

MARKET TRENDS, MOMENTUM EFFECT AND EFFICIENT MARKET HYPOTHESIS

TENDENCIAS DE MERCADO, EFECTO MOMENTUM E HIPÓTESIS DE MERCADO EFICIENTE

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Abstract:

The main purpose of this research project has been to analyse if any profitable intra-day strategy can be designed in the German DAX index, taking into account the previous day's trend. Regarding the pattern followed by this index, five different strategies have been ranked, including the trend strategy and mean reversion strategy. Once knowing that the DAX follows a determined pattern, the market efficiency has been tested to know how can an investor make profits from it. On the other side, the impact of Stop-Loss and Stop-Profit mechanisms has been analysed as well in terms of risk and return.

The main conclusions are that the German stock market is not completely efficient because the mean reversion strategy performs better than the other ones in almost all the sample period. Moreover, the use of Stop-Losses is extremely advisable, while the application of Stop-Profits depends on the investors risk profile.

Keywords: Momentum effect; Trend; Stops; Market efficiency

Resumen:

El objetivo principal de este trabajo de investigación es analizar si existen posibilidades de diseñar estrategias intradía beneficiosas en el índice alemán DAX. Dependiendo de la tendencia observada en la sesión anterior, cinco diferentes estrategias han sido desarrolladas. Una vez conocido si el índice DAX sigue algún patrón, la eficiencia del mercado ha sido analizada para determinar si existen ineficiencias que pueden ser aprovechadas para obtener beneficios. Por otro lado, también se han aplicado los mecanismos de Stop-Loss y Stop-Profit para medir su impacto en el riesgo y rentabilidad. Las conclusiones principales son que el mercado de acciones alemán no es completamente eficiente y que la estrategia de reversión a la media es la que mejor se ajusta en el periodo de muestra. Además, el uso de Stop-Loss es muy recomendable, mientras que la aplicación de Stop-Profits dependerá del perfil de riesgo del inversor.

Palabras clave: Efecto momentum; Tendencia; Stops; Eficiencia de mercado

JEL: G110, G140, G170

1. INTRODUCTION

The German stock market is one of the most important equity market in the world, being characterized by its high liquidity. The benchmark is the DAX index, which is composed by the 30 major companies of the Frankfurt Stock Exchange.

Operating according to the market trends gives to the investors the possibility to make profits (Pla-María and García, 2015; Wu *et al.* 2016, Arévalo *et al.*, 2017). The strategies based on these trends makes the most of the momentum effect. This effect consists on:

“The momentum effect is a quite usual market phenomenon by which asset prices follow a trend for a rather long time. This can mirror economic evolutions, but in some cases, it brings a growing discrepancy between prices and “fundamental” values (see effect, overreaction, trend, bandwagon...) ... until reality strikes back.” (Behavioral-Finance group, 2015)

Thus, if this phenomenon exists in the market, there is some kind of inefficiency, due to the investors does not always trade according to the fundamental value of the stocks in a rational way. This would give to rational investors the possibility to make profit. Therefore, it is quite interesting to discover if the DAX index follows any pattern and if it does, how can be used to take advantage of it.

Five different strategies have been proposed to observe their intra-day performance, taking a long or short position in openings to close it when the sessions end.

On the other side, the investors can set thresholds to close their positions when they have made profits or to stop the losses in negative sessions. If the position is closed in a profitable status a Stop-Profit is applied and a Stop-Loss in the opposite situation. These rules can affect to the investment's performance very significantly reducing the risk but having impact in the return as well. The objective of this paper is to determine an optimal Stops combination to maximize the return and minimize the risk.

2. HYPOTHESIS SPECIFICATION

After determining the main purposes of the paper and before starting to develop the analysis of the German stock market's evolution, the following hypothesis must be specified. The objective is to be able to prove if these hypotheses are true or not after the tests.

2.1. Hypothesis 1: The momentum effect does not exist:

In case of demonstrating that the performance of a stock is not influenced by its previous day's performance, it will be possible to assure that the momentum effect does not exist. In this case, the evolution of the prices will be completely unpredictable and the random walk theory will be fulfilled.

On the contrary, the existence of the momentum effect would demonstrate that the market is inefficient and when an upward trend is observed two alternatives could be considered: to take a long position (expecting that the trend will continue) or to take a short position (expecting that the trend will change and the price must go down because the fundamental value of the stock is lower than its price. This idea is based on the mean-reversion property).

2.2. Hypothesis 2: It is better to take a short position when the market experiments a downward trend.

Applying uniform criteria when testing different strategies, the results must show which alternative is better. That is the reason why the tests have been designed in the following way: Depending on the previous session performance, a long or short position will be taken. The tests will be carried out in all possible scenarios, including a random strategy (50% probability of taking a long position and 50% of taking a short position). The results will be analysed to verify if there is any strategy better than the rest or all of them report similar performance.

2.3. Hypothesis 3: Use of Stop loss and Stop profit in order to decrease the volatility of the investments.

It seems that these mechanisms could be useful in order to reduce the risk of having huge losses. This can happen because the Stop Loss allows to make impossible to loss more than a previously determined threshold and the Stop Profit ensures a profit if the performance of the investments is good enough. Hence the Stop Profit could be useful to prevent financial agents from changes of trend when they are in the profitable status.

However, in the same way in which the session profits can be lost because of market fluctuations, it is possible to have a turnaround in the loss status. If an investor applies Stop Loss, he can have his position closed and he will not get any benefit from this turnaround. So, are these mechanisms useful to reduce losses and guarantee a return or they are just limits applied to give some control feeling to the investors? And in case they are useful, which is the optimal point to determine a Stop in order to maximize returns and limit the risk?

2.4. Hypothesis 4: The mix between the best Stop combination and the best strategy will report great results.

In case of discovering an optimal investment strategy in the 2nd hypothesis and an optimal stop combination in the 3rd hypothesis, how it will perform if both are combined? Are the results better than in any other case? Can this strategy report similar performance in the future?

3. TRADING STRATEGIES

As mentioned above, five different strategies have been proposed to test the market efficiency in a sample of 21 years, from 26/11/1990 to 15/11/2011:

3.1. Random strategy

Consists on taking a long or short position with the same probability at the beginning of each session. At the closing of each session the position will be closed too. The main function of this test is to obtain the reference values to compare with the ones obtained with the other strategies.

3.2. Long position strategy

Index replicating financial assets are acquired at the opening of each session, to sell them again at the closing. In this way, the general trend of the index can be observed: if the value of the portfolio rise, an upward trend and if it decreases, a downward trend.

3.3. Short position strategy

The mechanism is similar to the previous one but instead of buying at the openings, a short position is taken in all the sessions to close it at the final of each one. In this case, when the portfolio value rises it is a clear indication of the downward trend of the index and vice versa.

3.4. Trend strategy

Following the momentum effect theory, assuming that the trend will continue as in the previous day, a short position will be taken if the previous session was bearish. Hence the stocks will be sold at the beginning of the day and bought again at the final of it. On the contrary, if the previous session was bullish, the investors may expect another

similar performance, so they will buy stocks at the beginning of the day and sell everything at the closing price. This is the key test to discover if the momentum exists or not: if it exists, the results obtained by this strategy must be much better than the ones obtained with the other strategies.

3.5. Mean reversion strategy

This strategy is the opposite of the trend strategy, thus when the previous session is bullish a short position has been taken at the beginning of the day. Logically in case of experiencing a bearish session, the investors expect a rise in prices and take a long position at the next open of the market. If the results of this test are very good, the stock market follows a trend but just in an inverse way of what the momentum effect states.

3.6. Stop-Loss and Stop-Profit mechanisms.

The same tests have been carried out but combining Stop-Loss and Stop-Profit mechanisms. In this case, the sample period is shorter due to it has been necessary to work with the index values with a timeframe of 15 minutes. The first day included in the sample is 02/11/2000 and the last one 02/12/2011, which constitutes a sample of 108,773 observations. The threshold values are the following:

Table 1: Stop combinations

		STOP LOSS			
STOP PROFIT	No Stop	No Stop	2%	1%	0.5%
	2%	No Stop	2%	1%	0.5%
	1%	No Stop	2%	1%	0.5%
	0.5%	No Stop	2%	1%	0.5%

4. RESULTS OF THE TESTS.

Table 2: Indicators of the analysis of daily simple returns

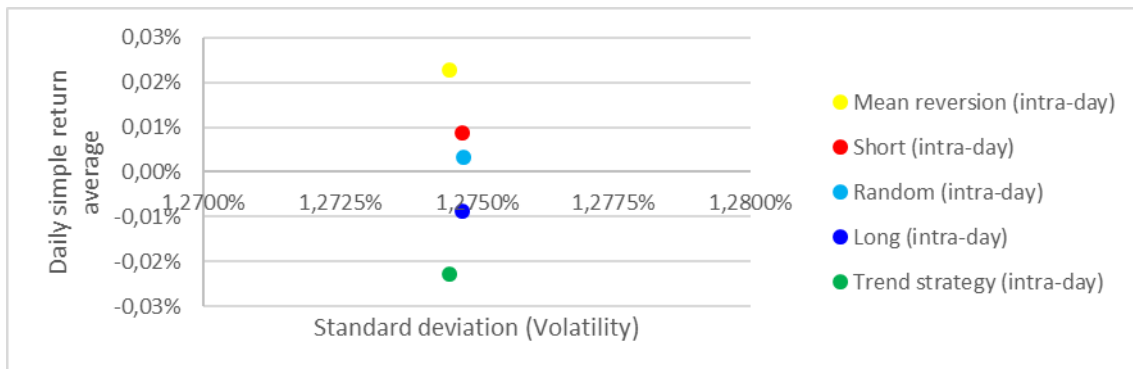
	Average return	Standard deviation	Portfolio value (1,000€)
Random	0,003299%	1,274759%	763,31€
Long	-0,008738%	1,274734%	409,18€
Short	0,008738%	1,274734%	1.032,15€
Trend strategy	-0,022904%	1,274494%	193,10€
Mean reversion	0,022904%	1,274494%	2.187,61€

The table shows very clearly that the best investment strategy for this sample is the mean reversion strategy, due to it obtains the higher average daily return by far with the lowest volatility. Nevertheless, the standard deviations of all the alternatives are very similar. So, investing 1,000€ at the beginning of the sample period and managing it in the proposed way, the profit would be higher than 118% without taking into account the transaction costs.

Logically, the worst alternative is the inverse strategy, that is, the one based on believing that the previous day's trend will continue in a similar way. It has the lowest return and the same risk as the mean reversion strategy. The same portfolio of 1,000€ would have a final value of 193.10€ if the trend strategy is followed (without including the transaction costs).

In order to represent the risk and return parameters in a more visual way, the performance graph is shown below:

Figure 1: Risk and return comparative without stops and gaps

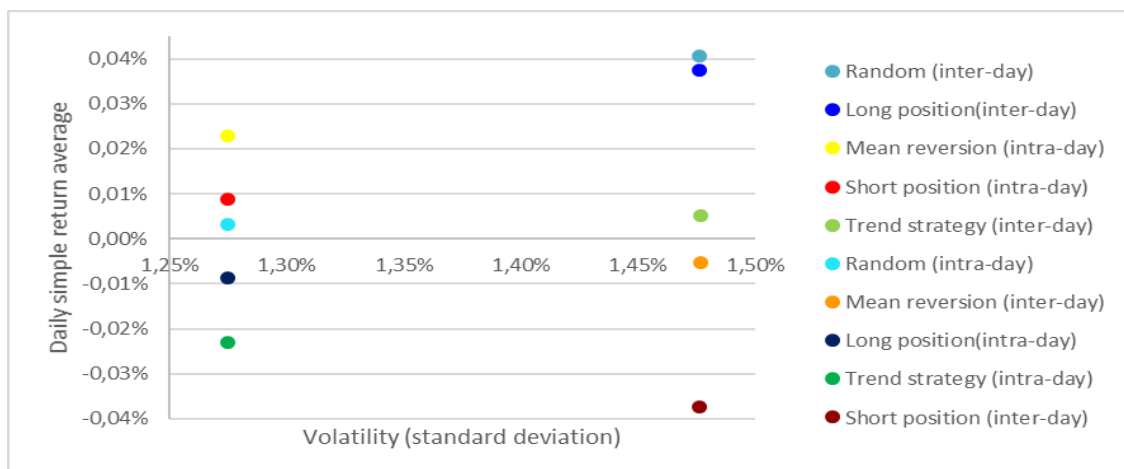


It is really shocking to see how a strategy based on betting against the market (short selling) has good results, when the opening DAX points were 1,466.3 in November 26, 1990 and the session of November 15, 2011 closed with 5,884.94 points.

These values show that during the sessions, the stock market has experienced more bearish days and the drops were sharper than the rises in bullish days, while the index value has multiplied its value by four. The explanation of this phenomena is that the gaps between sessions have a huge impact in the index. Therefore, the tests have been carried out again but including the gaps.

In this case, the best strategy is the random strategy. The following graph shows the risk and return of each alternative:

Figure 2: Risk/Return comparative without Stops



Finally, the impact of Stops has been measured, replicating the intra-day tests but applying the mechanisms explained in the 2.6. section.

In case of investing 1,000 € at the opening of the first day and keep doing the same transactions every day, these are the maximum and minimum values obtained with each strategy:

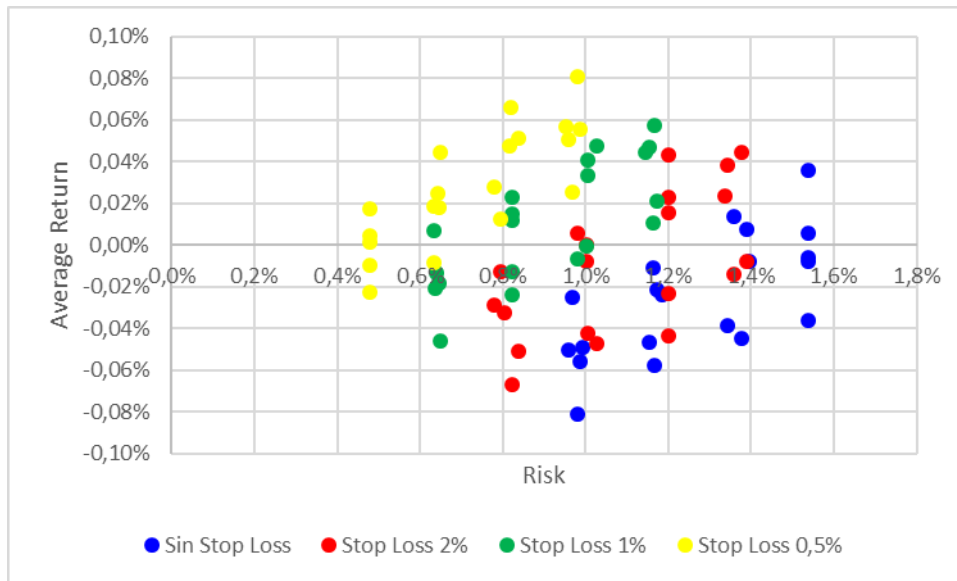
Table 3: Maximum and minimum values of 1,000 € portfolio applying Stops

Strategy	Min	Max
Random	216.23 €	4,367.43 €
Long	211.29 €	4,188.29 €
Short	181.04 €	3,647.30 €
Trend	89.13 €	1,793.26 €
Mean reversion	428.28 €	8,536.04 €

These figures highlight the relevance of choosing appropriate Stops because it can have an extreme impact in the returns. But which one is the optimal Stop combination?

To answer this question all the points derived from the risk/return graphs are represented in the same illustration but grouping the points with different criteria. In the first graph, the different points are sorted by the Stop Losses used in this paper, that is, 0.5%, 1%, 2% and no application of it, to know which one is the optimal.

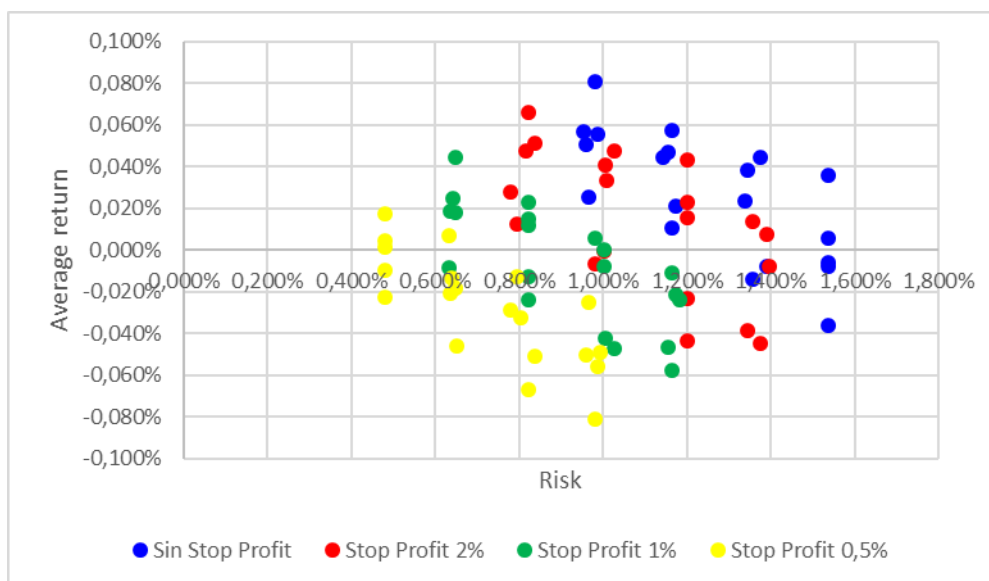
Figure 3: Stop Loss Analysis



The graph shows very clearly that the most adjusted Stop Loss, the higher return and lower return will get the investor. Therefore, it is correct to claim certainly that the Stop Loss must be adjusted as much as possible because it limits the volatility of the returns and the drops in negative days are much lighter.

On the other side, the same graph is shown as in the previous case but grouping by Stop Profits instead of Stop Losses:

Figure 4: Stop Profit Analysis

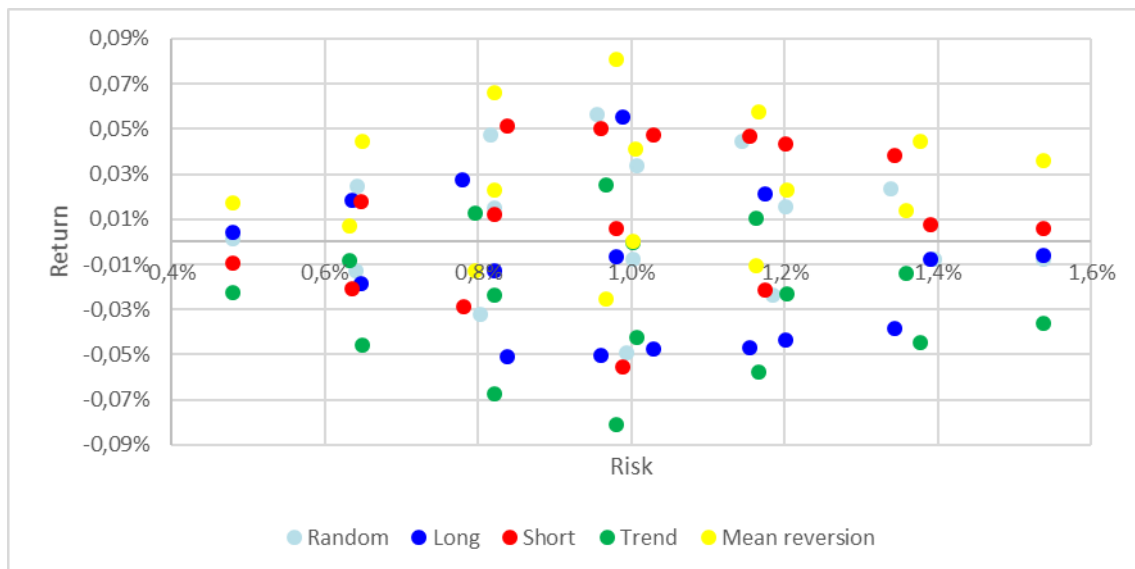


From the previous illustration, the Stop Profits reduce the returns. Moreover, the earlier the profits are taken, the more profits will be losing the investors. Therefore, if the stock market agents are looking for high returns it is not advisable to use Stop Profits because the application of this mechanism makes possible to have more positive days but the average increase in each of these days will be much lower.

However, apart from the returns, it is effective to reduce the risk of the investments as well, so it is quite appropriate for investors who are very risk averse. Therefore, the choice of the level of the Stop Profits will depend on each risk investor's profile: the risky investors will not apply any Stop Profit, while the ones who are trying to avoid big variations in their portfolio will use very adjusted thresholds.

On the other side, in the first part of this paper, the sections in which the intra-day returns without Stops are analysed, it has been demonstrated that the best alternative to invest during the sessions is the mean reversion strategy. To verify if this fact occurs again in the new sample, which is shorter but more exhaustive, the graph including all the points obtained by the combination of Stops and strategies is shown, but grouped in this case by the 5 different strategies tested in this paper.

Figure 5: Risk and return of all the strategies



Even changing the sample period and without applying any Stop, the mean reversion strategy continues being the best alternative. Therefore, it is clear that this one is the strategy which suits best to the DAX index in the recent years.

In the same way, the application of the Stops does not change this conclusion, because the graph shows that having a similar volatility, it gets the highest return in most cases. On the other side, logically, the worst strategy is the inverse one, that is, the trend strategy. All this shows that the combination of a good strategy, with a good stop combination makes possible to have a very good performance.

5. CONCLUSIONS

The tests show that the mean reversion strategy is the best alternative to invest during the sessions. Thus, it is advisable to take a long position if a downward trend is experienced in the previous session and vice versa, because the probability of experiencing trend changes is higher than the probability of chaining trends. This means that the market is not completely efficient because there is a pattern which can be followed to make profit in the German stock market.

However, the gaps are very relevant when analyzing the performance of the investments. If the gaps are included, the volatility increases significantly, as well as the returns. Therefore, the decision of keeping the investments alive during the gaps will depend on the investors profile. When the gaps are included in the analysis, the alternative which reports the best results is the random strategy.

Nevertheless, it is not possible to claim that the market is completely efficient because there is a possibility of designing more profitable strategies combining different intra-day and inter-day alternatives.

Regarding to the Stops, in general it is advisable to close position as soon as a loss is experienced, avoiding big devaluations in an individual session. In this way, most of the sessions will finish with negative sign but the falls will be very little and easy to compensate in a single positive session. On the other side, the choice of the Stop-Profit level will depend on each investor, due to it reduces the risk and return. Very risk averse investors will apply adjusted thresholds, having a very low risk and return, while the risky investors will prefer not to apply any Stop-Profit assuming higher volatility in their investments.

On the other side, the table 3 and the figure 4 show that the combination of a good strategy, with a good stop combination makes possible to have a very good performance as stated in the hypothesis number four.

Finally, all these points can be taken into account to design different strategies when investing in the future, as long as the readers trust in the repetition of the patterns observed in the sample used in this paper. By this way, this research can help to decide which position to be taken at the opening or at day close, which stop to apply, to keep the investment active during the gaps or not, etc. to develop profitable investment strategies by taking advantage of market trends.

6. REFERENCES

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