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FACTOR ANALYSIS IN THE STOCK MARKET – AN APPLICATION TO STATISTICAL ARBITRAGE

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Contents

1. Abstract

Although being very profitable in the past years, the contrarian strategy, that tries to exploit the reversion of the stock prices after an overreaction of the new available information, had decline in the past years. To boost the profitability of that specific strategy, I tried to divide the assets of Eurostoxx 600 by some firm specific factors. The results of such improvement were not clear, since the new strategy beat the benchmark in some periods, but none systematically achieved better results in all the sample periods.

Contrarian strategy; decline returns; improvements; trading costs.

2. Introduction

The contrarian strategy was first introduced by Bond and Thaler (1985), following the reasoning that people tend to overreact to unexpected information and drastic new events. This implies that if the stock prices overreact, they should reverse towards its real price when the overreaction forces cease to exist. In other words, if a stock price increases (decreases) drastically, compared to its peers, in some period, it must decline (increase) in the next, creating an opportunity to make gains by betting in the reverse strategy.

Andrew and Khandani (2007) explore the effects of this strategy providing some evidences about the declining profitability of this strategy in recent years. In the matter of fact, in their study they found that since 1995 to 2007 the annualized Sharpe ratio (with a 0% risk free) declined from 53.87 to 2.79. This huge decline in profitability provides the idea that the strategy begins to be exhausted by its overexploitation.

Since the strategy proved to be profitable in recent years, the question of making minor changes in the selection of stocks arises. With this in mind, the purpose of this work is to explore the impact of dividing the stocks by some statistical model to the profitability of the contrarian strategy. Although more than one factor can be used at each time, this work will focus only on the impact of using just one factor at each time. This should increase the diversification of the overall portfolio, enhancing the profitability of the contrarian strategy.

3. Literature Review

The idea of overreaction on stock markets was proposed by Bondt and Thaler (1985), stating that *"individuals tend to overweight recent information and underweight prior (or base rate) data"[1]*. They found that portfolios created with prior "losers" tend to outperform prior "winners", with the losers gaining in average a 25% return higher than the winners. This concludes that the overreaction effect is asymmetric since the losers' portfolio provide higher gains that the winners' one. However they also find that the large positive returns of the loser portfolio occurred every January.

As an extension of their prior study, Bondt and Thaler (1987) expand the understanding of returns of a contrarian strategy. In this new study they construct portfolios of the 50 most extreme losers and with the 50 most extreme winners to find that in the following five-years test period the losers' portfolio provides substantially higher gains than the winners' ones. More interesting was to find that the overreaction effect cannot be attributed to changes in the CAPM betas, because the positive beta (0.220) of the arbitrage portfolio is not enough to explain the annual average returns of the strategy (9.2%).

Lehmann (1988) in his study of market efficiency found strong evidence of market overreaction and reversion in short term intervals. Lehmann used short term periods in its strategy to avoid the predictability changes in expected returns due to changes in market fundamentals, constructing a costless portfolio in which he goes long in a portfolio of securities with negative returns in the previous week and go short in a portfolio with positive returns in the same time frame. His results suggested that *"portfolios of securities that had positive returns in one week typically had negative*

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[1] De Bondt, Werner F.M. and Richard Thaler. 1985. "Does the Stock Market Overreact?" *The Journal of Finance*, 40 (3): 793-805.

returns in the next week while those with negative returns in one week typically had positive returns in the next week"[2].

After the discussion that the contrarian strategy follows the reasoning of overreaction due to the fact that people tend to give more importance to the new information than the past one, Lo and MacKinlay (1990) provided a new insight about the reasoning of these abnormal returns provided by such strategy. In their paper, they state that the positive returns generated by the contrarian strategy were not strictly related to the overreaction of the prices to new information, but to some other explanations. By its reasoning, a contrarian strategy can provide positive returns even if the stock returns are not negatively correlated (a negative correlation implies the reversion of the abnormal swings in the prices to its fundamental values). Their study demonstrates that, if returns are positively cross autocorrelated, a contrarian strategy may yield positive returns even if the returns are serial independent. The overreaction of the stock market may enhance the profitability of such strategy but it is not necessary for such strategy to achieve positive returns. In fact, the empirical study showed that the importance of the overreaction to the expected returns of the contrarian strategy fall below the 50%, being the remaining due to the cross correlations among the stocks' returns.

In their attempt to explain the strong variation of stock returns in August 2007, Lo and Khandani (2007) also used a contrarian strategy in order to try to explain the mentioned variation. In their study, Lo and Khandani divided the stock assets by its market capitalization, and afterward applied the contrarian strategy in order to try to uncover the reasoning behind the extreme variations of the stock prices in the middle August 2007. However, the most interesting facts found in their work were regarded to the

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[2] Lehmann, Bruce. 1988. "Fads, Martingales, and Market Efficiency". *National Bureau of Economic Research Working Paper*, 2533: 1-34.

decrease of the profitability of that kind of strategy. Indeed, since 1995, the average daily return of the contrarian strategy decline from 1.38% to 0.13% and the annualized sharpe ratio (with a 0% risk free) decline from 53.87 to 2.79. However, it should be kept in mind that the results obtained in 1995 reflect a rebalancing of a portfolio with 4,781 assets on average which carries a substantial amount of trading costs. Another discovery was the fact that companies in the smallest deciles tended to provide higher average returns than the companies in the higher deciles in 1995, but these differences become almost neglected in 2007.

Also following Lo and Khandani (2007), the number of hedge funds regarding Long-Short strategies (in which the contrarian strategy belongs) had steadily increased, which combined with the declining profitability of the strategy leads to an increase of the leverage among the industry.

4. Data

The stock prices were gathered from Bloomberg since the beginning of 2005 to the end of 2010, providing 6 years to test the hypothesis. However, two of the assets, out of a global of 260, did not presented data at all so I decided to exclude them from the calculations.

The factors were also gathered from Bloomberg, but in this specific case data was gathered from the last trading day of 2004 to 2009 in order to compute the different groups without the problem of forward looking. The factors selected were Price Earnings (PE), Enterprise Value (EV), Enterprise Value to Book Value (EV to BV), Return on Equity (ROE) and Earnings per Share (EPS). These factors were chosen from many of other firm specific factors due to the availability of data presented on Bloomberg. Many of other factors had missing data for too many assets or for too many years in each asset, which may bias the results of the strategy and harms the comparability of the results from one factor to another. Due to that limitation, only these five factors were selected in order to divide the stocks.

5. Methodology

For the purpose, when we are comparing the different strategies, in the beginning we choose to ignore the transaction cost and other market frictions such price impacts, short sales and other institutional limitations. However, all these costs should be similar among all strategies, so for comparison we can ignore it. Later on, we will present the impact of the trading costs in the strategy because these can affect drastically the profitability of such strategy due to the daily rebalancing of the portfolio.

To compare the different strategies' profitability, we will use an approximation to the Sharpe ratio, in which we assume the risk free to be equal to zero, which, for convenience, it will be called *Info Sharpe*. We can ignore the risk free rate due to the fact that the strategy used in this work is a Long Short strategy that funds the long assets with the short ones avoiding the funding cost of the long only strategies.

In this case the strategy was used with several stocks of the same index (Eurostoxx 600). However, applying the strategy in such broad index can misplace the assets invested. For example, the banking system might suffer from some new information that makes its price fall. So, in this case, the strategy should buy all the banks presented in the index at that specific date, declining the diversification on the overall portfolio.

Since the stocks of the same industry follows the same trend, to introduce diversification on the portfolio we can divide the entire index into different industries, and therefore applied the strategy in each industry individually. This development in the contrarian strategy provides a better diversification of the overall portfolio, because even if the banking industry is crashing, we will not be long in all the banks. Instead, we only buy one or two banks (the ones who take the several decreases in price) and we will also be long in some assets in this industry (in this case that one who has the lower

decline of prices). This increase of diversification should improve the overall profitability of the portfolio leading to an increase of the Information Ratio.

However, this strategy became less appealing last years as stated by Lo and Khandani (2007), in which the risk adjusted return felt to 2.97 in 2007. Let's just remember that when we do not incorporate the transaction costs in the calculations of the returns of the strategy, the returns presented are biased positively.

Due to the degradation of the strategy profitability, new changes can and should be made in order to try to improve its results. Having this in mind, our next step will be divide the stocks presented in the Eurostoxx 600 related to different factors.

We rebalance the stocks presented in each group annually because these values can change substantially from one year to another, and by doing this we avoid the situation in which the profitability of the strategy depends on the time at which we choose to divide the stocks.

So, may approach was to divide all the 260 stocks into 13 different groups (20 assets per group), using a simply percentile division of the different factors. Moreover we must take in mind that not all groups always had 20 assets. As it has been explained early, some assets and some factors for specific stocks in specific years cannot be retrieved from Bloomberg, which may bias the results. However, since these differences were minimal, I chose to neglect that fact and used the available information to construct the different groups, ignoring the assets that do not present data for a specific period of time.

Following the reasoning of Lehmann (1988) that used short time intervals for the strategy to avoid changes in the fundamentals of the stock price, I chose to use a

contrarian strategy with only one day lag, buying the "yesterday" two losers and selling

the two winners.

6. Results

a. 1 day lag

In order to test the profitability of the proposed strategies, first we need to define some benchmark to compare the results. The benchmark chosen for the purpose of this work was the contrarian strategy applied to stoxx600's assets divided into the different industry groups. I will always go short and long in the same number of assets in each group (in this case two long and two short assets per group or industry) and I will applied the same methodology in terms of returns and Info Sharpes.

In the first case, after dividing the assets into each group, I ranked the returns of the previous days and I will go long in the two assets with the lowest return and short the highest ones. The returns of such strategy are presented below:

Return	Benchmark	EPS	EV	EV to BV	PE	ROE
2005	1.8%	1.7%	1.0%	0.2%	3.2%	3.0%
2006	12.6%	13.0%	13.2%	11.2%	16.3%	14.2%
2007	6.0%	7.2%	-0.7%	7.5%	5.9%	0.7%
2008	34.0%	-4.4%	-1.8%	3.6%	0.5%	-1.1%
2009	5.3%	-1.2%	3.2%	9.8%	2.4%	0.7%
2010	0.5%	-8.7%	-7.4%	-2.3%	-6.4%	-4.5%
Average	10.1%	1.2%	1.3%	5.0%	3.6%	2.2%

Table 1 – Returns of the contrarian strategy with one day lag

As it can be observed from the table above, the contrarian strategy with only one day of lag, or buying the previous day loser and sell the previous day winner, does not provide outstanding results. In the matter of fact, only in 2006 (and 2008 for the benchmark strategy) it provided considerable returns. By the observation of this numbers, clearly the division of the assets by these different factors did not improve the profitability of the strategy and even deteriorate it. The average returns of the benchmark in all the analyzed period was 10.1%, which is clearly greater than the second best return, 5.0%.

However, analyzing only the return of the strategy should not be sufficient because we want to see if the strategy can improve the adjusted risk returns over the benchmark. The next table summarizes the Information Sharpe by all the strategies in the different years.

Info Sharpe	Benchmark	EPS	EV	EV to BV	PE	ROE
2005	0.53	0.37	0.24	0.04	0.80	0.77
2006	2.40	2.01	2.06	1.83	2.59	2.27
2007	1.31	1.28	-0.11	1.39	1.03	0.12
2008	3.58	-0.35	-0.14	0.31	0.04	-0.08
2009	0.57	-0.11	0.29	0.97	0.22	0.06
2010	0.09	-1.20	-1.02	-0.33	-0.94	-0.70

Table 2 – Info Sharpe of the contrarian strategy with one day lag

The numbers provided show the decline of the strategy in 2009 and 2010, being 2008 an abnormal year due to the high volatility presented due to the financial crisis. However, none of the strategies provided better results than the benchmark, providing some evidence that such division cannot improve the risk adjust profitability of the contrarian strategy.

By this numbers, the strategy with only one day lag does not present outstanding results. In addition, the results presented did not incorporate trading costs, which may have a substantial effect due to the fact that such strategy rebalances almost the whole portfolio every day. So, in a universe of 13 groups (that grows to 16 in the benchmark strategy) with two long and two short positions in each group, rebalancing the total portfolio may imply 52 trading per day (26 for closing the long positions and another 26 to closing the short ones). With such trades every day, the trading cost plays a significant role in the profitability of the strategy. To see this effect on the contrarian strategy is presented below the same strategies when applied a trading cost of 0.05% per transaction, which should be a reasonable value for institutional investors.

Return	Benchmark	EPS	EV	EV to BV	PE	ROE
2005	-12.6%	-18.5%	-19.3%	-19.3%	-16.7%	-16.5%
2006	-2.4%	-7.4%	-7.3%	-8.5%	-4.2%	-5.7%
2007	-8.7%	-13.2%	-20.8%	-12.1%	-14.1%	-18.9%
2008	19.1%	-24.9%	-22.1%	-16.4%	-19.8%	-21.1%
2009	-9.5%	-21.5%	-17.0%	-10.1%	-17.7%	-18.8%
2010	-14.4%	-28.9%	-27.5%	-21.9%	-26.1%	-24.2%
Average	-4.8%	-19.1%	-19.0%	-14.7%	-16.4%	-17.5%

Table 3 – Returns of the contrarian strategy with 0.05% of trading costs.

Info Sharpe	Benchmark	EPS	EV	EV to BV	PE	ROE
2005	-3.60	-4.11	-4.44	-4.30	-4.17	-4.17
2006	-0.45	-1.13	-1.12	-1.36	-0.66	-0.89
2007	-1.91	-2.35	-3.46	-2.24	-2.44	-3.42
2008	2.01	-1.94	-1.71	-1.39	-1.61	-1.67
2009	-1.01	-1.95	-1.53	-0.99	-1.63	-1.74
2010	-2.35	-4.00	-3.78	-3.18	-3.84	-3.71

Table 4 – Info Sharpe of the contrarian strategy with 0.05% of trading costs.

The impact of the trading costs in the strategy is tremendous. Only the year of 2008 to the Benchmark strategy presented a positive return, and consequently a positive Information Sharpe. All other strategies presented always negative returns, which mean that the transaction costs overcome all the possible gains of such strategies. Also, it can be seen the effect of the trading cost in the return of this strategy, because the average returns moved from 1.2% in the EPS to -19.1%, which implies a decline of more than 20% only due to trading costs.

b. 5 day lag

The results presented earlier stated that we cannot improve the strategy by dividing the assets by different factors instead of dividing it by industry groups. However, even the benchmark strategy did not provided outstanding results, at least when compared to the results founded in the literature. So, instead of only focus in the "yesterday" returns, now I will look for the weekly returns in order to see which asset is overreacting in

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relation to the others. The strategy continued to be implemented in a daily basis, being the weekly returns calculated by a rolling average of 5 trading days. The results presented under the denomination of "All" correspond to invest in all the factor's strategies studied. Although it should not provide better returns, using all the strategies may smooth these returns, diminishing the standard deviation and improving the Info Sharpe. The returns of this modified strategy are presented below:

Return	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	5.7%	16.4%	14.7%	13.5%	18.5%	16.4%	15.9%
2006	7.6%	12.3%	13.4%	13.2%	7.7%	13.9%	12.1%
2007	8.0%	15.6%	9.0%	10.3%	8.9%	9.4%	10.6%
2008	41.3%	30.6%	30.6%	30.7%	33.9%	34.0%	32.0%
2009	10.1%	8.4%	6.6%	17.8%	23.1%	14.0%	14.0%
2010	5.7%	7.2%	10.5%	8.7%	2.6%	12.9%	8.4%
Average	13.1%	15.1%	14.2%	15.7%	15.8%	16.8%	15.5%

Table 5 – Returns of the contrarian strategy using a 5 day moving average to rank the stocks

The main conclusion that arose from the observation of these results is that using weekly returns to rank the stocks instead of using only the past day returns provide a better profitability for the contrarian strategy. In fact, the average return on the benchmark increased from the previous 10.1% to 13.1%, and the increase in the factors are even greater. For example, when dividing by EPS, the average return rose from the previous 1.2% to 15.1% only by using the 5 days average. It should be noted that the improvement on the factors' strategies were much greater than the observed in the benchmark, although I did not find any reasoning for this.

In this case, the returns of the strategy dividing the assets by some factor are often higher than the benchmark, being 2008 the only year where the benchmark reached a higher profitability than all the "factors".

Info Sharpe	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	1.69	3.44	3.66	2.54	4.67	3.33	3.86
2006	1.79	1.99	2.28	2.00	1.14	2.30	2.02
2007	1.64	2.30	1.30	1.60	1.24	1.36	1.64
2008	4.53	1.97	2.03	1.99	2.27	2.17	2.15
2009	1.10	0.63	0.54	1.55	1.97	1.09	1.18
2010	0.97	0.84	1.33	1.05	0.32	1.51	1.05

Table 6 – Info Sharpe of the contrarian strategy using a 5 day moving average to rank the stocks

In terms of Info Sharpe, the results are quite similar to the returns. This measure is substantially higher than when we only use the previous day return to rank the stocks and in this case, some of the factors beat the benchmark. However, there was not a single one that beat always the benchmark, because the Info Sharpe for the benchmark in 2008 is one of the highest achieved in all the tests. This reflects the reasoning that the benchmark strategy provided outstanding results in downturn periods, or period in which the volatility peak high. All the other strategies gather some of this effect too, but none of them delivered such high Info Sharpe than the benchmark.

If we ignore the year of 2008, has been almost an anomaly, it can be seen that almost all the strategies decline its risk adjusted return in the recent years. The strategy that had the higher decrease in risk adjusted return was when we used the PE to divide the stocks.

Another important issue at which we should look when comparing strategies is the percentage of positive months. For the calculation of the percentage of positive months I used a rolling average of 22 days as being the average return of a moth comprehended in that window of days. Afterward it was just dividing the positive returns by the total amount of observations in that year. The results for the strategies without transaction costs are presented below:

% positive months	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	61%	89%	86%	74%	96%	80%	87%
2006	59%	88%	91%	90%	85%	93%	90%
2007	59%	79%	64%	65%	60%	71%	67%
2008	93%	81%	78%	81%	83%	87%	83%
2009	53%	57%	58%	67%	79%	60%	66%
2010	53%	68%	72%	69%	58%	72%	70%

Table 7 – Percentage of positive months in the contrarian strategy

As it can be observed, excluding 2008, all the strategies beat the benchmark in this specific parameter. The benchmark presents a percentage of positive monthly returns in the area of the 50% (excepting for the 93% obtained in 2008), and the factor presented a percentage of positive monthly returns that range from 55% to almost 95%.

i. Transaction costs

As stated before, the transaction costs have a tremendous impact in the profitability of the contrarian strategy, due to the factors discussed before. Next tables show us the impact on the returns of 0.02% and 0.05% trading cost on these strategies:

Return	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	2.4%	11.4%	9.8%	8.6%	13.5%	11.4%	11.0%
2006	4.2%	7.8%	9.0%	8.7%	3.3%	9.3%	7.6%
2007	4.7%	11.1%	4.6%	5.8%	4.5%	5.0%	6.2%
2008	37.9%	26.0%	26.1%	26.0%	29.4%	29.5%	27.4%
2009	6.8%	3.9%	2.1%	13.3%	18.6%	9.5%	9.5%
2010	2.4%	2.8%	6.1%	4.3%	-1.6%	8.3%	4.0%
Average	9.7%	10.5%	9.6%	11.1%	11.3%	12.2%	10.9%

Table 8 – Returns of the contrarian strategy with 0.02% of trading costs.

Return	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	-2.5%	4.0%	2.4%	1.1%	6.1%	4.0%	3.5%
2006	-0.8%	1.1%	2.2%	2.0%	-3.3%	2.5%	0.9%
2007	-0.2%	4.3%	-2.0%	-0.9%	-2.0%	-1.7%	-0.5%
2008	32.8%	19.2%	19.3%	19.1%	22.6%	22.7%	20.6%
2009	1.7%	-2.8%	-4.6%	6.5%	11.8%	2.6%	2.7%
2010	-2.5%	-3.7%	-0.5%	-2.4%	-8.1%	1.6%	-2.6%
Average	4.7%	3.7%	2.8%	4.2%	4.5%	5.3%	4.1%

Table 9 – Returns of the contrarian strategy with 0.05% of trading costs.

As in the previous case, here the transaction costs continue to play a vital role in the profitability of the strategies. A simple 0.02% of transactions costs diminish the average profitability of the strategies in about 300b.p. in the benchmark case and 500b.p. in all the other cases. And when we increase the transaction costs to 0.05% these differences increase to 800b.p. to the benchmark and 1100b.p. to the other strategies. So when applying such strategy we must always take into account the level of transaction costs, because even with a 0.05% of transactions costs, the returns of the strategy become negative in some periods.

The only strategy that manages to deliver better average return (in the case of 0.05% of transaction costs) than the benchmark was the strategy employing ROE, which achieved an average return of 5.3%. However, it should be noted that the highest average gains were almost exclusively obtained in 2008. Without the contribution of that year, it seems like it was an abnormal return compared to the other periods, the benchmark and the EV strategies should present negative average returns, being ROE the one which presented the highest one (1.8%).

Info Sharpe	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	0.71	2.39	2.43	1.61	3.42	2.32	2.65
2006	1.00	1.27	1.52	1.32	0.49	1.55	1.27
2007	0.97	1.63	0.67	0.90	0.63	0.72	0.96
2008	4.15	1.68	1.73	1.69	1.96	1.88	1.84
2009	0.73	0.29	0.17	1.15	1.59	0.73	0.80
2010	0.41	0.33	0.78	0.51	-0.20	0.98	0.50

Table 10 – Info Sharpe of the contrarian strategy with 0.02% of trading costs.

Info Sharpe	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	-0.75	0.83	0.59	0.22	1.53	0.80	0.85
2006	-0.20	0.18	0.38	0.30	-0.48	0.42	0.15
2007	-0.04	0.63	-0.29	-0.14	-0.28	-0.25	-0.07
2008	3.58	1.24	1.28	1.24	1.51	1.45	1.38
2009	0.19	-0.21	-0.38	0.56	1.01	0.20	0.23
2010	-0.43	-0.43	-0.06	-0.29	-0.97	0.18	-0.33

Table 11 – Info Sharpe of the contrarian strategy with 0.05% of trading costs.

When we compare the Info sharp of the strategies, it also can be seen that it decreases as long as the transaction cost increased. Although a 0.02% of transaction costs provides often positive Info sharpes, when we increase that value to 0.05% the strategies decline sharply it risk adjusted return. If we ignore the year of 2008, we only found Info sharpes superior to one in two other situations, when we divide the stocks by their PE. However, in the last year that strategy provided poor results, which indicates some signs of variability of the returns.

| % positive months	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	51%	86%	74%	69%	90%	73%	75%
2006	48%	77%	82%	83%	72%	85%	83%
2007	54%	70%	54%	54%	57%	59%	59%
2008	91%	73%	75%	77%	75%	83%	78%
2009	45%	52%	56%	63%	68%	56%	60%
2010	45%	60%	69%	60%	48%	65%	64%

Table 12 – Percentage of positive months in the contrarian strategy with 0.02% of trading costs

% positive months	Benchmark	EPS	EV	EV to BV	PE	ROE	All
2005	38%	69%	58%	59%	74%	67%	68%
2006	35%	61%	59%	60%	44%	59%	53%
2007	42%	59%	40%	41%	47%	41%	44%
2008	85%	65%	66%	69%	67%	74%	70%
2009	37%	44%	46%	56%	61%	52%	51%
2010	37%	46%	58%	49%	40%	49%	46%

Table 13 – Percentage of positive months in the contrarian strategy with 0.05% of trading costs

A 0.02% of trading costs did not change substantially the percentage of positive months, with the differences ranging from 400b.p. to 1100b.p. However, when we increase the trading cost to 0.05%, this measure changes significantly, especially for the benchmark, in which does not provide positive month returns superior to 50%, excluding 2008.

In the next graphic, it is possible to see the cumulative returns of the strategies, with the 0.05% of trading costs:
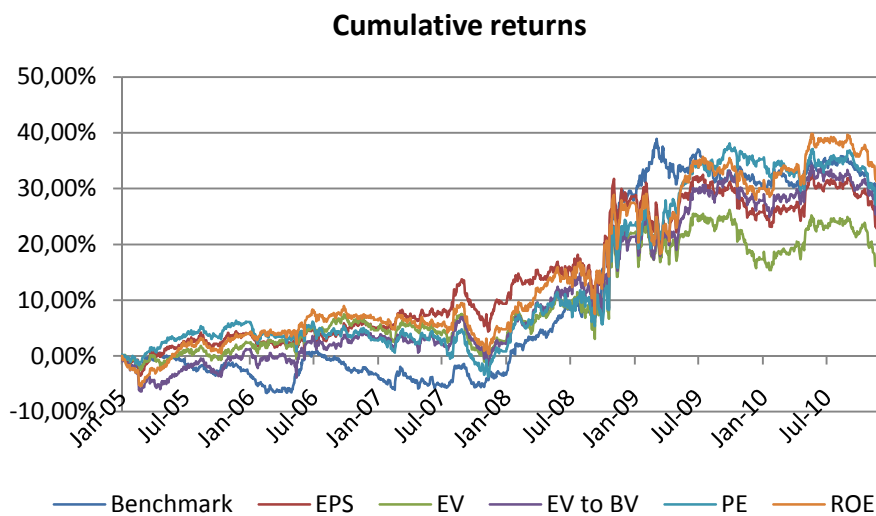
Graphic 1 – Cumulative returns of the contrarian strategy with 0.05% of trading costs

It was not very surprisingly that the cumulative returns of the benchmark strategy were negative until the beginning of 2008. All the other strategies overcome the benchmark until the biggest crash of the financial crisis of 2008. In fact, the huge boost of the returns of all the strategies coincide with the crash occurred in the third quarter of 2008 after the collapse of Bear Stearns and Lehman Brothers. It also can be noticed that in the

last semester of 2010, all strategies showed a negative trend. Moreover, it can be seen that the patterns of the returns under the different approaches did not differ significantly.

c. Limitations

The first thing that we always should keep in mind is that this was a study in historical data which may not reflect what will happen in future.

The results state that it may be possible to improve the contrarian strategy to achieved better gains than its benchmark. However, the study period encounters one of the biggest financial crises, which pushed down the stock markets all over the world. Nevertheless, that was the year in which the strategy provided the biggest risk adjusted strategy, which pushed upwards the overall profitability of such strategy. This increase may be derived to the high volatility of the period or even to the overreaction of the people subsequent to the market crash. The overreaction idea fits better in the available theory, but in this work we did not extend that line of thought. For comparison reasons, this effect should affect all the approaches equally which should not affect the overall conclusions.

These tests presented some degree of survivorship bias due to the fact that the assets used were the ones available in the Eurostoxx 600 in 2010. However, this does not mean that all the assets were already at the index in previous years. This can bias the results because the assets presented in the index in 2010 are the ones that survive until that date. However, since the index change, the stocks used should change too, but for simplicity I chose to avoid this issue due to the fact that it should not change very much the results.

The benchmark and the approaches followed had a different number of groups (16 to the benchmark and 13 to the other approaches).This means that overall, the benchmark has more long and short positions than the other approaches. I did not approach this problem, but the number of groups may affect the overall result, at least due to the transaction costs. More research in this area may be done to see the effects of different number of groups leading to a different number of assets in each group. Another difference remains to the number of assets in each group. In my approach I tried to construct groups with the same number of assets in each one and in the benchmark, the number of assets in each group varies from 8 in the smallest to 29 in the biggest one.

The data available was not always the best. As stated before, two of the assets did not presented data at all, and when searching for factors, many did not have data available to all the stocks in all the years. That restrained substantially the available factors that can be used without losing a lot of the stocks due to the unavailability of the data. However, I also did not search for all the available factors presented in the market which may change the conclusions obtained in this work.

7. Conclusion

The contrarian strategy is commonly used in the hedge funds industry. However, in the recent years, its profitability declines due to the higher competitiveness of the industry. Consequently improvements are needed in order to try to boost the returns of such strategy.

After dividing the Eurostxx 600 assets into industry groups and reached the conclusion that the contrarian strategy loss its returns last years, the next step was try to find new systematically ways to divide these stocks in order to increase the diversification of the portfolios of the strategy. This report tried different firm specific factors to divide the assets into different groups, but the results were unclear.

Using only the returns of the previous day to find the stocks in overreaction, lead to very negative returns, especially after applying the transactions costs. These costs play a very important role in this strategy because they rebalance the overall portfolio in a daily basis.

Using weekly returns, instead of the past day returns, enhances the profitability of the strategy, presenting some positive risk adjusted returns. However, almost all of those positive returns appear only in late 2008 and the beginning of 2009 which coincided with financial crises, leading to the conclusion that such strategy may had a counter cyclical nature.

The transaction costs represent a key factor to the profitability of such strategies. In overall, the presence of 0.05% of transaction cost decreased the yearly returns of the strategy in almost 1000b.p., which may lead to negative returns. Consequently, this strategy should only be pursued by some institutional investor that can access to lower transaction costs by investing larger sums of capital. It should be taken in account that if

the overall transaction costs raise above the 0.05% this strategy may become unprofitable.

Investing in all the strategies smooth its risk adjusted profitability, often delivering higher risk adjusted returns than the benchmark, failing only in 2008. However, the gains of using this type of strategy are not fantastic, and using a multivariate process to mix the assets, trying to increase its cross sectional relationships, as stated in Lo and MacKinlay (1990), can provide better results. However, there are a lot of multivariate processes to group the stocks, each one with its specifications. Due to that fact, this work did not address that thematic, being a subject to further research.

In the weekly return case, some of the risk adjusted returns found under the division of stock by the factors were higher than the benchmark, especially in the results obtained by ROE and EV to BV that only provides worst results in 2007 and 2008. However, since none of the factors overcome the benchmark in all the analyzed periods, we cannot conclude about the gains of using such division instead of the division into industries. Comparing the different factors used, none systematically presented results above the other, in all the sample analyzed, being, however, the ROE the one which consistently provided better results at least in the last years. This work only focused on a very specific case, in which I used 13 different groups and five different factors to divide the stocks into one of each group. The number of groups chosen and the factors used may influence the outcome of the strategy but this will demand more research to provide a more incisive conclusion.

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