

## **Bogumiła Brycz, Katarzyna Włodarczyk**

Faculty of Computer Science and Management,  
Wrocław University of Science and Technology  
e-mails: bogumiła.brycz@pwr.edu.pl; katarzyna.wlodarczyk@pwr.edu.pl

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# **TARGET PRICE ACCURACY AND THE INFORMATION CONTENT OF STOCK RECOMMENDATIONS ON THE WARSAW STOCK EXCHANGE**

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## **TRAFNOŚĆ CENY DOCELOWEJ A ZAWARTOŚĆ INFORMACYJNA REKOMENDACJI NA GIEŁDZIE PAPIERÓW WARTOŚCIOWYCH W WARSZAWIE**

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**Summary:** This paper examines target price accuracy conditional on whether the analyst's report contains a precise valuation model with underlying assumptions, as well as investigates whether target price accuracy is related to the forecast accuracy of the variables used as inputs in the valuation models. The study is conducted based on the analysts' stock recommendations issued in 2012 for companies listed on the Warsaw Stock Exchange. We find that approximately 67% of analysts' price targets are achieved within a 12-month period following the release of a report. Only in the case of positive recommendations we can observe that analysts who provide precise valuation model within their reports issue significantly more accurate target prices. We also find that target price forecast error is, on average, lower for reports with more accurate forecasts of such variables used as inputs in the valuation models as revenue, EBIT and net profit but the results are not always statistically significant.

**Keywords:** stock recommendation, target price, target price accuracy, analysts' forecasts valuation model.

**Streszczenie:** Artykuł ma na celu zbadanie trafności ceny docelowej określonej przez analityków w zależności od tego, czy raporty analityków zawierają szczegółową wycenę wraz z założeniami modeli wyceny, czy też nie, a następnie zbadanie, czy trafność ceny docelowej jest związana z trafnością prognoz wybranych zmiennych wykorzystywanych w modelu wyceny. Badaniem są objęte rekomendacje maklerskie wydane w 2012 r. dla spółek notowanych na Giełdzie Papierów Wartościowych w Warszawie. Otrzymane wyniki wskazują, że w przypadku 67% rekomendacji cena docelowa została osiągnięta w okresie 12 miesięcy od wydania rekomendacji. Można również zaobserwować, że tylko w przypadku rekomendacji pozytywnych raporty, które prezentują szczegółowy model wyceny, charakteryzują się znacznie większą trafnością ceny docelowej aniżeli raporty niezawierające takich informacji. Ponadto otrzymane wyniki wskazują, że błąd prognozy ceny docelowej jest przeciętnie niższy w przypadku rekomendacji charakteryzujących się bardziej trafnymi prognozami takich zmiennych, jak przychody, EBIT i zysk netto, ale otrzymane wyniki nie zawsze są statystycznie istotne.

**Słowa kluczowe:** rekomendacje giełdowe, cena docelowa, trafność ceny docelowej, prognozy analityków, model wyceny.

## 1. Introduction

Every year in Poland there are several hundred sell-side recommendations issued by brokerage houses which are available not only for the clients of these brokerage houses but also for a wider audience. Analysts issuing reports with stock recommendations provide information that is not always available to the average investor. They are expected to possess the expertise and some extraordinary skills in collecting and analysing value-relevant information when issuing stock recommendations, and the effectiveness of analysts' recommendations, also in the context of efficient market hypothesis, have been the subject of considerable research in recent years.

Sell-side analysts derive stock recommendations by developing forecasts and converting these forecasts into stock valuation using different valuation models, and the analysts' forecasts pose the unique value of each recommendation. In Polish sell-side recommendations the forecasts are usually presented in the form of a discounted cash flow (DCF) valuation model, relative valuation using multiples or, sometimes, abbreviated pro-forma financial statements, and along with the recommendation level, the analyst's report provides a target price projection which is usually the weighted average of the prices resulting from the DCF and multiple analysis.

In this study we investigate the accuracy of analysts' target price forecasts for the Polish stock market. Although this topic has been analysed before on the Polish market by e.g. Czyżycki [2013], Dąbrowski [2013], Prusak [2015], our paper differs from the previous ones. From the investors' point of view, attractive stocks are those whose intrinsic value is higher than the market price. Thus, investors should be interested in the possibility of understanding the basis for the calculations of the value estimated by analysts and comparing the estimated value and target price with the market price. However, not every report which recommends the purchase or sale of the stock presents a precise, quantitative model that justifies the analyst's target price. This seems to be important, e.g. in the context that previous research indicates that analysts' stock recommendations and target prices are biased. For example, the findings of Bonini et al. [2010] suggest that analysts may not have an incentive in truthfully revealing their information. Bradshaw [2004], points out that analysts do not fully incorporate earnings forecasts in their stock recommendations but instead rely on valuation heuristics. Therefore in our study we focus on the analysis of whether those analysts who provide a detailed valuation model with underlying assumptions within their reports issue more accurate target prices, we also contribute by analysing whether target price accuracy is related to the forecast accuracy of the variables used as inputs in the valuation models.

The rest of the paper is organized as follows. Section 2 provides a literature review and hypotheses development. Section 3 presents the sample and the methodology of our study. In section 4 we present and discuss the empirical results, and section 5 concludes the paper.

## 2. Literature review and development of hypotheses

A target price along with stock recommendation and valuation model containing forecasts of such variables as earnings and cash flow, is one of the main elements of sell-side analysts' reports and there is evidence that earnings forecasts, stock recommendations and target price all provide independent information to investors (e.g. Asquith et al. [2005]; Brav and Lehavy [2003]; Kerl and Walter [2008]). This study is related to research on the accuracy of analysts' target price forecasts and the factors influencing this accuracy. The target price accuracy was examined first on the US market (e.g. Asquith et al. [2005]; Bradshaw et al. [2013]) and then also in other countries (e.g. Bonini et al. [2010]; Imam et al. [2013]; Kerl [2011]). On the Polish stock market, target price accuracy was examined by Biedrzyński [2008], Adamczyk [2012], Dąbrowski [2013], Czyżycki [2013] and Prusak [2015] and the results obtained from their studies depend on the study period and the methodology used.

With respect to the factors that might be relevant for explaining target price accuracy, Asquith et al. [2005] examine the importance of valuation methodology and they do not find any systematic association between the valuation method employed by an analyst and the probability of achieving a price target. The influence of this factor is also investigated by Demirakos et al. [2010], but their results depend on the measure of target price accuracy as well as on the controlling for variables that capture the difficulty of the valuation task. Kerl [2011], examines such factors as company size, level of stock volatility, analyst-specific optimism, level of information that is disclosed within reports, reputation of the investment bank and conflicts of interest between the investment bank and the covered company. The author indicates that target price accuracy is higher for bigger firms but lower for stocks which are highly volatile and for stocks which have target prices that strongly deviate from the current stock price. Moreover, the findings show that target price accuracy is positively related to the level of the text-based information disclosed in the report and to the reputation of the investment bank - but these results only hold for positive recommendations. The author also finds that target price accuracy does not depend on the potentially existing conflicts of interest between the investment bank and the covered company. The study of Bonini et al. [2010], shows that analysts' target price accuracy is negatively correlated with research intensity and the market momentum, and additionally, it indicates that the accuracy drops with the predicted growth in the stock price, the size of the company and for loss-making firms. In turn, Bilinski et al. [2012], based on an international sample of 16 countries examine whether analyst and country-specific characteristics explain the variation in target price accuracy. Their findings confirm that some analysts have a superior ability to forecast target price and they also show that the significant variation in average target price accuracy across countries is due to differences in accounting disclosure quality, the origin of the legal system, cultural traits, and IFRS regulation.

In this study we examine the analysts' target price accuracy on the Polish capital market and we investigate whether the disclosure of detailed valuation models with underlying assumptions within the analyst's report might explain target price accuracy. The quality of stock recommendations has already been analysed for the Polish market, but in different aspects (e.g. Napiórkowski [2003], Kowalke [2012], Prusak [2015], Mielcarz [2016]). Only Mielcarz [2016], considers the effect of the disclosure of the details of the valuation model, however, not on the target price accuracy but on the abnormal stock returns, and his results indicate that investors' reaction to analysts' recommendations without details of the valuation model are weaker compared to reports containing such information, and this is especially visible in the case of negative recommendations. Adding to these studies we examine the hypothesis that H1: Recommendations containing detailed valuation models are characterized by greater target price accuracy than recommendations without such information.

Our paper is also related to research on analysts' forecasts, such as earnings and cash flow forecasts, especially within the context of stock recommendations. For example, Dreman and Berry [1995], and Wallmeier [2005], document that analysts' earnings forecasts are too optimistic and the former question the use of such earnings forecasts as integral to the most common valuation models. Eames et al. [2002], find that analysts' earnings forecast errors are significantly optimistic for buy recommendations and significantly pessimistic for sell recommendations. There is also evidence indicating that earnings forecasts are more accurate if analysts also publish cash flow forecasts (e.g. Pae et al. [2007], Call et al. [2009]). Additionally, there are studies that directly analyse the relation between analysts' earnings forecasts and recommendation profitability. For example, Bradshaw [2004] finds that investors would earn higher returns relying on present value models that incorporate analysts' earnings forecasts than on analysts' recommendations. Loh and Mian [2006] and Ertimur et al. [2007], report that analysts who make more accurate earnings forecasts also make more profitable stock recommendations.

Motivated by the above research, in this paper we analyse the association between the forecast accuracy of variables used as inputs in the valuation models and target price accuracy, thus we hypothesize that H2: Target price accuracy is related to the forecast accuracy of the variables used as inputs in the valuation models.

### **3. Sample description and research methods**

The research sample consists of 268 Polish stock recommendations published in 2012 and available in the EMIS database, on the finance web portal Bankier.pl, as well as on the websites of brokerage houses. From this initial sample we rejected analysts' reports that did not include direct investment advice, reports connected with the initial public offering and reports where target price was in a different currency than Polish zloty. Hence the final research sample consists of 264 stock recommendations published by twelve institutions: DM AmerBrokers, DM BDM,

BM BGŻ, DM BOŚ, DM BPS, DI BRE, DM BZ WBK, DM ING, DM Mercurius, DM Millennium, DM Noble Secure and DM PKO.

The primary source of data used in this study were Polish stock recommendations as described above; however in order to examine target price accuracy we also used stock quotes available on the website [gpwinfstrefa.com](http://gpwinfstrefa.com) and the annual reports available on the companies' websites and the web portal [Bankier.pl](http://Bankier.pl), to examine forecast accuracy of the variables used as inputs in the valuation models.

Table 1 provides the basic characteristics of the sample. The research sample is divided into reports which contain details of the company's valuation models with underlying assumptions (frequently including abbreviated pro-forma financial statements) and reports that do not contain such data, and we can observe that 55% (146 reports) of the reports in our sample fall into the first group while the remaining 45% (118 reports) fall into the second group. In the first group, 92% of these reports contain both the DCF valuation model and comparative valuation analysis, 5% contain both comparative valuation analysis and other valuation methods, and 3% of these reports contain only the DCF valuation model.

Table 1 also presents the sample according to the recommendation level. We can observe that positive recommendations (buy, accumulate) dominate in each of the two groups of reports (with and without detailed valuation models), however in the first group the percentage of positive recommendations is higher (33% compared to 19%). Overall, we can find positive recommendations in 52% of all the analysts' reports. Such a tendency is not surprising because it is well known that analysts are reluctant to issue negative recommendations (e.g. Womack [1996], Brav and Lehavy [2003], Jegadeesh and Kim [Jegadeesh et al. 2004], Ertimur et al. [2007] among others).

**Table 1.** Characteristics of the research sample

| Type of recommendation | Reports with valuation model |           | Reports without valuation model |           | Total      |            |
|------------------------|------------------------------|-----------|---------------------------------|-----------|------------|------------|
|                        | n                            | %         | n                               | %         | n          | %          |
| <b>Positive</b>        | <b>87</b>                    | <b>33</b> | <b>49</b>                       | <b>19</b> | <b>136</b> | <b>52</b>  |
| buy                    | 63                           | 24        | 38                              | 14        | 101        | 38         |
| accumulate             | 24                           | 9         | 11                              | 4         | 35         | 13         |
| <b>Neutral</b>         | <b>40</b>                    | <b>15</b> | <b>40</b>                       | <b>15</b> | <b>80</b>  | <b>30</b>  |
| hold                   | 40                           | 15        | 40                              | 15        | 80         | 30         |
| <b>Negative</b>        | <b>19</b>                    | <b>7</b>  | <b>29</b>                       | <b>11</b> | <b>48</b>  | <b>18</b>  |
| reduce                 | 10                           | 4         | 11                              | 4         | 21         | 8          |
| sell                   | 9                            | 3         | 18                              | 7         | 27         | 10         |
| <b>Total</b>           | <b>146</b>                   | <b>55</b> | <b>118</b>                      | <b>45</b> | <b>264</b> | <b>100</b> |

Source: own study.

To assess target price accuracy we use three measures. First, similarly to Asquith et al. [2005], Bradshaw et al. [2013], Imam et al. [2013], and Kerl [2011] we use the binary variable that is equal to one if the target price is met at any time during the

given period following the release of a report. Thus, for positive recommendations we consider the target price to be achieved if the analysed firm's stock price equals or exceeds the target price at any time during the given period following the release of a report, while for negative recommendations we consider the target price to be achieved if the stock price equals or falls below the target price. In the case of hold recommendations, we consider whether the analyst expects a positive or negative return, i.e. if the current price is lower than the target price we regard them the same as positive recommendations, otherwise we treat them as negative recommendations.

Second, for each stock covered by an analyst we compute the target price minimum relative absolute forecast error (TP\_MIN\_RAFE) as:

$$TP\_MIN\_RAFE = \min \left| \frac{P_t - TP}{TP} \right|,$$

where  $TP$  is the target price,  $P_t$  is the stock price at the end of each trading day  $t$  during the research period, and TP\_MIN\_RAFE is calculated within four intervals, i.e. within the first, second, third and fourth quarter following the release of a report. Third, for each stock covered by an analyst we compute the target price mean relative absolute forecast error (TP\_MEAN\_RAFE) as:

$$TP\_MEAN\_RAFE = \frac{1}{N} \sum_{t=1}^N \frac{|P_t - TP|}{TP},$$

where  $P_t$  is the stock price at the end of trading day  $t$ ,  $N$  is the number of trading days during the research period, and similarly to TP\_MIN\_RAFE, the TP\_MEAN\_RAFE is calculated within four intervals (as above).

To test the first hypothesis, we divide the sample into two subsamples as described above (the first subsample comprises reports which contain details of the valuation model and the second subsample comprises reports which do not contain such data). In the first step, using the first of our accuracy metric, we calculate the percentage of reports that achieve the target price within the 12-month forecast period in each subsample, and we use the chi-square test for independence for comparison of frequencies between the groups. In the second step, we compute the other two measures of accuracy, i.e. TP\_MIN\_RAFE and TP\_MEAN\_RAFE, and we use a parametric  $t$ -test to compare the mean level of accuracy as well as a non-parametric Mann-Whitney test to compare the median level of accuracy between the two subsamples.

To test the second hypothesis we use only the first subsample that comprises reports which contain a detailed valuation model with underlying assumptions. In the first step, for each firm covered by an analyst in this subsample we compute the relative absolute forecast error (RAFE) for three variables used as inputs in the valuation models, i.e. for revenue, EBIT and net profit. The relative absolute forecast error is calculated as:

$$RAFE = \frac{|F - A|}{|A|}$$

where  $F$  is the forecasted value of the given variable,  $A$  is the actual value of the given variable. RAFE is calculated for the first year forecasted by analysts in their valuation models. In the second step, based on the median value of RAFE in our subsample we divide this subsample into two groups. The first group comprises reports for which RAFE is greater than the median value while the second group comprises reports for which RAFE is less than the median value. Finally, using TP\_MIN\_RAFE and TP\_MEAN\_RAFE, we analyse target price accuracy in the two groups and we use a parametric  $t$ -test to investigate the differences in target price accuracy between them.

#### 4. Results and discussion

Table 2 presents price target accuracy during the 12-month period following the release of a report and the time necessary to achieve the target price. Panel A shows the results for the overall sample, categorized by the type of recommendation. Target prices are achieved in 66.7% of all cases in the research sample and they are achieved mostly in the first three months following the release of the recommendations (115 of the 176 instances). This is consistent, for example, with Bradshaw et al. [2013] who, using the sample of reports issued in the years 2000-2009 in the US, find that 64% of the target prices are met within the 12-month horizon. In comparison, Asquith et al. [2005] examine target price accuracy based on the reports issued from 1997 through 1999, and they report that approximately 54% of analysts' price targets are achieved within 12 months. Similarly, Imam et al. [2013], in their study for Eurozone stocks (included in the Dow Jones Euro Stoxx 50 Index), find the overall accuracy at just under 50%; Kerl [2011] in the study for the German market, indicates 56.5% accuracy in analysts' target prices within the 12-month period, whereas the findings of Bonini et al. [2010] for the Italian market, show only 33.1% accuracy. Prusak [2015], using similar methodology in the study for the Polish market based on stock recommendations issued in 2009-2012, finds that for buy and sell recommendations 54.5% of target prices are achieved within a 12-month period. Dąbrowski [2013], in his study for 1 029 recommendations issued in 2007-2011, indicates that 44.6% target prices are met within a determined time horizon. Also Czyżycki's study [2013], for 5 325 stock recommendations issued in 2006-2012, shows that two weeks after the release of a report on average 8% of analysts' target prices are achieved. After 100 trading days, 50% of target prices for buy recommendations and 57% for sell recommendations are still not achieved.

Panel A of Table 2 also shows that taking into account the type of recommendations, negative recommendations have the highest level of target price accuracy (83.3%)

compared to positive (57.4%) and neutral (72.5%) recommendations and the chi-square test indicates that the difference in proportion of the target price accuracy (during the 12-month period following the release of a report) between positive and negative recommendations is statistically significant at 1% level.

Panel B of Table 2 presents the target price accuracy in two subsamples categorized according to the presence of the details of the valuation model in the analyst's report. The results show that the percentage of firms which achieve the target price is higher for recommendations that contain a detailed valuation model than for recommendations without such information (70.6% vs. 61.9%), but the chi-square test indicates that the difference between these two proportions is not statistically significant. Thus, we are not able to reject the hypothesis that the target price accuracy and the disclosure of detailed valuation models with underlying assumptions and analysts' forecasts to justify their target price forecasts are independent.

In Panel C of Table 2 the target price accuracy is presented in two dimensions, firstly according to the type of recommendation and then according to the presence of detailed stock valuation models in the analyst's report. The results indicate that target prices of positive recommendations which are justified by presenting detailed valuation models with underlying assumptions and forecasts used as inputs in the models are achieved more often than target prices of positive recommendations which do not contain such information (64.4% vs. 44.9%) and the difference between the two proportions is statistically significant at 5% level. Thus in positive recommendations, target price accuracy is associated with the disclosure of a detailed valuation model to justify the target price forecast. In the case of neutral and negative recommendations the percentage of target prices which are achieved during the 12-month period is also higher for recommendations containing detailed valuation models than for recommendations without such data, but the difference in proportions between them is not statistically significant.

The lower percentage of target prices achieved within a 12-month period in the case of positive compared to negative recommendations can potentially be derived from the observed distribution of stock recommendations, i.e. analysts have propensities to issue positive recommendations and this may result in higher valuation error in the case of this type of recommendations. Moreover, the optimistic bias in analysts' recommendations may also explain the significantly lower percentage of target prices achieved within a 12-month period by positive recommendations which are not justified by presenting a precise valuation model compared to positive recommendations containing such information. On the contrary, because analysts are reluctant to issue negative recommendations, we suppose that they put more effort and care to produce accurate negative recommendations and as a result, in the case of this type of recommendations, target price accuracy is not associated with the disclosure of a precise valuation model within analysts' reports.



**Table 2.** Percentage of reports achieving target prices within the 12-month period

|   |                                 | Target price achieved | Target price achieved in: |                         |                         |                         | N    |    |
|---|---------------------------------|-----------------------|---------------------------|-------------------------|-------------------------|-------------------------|------|----|
|   |                                 |                       | 1 <sup>st</sup> quarter   | 2 <sup>nd</sup> quarter | 3 <sup>rd</sup> quarter | 4 <sup>th</sup> quarter |      |    |
| Panel A: Percentage of reports achieving target price by recommendation type  |                                 |                       |                           |                         |                         |                         |      |    |
| All recommendations   | n                               | 176                   | 115                       | 29                      | 20                      | 12                      | 264  |    |
|   | %                               | 66.67                 | 43.56                     | 10.98                   | 7.58                    | 4.55                    |      |    |
| Positive  | n                               | 78                    | 35                        | 15                      | 18                      | 10                      | 136  |    |
|   | %                               | 57.35                 | 25.74                     | 11.03                   | 13.24                   | 7.35                    |      |    |
| Neutral   | n                               | 58                    | 49                        | 6                       | 1                       | 2                       | 80   |    |
|   | %                               | 72.50                 | 61.25                     | 7.50                    | 1.25                    | 2.50                    |      |    |
| Negative  | n                               | 40                    | 31                        | 8                       | 1                       | 0                       | 48   |    |
|   | %                               | 83.33                 | 64.58                     | 16.67                   | 2.08                    | 0.00                    |      |    |
| p-value ( $\chi^2$ test)  |                                 | 0.0013***             |                           |                         |                         |                         |      |    |
| (Positive vs. Negative)   |                                 |                       |                           |                         |                         |                         |      |    |
| Panel B: Percentage of reports achieving target price according to the presence of valuation model                                |                                 |                       |                           |                         |                         |                         |      |    |
| Reports with valuation model  | n                               | 103                   | 64                        | 18                      | 13                      | 8                       | 146  |    |
|   | %                               | 70.55                 | 43.84                     | 12.33                   | 8.90                    | 5.48                    |      |    |
| Reports without valuation model   | n                               | 73                    | 51                        | 11                      | 7                       | 4                       | 118  |    |
|   | %                               | 61.86                 | 43.22                     | 9.32                    | 5.93                    | 3.39                    |      |    |
| p-value ( $\chi^2$ test)  |                                 | 0.1367                |                           |                         |                         |                         |      |    |
| Panel C: Percentage of reports achieving target price according to the type of recommendation and presence of the valuation model |                                 |                       |                           |                         |                         |                         |      |    |
| Positive  | Reports with valuation model    | n                     | 56                        | 27                      | 10                      | 13                      | 6    | 87 |
|   |                                 | %                     | 64.37                     | 31.03                   | 11.49                   | 14.94                   | 6.90 |    |
|   | Reports without valuation model | n                     | 22                        | 8                       | 5                       | 5                       | 4    | 49 |
|   |                                 | %                     | 44.90                     | 16.33                   | 10.20                   | 10.20                   | 8.16 |    |
| p-value ( $\chi^2$ test)  |                                 | 0.0275**              |                           |                         |                         |                         |      |    |
| Neutral   | Reports with valuation model    | n                     | 30                        | 25                      | 3                       | 0                       | 2    | 40 |
|   |                                 | %                     | 75.00                     | 62.50                   | 7.50                    | 0.00                    | 5.00 |    |
|   | Reports without valuation model | n                     | 28                        | 24                      | 3                       | 1                       | 0    | 40 |
|   |                                 | %                     | 70.00                     | 60.00                   | 7.50                    | 2.50                    | 0.00 |    |
| p-value ( $\chi^2$ test)  |                                 | 0.6165                |                           |                         |                         |                         |      |    |
| Negative  | Reports with valuation model    | n                     | 17                        | 12                      | 5                       | 0                       | 0    | 19 |
|   |                                 | %                     | 89.47                     | 63.16                   | 26.32                   | 0.00                    | 0.00 |    |
|   | Reports without valuation model | n                     | 23                        | 19                      | 3                       | 1                       | 0    | 29 |
|   |                                 | %                     | 79.31                     | 65.52                   | 10.34                   | 3.45                    | 0.00 |    |
| p-value ( $\chi^2$ test)  |                                 | 0.5975                |                           |                         |                         |                         |      |    |

\*\*, \*\*\* indicate that the differences are significant at 5 and 1 percent levels of significance, respectively

Source: own study.

The second approach to compare target price accuracy between the two subsamples – reports containing a detailed valuation model and reports without such data – is presented in Table 3. Panel A compares the averages (mean and median) of target price minimum relative absolute forecast error (TP\_MIN\_RAFE) and analogously, Panel B compares the averages of target price mean relative absolute forecast error (TP\_MEAN\_RAFE). The forecast errors are calculated for four intervals (within the first four quarters following the release of the report) and the analysis is conducted not only for all recommendations in the two subsamples but also separately for positive, neutral and negative recommendations.

In Panel A of Table 3 we can observe that in both subsamples the average TP\_MIN\_RAFE for all recommendations is the lowest in the first studied period and steadily increases in subsequent periods. Moreover, we can observe that TP\_MIN\_RAFE is, on average, lower for reports containing detailed valuation models compared to reports without such data, but the differences in TP\_MIN\_RAFE between the two subsamples are not statistically significant. However, when we analyse only positive recommendations, the differences in the average TP\_MIN\_RAFE between the reports with and without detailed valuation models are more visible and in the first three quarters they are statistically significant at 5%, 10% and 10% level, respectively. In turn, in the case of neutral recommendations the differences in the average TP\_MIN\_RAFE between the two subsamples are not so visible; there are no visible systematic patterns in the differences and they are not statistically significant. Similarly, in the case of negative recommendations the results are not so conclusive as for positive recommendations. Differently than expected, in the first quarter the mean and median TP\_MIN\_RAFE is higher for recommendations with a detailed valuation model than for recommendations without such data and although this reverses in subsequent quarters, the results are statistically significant only in the last quarter at the 5% level. We are also cautious in interpreting the results for negative recommendations due to the relatively small subsamples of these recommendations.

In the case of TP\_MEAN\_RAFE (Panel B of Table 3) the results for all recommendations are similar as in the case of TP\_MIN\_RAFE, i.e. in both subsamples the average TP\_MEAN\_RAFE is the lowest in the first studied period and steadily increases in the subsequent periods, as well as TP\_MEAN\_RAFE is on average lower for reports containing detailed valuation models than for the reports without such information, but different from the results for TP\_MIN\_RAFE in the third quarter the difference in the average TP\_MEAN\_RAFE between the two subsamples is statistically significant at the 10% level. When we take into account only positive recommendations, the results for TP\_MEAN\_RAFE are also similar to the results for TP\_MIN\_RAFE, i.e. TP\_MEAN\_RAFE is, on average, lower for the reports with detailed valuation models compared to the reports without such data but the difference between the two subsamples is statistically significant only in the first and second quarter at 5% and 10% level, respectively. The results for neutral

**Table 3.** Target price forecast error depending on the presence of detailed valuation models within analysts' reports

|  |            | Target price forecast error within:     |         |                         |         |                         |         |                         |         |
|--|------------|---|---------|-------------------------|---------|-------------------------|---------|-------------------------|---------|
|  |            | 1 <sup>st</sup> quarter                 |         | 2 <sup>nd</sup> quarter |         | 3 <sup>rd</sup> quarter |         | 4 <sup>th</sup> quarter |         |
| Panel A: Target price minimum relative absolute forecast error (TP_MIN_RAFE) |            |   |         |                         |         |                         |         |                         |         |
|  |            | Reports with / without valuation model: |         |                         |         |                         |         |                         |         |
|  |            | With                                    | Without | With                    | Without | With                    | Without | With                    | Without |
| All  | n          | 146                                     | 117     | 146                     | 117     | 144                     | 117     | 143                     | 115     |
|  | Mean [%]   | 6.11                                    | 7.04    | 11.27                   | 13.22   | 14.96                   | 17.97   | 18.59                   | 20.10   |
|  | Median [%] | 2.17                                    | 2.42    | 5.32                    | 7.89    | 9.39                    | 11.68   | 13.18                   | 12.66   |
| p-value (t-test)   |            | 0.3830                                  |         | 0.2943                  |         | 0.1780                  |         | 0.5587                  |         |
| Positive   | n          | 87                                      | 49      | 87                      | 49      | 87                      | 49      | 87                      | 49      |
|  | Mean [%]   | 8.65                                    | 13.48   | 12.57                   | 16.89   | 14.16                   | 19.11   | 17.91                   | 19.10   |
|  | Median [%] | 7.13                                    | 12.10   | 7.61                    | 13.05   | 8.08                    | 11.68   | 13.33                   | 11.63   |
| p-value (M-W test)   |            | 0.0245**                                |         | 0.0606*                 |         | 0.0598*                 |         | 0.6244                  |         |
| Neutral  | n          | 40                                      | 40      | 40                      | 40      | 39                      | 40      | 39                      | 39      |
|  | Mean [%]   | 1.73                                    | 2.45    | 9.55                    | 9.80    | 15.34                   | 15.26   | 22.03                   | 19.13   |
|  | Median [%] | 0.44                                    | 0.42    | 4.34                    | 3.04    | 12.13                   | 9.58    | 16.68                   | 10.96   |
| p-value (M-W test)   |            | 0.7972                                  |         | 0.9039                  |         | 0.6482                  |         | 0.6314                  |         |
| Negative   | n          | 19                                      | 28      | 19                      | 28      | 18                      | 28      | 17                      | 27      |
|  | Mean [%]   | 3.66                                    | 2.34    | 8.94                    | 11.70   | 17.98                   | 19.85   | 14.22                   | 23.31   |
|  | Median [%] | 1.06                                    | 0.46    | 1.95                    | 5.82    | 9.24                    | 19.24   | 3.60                    | 25.00   |
| p-value (M-W test)   |            | 0.3134                                  |         | 0.2881                  |         | 0.5660                  |         | 0.0481**                |         |
| Panel B: Target price mean relative absolute forecast error (TP_MEAN_RAFE)   |            |   |         |                         |         |                         |         |                         |         |
|  |            | Reports with / without valuation model: |         |                         |         |                         |         |                         |         |
|  |            | With                                    | Without | With                    | Without | With                    | Without | With                    | Without |
| All  | n          | 146                                     | 117     | 146                     | 117     | 146                     | 118     | 146                     | 117     |
|  | Mean [%]   | 14.69                                   | 16.47   | 20.07                   | 22.85   | 23.87                   | 28.57   | 30.07                   | 30.67   |
|  | Median [%] | 11.55                                   | 12.13   | 14.90                   | 17.87   | 18.08                   | 23.40   | 25.38                   | 24.70   |
| p-value (t-test)   |            | 0.2029                                  |         | 0.1761                  |         | 0.0572*                 |         | 0.8435                  |         |
| Positive   | n          | 87                                      | 49      | 87                      | 49      | 87                      | 49      | 87                      | 49      |
|  | Mean [%]   | 16.86                                   | 21.74   | 20.72                   | 25.18   | 22.49                   | 28.38   | 28.60                   | 29.64   |
|  | Median [%] | 15.42                                   | 19.39   | 17.89                   | 19.73   | 17.89                   | 23.01   | 25.93                   | 22.79   |
| p-value (M-W test)   |            | 0.0254**                                |         | 0.0953*                 |         | 0.1457                  |         | 0.8739                  |         |
| Neutral  | n          | 40                                      | 40      | 40                      | 40      | 40                      | 40      | 40                      | 39      |
|  | Mean [%]   | 10.50                                   | 11.54   | 18.79                   | 19.73   | 25.10                   | 26.47   | 33.50                   | 29.73   |
|  | Median [%] | 8.47                                    | 9.05    | 13.24                   | 14.74   | 21.01                   | 18.89   | 26.29                   | 23.66   |
| p-value (M-W test)   |            | 0.4443                                  |         | 0.6546                  |         | 0.9119                  |         | 0.7058                  |         |
| Negative   | n          | 19                                      | 28      | 19                      | 28      | 19                      | 29      | 19                      | 29      |
|  | Mean [%]   | 13.59                                   | 14.28   | 19.84                   | 23.23   | 27.56                   | 31.80   | 29.56                   | 33.66   |
|  | Median [%] | 11.92                                   | 9.77    | 10.98                   | 18.50   | 16.87                   | 35.42   | 17.58                   | 35.44   |
| p-value (M-W test)   |            | 0.9568                                  |         | 0.2461                  |         | 0.3116                  |         | 0.1773                  |         |

\*, \*\* indicate that the differences are significant at 10 and 5 percent levels of significance, respectively. M-W test means Mann-Whitney U test.

Source: own study.

recommendations indicate that, on average, TP\_MEAN\_RAFE do not differ much between the two subsamples and the differences are not statistically significant in any of the four quarters. In turn, in the case of negative recommendations the differences in the average TP\_MEAN\_RAFE between the reports with and without detailed valuation models are more visible, except for the first quarter, but they are also not statistically significant.

The results presented in Table 3 confirm the findings from Table 2. The significantly lower target price forecast error for reports containing a precise valuation model may potentially be explained by the optimistic bias in analysts' recommendations which can be stronger when analysts do not disclose such information within their reports. In the case of negative recommendations, analysts are supposed to put more effort and care to produce accurate recommendations and, as a result, in the case of this type of recommendations target price accuracy is not associated with the disclosure of a precise valuation model within a report. However, in interpreting the results we are aware that in the case of negative recommendations the two subsamples are relatively small.

In order to verify the second hypothesis, Table 4 investigates the association between target price accuracy and forecast accuracy of variables used as inputs in the valuation models. Panel A of Table 4 presents the mean and median target price minimum relative absolute forecast error (TP\_MIN\_RAFE) for analysts' recommendations sorted into two groups according to the median value of the relative absolute forecast error of such three variables as revenue (R\_RAFE), EBIT (E\_RAFE) and net profit (NP\_RAFE). Analogously, Panel B of Table 4 presents the mean and median target price mean relative absolute forecast error (TP\_MEAN\_RAFE) for the same groups of analysts' recommendations.

In Panel A of Table 4 we can observe that the mean value of target price minimum relative absolute forecast error (TP\_MIN\_RAFE) is lower for the reports with more accurate forecasts of variables used as inputs in the valuation models. This pattern is confirmed for all the subsamples, i.e. R\_RAFE-, E\_RAFE- as well as for NP\_RAFE-based subsamples, however the results are not always statistically significant. The observed differences in the mean value of TP\_MIN\_RAFE between the two groups sorted on the basis of revenue forecast accuracy (R\_RAFE) are statistically significant at 5% level in two periods, i.e. in the second and third quarter following the release of the recommendations, whereas the differences in the mean value of TP\_MIN\_RAFE between the two groups sorted on the basis of EBIT forecast accuracy (E\_RAFE) are statistically significant at 10% level in the first three quarters following the release of the recommendations. In turn, the results for the NP\_RAFE-based subsamples are not statistically significant in any of the four quarters.

A similar regularity is observed in Panel B of Table 4 for the target price accuracy measured by the target price mean relative absolute forecast error (TP\_MEAN\_RAFE). The observed differences in the mean value of TP\_MEAN\_RAFE between the two groups sorted on the basis of R\_RAFE are statistically significant at 1%, 5%

**Table 4.** Target price forecast error depending on the forecast accuracy of revenue, EBIT and net profit

| Panel A: Target price minimum relative absolute forecast error (TP_MIN_RAFE) |      |                         |          |            |                         |          |            |                         |          |            |                         |          |            |
|--|------|-------------------------|----------|------------|-------------------------|----------|------------|-------------------------|----------|------------|-------------------------|----------|------------|
|  |      | TP_MIN_RAFE             |          |            |                         |          |            |                         |          |            |                         |          |            |
|  |      | 1 <sup>st</sup> quarter |          |            | 2 <sup>nd</sup> quarter |          |            | 3 <sup>rd</sup> quarter |          |            | 4 <sup>th</sup> quarter |          |            |
|  |      | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] |
| R_RAFE   | < Me | 67                      | 5.53     | 1.81       | 67                      | 8.35     | 4.15       | 67                      | 11.69    | 6.24       | 66                      | 17.15    | 13.41      |
|  | > Me | 67                      | 6.69     | 2.91       | 67                      | 14.60    | 6.86       | 67                      | 18.39    | 13.21      | 67                      | 21.18    | 14.98      |
| p-value (t-test)   |      | 0.4026                  |          |            | 0.0205**                |          |            | 0.0290**                |          |            | 0.2516                  |          |            |
| E_RAFE   | < Me | 67                      | 4.91     | 2.81       | 67                      | 8.97     | 3.96       | 67                      | 12.23    | 7.20       | 66                      | 17.42    | 12.28      |
|  | > Me | 67                      | 7.31     | 1.76       | 67                      | 13.99    | 7.30       | 67                      | 17.85    | 16.59      | 67                      | 20.92    | 17.76      |
| p-value (t-test)   |      | 0.0815*                 |          |            | 0.0634*                 |          |            | 0.0681*                 |          |            | 0.3198                  |          |            |
| NP_RAFE  | < Me | 67                      | 5.10     | 2.20       | 67                      | 9.79     | 5.85       | 67                      | 13.45    | 9.50       | 66                      | 19.00    | 15.88      |
|  | > Me | 67                      | 7.13     | 1.95       | 67                      | 13.17    | 4.15       | 67                      | 16.62    | 7.20       | 67                      | 19.36    | 14.06      |
| p-value (t-test)   |      | 0.1424                  |          |            | 0.2133                  |          |            | 0.3054                  |          |            | 0.9180                  |          |            |
| Panel B: Target price mean relative absolute forecast error (TP_MEAN_RAFE)   |      |                         |          |            |                         |          |            |                         |          |            |                         |          |            |
|  |      | TP_MEAN_RAFE            |          |            |                         |          |            |                         |          |            |                         |          |            |
|  |      | 1 <sup>st</sup> quarter |          |            | 2 <sup>nd</sup> quarter |          |            | 3 <sup>rd</sup> quarter |          |            | 4 <sup>th</sup> quarter |          |            |
|  |      | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] | n                       | Mean [%] | Median [%] |
| R_RAFE   | < Me | 67                      | 13.00    | 9.84       | 67                      | 16.64    | 12.89      | 67                      | 21.20    | 17.23      | 67                      | 30.31    | 25.93      |
|  | > Me | 67                      | 16.73    | 12.70      | 67                      | 24.25    | 16.48      | 67                      | 27.28    | 22.24      | 67                      | 32.06    | 27.43      |
| p-value (t-test)   |      | 0.0424**                |          |            | 0.0086***               |          |            | 0.0669*                 |          |            | 0.6967                  |          |            |
| E_RAFE   | < Me | 67                      | 12.56    | 9.79       | 67                      | 17.86    | 12.64      | 67                      | 21.83    | 16.31      | 67                      | 30.37    | 23.44      |
|  | > Me | 67                      | 17.17    | 13.05      | 67                      | 23.03    | 18.62      | 67                      | 26.65    | 22.24      | 67                      | 32.00    | 29.22      |
| p-value (t-test)   |      | 0.0118**                |          |            | 0.0767*                 |          |            | 0.1474                  |          |            | 0.7175                  |          |            |
| NP_RAFE  | < Me | 67                      | 12.67    | 10.87      | 67                      | 18.88    | 14.94      | 67                      | 23.40    | 19.63      | 67                      | 32.25    | 26.23      |
|  | > Me | 67                      | 17.06    | 12.70      | 67                      | 22.01    | 13.99      | 67                      | 25.08    | 16.87      | 67                      | 30.12    | 26.31      |
| p-value (t-test)   |      | 0.0166**                |          |            | 0.2849                  |          |            | 0.6133                  |          |            | 0.6356                  |          |            |

R\_RAFE, E\_RAFE, NP\_RAFE means relative absolute forecast error (RAFE) for revenue, EBIT and net profit, respectively; Me means median; \*, \*\*, \*\*\* indicate that the differences are significant at 10, 5 and 1 percent levels of significance, respectively.

Source: own study.

and 10% level in the second, first and third quarter following the release of the recommendations, respectively. The results for the E\_RAFE-based subsamples indicate that the differences in the mean value of TP\_MEAN\_RAFE are statistically significant at 5% and 10% level in the first and second quarter, respectively, whereas the results for the NP\_RAFE-based subsamples indicate that the difference in the mean value of TP\_MEAN\_RAFE is statistically significant only in the first quarter following the release of the recommendations (at 5% level).

## 5. Conclusion

Target price is one of the main elements of sell-side analyst's stock recommendation and the accuracy of target prices has received considerable attention in the recent literature. Previous research on the effectiveness of analysts' stock recommendations and target prices indicate that they are biased. This may be because analysts may not have an incentive in truthfully revealing their information [Bonini et al. 2010]. It is unfortunately common that reports which recommend purchase or sale of the stock do not present a precise, quantitative model that justifies the analyst's target price and the type of the analyst's recommendation.

This paper examines target price accuracy conditional on whether the analyst's report contains a precise valuation model with underlying assumptions or not. The study is conducted based on the analysts' stock recommendations issued in 2012 for companies listed on the Warsaw Stock Exchange. We find that approximately 67% of analysts' price targets are achieved within a 12-month period following the release of a report, however for positive recommendations this percentage is 57% and for negative recommendations – 83%. Only in the case of positive recommendations we can observe that analysts' reports which provides precise valuation model with underlying assumptions have significantly more accurate target prices compared to reports which do not provide such information. This may potentially be explained by the optimistic bias in analysts' recommendations which can be stronger when analysts do not disclose detailed valuation model with underlying assumptions to justify their target price forecasts. Next, the paper examined whether target price accuracy is related to the forecast accuracy of the variables used as inputs in the valuation models. We find that target price forecast error is, on average, lower for the reports with more accurate forecasts of such variables used as inputs in the valuation models as revenue, EBIT and net profit but the results are not always statistically significant.

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