The DAX-Index

FIN11-TERM PAPER

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Introduction

In this term paper, we were supposed to choose a topic from the book that we wanted to analyse. During the semester, the lectures about the fundamental value traders caught our interest. We thought it was exciting to use data and different information to analyse a particular market and develop a trading strategy for when to take long or short positions in the market.

To choose a subject for our term paper, we met with Tore Andre Lysebo of Trient Asset Management. Trient manages various funds investing in fixed income, equities, currencies and equity indexes. The fund management rests on thorough analysis of fundamental values.

We explained what we wanted to analyse, and from this information he suggested that we should consider the DAX-Index and to develop a strategy using the Index value and the corresponding price to book ratio. He recommended that we should try to determine a business cycle, try to identify a strategy for when to make trades, and to test the strategy on the sample data. He also assisted us in downloading data from Bloomberg and with simplifying the data so that it would be easier for us to use the data in our analysis.

The data we downloaded from Bloomberg contained historical index values on the German DAX-Index from November 2000 until November 2016, and the corresponding price/book ratios for the index.

In this paper, we will lay out the theories and concepts of fundamental value trading, present the DAX index and the constituencies of the index, how to interpret book values, to explain the rationale behind our strategy, the effect of variations to the strategy, the test results of the strategy, and finally limitations and errors from the testing.

Theory

Fundamental value

According to Larry Harris the fundamental value is an imaginary concept (Harris, 2003). If everyone acting in a market knew all relevant information about a value and exactly how to process the information to estimate the value, the fundamental value would be the one that everyone would agree upon, or in other words the market price that the seller and buyer agree upon (Harris, 2003). In practice the fundamental value is often hard to determine, as nobody possess all information required to determine a value, and only a few market participants can process the information well (Harris, 2003).

The fundamental value or the intrinsic value refers to i.e. the value of a company, stock, currency or product and is determined through fundamental analysis. The value is normally calculated by summing up the discounted future cash flow available as dividends to the investors (Wikipedia, 2016).

Usually when we read about the market, the term market value comes up. The difference between the market value and the fundamental value is that the market value is the price at which traders can buy or sell the instrument (Harris, 2003). The fundamental value is the "true value" of the instrument.

Fundamental value trader

Value traders estimate fundamental value and take short- or long positions when market prices differ (significantly) from the intrinsic value in order to make profits from the trade. *These traders typically form their opinions from insightful analyses of publicly available information or from simple analyses of information that is not widely known* (Harris, p. 403, 2003). Value traders may employ a variety of experts in their efforts to estimate values. These experts can be financial analysts, statisticians, computer programmers and librarians. (Harris, 2003). Value traders are often referred to as informed traders.

Because it's a great deal of effort required to make these trades work, there are not many traders who become true value traders. But the ones that choose to act as a value trader and take long-term positions often earn a larger profit than the high-frequency traders.

There is not one answer as to how to identify what is over- or undervalued, but there are different parameters that are more important to analyse than others. In this term paper, we are focusing on the price-to-book ratio.

The relationship between the book value and market value of equity

When a company is established, the founders contribute equity to the company for the company to acquire assets. On day one, the company has equity and cash, and the fundamental value is in principle equal to the company's cash position (unless the founder has a brilliant idea the investors would pay up for). The next step is to acquire assets, and an example can be that the company buy one oil tanker 100 % equity financed. The ship is traded in an efficient sale and purchase market, and the vessel value will under normal circumstances be representative for the markets expectations of future earnings from the ship i.e. the fundamental value of the company should still be equal to the book equity after the purchase.

If we then assume that the company undergo an IPO, then various investors will decide for what price the company's shares are to be valued. This might differ from the book value, as the investors have different views of the future development in the freight market. This will continue after the IPO, when the stock is actively traded and the share price will differ from the book value of the equity, and from the net asset value provided information on value of the ship.

For a shipping company, there is often possible to make estimates of the value adjusted equity of the company, as the assets are traded in an active market. If the value adjusted equity is representative for the fundamental value, then an investor can in principle buy shares if the market value of the shares is below net asset value per share, or vice versa, buy the ship rather than the company if the shares are overvalued. Introducing long term charter contracts for the ship, and gearing makes the valuation more diffuse.

In most circumstances, the net asset value cannot be calculated as in the example above, and the fundamental value needs to be determined through thorough analysis of the future free cash flow available to pay dividends to the investors.

In earlier times the fixed assets of a company was closely linked to its ability to make profits, and hence the price-book ratio was closer to 1x. Today the book values bear little or no relationship to the underlying values of the assets of most companies, the exception being a small minority of companies like shipping companies, property companies and investment trusts that are asset based (Wikipedia, 2016)

Many of today's companies do not show their most valuable assets on the balance sheet, and they are therefore not included in the book value, except for activated R&D expenses, licenses or goodwill in companies after mergers or takeovers. In companies like Apple, Microsoft, Google, Facebook etc., where the company's values lie in their intellectual capital, brands, generated goodwill etc. these factors are more valuable than the assets on their balance sheets. Therefore, the use of net asset value is often seen as an old-fashioned measure when valuing a company (Wikipedia, 2016),

Despite the theoretical limitations of the price-book ratio for determining fundamental value, different academic research has persistently shown that stocks with low price-book ratios persistently outperform stocks with high price-book ratios (Wikipedia, 2016).

Exchange Traded Funds ("ETF")

Among various kinds of assets available to a fundamental value trader we are focusing on ETFs in this term paper. The advantage is obvious as ETF's are traded on stock exchanges similar to ordinary shares. In addition the management fee of the ETFs is low compared to the spread costs and brokerage fees an investor must carry to replicate various indexes. There is a great variety of ETF's, i.e. long and short positions for equity, bonds, commodities and currencies.

An important category of ETFs, which exists in great numbers, is index funds. These are funds that attempt to replicate the composition of the shares and thus the return of a particular reference index (aksjebloggen.no, 2010). Unlike regular mutual funds, also known as active funds, the investments undertaken by index funds are not based on company analysis for the fund manager to try to beat a comparable index.

Positions

As the market moves up and down a trader will choose different positions for his investments. A long position means that the trader owns the assets and has the full up- and downside from changes in value of the asset, and the risk is limited to the invested amount. A short position means that the trader borrow assets from another party, sells it in the market and repurchase the asset at a later stage to profit from a reduction in the value. The short position provides the trader with the full upside until the asset has no value; however, the downside is unlimited as there is no roof for how high the asset value might go. When taking a short position, the trader is normally required to deposit the sales proceeds in a margin account held with a settlement bank, and in addition deposit a security margin into the account. The required security will normally depend on the volatility of the asset. The trader will also pay loan interest to the party that lent out the asset (Aksjebloggen.no, 2011).

The DAX Index – Deutscher Aktieindex

The German Stock Index is a total return index of 30 selected German blue chip stocks traded on the Frankfurt Stock Exchange. Total return index means that dividends paid from the companies that constitute the index, is included in the index value. The equities use free float shares in the index calculation, i.e. shares owned by very large shareholders is not included by their market value (the Norwegian States shares in Statoil is a similar example). The DAX has a base value of 1,000 as of December 31 1987 (Bloomberg, 2016)

The prices that are used to calculate the DAX Index come through Xetra, which is an electronic trading system (Investopedia.com, 2016). It is used a free float methodology to calculate the index weightings along with a measure of average trading volume. The majority of all shares on the Frankfurt Exchange trade on the Xetra system (Investopedia.com, 2016).

The companies listed on this stock exchange are mostly large international companies, such as Adidas, BMW, Bayer and Deutsche Bank (Wikipedia, 2016). Below is a complete list of the companies currently included in the DAX Index.

	Company	Prime Standard industry group	Ticker symbol	Index weighting (%)[1]	Employees
	Adidas	Clothing	ADS	1.85	53,731
	Allianz	Insurance	ALV	7.82	147,627
	BASF	Chemicals	BAS	7.77	113,292
	Bayer	Pharmaceuticals and Chemicals	BAYN	10.03	118,888
	Beiersdorf	Consumer goods and Chemicals	BEI	0.91	17,398
	BMW	Manufacturing	BMW	3.46	116,324
	Commerzbank	Banking	CBK	1.29	52,103
	Continental	Manufacturing	CON	2.61	190,000
	Daimler	Manufacturing	DAI	9.06	279,972
	Deutsche Bank	Banking	DBK	4.11	98,138
	Deutsche Börse	Securities	DB1	1.76	4,540
	Deutsche Lufthansa	Transport Aviation	LHA	0.68	118,781
	Deutsche Post	Logistics	DPW	2.85	488,824
	Deutsche Telekom	Communications	DTE	6.13	228,248
	E.ON	Energy	EOAN	1.89	58,530
	Fresenius	Medical	FRE	3.22	216,275
	Fresenius Medical Care	Medical	FME	1.92	105,917
	HeidelbergCement	Building	HEI	1.15	44,900
	Henkel	Consumer goods and chemicals	HEN3	1.96	49,750
	Infineon Technologies	Semiconductors	IFX	1.38	29,807
	K+S	Chemicals	SDF	0.80	14,295
	Linde	Industrial gases	LIN	3.14	65,591
	Merck	Pharmaceuticals	MRK	1.31	39,639
	Munich Re	Insurance	MUV2	3.03	43,316
	RWE	Energy	RWE	0.66	59,784
	SAP	Software	SAP	6.62	74,406
	Siemens	Industrial, electronics	SIE	7.93	343,000
	ThyssenKrupp	Industrial, manufacturing	TKA	0.94	154,906
	Volkswagen Group	Manufacturing	VOW3	3.21	592,586
	Vonovia	Real estate	VNA	0.51	5,900

Figure 1 Companies listed on the DAX-Index (Wikipedia, 2016)

The index weighting tells the company's share of the total index. For example, Bayer constitutes ten percent of the underlying value of the index.

The companies that constitute the index are large international firms with a long history. Most of them have large market shares in their respective segments, and operate on a global scale. They are hence exposed to i.a. currency risks, global GDP growth and political risk.

Parameters that affect the DAX index

The DAX-Index can be affected by multiple external factors, such as world events, scandals, company news, politics, and natural disasters.

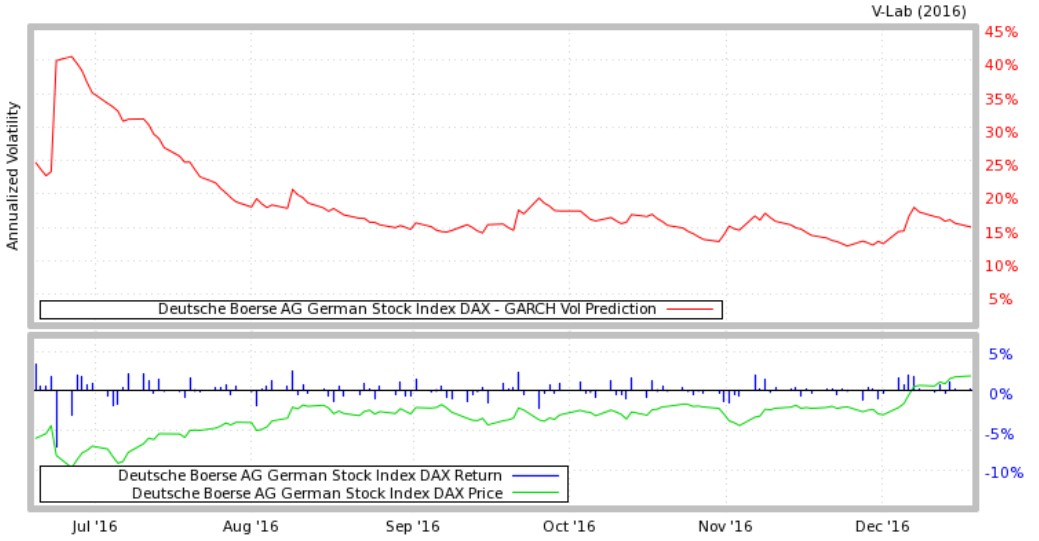
Recently the Volkswagen scandal had an impact on the DAX-index when Deutsche Bank downgraded the forecast for the entire DAX-Index in 2015. This downgrading was estimated to stick until the end of 2015 (Boyle, 2015)

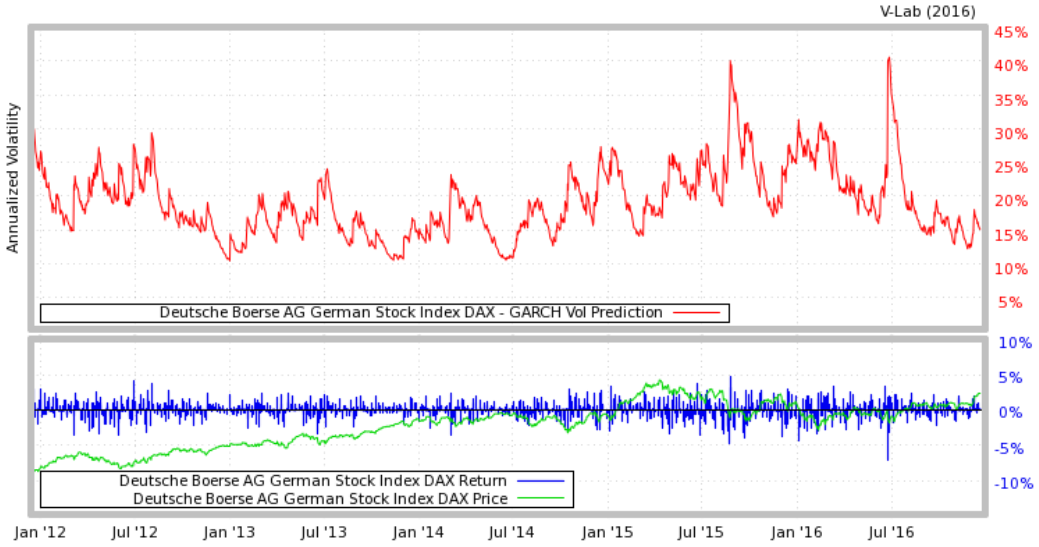
While after the UK voted to leave the EU the DAX-Index went down 10% before paring losses and closing at 8.6% down at June 23rd. (Kharpal, 2016)

As a major export economy, the value of the Euro is important to the DAX-Index and as a result the strength of the DAX becomes more directly affected by the strength of the Euro, than i.e. the strength of the FTSE is affected by the strength of the Sterling.

The federal German election in 2017 will most likely influence the DAX-Index. Whether the effect will be negative or positive is not yet clear. According to The Huffington Post, July 2016, there are some possible scenarios that could affect the financial market, in the event that Merkel would lose the upcoming election to a less EU-friendly Chancellor there will be some rattling of the Euro, European stocks and other risky assets which are exposed to the European market. Additionally, if the potential new Chancellor is less EU-friendly that might put the European Union at risk, hence the Euro as a major currency, due to the fact that financial theory states that investors do not tend to like this kind of uncertainty, this event might shake up the DAX-Index (Nwazor, 2016).

When looking at the historical volatility graphs, the DAX looks rather stable when looking at the last six months (06.19.16-12.19.16) according to the Deutsche Boerse AG German stock index DAX Garch volatility graph, but if the volatility is calculated for the last year, or five years it is clear that the DAX-Index is volatile.





One explanation is that the DAX-Index only consists of 30 companies, while in comparison the FTSE consists of 100 companies. Another is the fact that the Euro has a strong effect on the DAX-Index (V.Lab, 2016)

Developing a trading strategy for the DAX index

We have chosen to explore the potential of a trading strategy for when to take long- or short positions on the German DAX-index based on the pricing of the shares relative to the underlying book value of the shares, i.e. the price to book ratio. Our hypothesis is that history will repeat itself, and that historical data can be used as a basis to form a future trading strategy.

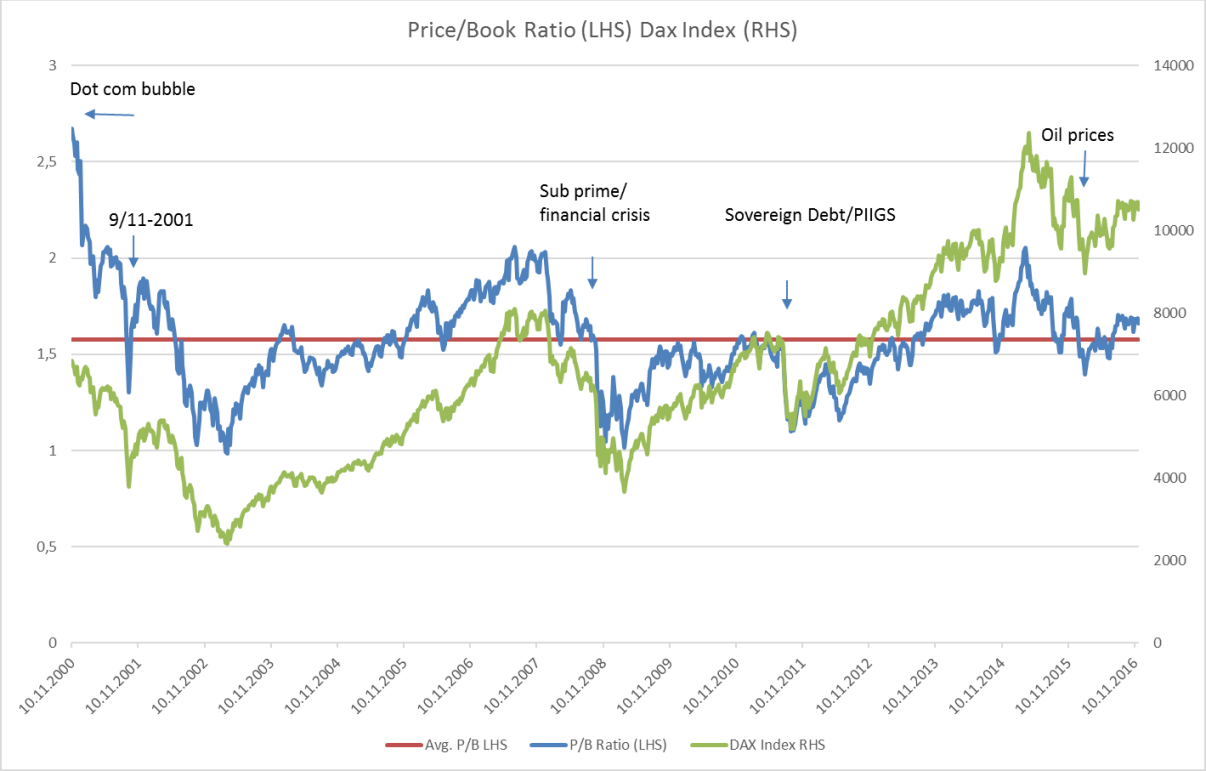


Figure 2 Price/Book Ratio (LHS) DAX Index (RHS)

The data set we are using was downloaded from Bloomberg, and is a list of weekly data on the value of the DAX-Index (Right Hand Scale) in the period November 2000 to November 2016, and the corresponding price/book ratio (Left Hand Scale) for the same time interval. The time series are shown in the graph above. Not surprisingly, there is a high correlation between the development in the index and the corresponding P/B ratio. It is also evident that the P/B ratio tends to move around an average.

In order to identify a full business cycle, we have looked at data from the Economic Cycle Research Institute "ECRI" that publishes their view on "official" dates for peaks and throughs

of business cycles (ECRI, 2016). They identified a peak in January 2001 and a through in August 2003 and a peak again in April 2008. When looking at major events during this time interval, the start of the period was affected by overly optimistic pricing of equity stemming from the "dot com bubble" and further negative sentiment caused by "9/11" and "the war on terror". The economy entered a more "normal" growth phase until the financial crisis hit in 2008.

If we look at the DAX index data, it appears as the stock market changes direction prior to the dates of the business cycles. We have chosen to use the data from November 2000 (the starting date of our data set) until November 2006 as this appears to represent a full cycle from peak to peak in the DAX Index.

In order to derive at a set of trading rules, we try to determine a normal trading range for the P/B ratio in the chosen time interval. After discussions with Tore Andre Lysebo, he recommended that we test the strategy by setting percentiles for the observations, where the 20th percentile represent the lowest boundary for the normal observations and the 80th percentile the corresponding upper boundary. When the index crosses these boundaries, a trade shall be initiated.

The 20th percentile is represented by a price/book ratio of 1.38x, and the 80th percentile 1.78x based on the said data. The normal trading range is hence assumed to be the P/B observations within this interval.

When falling below 1.38x a long position is taken, and this is kept until the ratio reaches 1.78x. At this point the position is reversed, i.e. the long position is closed and a short position taken.

To illustrate how the strategy works, the figure below shows the P/B ratio, the boundaries for when positions are to be taken illustrated by the dotted lines, and the actual trades resulting from the strategy marked by red circles (the corresponding graph showing the DAX Index is attached in enclosure 1).

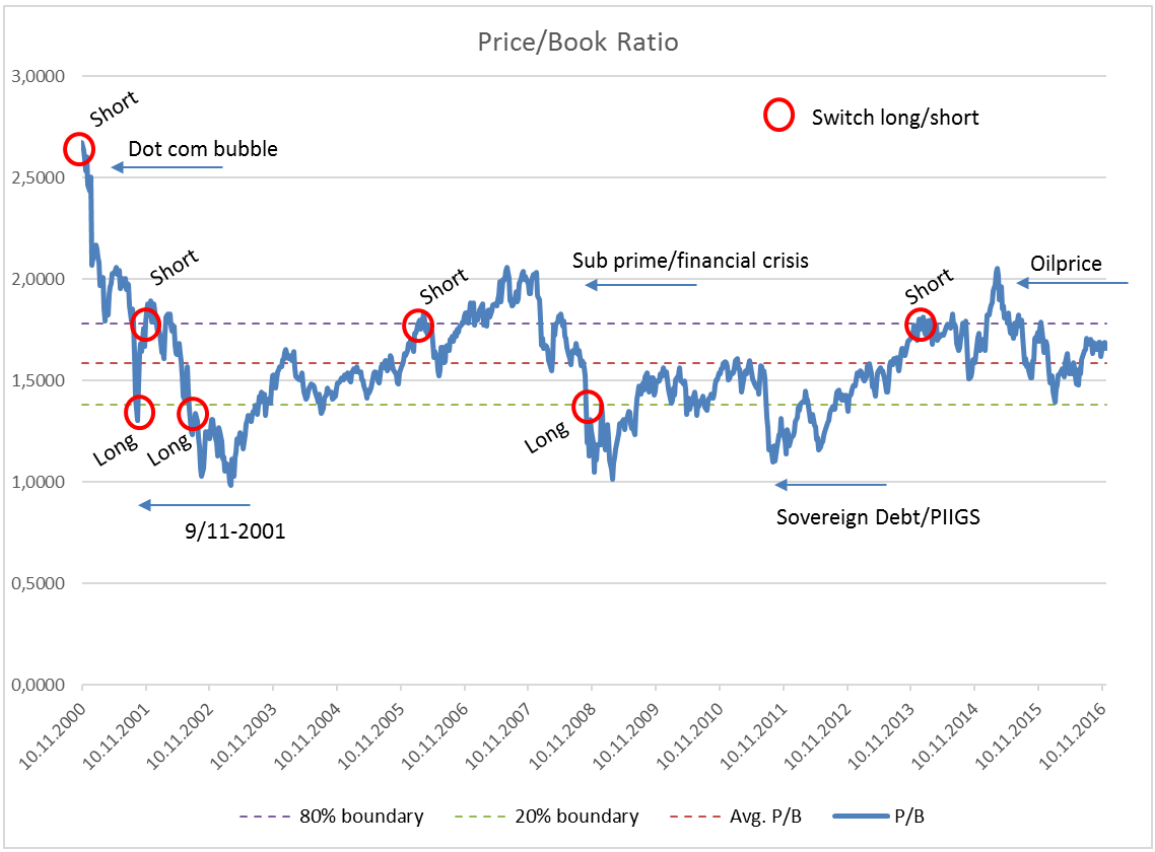


Figure 3 Price/Book-Ratio with events and trading signals

The table below shows the results achieved by the trades. In this example, it is assumed that there are no costs associated with holding the positions. The index level upon entering the positions are assumed to equal the equity invested, and the return is represented by the nominal change in index points. Annualized returns are based on the actual number of days divided by 365.

Position	Date in	Date out	Days	Price in	Price out	Gain/loss	Return annualized
Short	10.11.2000	21.09.2001	315	6 852	3 787	3 064	51,82 %
Long	21.09.2001	02.11.2001	42	3 787	4 910	1122,84	257,66 %
Short	02.11.2001	19.07.2002	259	4 910	3 892	1 018	29,22 %
Long	19.07.2002	24.02.2006	1 316	3 892	5 871	1978,91	14,10 %
Short	24.02.2006	10.10.2008	959	5 871	4 544	1 326	8,60 %
Long	10.10.2008	27.12.2013	1 904	4 544	9 589	5045,08	21,28 %
Short	27.12.2013	02.12.2016	1 071	9 589	10 513	- 924	-3,28 %
Total days			5 866				16,80 %

Figure 4 Return when trading in a market without costs

The weighted average annual return using this strategy is 16,8 %. It is obvious that the strategy has yielded solid annualized returns, especially for the first 3 periods. However, since July 2002 the trading intervals have become very long, and the annual returns are slimmer, but still decent. The return has also been significantly negative within the separate intervals. This might cause a challenge for the impatient investor, who is often acting on impulse trusting his gut feeling. The fund manager will have a hard time convincing the investor to stay, if it is not the managers own money. In the period since 2013 the strategy has so far yielded a negative return. This might indicate that the boundaries are too wide for the strategy to be successful.

Using the full set of data to simulate boundaries

If we use data from the full period from November 2000 until November 2016, the 20th percentile will be represented by a price/book of 1.39x, and the 80th percentile 1.77x. These percentiles are almost similar to the data used initially, and will yield exactly the same results when tested on the full sample as the trades will happen on exactly the same dates.

Changing the percentiles to narrow the boundaries

When looking closer at the P/B chart above, it is obvious that the strategy just merely missed a trade in February 2016. By expanding the normalized band to be within the 25th and the 75th percentiles, we assume that 50 % of the observations are to be considered normal.
The 25th percentile was represented by a price/book of 1.42, and the 75th 1.74x. The result is illustrated in the figure below.

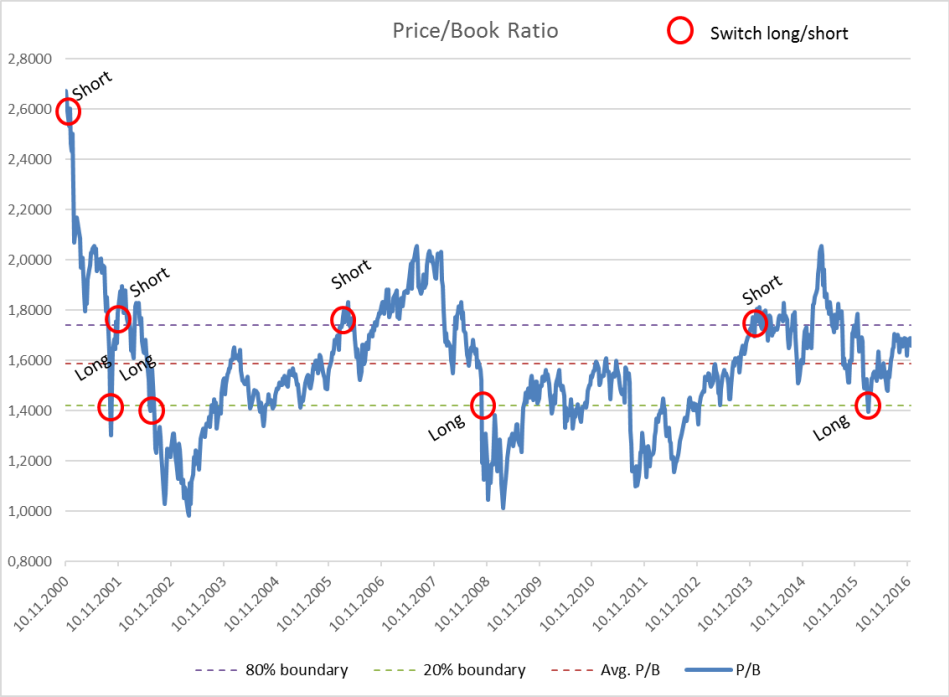


Figure 5 Price/Book ratio

The chart above looks very similar to the previous chart, with exception of the long position taken in February 2016. However, there are some other minor, but important differences with respect to the timing of the other trades. The result of this strategy is shown in the table below:

Return	Date in	Date out	Days	Price in	Price out	Gain/loss	Return annualized
Short	10.11.2000	14.09.2001	308	6 852	4 116	2 736	47,32 %
Long	14.09.2001	26.10.2001	42	4 116	4 820	704	148,70 %
Short	26.10.2001	21.06.2002	238	4 820	4 232	588	18,70 %
Long	21.06.2002	10.02.2006	1 330	4 232	5 701	1 469	9,53 %
Short	10.02.2006	10.10.2008	973	5 701	4 544	1 157	7,61 %
Long	10.10.2008	29.11.2013	1 876	4 544	9 405	4 861	20,81 %
Short	29.11.2013	12.02.2016	805	9 405	8 968	438	2,11 %
Long	12.02.2016	02.12.2016	294	8 968	10 513	1 546	21,40 %
Total days			5 866				15,75 %

Figure 6 Results from trading with new boundaries

The average annualized return of this strategy is 15,75 %. This is actually lower than the strategy using the 20th and 80th percentiles as boundaries. This looks surprising at first glance,

as the short position taken in 2013 is now reversed in 2016, and gains have been booked on both these positions.

The explanation is that the dates for execution of the trades from 2001 until 2008 happen 1-3 weeks before the execution dates using the 20th and 80th percentiles. As the positions are initiated during steep rise or decline in the index values, narrowing the bands significantly affect the index level at which the trade has been made. This can be seen from the table below:

	Strategy 80th/20th percentile				Strategy 75th/25th percentile				Days in
Return	Date in	Days	Gain/loss	Ann. Return	Date in	Days	Gain/loss	Ann. Return	advance
Short	10.11.2000	315	3 064	51,82 %	10.11.2000	308	2 736	47,32 %	0
Long	21.09.2001	42	1122,84	257,66 %	14.09.2001	42	704	148,70 %	7
Short	02.11.2001	259	1 018	29,22 %	26.10.2001	238	588	18,70 %	7
Long	19.07.2002	1 316	1978,91	14,10 %	21.06.2002	1 330	1 469	9,53 %	28
Short	24.02.2006	959	1 326	8,60 %	10.02.2006	973	1 157	7,61 %	14
Long	10.10.2008	1 904	5045,08	21,28 %	10.10.2008	1 876	4 861	20,81 %	0
Short	27.12.2013	1 071	- 924	-3,28 %	29.11.2013	805	438	2,11 %	28
Long					12.02.2016	294	1 546	21,40 %	
Total days		5 866		16,80 %		5 866		15,75 %	

Figure 7 Comparison of the results

Testing the strategy by using EFT and shorting shares

As the strategy appears to work in a market without costs, we also wanted to test if the strategy could work by using more realistic available trading instruments. We use the strategy based on the 75th and 25th percentile to illustrate.

For the long position, we managed to find an ETF corresponding to the DAX-Index and used the NAV reported by the fund manager (iShares Core Dax UCITS ETF). This was downloaded from iShares web page (iShares , 2016). The comparison between the ETF and the index shows almost perfect correlation. The annual commission charged by iShares is 0.16 % annually, which is charged from the NAV. The ETF is not distributing dividends, and dividends received by the fund manager are added to the NAV. The same is the case for the DAX index which includes dividends paid from the companies into the index values.

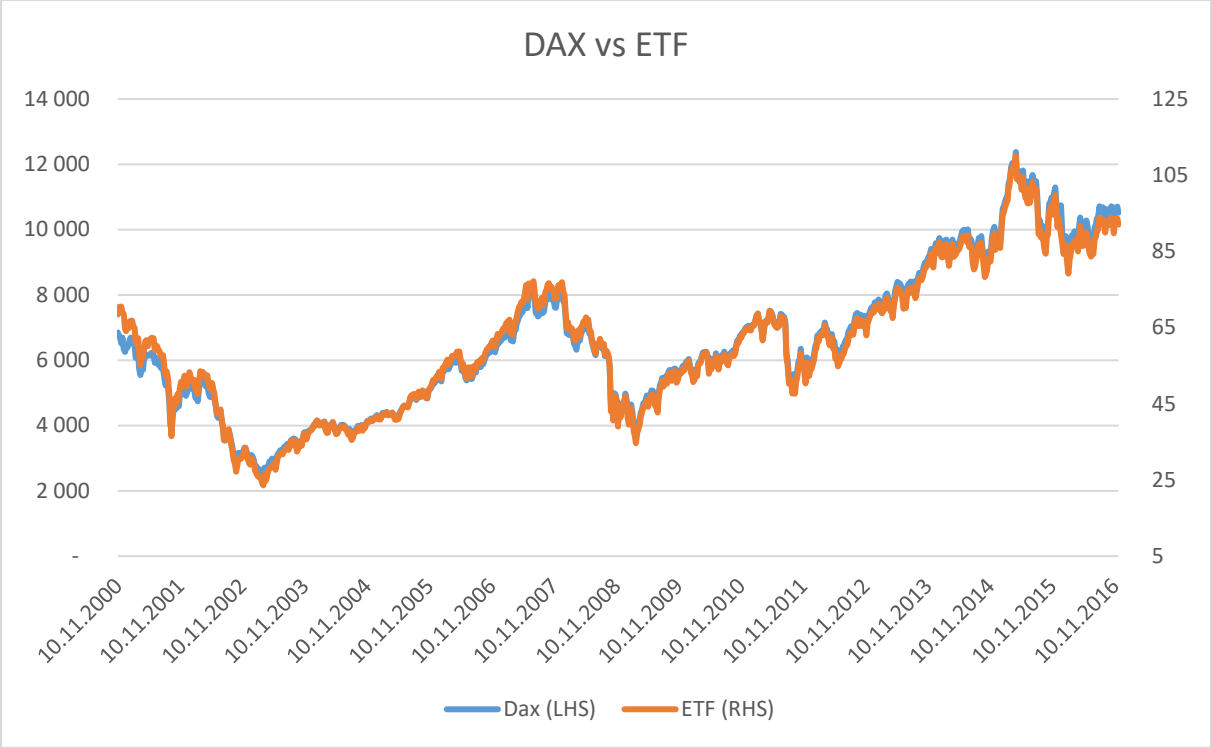


Figure 8 DAX vs ETF

We were unable to find an ETF that replicate a short position of the DAX for the relevant period. As the short EFT uses derivatives as an instrument for taking the short position, the expenses will over the course of time be relatively high. Hence this is normally not used as a tool for professional investors to take short positions.

In order to simulate a short position, we made the following assumptions:

- We borrow the shares of an equal amount as the index value at the date as the short position is initiated.
- The borrowing cost of the shares will be calculated on this value for the whole period of the short position.
- Annual interest expense for borrowing the shares is 3 % p.a.
- The equity that needs to be put into the margin account as security will equal 20 % of the maximum index value during the short period.
- No interest is earned on the margin account.
- Spread costs and administrative costs of rebalancing the portfolio upon changes in the weighting of shares in the DAX index is not included.

When we simulate the trades using the 25th and 75th percentile strategy, the results are as follows:

Margin, max % during short period				20 %					
Securities lending interest				3 %					
Return	Date in	Date out	Days	Price in	Price out	Margin	Interest	Nominal	Ann. Return
Short	10.11.2000	14.09.2001	308	6 852	4 116	1 370	173	2 562,3	221,58 %
Long	14.09.2001	26.10.2001	42	42	48			5,8	120,71 %
Short	26.10.2001	21.06.2002	238	4 820	4 232	1 080	94	493,6	70,07 %
Long	21.06.2002	10.02.2006	1 330	42	55			12,5	8,12 %
Short	10.02.2006	10.10.2008	973	5 701	4 544	1 619	456	701,2	16,25 %
Long	10.10.2008	29.11.2013	1 876	43	84			41,4	18,77 %
Short	29.11.2013	12.02.2016	805	9 405	8 968	2 475	622	- 184,5	-3,38 %
Long	12.02.2016	02.12.2016	294	79	92			12,8	20,09 %
Total days			5 866						26,42 %

Figure 9 Returns when using the strategy in the real market

The more realistic test of the strategy indicates a significantly higher annualized return compared to the return based on changes in the index values.

Comparing the return generated from the two tests shows the following results

				ETF/Margin	Index only
Positior	Date in	Date out	Days	Ann. Return	Ann. Return
Short	10.11.2000	14.09.2001	308	221,58 %	47,32 %
Long	14.09.2001	26.10.2001	42	120,71 %	148,70 %
Short	26.10.2001	21.06.2002	238	70,07 %	18,70 %
Long	21.06.2002	10.02.2006	1 330	8,12 %	9,53 %
Short	10.02.2006	10.10.2008	973	16,25 %	7,61 %
Long	10.10.2008	29.11.2013	1 876	18,77 %	20,81 %
Short	29.11.2013	12.02.2016	805	-3,38 %	2,11 %
Long	12.02.2016	02.12.2016	294	20,09 %	21,40 %
Total days			5 866	26,42 %	15,75 %

Figure 10 Comparison of returns

The return when using the ETF for long positions is lower than if we calculate based on index values. This is partly explained by the management commission, but might also be caused by the manager not being fully able to replicate the index and by the spread costs when trading.

The short positions yield a much higher return due to the gearing effect from only depositing the required security margin into the margin account, compared to assuming that the full index value is covered by equity in the case using only index values. The short position taken in November 2013 yields a negative return due to the interest costs on the position.

Conclusion

When writing this paper, we have learned how a fundamental value trader works, and how to develop strategies suitable for a fundamental value trader.

Through analysis of the weekly historical observations from the DAX-Index and the corresponding P/B ratios, we developed a strategy consisting of rules for when trades are to be initiated in this particular market to gain profits. We used the price/book-ratio to set the boundaries for when to trade. When the index crossed the boundaries, positions were taken.

After establishing the strategy, we needed to see if it worked. By using the whole set of data, we could see if the rules we had made, based on the values from the first six years of data, would be applicable also for the rest of the data set. By following the signals from the market, we gained an average return of 16.80 %.

When looking at the P/B chart it was obvious that the strategy just merely missed a trade in February 2016. In this context, we wanted to test what would have happened if we calculated other boundaries based on the 25^{th} percentile and the 75^{th} percentile.

With the new boundaries, we managed to include a trade based on the trigger in February 2016. We thought that the return would increase when this trade was included, but after calculating the returns from the different positions we saw that the average return in this case was 15.75%. This was caused by earlier execution of the trades, especially from 2001 until 2008. The long positions were taken 1-3 weeks earlier when narrowing the bands, hence the price when the trades happened was significantly higher for the long positions, and lower for the short positions.

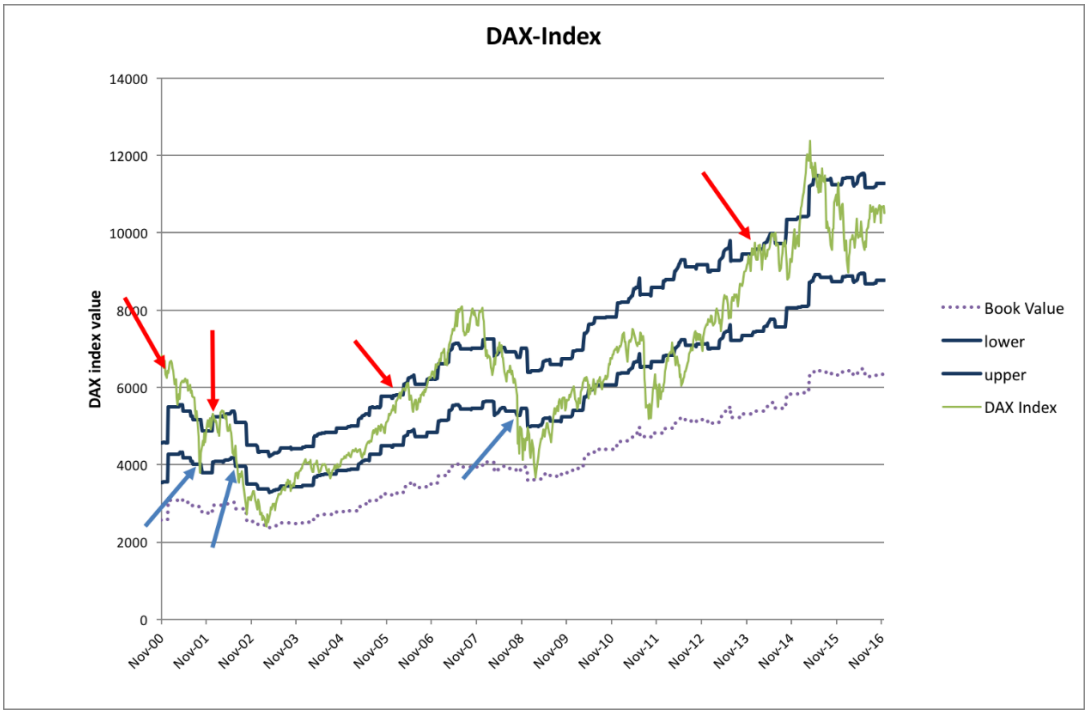
We also calculated the results of using the strategy with values from an actual ETF, and we saw that the more realistic test of the strategy indicates a significantly higher annualized return compared to the return based on changes in the index values.

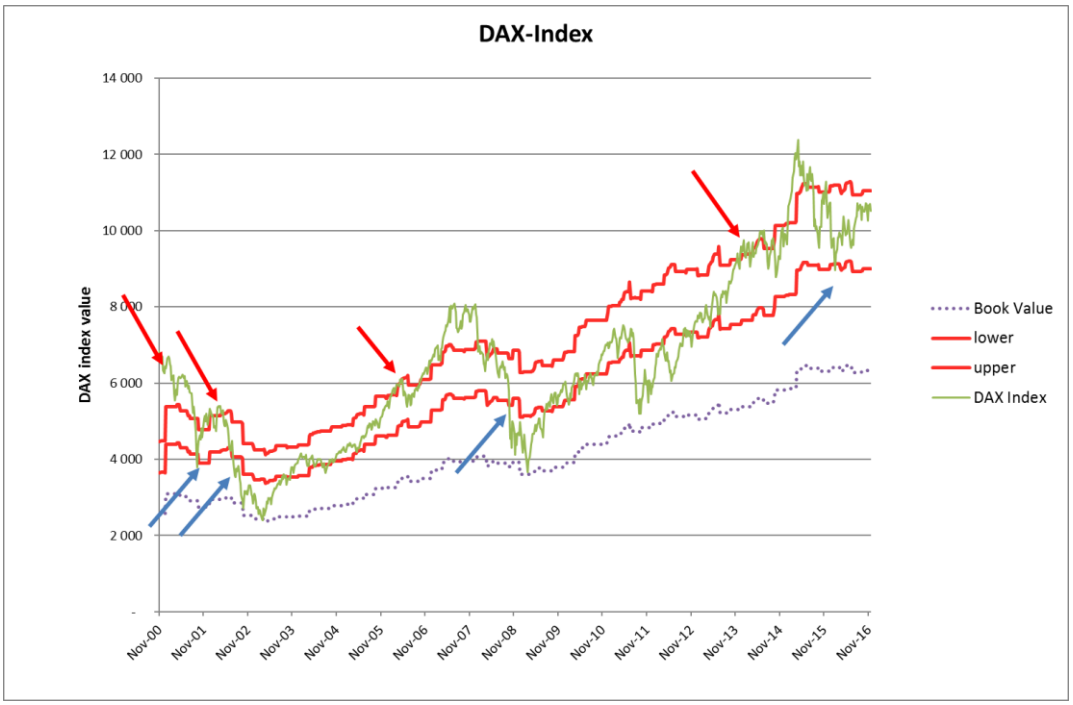
We have not focused on calculating the negative returns that can be measured within the various periods the positions are held. At a given point in time the strategy might show a significant loss, which might cause the investor to pull out of the position. The strategy hence carries a risk that the investor will terminate the position with a very unfavourable timing.

Trough analysis and different tests of the strategy we can conclude that the results strengthen our hypothesis, and that there is a potential profit that can be achieved by following the strategy and trade on the signals initiated by this strategy.

Enclosure 1 **Graphs showing the DAX index and the boundaries marked by the 20th and 80th percentile (top) and the 25th and 75th percentile (bottom)**

The graph above illustrates when the market signals that the trader needs to change position. The red arrows illustrate when to go short, and the blue arrows illustrate when to go long. In the real world, some of this positions would be considered as unprofitable, because of the costs related to taking these positions.





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