as a *hold*; a timeliness rank of 4 is defined as a *sell*; and a timeliness rank of 5 is defined as a *strong sell*. The actual EPS are obtained from the later issues of Value Line.

Broker-analysts' research reports including earnings forecasts, actual earnings, stock recommendations, and issuance dates are obtained from the Corporate and Industry Research Reports (CIRR). I used the research reports issued by Duff and Phelps Inc. I chose Duff & Phelps for two reasons: (1) quantitative recommendations and (2) relatively large numbers of companies being covered by analysts. Duff & Phelps stock recommendations run on the scale from 5 (*strong sell*) to 1 (*strong buy*) like Value Line. The reclassification of qualitative stock recommendations into quantitative ones are sometimes arbitrary.<sup>2</sup> For instance, Dugar and Nathan [1993] classified an *Accumulate* as a *Buy*. However, an *Accumulate* is not equivalent to a *Buy*. C.J. Lawrence research reports show that analysts upgrade their stock recommendations from an *Accumulate* to a *Buy*. In order to prevent this problem of reclassification into quantitative recommendations, I chose investment research reports with quantitative stock recommendations.

In addition, I chose a brokerage house which covers relatively large numbers of companies. I find that Piper, Jaffray & Hopwood, Wheat, Blunt, Eliis & Loewi, J.C. Bradford, Baird, Wood Gundy, Kidder, Peabody, and Fahnstock also provide quantitative recommendations, but these brokerage firms cover less than 100 companies and rarely issue *sell* recommendations.

I identified from the Corporate Finance Bluebook, the companies for which Duff & Phelps provides financial services including investment-banking,

pension-consulting, and pension-managing services and deleted those companies, because this paper does not address broker-analysts' incentives influenced by those relationships.

The sample of this study contains only December year-end firms covered by both Duff & Phelps and Value Line. I restricted my sample to December year-end firms for comparison with Francis and Philbrick [1993]. I drew 1,417 annual EPS forecasts (235 firms) for 1989 and 1990 made by Value Line and 1,562 annual EPS forecasts (235 firms) made by Duff & Phelps. I matched the Value Line forecasts with the Duff & Phelps forecasts issued on the closest date to the Value Line forecast issuance date. I restricted my sample to earnings forecasts within a six-week interval between Duff & Phelps and Value Line, because the volume of information about firms covered beyond an interval of more than six-weeks may be significantly different. That left 1,043 matched annual EPS forecasts (203 firms). I deleted 38 matched forecasts (6 firms) for which the companies became investment-banking clients and pension-managing (pension-consulting) clients of Duff & Phelps. I additionally deleted 7 matched forecasts (3 firms) for which Value Line ceased its coverage. The final sample contains 998 matched annual EPS forecasts (194 firms) for the tests related to analysts' forecast bias undeflated and deflated by actual EPS. I additionally deleted 53 matched annual EPS forecasts (10 firms) for which CRSP data were not available. The final sample for the

tests related to analysts' forecast bias deflated by security price contains 935 matched annual EPS forecasts (184 firms).

## 4.2 Data Description

Table 4-1 reports the frequency distributions of stock recommendations of Value Line and Duff & Phelps. To determine whether the sample selection criteria affect the distributions of stock recommendations and potentially limit the extent to which I can generalize the findings, I compare in Panel A, the Value Line sample distributions to the Value Line population distributions which contain about 5.88% (100/1700) *strong buys*, 17.65% (300/1700) *buys*, 52.94% (900/1700) *holds*, 17.65% (300/1700) *sells*, and 5.88% (100/1700) *strong sells*. The  $\chi^2$  goodness-of-fit test is unable to reject the null hypothesis that the sample and population distributions are similar (at the 10% significance level). Given the small number of observations in the *strong buy* and *strong sell* portfolios (52 and 57 forecasts), I combine these stocks with the *buy* and *sell* portfolios, respectively. All remaining tests are conducted on these three portfolios (i.e., *buy*, *hold*, and *sell* portfolios). In Panel B, I compare the frequency distributions of the Value Line sample to those of the population, using reclassified stock portfolios (i.e., three portfolios). The  $\chi^2$  goodness-of-fit test is also unable to reject the null hypothesis that the sample and population distributions are similar (at the 10% significance level).

Panel C presents the frequency distributions of the Duff & Phelps' stock recommendations. For a comparison with Value Line, I regroup the Duff & Phelps' stock recommendations into three portfolios: *buys*, *holds*, and *sells* in Panel D. The Duff & Phelps population distributions of stock recommendations are unknown. However, Schultz [1990] reports that, of a sample of 1,500 recommendations made by Zachs Investment Research, Inc., 44.67% (670/1500) were *buys*, 45.60% (684/1500) were *holds*, and 9.73% (146/1500) were *sells*. Assuming Schultz's sample distributions represents the population distributions of Duff & Phelps' stock recommendations, I compare in Panel D, the sample distributions of Duff & Phelps' stock recommendations to those of Schultz's sample of 1,500 recommendations made by Zachs Investment Research, Inc. The  $\chi^2$  goodness-of-fit test is unable to reject the null hypothesis that the Duff & Phelps' sample and Schultz's sample distributions of stock recommendations are similar (at the 5% significance level).

Panel E presents the difference in the sample distributions of stock recommendations between Value Line and Duff & Phelps. 55.8% of the Duff & Phelps recommendations are *buys*, whereas only 24.6% of the Value Line recommendations fall into this category. The Z-test rejects the null hypothesis that the frequency distributions of the Duff & Phelps and Value Line *buy* stocks are similar (at the 1% significance level). While 45.60% (9.73%) of the

Duff & Phelps recommendations are *holds (sells)*, 33.87% (10.32%) of the Value Line recommendations are *holds (sells)*. The Z-tests reject the null hypotheses that the frequency distributions of the Duff & Phelps and the Value Line *hold (sell)* stocks are similar (at the 1% significance level). That is, Duff & Phelps issues more *buys* and less *holds/sells*, relative to Value Line.

## Chapter 4 - Endnotes

- <sup>1</sup> The timeliness ranks of Value Line are used to infer stock recommendations by Francis and Philbrick [1993], Huberman and Kandel [1990], Stickel [1985], Copeland and Mayers [1982], Holloway [1981] and Black [1973]
- <sup>2</sup> Broker-analysts are actually trying to tell you something if only readers understand their language (Tanhauser [1993]). Researchers may not be familiar with the language used by broker-analysts.

## Chapter 5

### EMPIRICAL RESULTS

Table 5-1 presents the forecast bias ( $\varepsilon$ ) of Value Line and Duff & Phelps for all stock recommendation portfolios, using three different specifications for the forecast bias: (1) undeflated, (2) deflated by the actual EPS, and (3) deflated by share price at the beginning of the year. The significance levels of parametric t-tests and nonparametric Wilcoxon signed-ranks Z-tests for the Value Line and Duff & Phelps forecast bias indicate that the EPS forecasts are optimistic (at the 1% significance level in all cases). These results are consistent with the general optimism observed in analysts' earnings forecasts.<sup>1</sup>

Table 5-1 also reports tests for the differences in EPS forecast bias between Value Line and Duff & Phelps. The parametric t-tests and nonparametric Wilcoxon signed-ranks Z-tests for the difference in the biasedness of EPS forecasts between Value Line and Duff & Phelps indicate that there is no difference (at the 10% significance level in all cases except for Wilcoxon signed-ranks Z-tests for price-deflated forecast bias which is significant at the 10% level). In general, both Value Line and Duff & Phelps

analysts' forecasts are optimistically biased, but there is no difference in forecast bias between Value Line and Duff & Phelps for all stock recommendation portfolios.

### **5.1 Tests for Hypothesis 1 (Existence of Broker-analysts' Trade-Boosting Incentive)**

Table 5-2 compares the forecast bias between Value Line and Duff & Phelps by stock recommendation portfolio. Regardless of stock recommendations, the parametric t-tests and nonparametric Wilcoxon signed-ranks Z-tests indicate that the EPS forecasts of Value Line and Duff & Phelps are optimistic (at the 1% significance level in all but one case which is significant at the 5% level).

The differences in the EPS forecast bias between Value Line and Duff & Phelps by stock recommendation portfolio are also presented in Table 5-2. For *hold* stocks, the Value Line and Duff & Phelps EPS forecasts are not different for both parametric t-tests and non-parametric Wilcoxon ranks sum Z-tests (at the 10% significance level in all cases). For *buy* stocks, the Duff & Phelps EPS forecasts are more optimistic than the Value Line forecasts (at the 1% significance level in all cases for the parametric t-tests and nonparametric Wilcoxon ranks sum Z-tests). For *sell* stocks, Duff & Phelps EPS forecasts are less optimistic than Value Line (at the 5% significance level in all cases for

the nonparametric Wilcoxon ranks sum Z-tests and at the 10% significance level in the case where EPS forecasts are deflated by actual EPS for the parametric t-test). The results are consistent with the existence of Duff & Phelps analysts' trade-boosting incentive. In order to stimulate the trades on the stocks with *buy (sell)* recommendations, broker-analysts' forecasts (i.e., Duff & Phelps analysts) are more (less) optimistic for *buy (sell)* stocks than non-broker analysts (i.e., Value Line analysts) whose firms do not earn brokerage commissions.

Table 5-3 presents the frequency distributions of observations with positive forecast errors (i.e.,  $\varepsilon = F(X) - X$ , where  $F(X)$  = annual EPS forecast and  $X$  = actual EPS) for Value Line and Duff & Phelps. For a sample of 998 matched forecasts, the frequency distributions of analysts' forecast errors show that 60.63% of the Value Line analysts' forecasts are higher than actual earnings and 61.33% of the Duff & Phelps analysts' forecasts are higher than actual earnings. The Z-statistics (*a priori*) for 998 overall matched forecasts show that the proportion of observations with positive forecast errors of Value Line and Duff & Phelps (i.e.,  $F(X) - X = \varepsilon > 0$ ) exceeds the *a priori* probability (50%), which assumes an equal chance to occur positive forecast errors (at the 1% significance level in all cases). These results confirm that broker and non-broker analysts' earnings forecasts are in general optimistic. In addition, the difference in the fraction of observations

with positive forecast errors between Value line and Duff & Phelps is not significant at the 10% level. These results also confirm that there is no difference in forecast bias between Value Line and Duff & Phelps.

Table 5-3 also shows the frequency distributions of observations with positive forecast errors (i.e.,  $\varepsilon = F(X) - X$ , where  $F(X)$  = annual EPS forecast and  $X$  = actual EPS) for Value Line and Duff & Phelps by stock recommendation portfolio. For Value Line analysts' forecasts, the Z-statistics (*a priori*) for *buy* stocks show that the fractions of observations with positive forecast errors are not different from the *a priori* probability (50%) at the 10% significance level in all cases and those for *hold* and *sell* stocks show that the fractions of observations with positive forecast errors exceed the *a priori* probability (50%) at the 1% significance level in all cases. The Z-statistics (*a posteriori*) for *buy* stocks of Value Line show the fractions of observations with positive forecast errors are less than the *a posteriori* overall sample proportions for all recommendations (60.63%) at the 1% significance level in all cases and the fractions for *hold* and *sell* stocks are not different from the *a posteriori* overall sample proportions (60.63%) at the 10% significance level.

On the other hand, for Duff & Phelps analysts' forecasts, the Z-statistics (*a priori*) for *buy* and *hold* stocks show that the fractions of observations with positive forecast errors exceed the *a priori* probability (50%) at the 1% significance level in all cases. The Z-statistics (*a posteriori*) for *buy* stocks

show that the fractions of observations with positive forecast errors exceed the *a posteriori* overall sample proportions (61.33%) at the 5% significance level in all cases and the fractions for *hold* stocks are not different from the *a posteriori* overall sample proportions for all recommendations at the 5% significance level. For *sell* stocks of Duff & Phelps, the fractions of observations with positive forecast errors are not different from the *a priori* probability (50%) at the 10% significance level, but are less than the *a posteriori* overall sample fractions for all recommendations at the 5% significance level.

In general, while the fractions of observations with positive forecast errors for *buy* stocks of Value Line are less than Value Line's total sample proportions with positive forecast errors for all recommendations, the fractions of forecasts with positive forecast errors for *buy* (*sell*) stocks of Duff & Phelps are greater (less) than the Duff & Phelps total sample proportions with positive forecast errors for all stock recommendations. These results are also consistent with the existence of Duff & Phelps analysts' trade-boosting incentive.

In addition, Table 5-3 presents the comparisons in the proportions of observations with positive forecast errors between Value Line and Duff & Phelps. For *hold* stocks, the fractions of observations with positive forecast errors of Value Line are not different from those of Duff & Phelps (at the 5% significance level). For *buy* stocks, positive forecast errors are more prevalent

in Duff & Phelps than in Value Line (at the 1% significance level). For *sell* stocks, positive forecast errors are more prevalent in Value Line than in Duff & Phelps (at the 5% significance level). These results are also consistent with the existence of Duff & Phelps analysts' trade-boosting incentive.

Table 5-4 presents the results of regression analyses for the comparisons of the forecast bias between Value Line and Duff & Phelps analysts, using three different specifications for the forecast bias: (1) undeflated, (2) deflated by the actual EPS, and (3) deflated by share price at the beginning of the year. For all stock recommendation portfolios, there is no difference in the forecast bias between Value Line and Duff & Phelps in all cases. For *buy* stock portfolio, the Duff & Phelps analysts' forecast bias is greater than the Value Line in all cases at the 5% significance level. For *hold* stocks, there is no difference in the forecast bias between Value Line and Duff & Phelps in all cases. The Duff & Phelps analysts' forecast bias deflated by actual earnings is less than the Value Line for *sell* stocks at the 10% significance level. The results indicate that there is no difference in total forecast bias between Value Line and Duff & Phelps for all recommendations and *hold* stocks. The empirical results of regression analyses support the existence of the broker-analysts' (i.e., Duff & Phelps analysts') trade boosting incentive for *buy* stock portfolio, but not for *sell* stock portfolio.

In general, the results in Tables 5-1, 5-2, 5-3, and 5-4 show that there is no difference in total biasedness of Value Line and Duff & Phelps analysts' earnings forecasts for all recommendations and *hold* stocks. However, evidence shows that, for *buy (sell) stocks*, Duff & Phelps analysts' forecasts are more (less) optimistically biased than Value Line analysts' forecasts.

## **5.2 Tests for Hypothesis 2 (Dominance of Broker-analysts' Trade-Boosting Incentive)**

Table 5-5 compares the forecast bias among stock recommendation portfolios of Value Line and Duff & Phelps, using three different specifications for the forecast bias: (1) undeflated, (2) deflated by the actual EPS, and (3) deflated by share price at the beginning of the year. The management relation incentive predicts that analysts' earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks. The parametric t-test and nonparametric Wilcoxon ranks sum Z-tests show that Value Line analysts' earnings forecasts are more optimistically biased for *hold/sell* stocks than for *buy* stocks (at the 5% significance level in all cases). The parametric t-tests indicate that *sell* stocks are more optimistically biased than *hold* stocks at the 5% significance level for Value Line analysts' forecast bias deflated by actual EPS and security price. The Kruskal-Wallis  $\chi^2$  tests reject the hypothesis that the Value Line analysts' forecast bias is indifferent

among the three stock recommendation portfolios (at the 1% significance level). In general, these results are consistent with the Value Line analysts' management relation incentive that non-broker analysts' forecasts are more optimistically biased for less favorable stock recommendations in order to improve management relations.

Duff & Phelps analysts have the additional incentive to stimulate stock trades (the trade-boosting Incentive). Analysts' earnings forecasts for *buy* stocks would be more optimistically biased than those for *hold* stocks to stimulate stock trades. On the other hand, analysts' forecasts for *hold* stocks would be more optimistically biased than those for *buy* stocks to improve management relations for less favorable stock recommendations under the management relation incentive hypothesis. Table 5-5 shows the differences in the biasedness of Duff & Phelps analysts' forecasts between *buys* and *holds*. Parametric t-tests show that Duff & Phelps analysts' forecast bias undeflated and deflated by security price for *buy* stocks is more optimistic than that for *hold* stocks at the 5% significance level and nonparametric Wilcoxon ranks sum Z-tests show that Duff & Phelps analysts' forecast bias undeflated and deflated by actual EPS for *buy* stocks is more optimistic than that for *hold* stocks at the 5% significance level. These results provide a weak evidence for the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks.

On the other hand, the biasedness of Duff & Phelps analysts' forecasts for *hold* stocks is not different from that for *sell* stocks at the 10% significance level in all cases. In addition, Duff & Phelps analysts' earnings forecasts for *sell* stocks are optimistically biased, even in the presence of their trade-boosting incentive, at the 5% significance level in all cases. These results indicate that, for *sell* stocks, Duff & Phelps analysts' management relation incentive dominates their trade-boosting incentive.

In general, Table 5-5 shows that Value Line analysts' earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks, which is consistent with the non-broker analysts' management relation incentive. In contrast, Duff & Phelps analysts' earnings forecasts are more optimistically biased for *buy* stocks than *hold* stocks. However, there is no difference in the biasedness of Duff & Phelps analysts' earnings forecasts between *hold* stocks and *sell* stocks. These results are consistent with the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks, but not for *sell* stocks.

Table 5-6 compares the frequency distributions of observations with positive forecast errors (i.e.,  $\varepsilon = F(X) - X$ , where  $F(X)$  = annual EPS forecast and  $X$  = actual EPS) among stock recommendation portfolios for Value Line and Duff & Phelps. The fractions of observations with positive

forecast errors for Value Line analysts' *buy* stocks are less than those for *hold/sell* stocks at the 5% significance level in all cases. The results are consistent with the Value Line analysts' management relation incentive. Non-broker analysts (i.e., Value Line analysts) report more optimistic earnings forecasts for the companies with less favorable stock recommendations in order to improve the deteriorated management relationships caused by less favorable stock recommendations.

The fractions of observations with positive forecast errors for Duff & Phelps analysts' *buy* stocks are greater than those for *hold/sell* stocks at the 1% significance level. However, the proportions of observations with positive forecast errors for Duff & Phelps analysts' *hold* stocks are not different from those for *sell* stocks. These results are consistent with the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks. In general, the results presented in Table 5-6 confirm that non-broker analysts (i.e., Value Line analysts) have the management relation incentive and broker-analysts' (i.e., Duff & Phelps analysts') trade-boosting incentive dominates their management relation incentive for *buy* stocks, but not for *sell* stocks.

Table 5-7 presents the results of regression analyses for the comparisons of analysts' forecast bias among stock recommendation portfolios, using three different specifications for the forecast bias: (1) undeflated, (2) deflated by the

actual EPS, and (3) deflated by share price at the beginning of the year. For Value Line, the forecast bias for *buy* stocks are less optimistic than the bias for *hold/sell* stocks at the 5% significance level in all cases. The results are consistent with the Value Line analysts' management relation incentive hypothesis. In order to improve the deteriorated management relationships caused by less favorable stock recommendations, non-broker analysts (i.e., Value Line analysts) report more optimistic earnings forecasts for firms with *sell* recommendations. For Duff & Phelps, the forecast bias undeflated and deflated by security price at the beginning of the year for *buy* stocks are more optimistic than the bias for *hold* stocks at the 5% significance level. The results are consistent with the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stock portfolios. In order to stimulate the trades on the stocks broker-analysts (i.e., Duff & Phelps analysts) recommend as *buy*, they report more optimistic earnings forecasts for the firms with *buy* recommendations. In addition, for *buy* stocks, the trade-boosting incentive dominates the management relation incentive which predicts that analysts report more optimistic earnings forecasts for *hold* stocks than for *buy* stocks.

In general, Tables 5-5, 5-6, and 5-7 show that Value Line analysts' forecasts for *buy* stocks are less optimistic than those for *hold/sell* stocks, which is consistent with the management relation incentive hypothesis. Duff &

Phelps analysts' forecast for *buy* stocks are more optimistic than those for *hold* stocks and there is no difference in the bias between *hold* stocks and *sell* stocks, which is consistent with the dominance of the trade-boosting incentive over the management incentive for *buy* stocks, but not for *sell* stocks.

### 5.3 Tests for Hypothesis 3 (Investors' Ability to Adjust for Analysts')

#### Forecast Bias

Table 5-8 presents the investors' reactions to analysts' forecast errors (i.e.,  $(X - F(X))/P_{t-5}$ , where  $X$  is actual EPS,  $F(X)$  is analysts' earnings forecasts, and  $P_{t-5}$  is security price 5 days before the actual earnings announcement date). The cumulative abnormal returns, using 250 trading days of estimation periods, for one day before and on the date of earnings announcements are used. The investors' ability to adjust for the forecast errors which are caused by analysts' incentives predicts that the regression coefficients of broker-analysts' forecast errors are smaller (larger) than those of non-broker analysts' forecast errors for *buy* (*sell*) stocks.

For overall sample of 268 analysts' forecasts issued after the third quarter earnings announcement dates and before annual earnings announcement dates, there is no difference in the investors' reactions to both Value Line and Duff & Phelps analysts' forecast errors. For *buy* stocks, investors react more to Value Line analysts' forecast errors than to Duff & Phelps analysts' forecast

errors at the 10% significance level. For *hold* and *sell* stocks, there is no difference in investors reactions to Value line and Duff & Phelps forecast errors. In general, the results in Table 5-8 do not suggest that investors adjust for the forecast bias caused by analysts' incentives.

#### **5.4 Tests for Hypotheses 1 and 2 Using a Reduced Sample**

I retest Hypotheses 1 and 2, using a reduced sample consisting of 357 matched analysts forecasts with the same stock recommendations for Value Line and Duff & Phelps in order to control for the differences in analysts' forecast bias for the different companies which analysts follow. Thus, in a reduced sample, analysts' forecasts are matched by the same stock recommendations and the same companies. Table 5-9 presents the forecast bias of Value Line and Duff & Phelps for all stock recommendation portfolios. The significance levels of parametric t-tests and nonparametric Wilcoxon signed-ranks Z-tests for the Value Line and Duff & Phelps forecast bias indicate that the EPS forecasts are optimistic (at the 1% significance level in all cases). These results are consistent with the general optimism observed in analysts' earnings forecasts.

Table 5-9 also reports the test results for the differences in the EPS forecast bias between Value Line and Duff & Phelps for all stock recommendation portfolios. The parametric t-tests and nonparametric

Wilcoxon signed-ranks Z-tests for the difference in the biasedness of EPS forecasts between Value Line and Duff & Phelps indicate that there is no difference (at the 10% significance level in all cases). In general, both Value Line and Duff & Phelps analysts' forecasts are optimistically biased, but there is no difference in forecast bias between Value Line and Duff & Phelps.

Table 5-10 presents the forecast bias of Value Line and Duff & Phelps by stock recommendation portfolio for a reduced sample. Regardless of stock recommendations, the parametric t-tests and nonparametric Wilcoxon signed-ranks Z-tests indicate that the EPS forecasts of Value Line and Duff & Phelps are optimistic (at the 5% significance level in all but one case which is significant at the 10% level).

The differences in the biasedness of EPS forecasts between Value Line and Duff & Phelps by stock recommendation portfolio are also presented in Table 5-10. For *hold* and *sell* stocks, the Value Line and Duff & Phelps EPS forecasts are not different for both parametric t-tests and non-parametric Wilcoxon ranks sum Z-tests (at the 10% significance level in all cases). For *buy* stocks, the Duff & Phelps EPS forecasts are more optimistic than the Value Line forecasts (at the 1% significance level in all cases for the parametric t-tests and nonparametric Wilcoxon ranks sum Z-tests). The results are consistent with the existence of Duff & Phelps analysts' trade-boosting incentive for *buy* stocks. In order to stimulate the trades on the stocks with

*buy* recommendations, broker-analysts' forecasts (i.e., Duff & Phelps analysts' forecasts) are more optimistic for *buy* stocks than non-broker analysts (i.e., Value Line analysts) whose firms do not earn brokerage commissions.

Table 5-11 presents the frequency distributions of observations with positive forecast errors (i.e.,  $\varepsilon = F(X) - X$ , where  $F(X)$  = annual EPS forecast and  $X$  = actual EPS) for Value Line and Duff & Phelps. For a sample of 357 matched forecasts, the frequency distributions of analysts' forecast errors show that 57.63% of the Value Line analysts' forecasts are higher than actual earnings and 60.43% of the Duff & Phelps analysts' forecasts are higher than actual earnings. The Z-statistics (*a priori*) for 357 overall matched forecasts show that the proportion of observations with positive forecast errors of Value Line and Duff & Phelps (i.e.,  $F(X) - X = \varepsilon > 0$ ) exceeds the *a priori* probability (50%), which assumes an equal chance to occur positive forecast errors (at the 1% significance level in all cases). These results confirm that broker and non-broker analysts' earnings forecasts are in general optimistic. In addition, the difference in the fraction of observations with positive forecast errors between Value line and Duff & Phelps is not significant at the 10% level. These results also confirm that there is no difference in forecast bias between Value Line and Duff & Phelps.

Table 5-11 also presents the frequency distributions of the observations with positive forecast errors for Value Line and Duff & Phelps by stock

recommendation portfolio. For Value Line analysts' forecasts, the Z-statistics (*a priori*) for *buy* stocks show that the fractions of observations with positive forecast errors are not different from the *a priori* probability (50%) at the 10% significance level in all cases and those for *hold* stocks show that the fractions of observations with positive forecast errors exceed the *a priori* probability (50%) at the 1% significance level in all cases.

On the other hand, for Duff & Phelps analysts' forecasts, the Z-statistics (*a priori*) for *buy* and *hold* stocks show that the fractions of observations with positive forecast errors exceed the *a priori* probability (50%) at the 5% significance level in all cases.

In addition, Table 5-11 presents the comparisons in the proportions of observations with positive forecast errors between Value Line and Duff & Phelps. For *hold* and *sell* stocks, the fractions of observations with positive forecast errors of Value Line are not different from those of Duff & Phelps (at the 10% significance level). For *buy* stocks, positive forecast errors are more prevalent in Duff & Phelps than in Value Line (at the 1% significance level). These results are also consistent with the existence of Duff & Phelps analysts' trade-boosting incentive for *buy* stocks.

Table 5-12 presents the results of regression analyses for the comparisons of analysts' forecast bias between Value Line and Duff & Phelps, using a reduced sample of 357 matched analysts' forecast bias with the same

stock recommendations. For all stock recommendation portfolios, there is no difference in total forecast bias between Value Line and Duff & Phelps in all cases. For *buy* stock portfolio, the Duff & Phelps analysts' forecast bias is greater than the Value Line in all cases at the 10% significance level. For *hold* and *sell* stocks, there is no difference in the forecast bias between Value Line and Duff & Phelps in all cases. The results are consistent with the existence of broker-analysts' trade-boosting incentive for *buy* stock portfolio. In order to stimulate the trades on the stocks which broker-analysts (i.e. Duff & Phelps analysts) recommend as *buy*, they report more optimistic earnings forecasts for the companies with *buy* recommendations.

In general, the results in Tables 5-9, 5-10, 5-11, and 5-12 show that there is no difference in total biasedness of Value Line and Duff & Phelps analysts' earnings forecasts for all recommendations and *hold* stocks. However, evidence shows that, for *buy* stocks, Duff & Phelps analysts' forecasts are more optimistically biased than Value Line analysts' forecasts.

Table 5-13 presents the forecast bias among stock recommendation portfolios for Value Line and Duff & Phelps. The management relation incentive predicts that analysts' earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks. The parametric t-tests show that Value Line analysts' earnings forecasts are more optimistically biased for *sell* stocks than for *buy* stocks (at the 5%

significance level in all cases except for the undeflated forecast bias which is significant at 10% level). The nonparametric Wilcoxon ranks sum Z-tests show that Value Line analysts' earnings forecasts are more optimistically biased for *hold* stocks than for *buy* stocks (at the 5% significance level in all cases except for the undeflated forecast bias which is significant at 10% level). The parametric t-tests indicate that *sell* stocks are more optimistically biased than *hold* stocks at the 5% significance level for Value Line analysts' forecast bias deflated by actual EPS. In general, these results are consistent with the Value Line analysts' management relation incentive that non-broker analysts' forecasts are more optimistically biased for less favorable stock recommendations in order to improve management relations.

Duff & Phelps analysts have the additional incentive to stimulate stock trades (the trade-boosting Incentive). Analysts' earnings forecasts for *buy* stocks would be more optimistically biased than those for *hold* stocks to stimulate stock trades. On the other hand, analysts' forecasts for *hold* stocks would be more optimistically biased than those for *buy* stocks to improve management relations for less favorable stock recommendations under the management relation incentive hypothesis. Table 5-13 shows the differences in biasedness of Duff & Phelps analysts' forecasts between *buys* and *holds*. Parametric t-tests show that Duff & Phelps analysts' forecast bias undeflated and deflated by security price for *buy* stocks is more optimistic than that for

*hold* stocks at the 10% significance level. These results provide a weak evidence for the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks.

On the other hand, the biasedness of Duff & Phelps analysts' forecasts for *hold* stocks is not different from that for *sell* stocks at the 10% significance level in all cases. These results indicate that, for *sell* stocks, Duff & Phelps analysts' management relation incentive dominates their trade-boosting incentive.

In general, Table 5-13 shows that Value Line analysts' earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks, which is consistent with non-broker analysts' management relation incentive. In contrast, Duff & Phelps analysts' earnings forecasts are more optimistically biased for *buy* stocks than *hold* stocks. However, there is no difference in the biasedness of Duff & Phelps analysts' earnings forecasts between *hold* stocks and *sell* stocks. These results are consistent with the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks, but not for *sell* stocks.

Table 5-14 presents frequency distributions of observations with positive forecast errors (i.e.,  $\varepsilon = F(X) - X$ , where  $F(X)$  = annual EPS forecast and  $X$  = actual EPS) among stock recommendation portfolios for Value Line and

Duff & Phelps. The fractions of observations with positive forecast errors for Value Line analysts' *buy* stocks are less than those for *hold* stocks at the 5% significance level for the price deflated forecast bias, which is consistent with non-broker analysts' management relation incentive.

The fractions of observations with positive forecast errors for Duff & Phelps analysts' *buy* stocks are greater than those for *hold* stocks at the 10% significance level. However, the proportions of observations with positive forecast errors for Duff & Phelps analysts' *hold* stocks are not different from those for *sell* stocks. These results provide a weak evidence that the Duff & Phelps analysts' trade-boosting incentive dominates their management relation incentive for *buy* stocks, but not for *sell* stocks. In general, the results in Table 5-14 confirm that non-broker analysts (i.e., Value Line analysts) have the management relation incentive and broker-analysts' (i.e., Duff & Phelps analysts') trade-boosting incentive dominates their management relation incentive for *buy* stocks, but not for *sell* stocks.

Table 5-15 presents the results of regression analyses for analysts' forecast bias among stock recommendation portfolios for Value Line and Duff & Phelps. For Value Line, the forecast bias for *buy* stocks are less optimistic than the bias for *sell* stocks at the 5% significance level in all cases. The results are consistent with the non-broker analysts' management relation incentive. Value Line analysts reports more optimistic earnings forecasts for

the companies with less favorable stock recommendations in order to improve the deteriorated relationships with management of the companies caused by less favorable stock recommendations.

For Duff & Phelps, the forecast bias undeflated and deflated by security price for *buy* stocks are more optimistic than the bias for *hold* stocks at the 10% significance level. The results provide a weak evidence for the dominance of Duff & Phelps analysts' trade-boosting incentive over their management relation incentive for *buy* stocks. Duff & Phelps analysts report more optimistic earnings forecasts for the companies with *buy* recommendations in order to stimulate the trades on the stocks they recommend as *buy*.

In general, Tables 5-13, 5-14, and 5-15 show that for a reduced sample consisting of analysts' forecast bias with the same stock recommendations, Value Line analysts' forecasts for *buy* stocks are less optimistic than those for *hold/sell* stocks, which is consistent with the management relation incentive hypothesis. Duff & Phelps analysts' forecast for *buy* stocks are more optimistic than those for *hold* stocks and there is no difference in the bias between *hold* stocks and *sell* stocks, which is consistent with the dominance of the Duff & Phelps analysts' trade-boosting incentive over the management incentive for *buy* stocks, but not for *sell* stocks.

### Chapter 5 - Endnote

- <sup>1</sup> For general optimism observed in broker-analysts' earnings forecasts, see Lin and McNichols [1993], Dugar and Nathan [1993], DeBondt and Thaler [1991], Lys and Sohn [1990], Klein [1990], and O'Brien [1988]. Refer to Endnote 2 of Chapter 3 for optimistic biasedness of non-broker analysts' earnings forecasts.

## Chapter 6

### SUMMARY AND CONCLUSIONS

Non-broker analysts (i.e., Value Line) have the incentive to cultivate relations with management (the management relation incentive). Alternatively, broker-analysts (i.e., Duff & Phelps) have the additional incentive to boost trading on the stocks they recommend (the trade-boosting incentive). For a sample of 998 matched forecasts, I find that broker-analysts' earnings forecasts are more (less) optimistically biased for *buy* (*sell*) stocks than non-broker analysts' forecasts and that there is no difference for *hold* stocks in the biasedness of earnings forecasts between broker and non-broker analysts. These results are consistent with the existence of broker-analysts' trade-boosting incentive.

This paper also investigates the relative dominance of broker-analysts' trade-boosting incentive over their management relation incentive. I find that non-broker analysts' earnings forecasts are more optimistically biased for *sell* stocks than *hold* stocks, and for *hold* stocks than *buy* stocks, which is consistent with the non-broker analysts' management relation incentive. In contrast, this paper shows that broker-analysts' earnings forecasts are more optimistically biased for *buy* stocks than *hold* stocks and that there is no

difference in the biasedness of broker-analysts' earnings forecasts between *hold* stocks and *sell* stocks. In addition, broker-analysts' forecasts for *sell* stocks are optimistically biased. These results are consistent with the dominance of broker-analysts' trade-boosting incentive over their management relation incentive for *buy* stocks, but not for *sell* stocks. This is not surprising, because brokerage firms rarely earn brokerage commissions from investors who do not own the stocks with *sell* recommendations.

Broker-analysts issue more *buys* and less *sells/holds*, relative to non-broker analysts. These results, together with the management relation incentive, imply that in the absence of broker-analysts' trade-boosting incentive, their earnings forecasts for all recommendations are less optimistically biased than non-broker analysts' forecasts. In contrast, I find that there is no difference in total biasedness between broker and non-broker analysts for all stock recommendations. These results imply that the broker-analysts' trade-boosting incentive provides an alternative explanation for the general optimism observed in their earnings forecasts, in addition to the management relation incentive and the investment banking incentive.

Finally, investors' ability to adjust for analysts' forecast bias predicts that the regression coefficients of broker-analysts' forecast errors are smaller (larger) than those of non-broker analysts' forecast errors for *buy* (*sell*) stocks. The results do not suggest that investors adjust for analysts' forecast bias.

**TABLES**

Table 4-1

*Frequency Distributions of Stock Recommendations for Value Line and Duff & Phelps*

Stock Recommendations	Sample Distribution		Population Distribution <sup>1</sup>		Difference %
	Size	%	Size	%	
2 ( <i>strong buy</i> )	52	5.21%	100	5.88%	-0.67%
1 ( <i>buy</i> )	194	19.44%	300	17.65%	1.79%
0 ( <i>hold</i> )	492	49.30%	900	52.94%	-3.64%
-1 ( <i>sell</i> )	203	20.34%	300	17.65%	2.69%
-2 ( <i>strong sell</i> )	57	5.71%	100	5.88%	
0.17%					
<b>Total</b>	<b>998</b>	<b>100.00%</b>	<b>1700</b>	<b>100.00%</b>	
$\chi^2$ goodness-of-fit <sup>2</sup>					<b>0.9230</b>

<sup>1</sup> Value Line covers 1,700 stocks out of which it has a policy to issue 100 *strong buys*, 300 *buys*, 900 *holds*, 300 *sells*, and 100 *strong sells*.

<sup>2</sup> The  $\chi^2$  goodness-of-fit statistic tests whether the sample frequency distribution of Value Line's stock recommendations differs from the population distribution. Critical  $\chi^2$  values are 7.7794 for the 10% significance level and 9.4877 for the 5% level at degree of freedom = 4.

\*(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 4-1 (Contd.)

Panel B: Frequency Distribution of Value Line's Stock Recommendations (3 Classification)

Stock Recommendations	Sample Distribution		Population Distribution <sup>1</sup>		Difference %
	Size	%	Size	%	
1 ( <i>buy &amp; strong buy</i> )	246	24.65%	400	23.53%	1.12%
0 ( <i>hold</i> )	492	49.30%	900	52.94%	-3.64%
-1 ( <i>sell &amp; strong sell</i> )	260	26.05%	400	23.53%	2.52%
<b>Total</b>	<b>998</b>	<b>100.00%</b>	<b>1700</b>	<b>100.00%</b>	
$\chi^2$ goodness-of-fit <sup>2</sup>					<b>0.5735</b>

<sup>1</sup> Value Line covers 1,700 stocks out of which it has a policy to issue 400 *strong buys* or *buys*, 900 *holds*, 400 *sells* or *strong sells*.

<sup>2</sup> The  $\chi^2$  goodness-of-fit statistic tests whether the sample frequency distribution of Value Line's stock recommendations differs from the population distribution. Critical  $\chi^2$  values are 4.6052 for the 10% significance level and 5.9915 for the 5% level at degree of freedom = 2.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 4-1 (Contd.)

Panel C: Frequency Distribution of Duff & Phelps' Stock Recommendations

Stock Recommendations	Sample Distribution	
	Size	%
2 ( <i>strong buy</i> )	171	17.12%
1 ( <i>buy</i> )	386	38.69%
0 ( <i>hold</i> )	338	33.87%
-1 ( <i>sell</i> )	103	10.32%
Total	998	100.00%

(Contd.)

Table 4-1 (Contd.)

Panel D: Frequency Distribution of Duff & Phelps' Stock Recommendations (3 Classification)

Stock Recommendations	Sample Distribution		Schultz's Distribution <sup>1</sup>		Difference %
	Size	%	Size	%	
1 ( <i>buy &amp; strong buy</i> )	557	55.81%	670	44.67%	11.14%
0 ( <i>hold</i> )	338	33.87%	684	45.60%	-11.73%
-1 ( <i>sell &amp; strong sell</i> )	103	10.32%	146	9.73%	0.59%
Total	998	100.00%	1500	100.00%	
$\chi^2$ goodness-of-fit <sup>2</sup>					5.8313*

<sup>1</sup> Schultz [1990] reports that of a sample of 1,500 recommendations made by Zachs Investment Research, Inc., 44.67% were *buys*, 45.60% were *holds*, and 9.73% were *sells*.

<sup>2</sup> The  $\chi^2$  goodness-of-fit statistic tests whether the sample frequency distribution of the Duff & Phelps' stock recommendations differs from Schultz's sample distribution of stock recommendations made by Zachs Investment Research, Inc., assuming Schultz's sample distribution represents population distribution of broker-analysts' stock recommendations. Critical  $\chi^2$  values are 5.9915 (4.6052) for the 5% (10%) significance level at degree of freedom = 2.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 4-1 (Contd.)

Panel E: Frequency Distribution of Duff & Phelps' and Value Line's Stock Recommendations

Stock Recommendations	Duff & Phelps Distribution		Value Line Distribution		Difference	
	Size	%	Size	%	%	(Z-statistic) <sup>1</sup>
1 ( <i>buy</i> )	557	55.81%	246	24.65%	31.16%	(14.9643) <sup>***</sup>
0 ( <i>hold</i> )	338	33.87%	492	49.30%	-15.43%	(-7.0775) <sup>***</sup>
-1 ( <i>sell</i> )	103	10.32%	262	26.05%	-15.73%	(-9.3012) <sup>***</sup>
Total	998	100.00%	998	100.00%		

<sup>1</sup> The Z-statistic compares the proportion of observations between Duff & Phelps and Value Line by stock recommendation portfolio. For example, the Z-statistic of 14.9643 in Panel E tests whether the fraction of Duff & Phelps' stock recommendations with *buys* (55.81%) exceeds that of Value Line's recommendations with *buys* (24.65%).

<sup>\*\*\*</sup> designates statistical significance at the 10%(5%/1%) level, one-tailed test.

**Table 5-1**  
***Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup>***  
***for All Stock Recommendation Portfolios***  
***(Value Line vs. Duff & Phelps)***

<b>Panel A: Undeclared Analysts' Forecast Bias</b>		
	N = 998	
	Mean <i>(t-statistic)</i>	Median <i>(Z-statistic)</i>
Value Line <sup>2</sup>	0.5349 <i>(8.9689)***</i>	0.1100 <i>(14.0390)***</i>
Duff & Phelps <sup>2</sup>	0.5709 <i>(9.6536)***</i>	0.1200 <i>(13.9276)***</i>
Diff (DP - VL) <sup>3</sup>	0.0360 <i>(1.3946)</i>	0.0000 <i>(1.5525)</i>

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t-test* and a nonparametric Wilcoxon signed-ranks *Z-test*, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t-test* and a nonparametric Wilcoxon signed-ranks *Z-test*, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

\*(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-1 (Contd.)

Panel B: Analysts' Forecast Bias Deflated by Actual EPS<sup>1</sup>

	N = 998	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.2544 (10.6964) <sup>***</sup>	0.0406 (14.8285) <sup>***</sup>
Duff & Phelps <sup>2</sup>	0.2623 (10.3048) <sup>***</sup>	0.0424 (14.8533) <sup>***</sup>
Diff (DP - VL) <sup>3</sup>	0.0059 (0.3180)	0.0000 (1.5847)

<sup>1</sup>  $\varepsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\varepsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-1 (Contd.)

Panel C: Analysts' Forecast Bias Deflated by Security Price<sup>1</sup>

	N = 935	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.0178 (7.2453) <sup>***</sup>	0.0038 (14.1585) <sup>***</sup>
Duff & Phelps <sup>2</sup>	0.0205 (8.2233) <sup>***</sup>	0.0035 (13.9231) <sup>***</sup>
Diff (DP - VL) <sup>3</sup>	0.0027 (1.3364)	0.0000 (1.6550) <sup>*</sup>

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level.

Table 5-2 (Tests for H<sub>1</sub>)

**Analysts' Forecast Bias ( $\epsilon$ ) by Stock Recommendation Portfolio  
(Value Line vs. Duff & Phelps)**

**Panel A: Undeclared Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup>**

N = 998

Stock Recommendations

	BUY		HOLD		SELL	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	(n = 246) 0.2312 (3.8294)***	0.0200 (3.9368)***	(n = 492) 0.5887 (6.1589)***	0.1500 (10.6155)***	(n = 260) 0.7207 (5.6906)***	0.1800 (8.6922)***
Duff & Phelps <sup>2</sup>	(n = 557) 0.6801 (7.3596)***	0.1300 (12.3905)***	(n = 338) 0.4179 (6.1141)***	0.1050 (6.8621)***	(n = 103) 0.4830 (2.9150)***	0.0500 (2.6813)***
Diff (DP - VL) <sup>3</sup>	0.4489 (4.0659)***	0.1100 (4.2513)***	-0.1708 (-1.4535)	-0.0450 (-1.5062)	-0.2377 (-1.1393)	-0.1300 (-2.0111)**

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ). The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of the differences in two means and two medians respectively.

(\*\*/\*\*\* ) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

(Contd.)

Table 5-2 (Contd.)

Panel B: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS<sup>1</sup>

N = 998

Stock Recommendations

	BUY		HOLD		SELL	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	(n = 246) 0.1090 (4.3616)***	0.0053 (4.4447)***	(n = 492) 0.2533 (7.7595)***	0.0500 (10.9349)***	(n = 260) 0.3942 (6.3729)***	0.0742 (9.1235)***
Duff & Phelps <sup>2</sup>	(n = 557) 0.2853 (8.1089)***	0.0461 (13.0975)***	(n = 338) 0.2346 (7.0769)***	0.0333 (7.4607)***	(n = 103) 0.2097 (1.9180)**	0.0302 (3.1633)***
Diff (DP - VL) <sup>3</sup>	0.1763 (4.0875)***	0.0408 (4.6527)***	-0.0187 (-0.4037)	-0.0167 (-1.0858)	-0.1845 (-1.5374)*	-0.0440 (-2.1142)**

<sup>1</sup>  $\epsilon$ /actual EPS = (annual EPS forecast - actual EPS)/actual EPS

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ). The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of the differences in two means and two medians respectively.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

(Contd.)

Table 5-2 (Contd.)

Panel C: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Security Price<sup>1</sup>

N = 935

Stock Recommendations

	BUY		HOLD		SELL	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	(n = 226) 0.0110 (3.1700)***	0.0005 (4.2806)***	(n = 462) 0.0165 (4.5697)***	0.0049 (10.6320)***	(n = 247) 0.0265 (4.7909)***	0.0070 (8.5200)***
Duff & Phelps <sup>2</sup>	(n = 523) 0.0241 (6.0762)***	0.0036 (12.1367)***	(n = 321) 0.0141 (5.5025)***	0.0035 (7.1040)***	(n = 91) 0.0217 (3.0850)***	0.0021 (2.9170)***
Diff (DP - VL) <sup>3</sup>	0.0131 (2.4908)***	0.0031 (3.8008)***	-0.0024 (-0.5294)	-0.0014 (-1.0721)	-0.0048 (-0.5412)	-0.0049 (-1.8216)**

<sup>1</sup>  $\epsilon$ /price = (annual EPS forecast - actual EPS)/price, where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ). The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of the differences in two means and two medians respectively.

(\*\*/\*\*\* ) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

Table 5-3 (Tests for H<sub>1</sub>)

**Frequency of Positive Forecast Errors ( $\varepsilon$ )<sup>1</sup>  
and Stock Recommendations  
(Value Line vs. Duff & Phelps)**

Panel A: Frequency of Positive Forecast Errors Undeclared and Deflated by Actual EPS				
N = 998				
Stock Portfolio				
	OVERALL	BUY	HOLD	SELL
Value Line	(n = 998)	(n = 246)	(n = 492)	(n = 260)
Fraction of Observations <sup>2</sup>	60.63%	52.50%	62.87%	64.08%
Z-statistic (a priori) <sup>3</sup>	(7.0196)***	(0.7906)	(6.0589)***	(4.8597)***
Z-statistic (a posteriori) <sup>4</sup>		(-2.5654)***	(1.0549)	(1.1902)
Duff & Phelps	(n = 998)	(n = 557)	(n = 338)	(n = 103)
Fraction of Observations <sup>2</sup>	61.33%	65.48%	57.24%	52.31%
Z-statistic (a priori) <sup>3</sup>	(7.5175)***	(7.9262)***	(2.7290)***	(0.4705)
Z-statistic (a posteriori) <sup>4</sup>		(2.1244)**	(-1.5404)	(-1.8367)**
Difference (DF - VL)				
Fraction of Observations <sup>5</sup>	0.70%	12.98%	-5.63%	-11.77%
Z-statistic <sup>6</sup>	(0.3283)	(3.4871)***	(-1.6554)*	(-2.0636)**

<sup>1</sup>  $\varepsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> Fraction of observations with  $\varepsilon$  (undeclared and deflated by actual EPS) > 0

(Contd.)

### Table 5-3 (Contd.)

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 7.9262 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds *a priori* probability (50%).

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 2.1244 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with positive forecast errors (61.33%).

<sup>5</sup> Differences in fractions of observations with positive analyst forecast errors ( $\varepsilon$ ) between Duff & Phelps and Value Line.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between Duff & Phelps and Value Line for each stock recommendation portfolio. For example, the *Z-statistic* of 3.4871 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds that of Value Line's *buy* stocks with  $\varepsilon > 0$  (52.50%).

(\*/\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for *a posteriori* *Z-tests* for *hold* stocks and difference tests for total stocks and *hold* stocks.

(Contd.)

Table 5-3 (Contd.)

Panel B: Frequency of Positive Forecast Errors Deflated by Security Price<sup>1</sup>

N = 935

Stock Portfolio

	OVERALL	BUY	HOLD	SELL
Value Line	(n = 935)	(n = 226)	(n = 462)	(n = 247)
Fraction of Observations <sup>2</sup>	61.35%	53.52%	64.18%	63.21%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(7.2878)***	(1.0688)	(6.5375)***	(4.4122)***
<i>Z-statistic (a posteriori)</i> <sup>4</sup>		(-2.3747)***	(1.3065)	(0.6210)
Duff & Phelps	(n = 935)	(n = 523)	(n = 321)	(n = 91)
Fraction of Observations <sup>2</sup>	61.67%	65.79%	57.68%	52.04%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(7.5104)***	(7.8566)***	(2.8267)***	(0.3907)
<i>Z-statistic (a posteriori)</i> <sup>4</sup>		(2.0506)**	(-1.4667)	(-1.8396)**
Difference (DF - VL)				
Fraction of Observations <sup>5</sup>	0.32%	12.27%	-6.50%	-11.17%
<i>Z-statistic</i> <sup>6</sup>	(0.1459)	(3.2741)***	(-1.8691)*	(-1.9033)**

<sup>1</sup>  $\varepsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Fraction of observations with  $\varepsilon$  deflated by security price) > 0

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 7.8566 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds *a priori* probability (50%).

(Contd.)

### Table 5-3 (Contd.)

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 2.0506 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with positive forecast errors (61.67%).

<sup>5</sup> Differences in fractions of observations with positive analyst forecast errors ( $\varepsilon$ ) between Duff & Phelps and Value Line.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between Duff & Phelps and Value Line for each stock recommendation portfolio. For example, the *Z-statistic* of 3.2741 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds that of Value Line's *buy* stocks with  $\varepsilon > 0$  (53.52%).

(\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for *a posteriori Z-tests* for *hold* stocks and difference tests for total stocks and *hold* stocks.

Table 5-4 (Tests for  $H_1$ )

**Regression Analyses: Analysts' Forecast Bias ( $\varepsilon$ )<sup>1</sup>**  
**(Value Line vs. Duff & Phelps)**

<b>Panel A: Undeclared Analyst Forecast Bias (<math>\varepsilon</math>)</b>			
Equation <sup>2</sup> : $\varepsilon = \beta_0 + \beta_1$ BROKER			
N = 1996			
	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL	(n = 1996)		
Coefficient	0.5349	0.0360	-0.0004
(t-statistic)	(9.0068) <sup>***</sup>	(0.4284)	(0.1835)
BUY	(n = 803)		
Coefficient	0.2312	0.4489	0.0106
(t-statistic)	(1.9180) <sup>**</sup>	(3.1005) <sup>***</sup>	(9.6131) <sup>***</sup>
HOLD	(n = 830)		
Coefficient	0.5887	-0.1708	0.0009
(t-statistic)	(7.1791) <sup>***</sup>	(-1.3292)	(1.7666)
SELL	(n = 363)		
Coefficient	0.7207	-0.2376	0.0003
(t-statistic)	(5.9683) <sup>***</sup>	(-1.0482)	(1.0988)

<sup>1</sup>  $\varepsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-4 (Contd.)

Panel B: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS

Equation<sup>2</sup>:  $\epsilon / \text{AEPS} = \beta_0 + \beta_1 \text{BROKER}$

N = 1996

	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL (n = 1996)			
Coefficient	0.2544	0.0059	-0.0005
(t-statistic)	(10.3698)***	(0.1699)	(0.0289)
BUY (n = 803)			
Coefficient	0.1090	0.1764	0.0106
(t-statistic)	(2.3569)***	(3.1779)***	(10.0992)***
HOLD (n = 830)			
Coefficient	0.2533	-0.0188	-0.0010
(t-statistic)	(8.2662)***	(-0.3911)	(0.1530)
SELL (n = 363)			
Coefficient	0.3942	-0.1844	0.0038
(t-statistic)	(6.1686)***	(-1.5374)*	(2.3637)

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. AEPS stands for actual EPS. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

\* (\*\*/\*\*\* ) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-4 (Contd.)

Panel C: Analysts' Forecast Bias ( $\varepsilon$ ) Deflated by Price

Equation<sup>2</sup>:  $\varepsilon / \text{Price} = \beta_0 + \beta_1 \text{BROKER}$

N = 1870

	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL (n = 1870)			
Coefficient	0.0178	0.0027	-0.0002
(t-statistic)	(7.2015) <sup>***</sup>	(0.7576)	(0.5739)
BUY (n = 749)			
Coefficient	0.0110	0.0131	0.0042
(t-statistic)	(2.0375) <sup>**</sup>	(2.0335) <sup>**</sup>	(4.1352) <sup>**</sup>
HOLD (n = 783)			
Coefficient	0.0165	-0.0024	-0.0010
(t-statistic)	(5.3312) <sup>***</sup>	(-0.4855)	(0.2357)
SELL (n = 338)			
Coefficient	0.0265	-0.0048	-0.0023
(t-statistic)	(5.0750) <sup>***</sup>	(-0.4807)	(0.2311)

<sup>1</sup>  $\varepsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. Price represents security price at the beginning of the year. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

\*(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level.

Table 5-5 (Tests for H<sub>2</sub>)

**Comparisons of Analysts' Forecast Bias  
among Stock Recommendation Portfolios**

**Panel A: Undeclared Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup>**

N = 998

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>2</sup>	(n = 246) 0.2312 (3.8294) <sup>***</sup>	0.0200 (3.9368) <sup>***</sup>	(n = 557) 0.6801 (7.3596) <sup>***</sup>	0.1300 (12.3905) <sup>***</sup>
HOLD <sup>2</sup>	(n = 492) 0.5887 (6.1589) <sup>***</sup>	0.1500 (10.6155) <sup>***</sup>	(n = 338) 0.4179 (6.1141) <sup>***</sup>	0.1050 (6.8621) <sup>***</sup>
SELL <sup>2</sup>	(n = 260) 0.7207 (5.6906) <sup>***</sup>	0.1800 (8.6922) <sup>***</sup>	(n = 103) 0.4830 (2.9150) <sup>***</sup>	0.0500 (2.6813) <sup>***</sup>
DIFBH (BUY - HOLD) <sup>3</sup>	-0.3575 (-3.1615) <sup>***</sup>	-0.1300 (-3.3685) <sup>***</sup>	0.2622 (2.2812) <sup>**</sup>	0.0250 (2.2964) <sup>**</sup>
DIFHS (HOLD - SELL) <sup>3</sup>	-0.1320 (-0.8224)	-0.0300 (-0.7623)	-0.0651 (-0.3636)	0.0550 (0.7180)
DIFBS (BUY - SELL) <sup>3</sup>	-0.4895 (-3.4884) <sup>***</sup>	-0.1600 (-3.6393) <sup>***</sup>	0.1971 (1.0383)	0.0800 (2.0958) <sup>**</sup>

Kruskal-Wallis Test<sup>4</sup>: Value Line:  $\chi^2 = 15.55$ , Prob. >  $\chi^2 = 0.0004$ ,  
Duff & Phelps:  $\chi^2 = 7.86$ , Prob. >  $\chi^2 = 0.0196$ .

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.

<sup>4</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-5 (Contd.)

Panel B: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS<sup>1</sup>

N = 998

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>2</sup>	(n = 246) 0.1090 (4.3616)***	0.0053 (4.4447)***	(n = 557) 0.2853 (8.1089)***	0.0461 (13.0975)***
HOLD <sup>2</sup>	(n = 492) 0.2533 (7.7595)***	0.0500 (10.9349)***	(n = 338) 0.2346 (7.0769)***	0.0333 (7.4607)***
SELL <sup>2</sup>	(n = 260) 0.3942 (6.3729)***	0.0742 (9.1235)***	(n = 103) 0.2097 (1.9180)**	0.0302 (3.1633)***
DIFBH (BUY - HOLD) <sup>3</sup>	-0.1443 (-3.5124)***	-0.0447 (-3.7060)***	0.0507 (1.0504)	0.0128 (1.7710)**
DIFHS (HOLD - SELL) <sup>3</sup>	-0.1409 (-2.0136)**	-0.0242 (-1.4419)*	0.0249 (0.2172)	0.0031 (0.6897)
DIFBS (BUY - SELL) <sup>3</sup>	-0.2852 (-4.2759)***	-0.0689 (-4.3009)***	0.0756 (0.6580)	0.0159 (1.6941)**

Kruskal-Wallis Test<sup>4</sup>: Value Line:  $\chi^2 = 21.11$ , Prob.  $> \chi^2 = 0.0001$ ,  
Duff & Phelps:  $\chi^2 = 4.92$ , Prob.  $> \chi^2 = 0.0855$ .

<sup>1</sup>  $\epsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$ <sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.<sup>3</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.<sup>4</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

\*(\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-5 (Contd.)

Panel C: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Security Price<sup>1</sup>

N = 935

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>2</sup>	(n = 226) 0.0110 (3.1700)***	0.0005 (4.2806)***	(n = 523) 0.0241 (6.0762)***	0.0036 (12.1367)***
HOLD <sup>2</sup>	(n = 462) 0.0165 (4.5697)***	0.0049 (10.6320)***	(n = 321) 0.0141 (5.5025)***	0.0035 (7.1040)***
SELL <sup>2</sup>	(n = 247) 0.0265 (4.7909)***	0.0070 (8.5200)***	(n = 91) 0.0217 (3.0850)***	0.0021 (2.9170)***
DIFBH (BUY - HOLD) <sup>3</sup>	-0.0055 (-1.9997)**	-0.0044 (-3.3023)***	0.0100 (2.1080)**	0.0001 (1.4522)*
DIFHS (HOLD - SELL) <sup>3</sup>	-0.0100 (-1.5677)*	-0.0021 (-0.9685)	-0.0076 (-1.0047)	0.0010 (0.6692)
DIFBS (BUY - SELL) <sup>3</sup>	-0.0155 (-2.3757)***	-0.0065 (-3.4189)***	0.0024 (0.3046)	0.0011 (1.6511)**

Kruskal-Wallis Test<sup>4</sup>: Value Line:  $\chi^2 = 14.63$ , Prob. >  $\chi^2 = 0.0007$ ,  
Duff & Phelps:  $\chi^2 = 3.89$ , Prob. >  $\chi^2 = 0.1427$ .

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.

<sup>4</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-6 (Tests for H<sub>2</sub>)

**Comparisons of Frequencies of Positive Forecast Errors ( $\varepsilon$ )<sup>1</sup>  
among Stock Recommendation Portfolios**

**Panel A: Frequency of Positive Forecast Errors Undeclared and  
Deflated by Actual EPS**

N = 998

Stock Portfolio	Value Line	Duff & Phelps
OVERALL (n = 998)	(n = 998)	(n = 998)
Fraction of Observations <sup>2</sup>	60.33%	61.33%
Z-statistic (a priori) <sup>3</sup>	(7.0196)***	(7.5175)***
BUY	(n = 246)	(n = 557)
Fraction of Observations <sup>2</sup>	52.50%	65.48%
Z-statistic (a priori) <sup>3</sup>	(0.7906)	(7.9262)***
Z-statistic (a posteriori) <sup>4</sup>	(-2.5604)***	(2.1244)**
HOLD	(n = 492)	(n = 338)
Fraction of Observations <sup>2</sup>	62.87%	57.24%
Z-statistic (a priori) <sup>3</sup>	(6.0589)***	(2.7290)***
Z-statistic (a posteriori) <sup>4</sup>	(1.0549)	(-1.5404)
SELL	(n = 260)	(n = 103)
Fraction of Observations <sup>2</sup>	64.08%	52.31%
Z-statistic (a priori) <sup>3</sup>	(4.8597)***	(0.4705)
Z-statistic (a posteriori) <sup>4</sup>	(1.1902)	(-1.8367)**
DIFBH (BUY - HOLD)		
Fraction of Observations <sup>5</sup>	-10.37%	8.24%
Z-statistic <sup>6</sup>	(-2.7181)***	(2.4997)***
DIFHS (HOLD - SELL)		
Fraction of Observations <sup>5</sup>	-1.21%	4.93%
Z-statistic <sup>6</sup>	(-0.3360)	(0.8835)
DIFBS (BUY - SELL)		
Fraction of Observations <sup>5</sup>	-11.58%	13.17%
Z-statistic <sup>6</sup>	(-2.6963)***	(2.4916)***

<sup>1</sup>  $\varepsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> Fraction of observations with  $\varepsilon$  undeclared and deflated by actual EPS > 0

(Contd.)

Table 5-6 (Contd.)

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 7.9262 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds *a priori* probability (50%).

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 2.1244 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with  $\varepsilon > 0$  (61.33%).

<sup>5</sup> Differences in fractions of observations with positive forecast errors ( $\varepsilon$ ) between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between stock recommendation portfolios. For example, the *Z-statistic* of 2.4997 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.48%) exceeds the fraction of Duff & Phelps' *hold* stocks with  $\varepsilon > 0$  (57.24%).

\*(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-6 (Contd.)

Panel B: Frequency of Positive Forecast Errors Deflated by Security Price<sup>1</sup>

N = 935

Stock Portfolio	Value Line	Duff & Phelps
OVERALL	(n = 935)	(n = 935)
Fraction of Observations <sup>2</sup>	61.35%	61.67%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(7.2878)***	(7.5104)***
BUY	(n = 226)	(n = 523)
Fraction of Observations <sup>2</sup>	53.52%	65.79%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(1.0688)	(7.8566)***
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(-2.3747)***	(2.0506)**
HOLD	(n = 462)	(n = 321)
Fraction of Observations <sup>2</sup>	64.18%	57.68%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(6.5375)***	(2.8267)***
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(1.3065)	(-1.4667)
SELL	(n = 247)	(n = 91)
Fraction of Observations <sup>2</sup>	63.21%	52.04%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(4.4122)***	(0.3907)
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(0.6210)	(-1.8396)**
DIFBH (BUY - HOLD)		
Fraction of Observations <sup>5</sup>	-10.66%	8.11%
<i>Z-statistic</i> <sup>6</sup>	(-2.7019)***	(2.3986)***
DIFHS (HOLD - SELL)		
Fraction of Observations <sup>5</sup>	0.97%	5.64%
<i>Z-statistic</i> <sup>6</sup>	(0.2638)	(0.9564)
DIFBS (BUY - SELL)		
Fraction of Observations <sup>5</sup>	-9.69%	13.75%
<i>Z-statistic</i> <sup>6</sup>	(-2.1754)**	(2.4526)***

<sup>1</sup>  $\varepsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

(Contd.)

Table 5-6 (Contd.)

<sup>2</sup> Fraction of observations with  $\varepsilon$  deflated by security price  $> 0$

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from a *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 7.8566 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds *a priori* probability (50%).

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from a *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 2.0506 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with  $\varepsilon > 0$  (61.67%).

<sup>5</sup> Differences in fractions of observations with positive forecast errors ( $\varepsilon$ ) between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between stock recommendation portfolios. For example, the *Z-statistic* of 2.3986 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (65.79%) exceeds the fraction of Duff & Phelps' *hold* stocks with  $\varepsilon > 0$  (57.68%).

(\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-7 (Tests for H<sub>2</sub>)

**Regression Analyses: Comparisons of Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup> among Stock Recommendations**

**Panel A: Undeformed Analyst Forecast Bias ( $\epsilon$ )**

Equation<sup>2</sup>:  $\epsilon = \beta_0 + \beta_1 \text{ HOLD} + \beta_2 \text{ SELL}$

N = 998

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
Value Line				
Coefficient	0.2312	0.3574	0.4894	0.0074
(t-statistic)	(1.9319)**	(2.4382)***	(2.9311)***	(4.6930)***
Duff & Phelps				
Coefficient	0.6801	-0.2622	-0.1970	0.0024
(t-statistic)	(8.6008)***	(-2.0377)**	(-0.9843)	(2.2035)

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations. ( $\beta_0 + \beta_1$ ) represents the mean value of analysts' forecast bias for *hold* stocks and ( $\beta_0 + \beta_2$ ) represents the mean value of analysts' forecast bias for *sell* stocks.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-7 (Contd.)

Panel B: Analyst Forecast Bias Deflated by Actual EPS<sup>1</sup>

Equation<sup>2</sup>:  $\varepsilon/\text{AEPS} = \beta_0 + \beta_1 \text{ HOLD} + \beta_2 \text{ SELL}$

N = 998

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
Value Line				
Coefficient	0.1090	0.1444	0.2852	0.0163
(t-statistic)	(2.2927)**	(2.4810)***	(4.3025)***	(9.2569)***
Duff & Phelps				
Coefficient	0.2853	-0.0508	-0.0756	-0.0007
(t-statistic)	(8.4347)***	(-0.9224)	(-0.8827)	(0.6550)

<sup>1</sup>  $\varepsilon/\text{AEPS} = (\text{annual EPS} - \text{actual EPS})/\text{AEPS}$ , where AEPS represents actual EPS.

<sup>2</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations.  $(\beta_0 + \beta_1)$  represents the mean value of analysts' forecast bias for *hold* stocks and  $(\beta_0 + \beta_2)$  represents the mean value of analysts' forecast bias for *sell* stocks.

\*(/\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-7 (Contd.)

Panel C: Analyst Forecast Bias Deflated by Security Price<sup>1</sup>

Equation<sup>2</sup>:  $\varepsilon/\text{Price} = \beta_0 + \beta_1 \text{ HOLD} + \beta_2 \text{ SELL}$

N = 935

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
<b>Value Line</b>				
Coefficient	0.0110	0.0055	0.0155	0.0040
(t-statistic)	(2.2025)**	(1.9038)**	(2.2458)**	(3.6615)**
<b>Duff &amp; Phelps</b>				
Coefficient	0.0241	-0.0100	-0.0025	0.0015
(t-statistic)	(7.2568)***	(-1.8499)**	(-0.2845)	(1.7237)

<sup>1</sup>  $\varepsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. AEPS stands for actual EPS and Price represents the security price at the beginning of the year. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations. ( $\beta_0 + \beta_1$ ) represents the mean value of analysts' forecast bias for *hold* stocks and ( $\beta_0 + \beta_2$ ) represents the mean value of analysts' forecast bias for *sell* stocks.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-8 (Tests for H<sub>3</sub>)*Investors' Reactions to Analysts' Forecast Errors (PFE)<sup>1</sup>***Panel A: All Sample<sup>2</sup>**

$$\text{Model}^3: \text{CAR}(-1,0) = \beta_0 + \beta_1 \text{PFE} + \beta_2 \text{BRK} * \text{PFE}$$

N = 268

	Intercept	PFE	PFE * BRK	Adj R <sup>2</sup> (F-statistic)
Coefficient (t-statistic)	0.0048 (2.9897) <sup>***</sup>	0.0454 (3.8932) <sup>***</sup>	0.0112 (0.7358)	0.0224 (4.1257) <sup>**</sup>

**Panel B: Buy Sample**

$$\text{Model}^3: \text{CAR}(-1,0) = \beta_0 + \beta_1 \text{PFE} + \beta_2 \text{BRK} * \text{PFE}$$

N = 110

	Intercept	PFE	PFE * BRK	Adj R <sup>2</sup> (F-statistic)
Coefficient (t-statistic)	0.0038 (2.6923) <sup>**</sup>	0.0537 (1.9629) <sup>**</sup>	-0.0437 (-1.4188) <sup>*</sup>	0.0137 (2.8657) <sup>*</sup>

<sup>1</sup> PFE represents analysts' forecast errors deflated by stock price five days before the earnings announcement date. That is,  $\text{PFE} = (\text{Actual Earnings} - \text{Forecasts}) / \text{Price}_{t-5}$ .

<sup>2</sup> All sample includes analysts' forecasts which issued after the third quarter earnings announcements but before annual earnings announcement dates.

<sup>3</sup> CAR(-1,0) stands for cumulative abnormal returns for one day before and on the date of earnings announcements using 250 trading days of estimation periods. BRK represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast errors and 0 to Value Line forecast errors.  $\beta_1$  shows investors' reaction to Value Line forecast errors and  $\beta_2$  represents the difference in investors' reaction between Value Line and Duff & Phelps.  $(\beta_1 + \beta_2)$  shows investors' reaction to Duff & Phelps analysts' forecast errors.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-8 (Contd.)

**Panel C: Hold Sample**

$$\text{Model}^1: \text{CAR}(-1,0) = \beta_0 + \beta_1 \text{PFE} + \beta_2 \text{BRK} * \text{PFE}$$

N = 105

	Intercept	PFE	PFE * BRK	Adj R <sup>2</sup> (F-statistic)
Coefficient (t-statistic)	0.0034 (1.3515)*	0.0307 (1.6533)**	0.0136 (0.4545)	0.0091 (1.4074)

**Panel D: Sell Sample**

$$\text{Model}^1: \text{CAR}(-1,0) = \beta_0 + \beta_1 \text{PFE} + \beta_2 \text{BRK} * \text{PFE}$$

N = 53

	Intercept	PFE	PFE * BRK	Adj R <sup>2</sup> (F-statistic)
Coefficient (t-statistic)	0.0093 (1.9952)*	0.0110 (1.4753)*	0.0098 (0.5058)	0.0121 (1.3182)

<sup>1</sup> PFE represents analysts' forecast errors deflated by stock price five days before the earnings announcement date. That is,  $\text{PFE} = (\text{Actual Earnings} - \text{Forecasts}) / \text{Price}_{.5}$ .  $\text{CAR}(-1,0)$  stands for cumulative abnormal returns for one day before and on the date of earnings announcements using 250 trading days of estimation periods. BRK represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast errors and 0 to Value Line forecast errors.  $\beta_1$  shows investors' reaction to Value Line forecast errors and  $\beta_2$  represents the difference in investors' reaction between Value Line and Duff & Phelps.  $(\beta_1 + \beta_2)$  shows investors' reaction to Duff & Phelps analysts' forecast errors.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-9

***Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup> for All Stock Recommendation  
Portfolios for a Reduced Sample<sup>2</sup>  
(Value Line vs. Duff & Phelps)***

**Panel A: Undeclared Analysts' Forecast Bias**

	N = 357	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>3</sup>	0.2951 (7.5239)***	0.0600 (7.2129)***
Duff & Phelps <sup>3</sup>	0.2993 (7.1721)***	0.0700 (7.3665)***
Diff (DP - VL) <sup>4</sup>	0.0042 (0.1256)	0.0000 (1.1623)

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the matched sample by the same stock recommendation for both Value Line and Duff & Phelps.

<sup>3</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>4</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-9 (Contd.)

Panel B: Analysts' Forecast Bias Deflated by Actual EPS<sup>1</sup>

	N = 357	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.1795 (5.5893) <sup>***</sup>	0.0197 (7.6202) <sup>***</sup>
Duff & Phelps <sup>2</sup>	0.1488 (4.2039) <sup>***</sup>	0.0297 (7.8815) <sup>***</sup>
Diff (DP - VL) <sup>3</sup>	-0.0307 (-0.8204)	0.0000 (1.5741)

<sup>1</sup>  $\epsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level.

(Contd.)

Table 5-9 (Contd.)

Panel C: Analysts' Forecast Bias Deflated by Security Price<sup>1</sup>

N = 331

	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.0102 (6.9850)***	0.0016 (7.5677)***
Duff & Phelps <sup>2</sup>	0.0109 (6.8878)***	0.0018 (7.4190)***
Diff (DP - VL) <sup>3</sup>	0.0007 (0.6507)	0.0000 (1.0525)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*\*/\*\*\* ) designates statistical significance at the 10%(5%/1%) level.

Table 5-10 (Tests for H<sub>1</sub>)

**Analysts' Forecast Bias ( $\epsilon$ ) by Stock Recommendation Portfolio for a Reduced Sample<sup>1</sup>  
(Value Line vs. Duff & Phelps)**

**Panel A: Undeclared Analysts' Forecast Bias ( $\epsilon$ )<sup>2</sup>**

N = 357

Stock Recommendations

	BUY (n = 162)		HOLD (n = 165)		SELL (n = 30)	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>3</sup>	0.2489 (4.6600)***	0.0200 (3.9457)***	0.2950 (5.5365)***	0.1100 (5.6292)***	0.5450 (2.4791)***	0.1150 (2.0758)**
Duff & Phelps <sup>3</sup>	0.3639 (5.7269)***	0.1100 (5.8199)***	0.2394 (4.8814)***	0.0900 (4.5871)***	0.2800 (1.1718)	0.0700 (1.8306)**
Diff (DP - VL) <sup>4</sup>	0.1150 (3.3301)***	0.0275 (3.2043)***	-0.0556 (-1.2596)	-0.0200 (-1.3807)	-0.2650 (-1.0570)	0.0000 (-0.0841)

<sup>1</sup> A reduced sample represents the matched sample by the same stock recommendation for both Value Line and Duff & Phelps.

<sup>2</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>3</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>4</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

(Contd.)

Table 5-10 (Contd.)

Panel B: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS<sup>1</sup>

N = 357

Stock Recommendations

	BUY (n = 162)		HOLD (n = 165)		SELL (n = 30)	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.1041 (3.3541)***	0.0053 (4.0228)***	0.1650 (5.3644)***	0.0457 (5.9865)***	0.6669 (2.3128)***	0.0577 (2.4110)***
Duff & Phelps <sup>2</sup>	0.1670 (4.4713)***	0.0707 (6.3581)***	0.1239 (4.7542)***	0.0326 (4.8959)***	0.1879 (0.5427)	0.0257 (2.1185)**
Diff (DP - VL) <sup>3</sup>	0.0629 (2.9557)***	0.0126 (3.7390)***	-0.0411 (-1.5682)	-0.0075 (-1.0706)	-0.4789 (-1.1923)	0.0000 (-0.0240)

<sup>1</sup>  $\epsilon$ /actual EPS = (annual EPS forecast - actual EPS)/actual EPS

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

(Contd.)

Table 5-10 (Contd.)

Panel C: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Security Price<sup>1</sup>

N = 331

Stock Recommendations

	BUY (n = 150)		HOLD (n = 156)		SELL (n = 25)	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
Value Line <sup>2</sup>	0.0084 (4.5637)***	0.0005 (4.1661)***	0.0105 (5.1006)***	0.0050 (6.0064)***	0.0193 (2.0601)**	0.0035 (1.5429)*
Duff & Phelps <sup>2</sup>	0.0125 (5.0465)***	0.0101 (5.6616)***	0.0080 (3.9088)***	0.0033 (4.9060)***	0.0191 (2.6735)***	0.0013 (1.0853)**
Diff (DP - VL) <sup>3</sup>	0.0041 (3.1897)***	0.0003 (2.7783)***	-0.0025 (-1.5546)	-0.0005 (-1.0708)	-0.0002 (-0.0562)	0.0000 (0.3000)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Mean and median tests (from zero) of the differences between Duff & Phelps and Value Line analysts' forecast bias ( $\epsilon$ ) are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively. Note that the median values of the differences between Duff & Phelps and Value Line analysts' forecast bias are different from the differences in medians between the two analysts' bias.

(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for difference tests for *hold* stocks.

Table 5-11 (Tests for H<sub>1</sub>)

**Frequency of Positive Forecast Errors ( $\epsilon$ )<sup>1</sup>  
and Stock Recommendations for a Reduced Sample<sup>2</sup>  
(Value Line vs. Duff & Phelps)**

**Panel A: Frequency of Positive Forecast Errors Undeformed and Deflated by Actual EPS**

N = 357

Stock Portfolio

	OVERALL (n = 357)	BUY (n = 162)	HOLD (n = 165)	SELL (n = 30)
<b>Value Line</b>				
Fraction of Observations <sup>3</sup>	57.63%	53.41%	60.85%	62.67%
Z-statistic (a priori) <sup>4</sup>	(2.9583) <sup>***</sup>	(0.8744)	(2.9098) <sup>***</sup>	(1.4470) <sup>*</sup>
Z-statistic (a posteriori) <sup>5</sup>		(-1.0822)	(0.8647)	(0.5759)
<b>Duff &amp; Phelps</b>				
Fraction of Observations <sup>3</sup>	60.43%	64.52%	57.21%	56.00%
Z-statistic (a priori) <sup>4</sup>	(4.1090) <sup>***</sup>	(3.9665) <sup>***</sup>	(1.8955) <sup>**</sup>	(0.6595)
Z-statistic (a posteriori) <sup>5</sup>		(1.1181)	(-0.8446)	(-0.4865)
<b>Difference (DF - VL)</b>				
Fraction of Observations <sup>6</sup>	2.80%	11.11%	-3.64%	-6.67%
Z-statistic <sup>7</sup>	(1.0914)	(2.9110) <sup>***</sup>	(-0.9484)	(-1.0000)

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the matched sample with the same stock recommendations for both Value Line and Duff & Phelps.

(Contd.)

**Table 5-11 (Contd.)**

<sup>3</sup> Fraction of observations with  $\epsilon$  undeflated and deflated by actual EPS > 0

<sup>4</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 3.9665 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\epsilon > 0$  (64.52%) exceeds *a priori* probability (50%).

<sup>5</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\epsilon > 0$ . For example, the *Z-statistic* of 1.1181 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\epsilon > 0$  (64.52%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with positive forecast errors (60.43%).

<sup>6</sup> Differences in fractions of observations with positive analyst forecast errors ( $\epsilon$ ) between Duff & Phelps and Value Line.

<sup>7</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between Duff & Phelps and Value Line for each stock recommendation portfolio. For example, the *Z-statistic* of 2.9110 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\epsilon > 0$  (64.52%) exceeds that of Value Line's *buy* stocks with  $\epsilon > 0$  (53.41%).

\*(\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for *a posteriori Z-tests* for *hold* stocks and difference tests for total stocks and *hold* stocks.

**(Contd.)**

Table 5-11 (Contd.)

Panel B: Frequency of Positive Forecast Errors Deflated by Security Price<sup>1</sup>

	Stock Portfolio			
	OVERALL (n = 331)	BUY (n = 150)	HOLD (n = 156)	SELL (n = 25)
<b>Value Line</b>				
Fraction of Observations <sup>2</sup>	59.14%	54.67%	63.95%	56.00%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(3.4425) <sup>***</sup>	(1.1568)	(3.7212) <sup>***</sup>	(0.6000)
<i>Z-statistic (a posteriori)</i> <sup>4</sup>		(-1.1094)	(1.2823)	(-0.3142)
<b>Duff &amp; Phelps</b>				
Fraction of Observations <sup>2</sup>	60.35%	64.00%	58.18%	52.00%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(3.9257) <sup>***</sup>	(3.6635) <sup>***</sup>	(2.0999) <sup>**</sup>	(0.1974)
<i>Z-statistic (a posteriori)</i> <sup>4</sup>		(0.9550)	(-0.5574)	(-0.8241)
<b>Difference (DF - VL)</b>				
Fraction of Observations <sup>5</sup>	1.21%	9.33%	-5.77%	-4.00%
<i>Z-statistic</i> <sup>6</sup>	(0.4709)	(2.4403) <sup>***</sup>	(-1.5278)	(-0.5695)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Fraction of observations with  $\epsilon$  (undeflated, deflated by actual EPS, and deflated by security price)  $> 0$

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 3.6635 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\epsilon > 0$  (64.00%) exceeds *a priori* probability (50%).

(Contd.)

### Table 5-11 (Contd.)

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 0.9550 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.00%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with positive forecast errors (60.35%).

<sup>5</sup> Differences in fractions of observations with positive analyst forecast errors ( $\varepsilon$ ) between Duff & Phelps and Value Line.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between Duff & Phelps and Value Line for each stock recommendation portfolio. For example, the *Z-statistic* of 2.4403 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.00%) exceeds that of Value Line's *buy* stocks with  $\varepsilon > 0$  (54.67%).

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests except for *a posteriori Z-tests* for *hold* stocks and difference tests for total stocks and *hold* stocks.

Table 5-12 (Tests for H<sub>1</sub>)

***Reression Analyses: Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup>  
for a Reduced Sample<sup>2</sup>  
(Value Line vs. Duff & Phelps)***

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**Panel A: Undeclared Analyst Forecast Bias ( $\epsilon$ )**

Equation<sup>3</sup>:  $\epsilon = \beta_0 + \beta_1 \text{ BROKER}$

N = 714

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	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL	(n = 714)		
Coefficient	0.2951	0.0042	-0.0014
<i>(t-statistic)</i>	<i>(7.2869)***</i>	<i>(0.0736)</i>	<i>(0.0054)</i>
BUY	(n = 324)		
Coefficient	0.2489	0.1150	0.0028
<i>(t-statistic)</i>	<i>(4.2406)***</i>	<i>(1.3853)*</i>	<i>(1.9190)</i>
HOLD	(n = 330)		
Coefficient	0.2950	-0.0556	-0.0013
<i>(t-statistic)</i>	<i>(5.7608)***</i>	<i>(-0.7675)</i>	<i>(0.5891)</i>
SELL	(n = 60)		
Coefficient	0.5450	-0.2650	-0.0057
<i>(t-statistic)</i>	<i>(2.3738)**</i>	<i>(-0.8162)</i>	<i>(0.6661)</i>

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the matched sample with the same stock recommendations for both Value Line and Duff & Phelps.

<sup>3</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-12 (Contd.)

Panel B: Analysts' Forecast Bias ( $\varepsilon$ ) Deflated by Actual EPS<sup>1</sup>

Equation<sup>2</sup>:  $\varepsilon / \text{AEPS} = \beta_0 + \beta_1 \text{BROKER}$

N = 714

	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL	(n = 714)		
Coefficient	0.1795	-0.0307	-0.0008
(t-statistic)	(5.3117) <sup>***</sup>	(-0.6427)	(0.4130)
BUY	(n = 324)		
Coefficient	0.1041	0.0629	0.0021
(t-statistic)	(3.0319) <sup>***</sup>	(1.2948) <sup>*</sup>	(1.6765) <sup>*</sup>
HOLD	(n = 330)		
Coefficient	0.1650	-0.0411	0.0001
(t-statistic)	(5.7882) <sup>***</sup>	(-1.0196)	(1.0397)
SELL	(n = 60)		
Coefficient	0.6669	-0.4789	0.0022
(t-statistic)	(2.0929) <sup>***</sup>	(-1.0628)	(1.1296)

<sup>1</sup>  $\varepsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$ <sup>2</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. AEPS stands for actual EPS. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

\*(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-12 (Contd.)

Panel C: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Price<sup>1</sup>

Equation<sup>2</sup>:  $\epsilon / \text{Price} = \beta_0 + \beta_1 \text{ BROKER}$

N = 662

	Intercept	Broker	Adj R <sup>2</sup> (F-value)
OVERALL (n = 662)			
Coefficient	0.0102	0.0007	-0.0014
(t-statistic)	(6.7113) <sup>***</sup>	(0.3080)	(0.0921)
BUY (n = 300)			
Coefficient	0.0084	0.0041	0.0026
(t-statistic)	(3.8480) <sup>***</sup>	(1.3308) <sup>*</sup>	(1.7747) <sup>*</sup>
HOLD (n = 312)			
Coefficient	0.0105	-0.0025	-0.0008
(t-statistic)	(5.1137) <sup>***</sup>	(-0.8595)	(0.7424)
SELL (n = 50)			
Coefficient	0.0193	-0.0002	-0.0208
(t-statistic)	(2.3183) <sup>**</sup>	(-0.0201)	(0.0004)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> The variable 'BROKER' represents a dummy variable for which 1 is assigned to Duff & Phelps analysts' forecast bias and 0 to Value Line analysts' forecast bias. Price represents the security price at the beginning of the year. The intercept of the regression model ( $\beta_0$ ) represents mean value of Value Line analysts' forecast bias and the slope coefficient ( $\beta_1$ ) represents the difference in forecast bias between Value Line and Duff & Phelps. ( $\beta_0 + \beta_1$ ) represents the mean value of Duff & Phelps forecast bias.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-13 (Tests for H<sub>2</sub>)

**Comparisons of Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup> among Stock Recommendation Portfolios for a Reduced Sample<sup>2</sup>**

**Panel A: Undeclared Analysts' Forecast Bias ( $\epsilon$ )**

N = 357

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>3</sup> (n = 162)	0.2489 (4.6600)***	0.0200 (3.9457)***	0.3639 (5.7269)***	0.1100 (5.8199)***
HOLD <sup>3</sup> (n = 165)	0.2950 (5.5365)***	0.1100 (5.6292)***	0.2394 (4.8814)***	0.0900 (4.5871)***
SELL <sup>3</sup> (n = 30)	0.5450 (2.4791)***	0.1150 (2.0758)***	0.2800 (1.1718)	0.0700 (1.8306)**
DIFBH (BUY - HOLD) <sup>4</sup>	-0.0461 (-0.6114)	-0.0900 (-1.4990)*	0.1245 (1.5503)*	0.0200 (0.7213)
DIFHS (HOLD - SELL) <sup>4</sup>	-0.2500 (-1.1051)	-0.0050 (-0.2040)	-0.0406 (-0.1663)	0.0200 (0.3676)
DIFBS (BUY - SELL) <sup>4</sup>	-0.2961 (-1.3088)*	-0.0950 (-0.9266)	0.0839 (0.3392)	0.0400 (0.1824)

Kruskal-Wallis Test<sup>5</sup>: Value Line:  $\chi^2 = 2.54$ , Prob. >  $\chi^2 = 0.2801$ ,  
Duff & Phelps:  $\chi^2 = 0.56$ , Prob. >  $\chi^2 = 0.7540$ .

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the sample with the same stock recommendations for both Value Line and Duff & Phelps.

<sup>3</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>4</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.

<sup>5</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-13 (Contd.)

Panel B: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS<sup>1</sup>

N = 357

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>2</sup> (n = 162)	0.1041 (3.3541)***	0.0053 (4.0228)***	0.1670 (4.4713)***	0.0707 (6.3581)***
HOLD <sup>2</sup> (n = 165)	0.1650 (5.3644)***	0.0457 (5.9865)***	0.1239 (4.7542)***	0.0326 (4.8959)***
SELL <sup>2</sup> (n = 30)	0.6669 (2.3128)***	0.0577 (2.4110)***	0.1879 (0.5427)	0.0257 (2.1185)**
DIFBH (BUY - HOLD) <sup>3</sup>	-0.0609 (-1.3945)*	-0.0404 (-2.1178)**	0.0431 (0.9453)	0.0381 (0.2591)
DIFHS (HOLD - SELL) <sup>3</sup>	-0.5019 (-1.7307)**	-0.0120 (-0.7369)	-0.0640 (-0.1844)	0.0069 (0.5821)
DIFBS (BUY - SELL) <sup>3</sup>	-0.5628 (-1.9406)**	-0.0524 (-1.5042)*	-0.0209 (-0.0603)	0.0450 (0.3416)

Kruskal-Wallis Test<sup>4</sup>: Value Line:  $\chi^2 = 5.59$ , Prob. >  $\chi^2 = 0.0611$ ,  
Duff & Phelps:  $\chi^2 = 0.31$ , Prob. >  $\chi^2 = 0.8565$ .

<sup>1</sup>  $\epsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.

<sup>4</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-13 (Contd.)

Panel C: Analysts' Forecast Bias ( $\epsilon$ ) Deflated by Security Price<sup>1</sup>

N = 331

Stock Recommendations	Value Line		Duff & Phelps	
	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)	Mean ( <i>t</i> -statistic)	Median ( <i>Z</i> -statistic)
BUY <sup>2</sup> (n = 150)	0.0084 (4.5637)***	0.0005 (4.1661)***	0.0125 (5.0465)***	0.0101 (5.6616)***
HOLD <sup>2</sup> (n = 156)	0.0105 (5.1006)***	0.0050 (6.0064)***	0.0080 (3.9088)***	0.0033 (4.9060)***
SELL <sup>2</sup> (n = 25)	0.0193 (2.0601)**	0.0035 (1.5429)*	0.0191 (2.6735)***	0.0013 (1.0853)
DIFBH (BUY - HOLD) <sup>3</sup>	-0.0021 (-0.7707)	-0.0045 (-2.1795)**	0.0045 (1.3915)*	0.0068 (0.2151)
DIFHS (HOLD - SELL) <sup>3</sup>	-0.0088 (-1.3882)*	0.0015 (0.1809)	-0.0111 (-1.4910)	0.0020 (0.5428)
DIFBS (BUY - SELL) <sup>3</sup>	-0.0109 (-1.8604)**	-0.0030 (-0.4755)	0.0066 (0.8741)	0.0088 (0.1215)

Kruskal-Wallis Test<sup>4</sup>: Value Line:  $\chi^2 = 4.47$ , Prob.  $> \chi^2 = 0.1068$ ,  
Duff & Phelps:  $\chi^2 = 0.14$ , Prob.  $> \chi^2 = 0.9311$ .

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Mean and median tests (from zero) of analysts' forecast bias are based on a parametric *t*-test and a nonparametric Wilcoxon signed-ranks *Z*-test, respectively.

<sup>3</sup> Differences in means and medians of analysts' forecast bias between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks. The *t*-test and Wilcoxon ranks sum *Z*-test are used to examine the statistical significance level of differences in two means and two medians respectively between stock recommendation portfolios.

<sup>4</sup> Kruskal-Wallis  $\chi^2$  tests whether forecast bias by stock recommendation portfolio is different.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-14 (Tests for H<sub>2</sub>)

**Comparisons of Frequencies of Positive Forecast Errors ( $\epsilon$ )<sup>1</sup>  
among Stock Recommendations for a Reduced Sample<sup>2</sup>**

**Panel A: Frequency of Positive Forecast Errors Undeformed and Deformed by Actual EPS**

N = 357

Stock Portfolio	Value Line	Duff & Phelps
<b>OVERALL (n = 357)</b>		
Fraction of Observations <sup>3</sup>	57.63%	60.43%
<i>Z-statistic (a priori)</i> <sup>4</sup>	<i>(2.9583)</i> <sup>***</sup>	<i>(4.1090)</i> <sup>***</sup>
<b>BUY (n = 162)</b>		
Fraction of Observations <sup>3</sup>	53.41%	64.52%
<i>Z-statistic (a priori)</i> <sup>4</sup>	<i>(0.8744)</i>	<i>(3.9665)</i> <sup>***</sup>
<i>Z-statistic (a posteriori)</i> <sup>5</sup>	<i>(-1.0822)</i>	<i>(1.1181)</i>
<b>HOLD (n = 165)</b>		
Fraction of Observations <sup>3</sup>	60.85%	57.21%
<i>Z-statistic (a priori)</i> <sup>4</sup>	<i>(2.9098)</i> <sup>***</sup>	<i>(1.8955)</i> <sup>**</sup>
<i>Z-statistic (a posteriori)</i> <sup>5</sup>	<i>(0.8647)</i>	<i>(-0.8446)</i>
<b>SELL (n = 30)</b>		
Fraction of Observations <sup>3</sup>	62.67%	56.00%
<i>Z-statistic (a priori)</i> <sup>4</sup>	<i>(1.4470)</i> <sup>*</sup>	<i>(0.6595)</i>
<i>Z-statistic (a posteriori)</i> <sup>5</sup>	<i>(0.5759)</i>	<i>(-0.4865)</i>
<b>DIFBH (BUY - HOLD)</b>		
Fraction of Observations <sup>6</sup>	-7.44%	7.31%
<i>Z-statistic</i> <sup>7</sup>	<i>(-1.3797)</i> <sup>*</sup>	<i>(1.3839)</i> <sup>*</sup>
<b>DIFHS (HOLD - SELL)</b>		
Fraction of Observations <sup>6</sup>	-1.82%	1.21%
<i>Z-statistic</i> <sup>7</sup>	<i>(-0.1911)</i>	<i>(0.1229)</i>
<b>DIFBS (BUY - SELL)</b>		
Fraction of Observations <sup>6</sup>	-9.26%	8.52%
<i>Z-statistic</i> <sup>7</sup>	<i>(-0.9663)</i>	<i>(0.8687)</i>

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the sample with the same stock recommendations for both Value Line and Duff & Phelps.

<sup>3</sup> Fraction of observations with  $\epsilon$  undeformed and deformed by actual EPS > 0

(Contd.)

Table 5-14 (Contd.)

<sup>4</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 3.9665 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.52%) exceeds *a priori* probability (50%).

<sup>5</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 1.1181 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.52%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with  $\varepsilon > 0$  (60.43%).

<sup>6</sup> Differences in fractions of observations with positive forecast errors ( $\varepsilon$ ) between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks.

<sup>7</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between stock recommendation portfolios. For example, the *Z-statistic* of 1.3839 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.52%) exceeds the fraction of Duff & Phelps' *hold* stocks with  $\varepsilon > 0$  (57.21%).

\*(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-14 (Contd.)

Panel B: Frequency of Positive Forecast Errors Deflated by Security Price<sup>1</sup>

N = 331

Stock Portfolio	Value Line	Duff & Phelps
OVERALL (n = 331)		
Fraction of Observations <sup>2</sup>	57.63%	60.35%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(2.9583)***	(3.9257)***
BUY (n = 150)		
Fraction of Observations <sup>2</sup>	54.67%	64.00%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(1.1568)	(3.6635)***
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(-1.1094)	(0.9550)
HOLD (n = 156)		
Fraction of Observations <sup>2</sup>	63.95%	58.18%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(3.7212)***	(2.0999)**
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(1.2823)	(-0.5574)
SELL (n = 25)		
Fraction of Observations <sup>2</sup>	56.00%	52.00%
<i>Z-statistic (a priori)</i> <sup>3</sup>	(0.6000)	(0.1974)
<i>Z-statistic (a posteriori)</i> <sup>4</sup>	(-0.3142)	(-0.8241)
DIFBH (BUY - HOLD)		
Fraction of Observations <sup>5</sup>	-9.28%	5.82%
<i>Z-statistic</i> <sup>6</sup>	(-1.6854)**	(1.0667)
DIFHS (HOLD - SELL)		
Fraction of Observations <sup>5</sup>	7.95%	6.18%
<i>Z-statistic</i> <sup>6</sup>	(0.7443)	(0.5693)
DIFBS (BUY - SELL)		
Fraction of Observations <sup>5</sup>	-1.33%	12.00%
<i>Z-statistic</i> <sup>6</sup>	(-0.1237)	(1.1081)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> Fraction of observations with  $\epsilon$  deflated by security price at the beginning of the year  $> 0$

<sup>3</sup> *Z-statistic (a priori)* tests whether the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from a *a priori* probability (i.e., 50%). For example, the *Z-statistic* of 3.6635 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\epsilon > 0$  (64.00%) exceeds *a priori* probability (50%).

(Contd.)

Table 5-14 (Contd.)

<sup>4</sup> *Z-statistic (a posteriori)* tests the proportion of observations with positive forecast errors for each stock recommendation portfolio is different from *a posteriori* probability of Duff & Phelps/Value Line overall sample observations with  $\varepsilon > 0$ . For example, the *Z-statistic* of 0.9550 tests whether the fraction of observations for Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.00%) exceeds *a posteriori* probability of Duff & Phelps' overall sample observations with  $\varepsilon > 0$  (60.35%).

<sup>5</sup> Differences in fractions of observations with positive forecast errors ( $\varepsilon$ ) between stock recommendation portfolios. DIFBH stands for the difference between *buy* stocks and *hold* stocks, DIFHS stands for the difference between *hold* stocks and *sell* stocks, and DIFBS stands for the difference between *buy* stocks and *sell* stocks.

<sup>6</sup> *Z-statistic* compares the proportion of observations with positive forecast errors between stock recommendation portfolios. For example, the *Z-statistic* of 1.0667 tests whether the fraction of Duff & Phelps' *buy* stocks with  $\varepsilon > 0$  (64.00%) exceeds the fraction of Duff & Phelps' *hold* stocks with  $\varepsilon > 0$  (58.18%).

\*(\*\*/\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

Table 5-15 (Tests for H<sub>2</sub>)

**Regression Analyses:  
Comparisons of Analysts' Forecast Bias ( $\epsilon$ )<sup>1</sup> among Stock  
Recommendations for a Reduced Sample<sup>2</sup>**

**Panel A: Undeclared Analyst Forecast Bias ( $\epsilon$ )**

Equation<sup>3</sup>:  $\epsilon = \beta_0 + \beta_1 \text{ HOLD} + \beta_2 \text{ SELL}$

N = 357

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
Value Line				
Coefficient	0.2489	0.0461	0.2961	0.0058
(t-statistic)	(4.2871)***	(0.5644)	(2.0161)**	(2.0324)
Duff & Phelps				
Coefficient	0.3639	-0.1244	-0.0839	0.0002
(t-statistic)	(5.8740)***	(-1.4270)*	(-0.5352)	(1.0279)

<sup>1</sup>  $\epsilon$  = annual EPS forecast - actual EPS

<sup>2</sup> A reduced sample represents the sample with the same stock recommendations for both Value Line and Duff & Phelps.

<sup>3</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations. ( $\beta_0 + \beta_1$ ) represents the mean value of analysts' forecast bias for *hold* stocks and ( $\beta_0 + \beta_2$ ) represents the mean value of analysts' forecast bias for *sell* stocks.

(\*/\*\*/\*\*\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-15 (Contd.)

Panel B: Analyst Forecast Bias ( $\epsilon$ ) Deflated by Actual EPS<sup>1</sup>

Equation<sup>2</sup>:  $\epsilon/AEPS = \beta_0 + \beta_1 \text{ HOLD} + \beta_2 \text{ SELL}$

N = 357

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
Value Line				
Coefficient	0.1041	0.0609	0.5628	0.0563
(t-statistic)	(2.2470)**	(0.9344)	(4.8025)***	(11.6250)***
Duff & Phelps				
Coefficient	0.1670	-0.0430	0.0210	-0.0044
(t-statistic)	(3.1699)***	(-0.5805)	(0.1576)	(0.2243)

<sup>1</sup>  $\epsilon/\text{actual EPS} = (\text{annual EPS forecast} - \text{actual EPS})/\text{actual EPS}$ <sup>2</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. AEPS stands for actual EPS. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations.  $(\beta_0 + \beta_1)$  represents the mean value of analysts' forecast bias for *hold* stocks and  $(\beta_0 + \beta_2)$  represents the mean value of analysts' forecast bias for *sell* stocks.

(\*\*/\*\*) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

(Contd.)

Table 5-15 (Contd.)

Panel C: Analyst Forecast Bias ( $\epsilon$ ) Deflated by Security Price<sup>1</sup>

Equation<sup>2</sup>:  $\epsilon/\text{Price} = \beta_0 + \beta_1 \text{HOLD} + \beta_2 \text{SELL}$

N = 331

	INTERCEPT	HOLD	SELL	Adj R <sup>2</sup> (F-statistic)
Value Line				
Coefficient	0.0084	0.0021	0.0109	0.0051
(t-statistic)	(3.8700) <sup>***</sup>	(0.7013)	(1.9089) <sup>**</sup>	(1.8429)
Duff & Phelps				
Coefficient	0.0125	-0.0045	0.0066	0.0063
(t-statistic)	(5.3390) <sup>***</sup>	(-1.3653) <sup>*</sup>	(1.0678)	(2.0366)

<sup>1</sup>  $\epsilon/\text{price} = (\text{annual EPS forecast} - \text{actual EPS})/\text{price}$ , where security price at the beginning of the year is used.

<sup>2</sup> The variable 'HOLD' represents a dummy variable for which 1 is assigned to *hold* recommendations and 0 to *buy/sell* recommendations. The variable 'SELL' represents a dummy variable for which 1 is assigned to *sell* recommendations and 0 to *buy/hold* recommendations. Price represents the security price at the beginning of the year. The intercept of the regression model ( $\beta_0$ ) represents mean value of analysts' forecast bias for *buy* recommendations,  $\beta_1$  represents the difference in analysts' forecast bias between *buy* and *hold* recommendations, and  $\beta_2$  represents the difference in analysts' forecast bias between *buy* and *sell* recommendations.  $(\beta_0 + \beta_1)$  represents the mean value of analysts' forecast bias for *hold* stocks and  $(\beta_0 + \beta_2)$  represents the mean value of analysts' forecast bias for *sell* stocks.

<sup>\*</sup>(<sup>\*\*</sup>/<sup>\*\*\*</sup>) designates statistical significance at the 10%(5%/1%) level, one-tailed tests.

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