Some Stylized Facts about Analyst Errors[*]

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Abstract. In our paper we outline some empirical evidences about aggregated analyst errors, i.e. systematic differences between consensually forecasted and observed prices. In particular, we find that the error is independent from the amount of analysts covering the stock, while industry plays an important role, although an error is bigger for growth companies. We also confirm previous evidence that price estimates aggregation over an index result in better estimates performance. Along with that, EPS is predicted better than price itself. Based on mentioned facts we deduce that the main reason for poor performance of analysts should likely be in their disability to choose correct discount rate. Our result contributes to literature on efficient market hypothesis, to studies of stock market analyst accuracy and to surveys of best/worst practices of equity valuation.

Аннотация. В статье приводятся эмпирические свидетельства об ошибках в агрегированных прогнозах аналитиков рынка акций, т.е. систематических различиях между прогнозируемыми и наблюдаемыми ценами. В частности, мы показываем, что ошибка не зависит от количества аналитиков, покрывающих акцию, в то время как отрасль, в которую входит акция, играет существенную роль; вместе с тем компании роста в целом имеют большую ошибку по сравнению с компаниями стоимости. Мы также подтверждаем предыдущие свидетельства того, что сложение оценок аналитиков в индекс позволяет сделать оценку более точной (т.е. индекс предсказывается лучше отдельных акций). Вместе с тем EPS прогнозируется лучше, чем цена. На основании указанных фактов мы предполагаем, что основная причина неточности в прогнозах, скорее всего, заключается в неспособности аналитиков выбирать правильную ставку дисконтирования. Наш результат является вкладом в литературу одновременно по теории эффективного рынка, исследования точности аналитиков рынка акций и лучших/худших практик оценки капитала.

Key words: Analyst performance, efficient market hypothesis, equity valuation.

1. INTRODUCTION

There are two types of stock prices: observed and theoretic, or "fair". The latter is usually defined by discounting expected flows from the stock and multiplying it by some factor, reflecting comparative current utility of the risk, implied by holding the stock – approach, generally referred to as "stochastic discounting factor" framework (see, e.g. (Lucas, 1978), (Ross, 1978), (Harrison & Kreps, 1979), (Campbell, 2014)). Though efficient market hypothesis postulates that there should be no systematic difference between the fair and observed price, at least from the seminal papers by (Shiller, 1993) and (Mehra & Prescott, 1985), it is generally doubted that this claim is supported by empirical evidence. Many pro-EMH and contra-EMH arguments were brought since then. Instead of directly proxying "fair" price in SDF framework, in our paper we resort to other approach: we calculate divergence between predicted and fair prices and test

for possible reasons of such discrepancy. Our approach, thus, is at least particularly in lines with (Fernandez, 2015) and many other papers, published recently on issues of divergence between valuation practice and theory. The rest of the paper is organized as follows: first, we describe the very stylized facts and their derivation; secondly, we discuss possible reasons of errors; in final section we conclude.

2. STYLIZED FACTS

2.1 DATASET AND GENERAL STATISTICS

Our dataset includes estimated stock prices for S&P-500 constituents from 2000 to 2014, taken from Bloomberg. Estimates are aggregated across stocks, and blended 12 months forward. We calculate errors at time t for each stock as follows:

$$E^t = \frac{P_{forecast}^t - P_{observed}^{t+12}}{P_{observed}^{t+12}} \qquad (1)$$

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where E^t is error, $P^t_{forecast}$ is forecasted price, and $P^{t+12}_{observed}$ is the price observed in 12 months after forecast. There are 99731 historical and 52279 target returns (hence 52279 errors) in our dataset.

Both observed and target returns exhibit extreme fat tails as compared to normal distribution (Figure 1). While observed prices are extremely leptokurtic (which is in line with previous literature on stock returns stylized facts), target returns are, on opposite, platykurtic. Historical returns are almost symmetrical around its mean with left tail slightly bigger. We confirm widely reported extreme positive bias in analyst recommendations (mean observed return 0.0086 *vs.* mean target return 0.1421, KS-test results: D = 0.5256, p-value < 2.2e-16). Extreme positive bias for target returns leads to significant difference in standard deviations: 0.0857 for historical prices *vs.* 0.1570 for target.

2.2. STYLIZED FACT 1: AGGREGATION OF ESTIMATES ACROSS INDEX DECREASES ERRORS

As was shown in (Didenko, 2014), the index overall level estimates are more accurate than those of the individual stock price. In our research, instead relying on graphical analysis, we choose more rigorous approach and compare average individual errors of stocks in index and average aggregated error of forecasted index price.

As can be seen from the Figure 2, while mean error for the index is 0.1, almost symmetric and normal, mean error for individual stock is right-tailed and leptokurtic with the mean 0.1498.

By applying KS-test, we get D = 0.6055 with p-value < 2.2e-16. Thus, we confirm observation in (Didenko, 2014) that the aggregated expectation of price is more accurate than individual. Several further chapters are dedicated to finding possible reasons for that.

2.3. STYLIZED FACT 2: LEVEL OF COVERAGE IS INSIGNIFICANT

First natural reason for increasing analyst accuracy with aggregation of their estimates in index could be plain offset of individual errors, achieved with pooling together individual target returns: estimated "undershoots" should on average offset "overshoots". Hence our first hypothesis to test would be as follows: the more analysts are covering the stock, and, consequently, the more estimates a stock has, the more accurate will be aggregated estimates for the stock. We
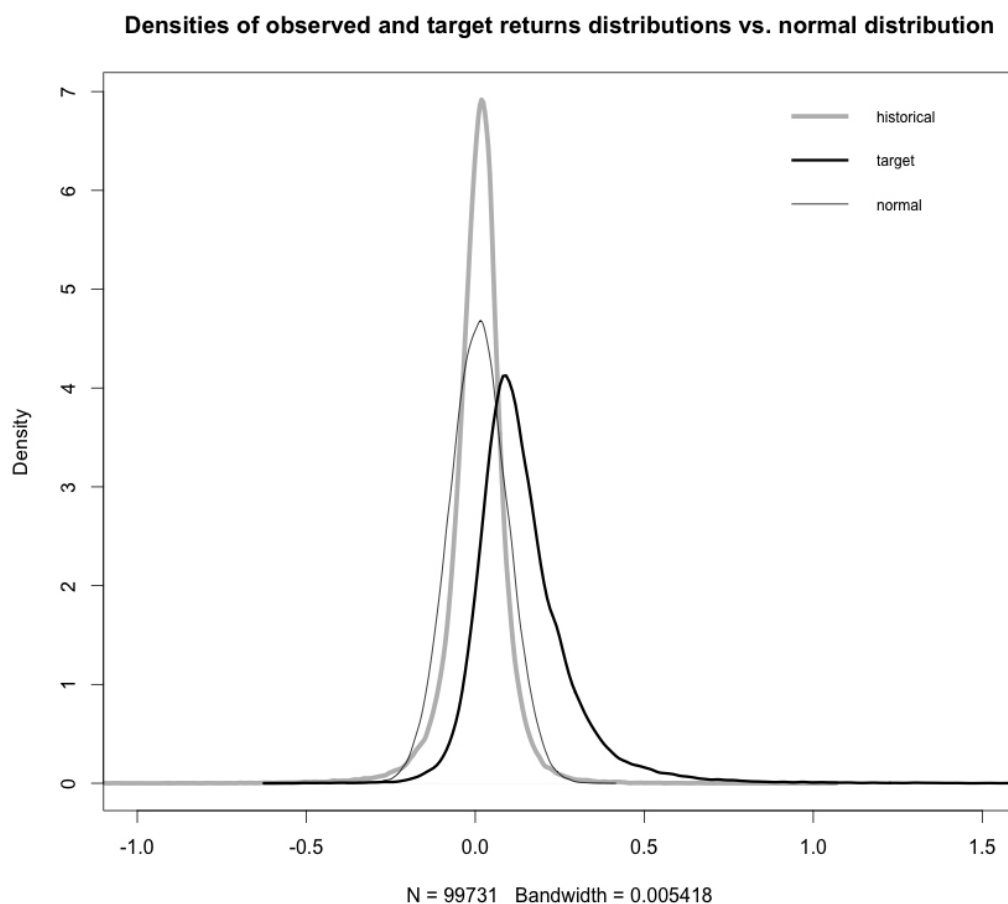

Densities of observed and target returns distributions vs. normal distribution

N = 99731   Bandwidth = 0.005418

Figure 1.

test it in the following manner: take current number of analysts covering a stock, and correlate it to average error for this stock throughout the whole timespan. Resulting Pearson correlation coefficient 0,03, obtained for an array of 500 stocks in our database, suggests that there is no statistically significant relationship between the scale of error and the quantity of analysts covering the stock. Hence we can conclude that consensual forecast accuracy is not determined by the size of the crowd of analysts watching the stock.

2.4. STYLIZED FACT 3: INDUSTRY IS SIGNIFICANT

Second possible reason of decreasing error with aggregation in wide-market index could be due to industry-level errors offset. For example, analysts could systematically underprice stocks of some industry while overpricing others; it may lead to inefficient estimates of individual stocks, but again, offset errors on index level. That industry-level differential inefficiency could be explained by various factors, including cyclical issues, differences in average maturities of companies across industries, etc. For example, if a company was founded as a zinc extraction and even computer components assembly and successfully operated on the market, for in-

stance, for fifty years, we may consider analyst predictions to be more accurate.

To test this hypothesis we separate errors of companies in our dataset by industries and compare means, deviations and overall form of distributions (Figure 3). Companies in the energy sector were the hardest to predict, which perhaps can be explained by energy markets volatility. In contrast, the utilities segment is predicted best, probably due to relative simplicity of business models of utility companies. In other industries, there are some differences that are at a relatively generic level, while overall result suggesting that industry membership plays significant role for how accurate would be aggregated stock price forecast.

2.5. STYLIZED FACT 4: VALUE COMPANIES ARE HARDER TO PREDICT

In this section we consider such factors as possible discrepancies in errors between the companies often denoted as the companies of growth and value. Growth company is perceived by investors as an object yielding from repricing, or growth, hence an investor would benefit from selling a stock in a future receiving a marginal revenue. From the other side, the value company is a mature corporation that is at par-
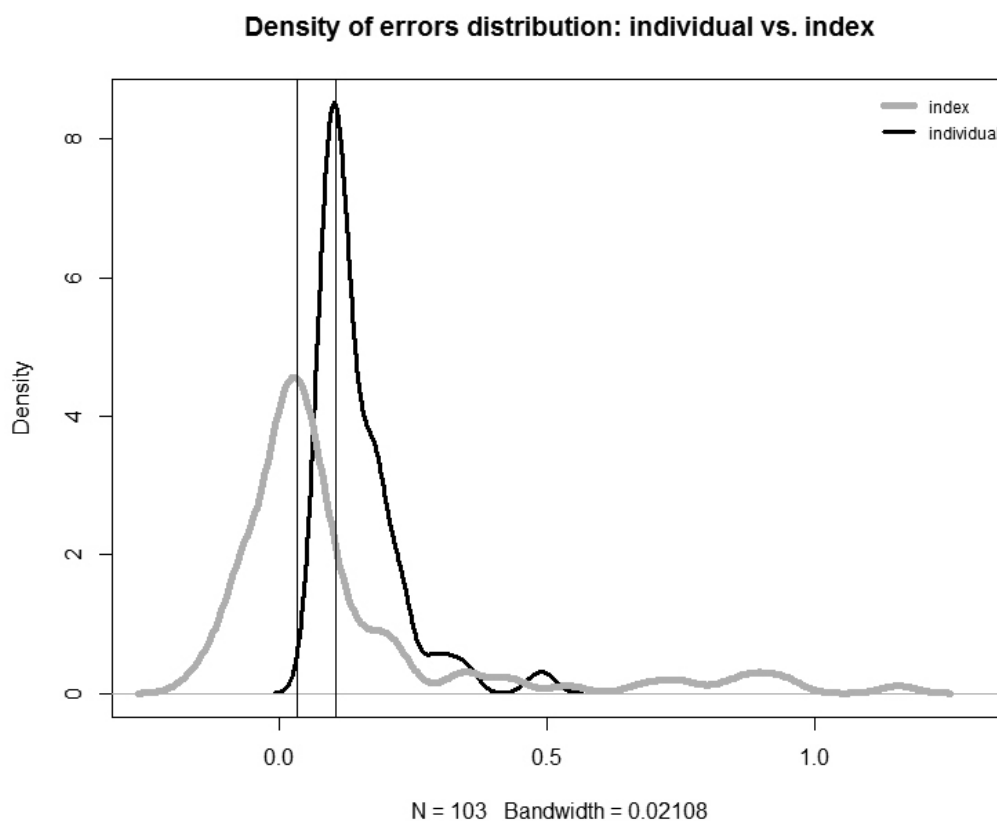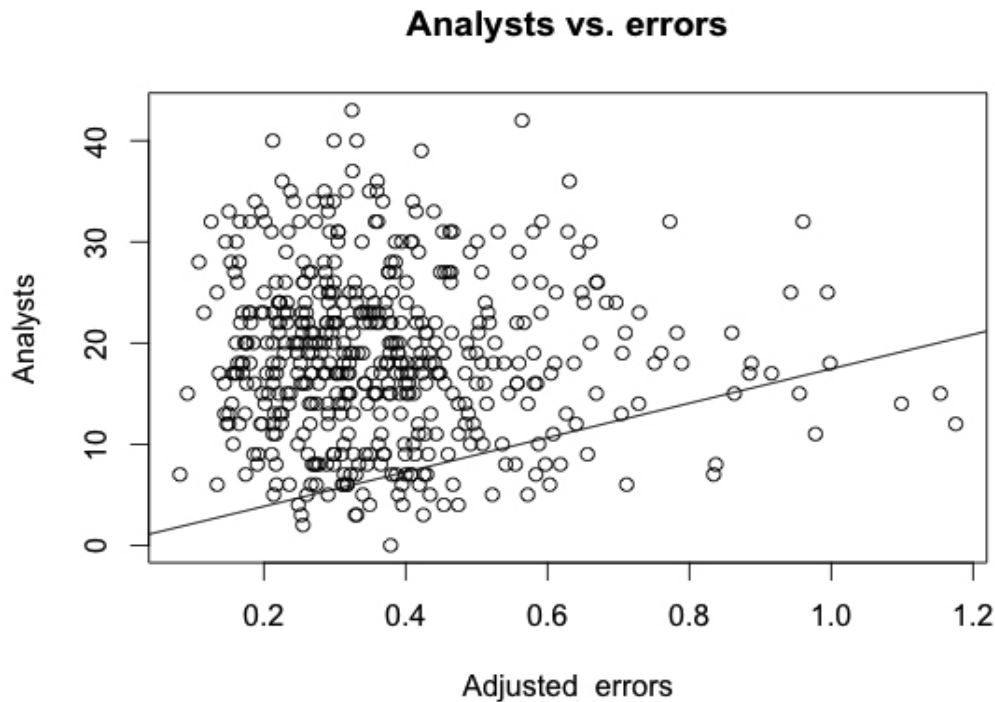

Figure 2.

Analysts vs. errors

Figure 3.

amount of its growth potential, operating in mature stable industry, which started to pay out dividends.

To test this hypothesis we take extremely best and worst predicted stocks in our dataset throughout the whole history, and check whether there is significant difference in ratio of growth to value companies in these two groups. As a basis we took the natural exponent of P/E and compared it with the average P/E across the whole dataset. Companies with lesser than average P/E were considered value stocks. Extremely best and worst predicted stocks were identified as follows: if the average error for a company during observing period was more than the average error in the sample for the same time period plus ½ of the error, hence the stock can be defined as an error "leader". After that the already described iterations for each leader were produced. Thus, through the implementation of the above plan, we can safely say that the value companies are consistently worse predicted.

2.6 STYLIZED FACT 5: EPS IS PREDICTED BETTER THAN PRICE

If we can not figure out where brokers are wrong, we should find out why they are wrong. It can be elucidated by taking three indicators: share price, sales and EPS, and then by comparing the first to the second and third. Thus, we may have two possible outcomes: either an error is in EPS and sales, or if they, in principle, quite correctly predict these figures, it means that the problem is in the discount rate.

This hypothesis was tested out in the following way. Firstly, we calculate EPS and sales forecast errors

analogous to target price errors (i.e. by calculating ratio of difference between indicator's actual value and its 12 months blended forward indicator, to its actual value). Then we apply KS-test criterion to average error for target price and EPS. Result is as follows: D = 0.1884 with p-value = 1.401e-02. Error in EPS is lower than the error in price; hence the case is in the discount rate.

3. DISCUSSION

In this section we elaborate more on possible reasons of deviation of observed prices from prices expected by analysts.

In our research we start from checking whether aggregated expected level of an index is more precise, than a future value of each specific share. Perhaps, averaging of fat-tails at the expense of predictions of the shares having rather high precision can serve one of the reasons for it. It can seem obvious, but it is confirmed with the result we received. The second point is the confuted assumption that the more analysts predict future value of the share, the more exact will be the assessment. Whatever logical this assumption seemed, it is confuted by the value of the Pearson correlation coefficient 0.22 counted in total for five hundred companies of the S&P500 Index. In contrast the result received during research shows that the industry in which the company functions is one of the determining factors in a prediction of future cost of its share. This fact means that there are industries which are easier to predict
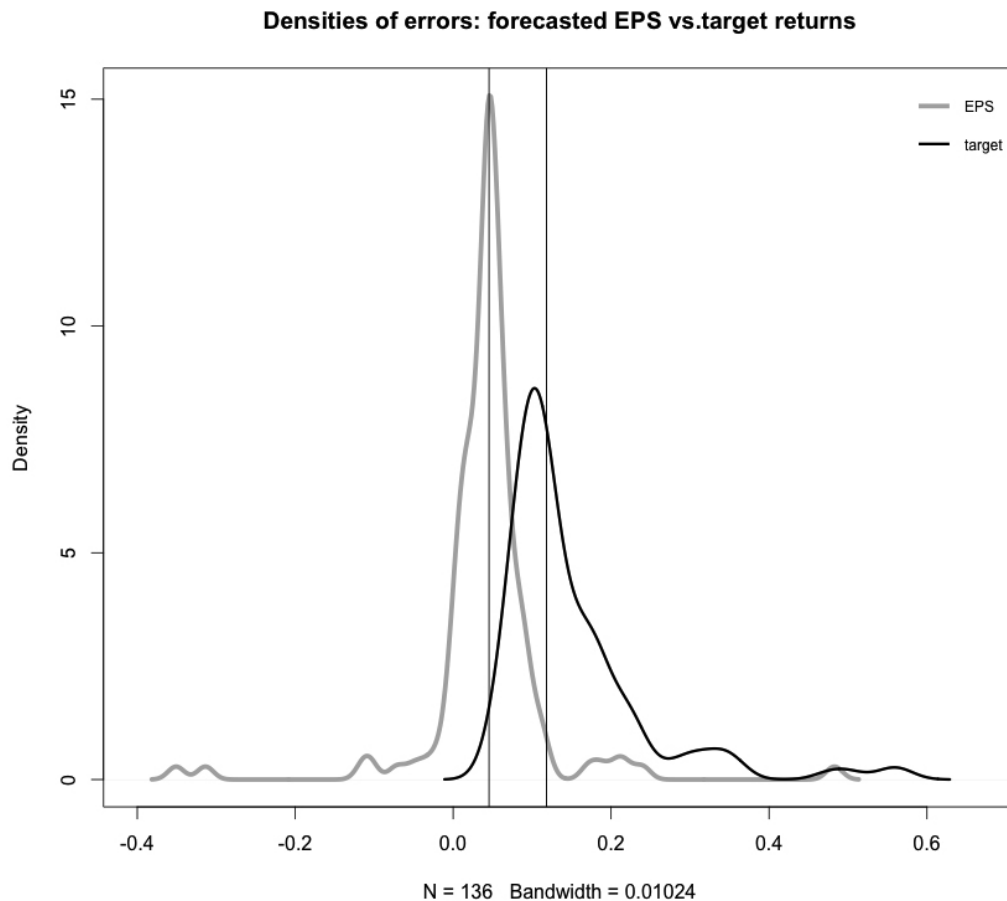
Densities of errors: forecasted EPS vs.target returns

N = 136   Bandwidth = 0.01024

Figure 5.

than others. In other words, the future is not equally ambiguous for all companies. However, there is information that allows starting with something when predicting the future value of the shares, namely confirmed hypothesis that the value companies are worse predicted than the growth companies. Having assumed P/E indicator as a basis we calculated that the companies with the current P/E lower than average P/E of an index have higher and more frequent mistakes that may be due to the fact that it is more difficult to predict the amount of dividend payments than share value, because it is necessary to predict correctly considerable quantity of other indicators, such as sales to the company, profit, net profit etc.

Another hypothesis we confirmed is the case that the EPS indicator of the company is foretold better than share value that, obviously, means that a problem is in a discounting rate. Thus, we localized a problem space of analytical estimates, gave them a chance to be focused on a specific indicator – a discount rate. Even though it opens, perhaps, a large field for research, since the definition of the correct discount rate is very complex, result we received shows to which point analysts need to pay special attention. Difficulties in choosing the right discount rate can occur primarily due to the fact that if bro-

kers take it as WACC, then in one of its components is necessary to use CAPM beta of the future period; the obstacle is that beta is calculated *ex-post* and hence the prediction is biased.

Finally there is a subjective factor; it is perception of market data by every analyst, and as they all cannot be right, which follows from the first hypothesis, the overall result will be anyway wrong.

4. CONCLUSION

Based on our research, it is possible to allocate several noteworthy moments for analysts performing forecasts of the stock quotations. As we found out, the problem is in the incorrect estimates; it lies in wrong determination of a discount rate, and the problem core is that it is necessary to be based on historical data to predict future values.

Thus, analysts should take into account the fact that historical data are not completely representative on the basis of which all expected values for future periods should be taken not as a number, but as an interval. In this manner the total cost of the company should be considered as the consolidated interval calculated on the basis of values of each component of the chosen method. At the same time,

it is necessary to pay attention that if the impossibility of exact determination of any values leads to an essential discrepancies between the predicted and actual value, moreover, to various results of the different analysts using the same method of estimation, perhaps it is necessary to standardize some key parameters, for instance, risk-free rate for several groups of companies.

Thus, in conditions of the current development of the estimation process there are a lot of discrepancies which lead to the fact that a significant role in predicting of future share value plays by the subjective factor. It means that the perception of the veracity of estimation results depends on the estimator's authority.

Perhaps, in the long term it is necessary to test such hypotheses as: whether the mistake in predictions of future share price depends on the size of the capitalization of the company, or on the size of its volatility? Evidently, there are several moments which should be tested and in perspective our research will be more detailed and reflect the current situation in the financial markets.

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