



Passive Insights

Momentum investing with Sector ETFs

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Executive Summary

Historically, allocation of global equity portfolios has primarily been built around country allocation. As a consequence to the global convergence of economies, there is mounting evidence that a portfolio would benefit from an industry-based approach.

Furthermore, academics have demonstrated the strength of the momentum factor at sector level which is used by investors to allocate capital between sectors over time.

In this paper, we illustrate the underlying value of sector rotation using, in particular, momentum as a driver for that rotation. First, we highlight the dispersion and the diversification potential of sector performance. Then we analyse a straightforward momentum-driven strategy as a way to outperform the market cap-weighted index.

- The investment universes we are contemplating are Emerging Markets (EM) and Developed Markets (DM)
- We focus essentially on ETFs as potential investments, looking at:
 - 10 EM sectors ETFs
 - 10 DM Sectors ETFs

Our analysis concludes that:

- **Sector performances are dispersed, on the basis of simulated results, which place them as good potential candidates for rotation strategies.** Sector allocation may therefore be a valuable avenue when investing in global equities.
- Momentum-driven sector rotation strategies exhibit a **higher risk adjusted return as compared to market cap weighted global stock indices, on the basis of simulated results.**
- Results indeed show that the ETF-based EM sector rotation portfolio would have demonstrated, on a simulated basis, a Sharpe Ratio 0.73 versus 0.52 for the MSCI EM Index and a CAGR of 14.8% versus 12.2% for the MSCI EM Index¹.

¹ Please note that the performance data shown for the ETF based Momentum-driven sector rotation strategy is simulated and has been calculated based on the historical performance of indices used as proxies for ETFs selected according to the methodology described in the paper. These strategies' simulated returns do not represent historical returns of any actual product, portfolio or strategy issued or managed in the past. In simulating the past performance of this hypothetical strategy, an estimated annual rebalancing cost further specified in page 5 was assumed.



- Results indeed show that the ETF-based DM sector rotation portfolio would have demonstrated, on a simulated basis, a Sharpe Ratio 0.27 versus 0.15 for the MSCI DM Index and a CAGR of 6.2% versus 4.4% for the MSCI DM Index.
- Sector ETFs may enable the implementation of such a momentum strategy in a straightforward, cheap and liquid way.

1 Introduction

Allocation in a global Equity universe is a tough topic. There is no easy choice between focusing on stock picking, country allocation or sector allocation. Historically, a lot of practitioners approached this problem through a national or regional prism first; the implicit assumption for this being that the benefits of international diversification outweigh the benefits of intra-country dispersion and, in particular, inter-sector diversification. As a result, the historical dominance of the country effect has been decreasing with the integration of global economies and country effects no longer dominate sector effects (Baca, Garbe and Weiss [2000]). The first part of this paper aims to illustrate how the different sector performances and characteristics differ significantly over time and the diversification potential that lies in a sector-based allocation.

In previous papers, we have studied systematic passive ETF-focused strategies to unlock the potential performance of several top-down approaches. In particular, we looked at low volatility portfolios as well as equal weight portfolios of sector ETFs². Both strategies demonstrated attractive risk return profiles, on the basis of simulated results. Based on this analysis, they also showed performances similar to their corresponding stock-based strategies that would require significantly more operational work. Medium-term stock momentum has been researched widely by both researchers and practitioners over the years as an anomaly that did generate positive returns over time. Researchers have indeed spent a significant amount of resources to investigate this strategy, its robustness, its causes, as well as its implications on market efficiency. One of their important findings has been that stock level momentum can be captured at sector level (Moskowitz and Grinblatt [1999], O'Neal[2000]). Finally, in the third part of the paper we suggest one implementation of a momentum-based sector rotation strategy. As we implement this strategy on a global universe, country-specific effects are mitigated to a certain extent making these strategies focus solely on sector rotation. We will also look at the many advantages and potential drawbacks of this strategy in detail.

When it comes to implementing such a strategy, it is important to properly choose the tradable instruments that will be used. Here, we have indeed focused on ETFs.

1.1 Case for using ETFs to build Sector Rotation Strategies

- Allocation into sectors rather than single stocks demonstrates similar benefits as its single stock equivalent;

² “[Smart Beta: Building Low Volatility Portfolios of ETFs](#)”, Journal of Index Investing, 2014
“Equal Weighted Portfolios of ETFs”, Passive Insights #3, Summer 2014



- Accessibility through relatively cheap and liquid instruments;
- Straightforward, easy to monitor portfolios of 10 sector based ETFs (as compared with hundreds of stocks).

1.2 A challenge in implementing Sector Rotation Strategies

- Higher turnover: periodical rebalancing of the portfolio may significantly increase the turnover which translates in higher transaction costs.

2 Sector ETFs demonstrates real diversification

Unless otherwise specified, we use Sectors for Developed and Emerging Markets to implement the strategies described herein.

Hereafter we look in particular at the MSCI Emerging Market (EM) Sectors and the MSCI World Developed Market (DM) Sectors universe.

Universe of Emerging Market Sectors: EM Consumer Discretionary, EM Consumer Staples, EM Energy, EM Financials, EM Healthcare, EM Industrials, EM Information and Technology, EM, Materials, EM Telecom and EM Utilities.

Universe of World Market Sectors: DM Consumer Discretionary, DM Consumer Staples, DM Energy, DM Financials, DM Healthcare, DM Industrials, DM Information and Technology, DM Materials, DM Telecom and DM Utilities

As illustrated in Figure 1³, there seems to be no apparent relationship between the year-on-year performances of each EM sector. This sector dispersion is indeed very important. Should one benefit from perfect foresight, by investing in the top performing sector each year, it would be easy to significantly outperform the market.

Looking further into the performance dispersion between sector indices, we look at the general correlation between the EM sectors, as shown in Figure 2⁴. Some sectors such as IT and Utilities, for example, demonstrate low correlation but overall the correlations are still relatively high. Each sector still exhibits a significant beta. To isolate the impact performance of the sector from that of the market, we strip the performance of the overall benchmark from the performance of each sector. We then calculate the correlation matrix of the excess returns of each sector. As shown in Figure 3⁵, it is much clearer from this analysis that the excess returns are fairly uncorrelated. This could therefore allow an investor to benefit from a potentially stronger diversification effect when building a sector based portfolio, relative to the benchmark..

³ Source: Deutsche Bank, Bloomberg. Yearly performance of ten MSCI Emerging Market Net TR Sector Indices.

⁴ Source: Deutsche Bank, Bloomberg. Correlation using daily returns for the period: Dec 2000 to Jul 2014.

⁵ Source: Deutsche Bank, Bloomberg. Correlation using daily sector excess returns for the period: Dec 2000 to Jul 2014. Sector Excess Returns is a term used to describe EM Specific Sector Returns minus MSCI EM Net TR Returns.



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With regards to the DM sectors, year-on-year performance of sectors seems fairly dispersed, in accordance with the findings for the EM sectors. However, the difference between the best and worst performer of the year is lower as compared with the EM sectors. DM sectors still exhibit very strong dispersion in line with what is observed for EM sectors in Figure 2 and Figure 3. Please see Figure 23, Figure 24 and Figure 25 in the appendix

Yearly performance of EM Sectors shows relative dispersion

Yearly performance of Emerging Market Sectors											1
Performance during year	Sector Performance: Highest to Lowest Returns										
2001	EG 13.9%	ML 6.4%	CD 5.4%	IT 3.1%	FIN -2.0%	ULI -2.2%	CS -5.9%	IND -10.4%	HC -15.2%	TS -18.3%	
2002	ML 17.8%	HC 16.8%	CD 7.9%	EG 4.4%	IND -0.7%	CS -4.0%	FIN -6.8%	ULI -18.5%	TS -19.8%	IT -22.1%	
2003	EG 84.1%	ULI 80.9%	CD 72.2%	IND 64.8%	ML 63.9%	HC 61.8%	IT 45.5%	FIN 44.7%	TS 42.2%	CS 39.4%	
2004	FIN 39.0%	TS 34.1%	IND 32.9%	CD 27.9%	CS 27.8%	EG 25.1%	ML 21.2%	ULI 21.1%	IT 9.5%	HC 7.6%	
2005	EG 61.8%	CS 37.7%	HC 36.3%	ULI 35.0%	CD 33.6%	FIN 31.7%	IT 31.4%	ML 29.2%	TS 25.2%	IND 25.1%	
2006	ULI 47.0%	ML 42.8%	EG 42.0%	TS 41.0%	FIN 39.6%	CS 38.0%	IND 38.0%	CD 13.0%	IT 12.5%	HC -8.7%	
2007	IND 69.3%	ML 63.0%	EG 55.1%	TS 54.6%	ULI 37.6%	FIN 31.4%	HC 29.6%	CS 26.5%	CD 18.0%	IT 1.6%	
2008	HC -17.5%	CS -35.1%	ULI -41.9%	TS -43.5%	IT -50.6%	CD -52.4%	FIN -53.0%	ML -58.9%	EG -61.2%	IND -62.1%	
2009	CD 116.9%	IT 108.5%	ML 107.8%	EG 86.3%	FIN 80.3%	CS 70.6%	IND 59.4%	ULI 56.2%	HC 41.4%	TS 26.5%	
2010	CD 31.4%	CS 30.4%	IND 29.0%	HC 26.8%	ML 22.8%	FIN 17.0%	IT 16.4%	TS 14.6%	EG 9.9%	ULI 8.1%	
2011	CS 0.7%	TS -4.5%	CD -9.1%	ULI -13.7%	IT -15.4%	EG -18.1%	HC -22.3%	FIN -23.6%	ML -27.0%	IND -29.3%	
2012	HC 33.3%	IT 28.5%	FIN 25.5%	CS 25.4%	IND 16.9%	CD 16.3%	TS 14.0%	ML 9.9%	ULI 6.4%	EG 6.0%	
2013	IT 13.9%	HC 9.1%	CD 5.8%	IND -1.0%	TS -1.7%	ULI -3.1%	CS -3.8%	FIN -4.2%	EG -10.7%	ML -17.0%	

Legend	
CD	Consumer Discretionary (Cyclical)
CS	Consumer Staples (Defensive)
EG	Energy (Defensive)
FIN	Financials (Cyclical)
HC	Healthcare (Defensive)
IND	Industrials (Cyclical)
IT	Information Technology (Cyclical)
ML	Materials (Cyclical)
TS	Telecommunication Services (Defensive)
ULI	Utilities (Defensive)

Inter-sector Correlation is limited

Correlation between Total Returns of individual EM sectors											2
	Cons. Disc.	Cons. Staples	Energy	Financials	Healthcare	Industrials	I.T.	Materials	Telecom	Utilities	
Cons. Disc.	1										
Cons. Staples	0.82	1									
Energy	0.73	0.77	1								
Financials	0.89	0.85	0.80	1							
Healthcare	0.48	0.49	0.46	0.51	1						
Industrials	0.88	0.79	0.73	0.89	0.47	1					
I.T.	0.75	0.56	0.50	0.71	0.36	0.74	1				
Materials	0.80	0.84	0.84	0.85	0.47	0.80	0.58	1			
Telecom	0.80	0.82	0.76	0.84	0.45	0.77	0.60	0.79	1		
Utilities	0.76	0.82	0.80	0.82	0.46	0.75	0.53	0.80	0.80	1	

Correlation between Excess Returns of individual EM sectors											3
	Cons. Disc.	Cons. Staples	Energy	Financials	Healthcare	Industrials	I.T.	Materials	Telecom	Utilities	
Cons. Disc.	1										
Cons. Staples	0.08	1									
Energy	-0.36	-0.10	1								
Financials	0.06	-0.06	-0.18	1							
Healthcare	0.01	0.40	-0.11	-0.06	1						
Industrials	0.24	-0.04	-0.30	0.15	-0.01	1					
I.T.	0.16	-0.33	-0.54	-0.18	-0.08	0.14	1				
Materials	-0.27	0.00	0.25	-0.22	-0.15	-0.22	-0.47	1			
Telecom	-0.04	0.32	-0.08	-0.14	0.14	-0.21	-0.29	-0.14	1		
Utilities	-0.08	0.44	0.12	-0.07	0.24	-0.11	-0.37	0.00	0.26	1	

Cyclical vs Defensive sectors

Over time, some sectors have been classified by academics and practitioners as defensive and others as cyclical in response to their behaviour at different stages of market cycles. Cyclical sectors are deemed to perform better during bull cycles whereas defensive sectors are deemed to perform better during bear markets. This dual behaviour is fairly well demonstrated by the rotation of the best and worst performers in Figure 1.



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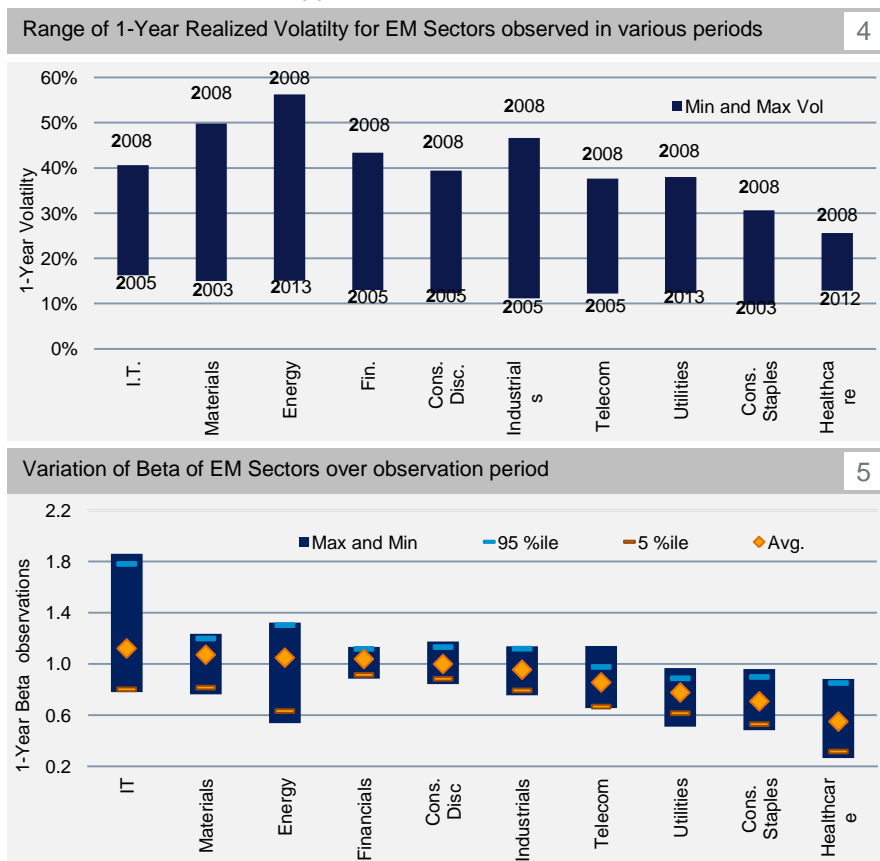
It can also be illustrated by looking at the volatility and the beta (versus the EM index) of the sectors as illustrated below in Figure 4⁶ and 5⁷.

In Figure 4, we calculated the 1Y rolling volatility of each of the EM sectors and printed the minimum and maximum 1Y volatility realized as well as the year of occurrence of these troughs and peaks of volatility.

This analysis shows that cyclical sectors demonstrate significant volatility variations over time while defensive sectors show relatively smaller changes. It is also interesting to note that individual sectors do not exhibit a low/high volatility regime at the same time of the cycle (with the notable exception of the 2008 crisis).

In Figure 5, we study the 1Y rolling Beta of the EM Sectors. Similarly to the volatility analysis, some sectors exhibit above average beta (which can be considered as “cyclical”) and others demonstrate below average betas (which can be considered as “defensive”). Both beta and volatility exhibit strong variations over time in line with business cycles. For example, variation in volatility became more prominent during stressed market conditions of 2002 and 2008.

In this instance also, results for both developed and emerging markets are very similar. DM sectors exhibit cyclical or defensive behaviors with large variations in volatility across time. Please see Figure 26 and Figure 27 for more information in the appendix.



⁶ Source: Deutsche Bank, Bloomberg. 1-Year volatility using daily returns is calculated at the end of each year. Observation period: Dec 2000 to Dec 2013.

⁷ Source: Deutsche Bank, Bloomberg. 1-Year beta using daily returns for the period: Dec 2000 to Jul 2014. Proxy for market: MSCI EM TR Net Index. Avg. Beta is calculated with monthly observations of 1-Year beta.



As described above, industry performance is dispersed and, therefore, one could use, if properly implemented, these sectors within a rotation strategy with good results. However, to unlock this potential, one needs to think carefully about their investment strategy to try to allocate capital to the right sector at the right moment.

In this paper we propose to use a straightforward momentum methodology.

3 A first look at sector momentum

Momentum is an empirically observed phenomenon based on the theory that high performing securities will continue to perform well and that underperforming securities will continue to underperform. Academics have largely attributed this phenomenon to behavioural biases such as investor herding, investor over-and-under reaction and confirmation bias. A momentum strategy will buy or overweight (or, alternatively, sell or underweight) securities which have performed well (or, alternatively, poorly) in the past for a particular observation period.

In this section, we use the methodology supported by Jegadeesh and Titman [1993], to illustrate the existence of strong momentum in Sector Indices.

The methodology observes the excess returns over an observation period of a certain number of months (1M, 3M and 6M) and shows the excess returns realized over the following period of Y months (1M, 3M). The numbers tabulated in Figure 6⁸ show the percentage of total observations in which the positive (or negative respectively) excess returns realized during the observation period are followed by positive (or negative respectively) excess returns realized during the following period.

Excess return is defined as a sector's performance over the period minus the average performance of all the sectors for the same period. When calculating the ratio for the MSCI EM Index, absolute returns are considered instead of excess returns.

Out of all the multiple observation and realization periods, 47 out of a total of 60 past observations are exhibiting a hit ratio greater than 50%, which may be considered a relatively clear indication of a momentum effect in sectors in the past.

Percentage of total observations exhibiting momentum in EM Sectors						6
	N=1M, Y=1M.	N=3M, Y=1M.	N=6M, Y=1M.	N=1M, Y=3M.	N=3M, Y=3M.	N=6M, Y=3M.
Cons. Disc.	63.0%	54.4%	59.2%	56.6%	54.7%	53.8%
Cons. Staples	51.9%	53.8%	52.2%	56.6%	60.4%	55.8%
Energy	61.1%	51.9%	49.0%	45.3%	43.4%	50.0%
Fin.	50.6%	49.4	50.3%	54.7%	54.7%	50.0%
Healthcare	59.9%	58.1%	54.1%	56.6%	60.4%	48.1%
Industrials	50.6%	51.3%	51.6%	67.9%	56.6%	50.0%
I.T.	51.2%	49.4%	49.0%	47.2%	54.7%	57.7%
Materials	57.4%	54.4%	51.6%	50.9%	49.1%	48.1%
Telecom	54.3%	53.1%	54.1%	52.8%	58.5%	57.7%
Utilities	54.9%	51.3%	52.9%	41.5%	43.4%	44.2%
MSCI EM Net TR	58.0%	58.8%	56.1%	66.0%	56.6%	51.9%

⁸ Source: Deutsche Bank, Bloomberg. Historical simulation period: Dec 2000 to Jul 2014.



In the developed markets, as illustrated in Figure 7⁹, 39 out of a total of 60 past observations exhibit a hit ratio greater than 50%. While this may still be perceived as evidence of momentum effect in sectors of the developed market, such momentum effect seems more pronounced in the Emerging Markets. As both the percentage of occurrences confirming momentum and the dispersion (maximum sector return minus minimum sector return) in the DM sector are lower, it seems that momentum strategies are likely to be more successful in EM as compared to DM.

Percentage of total observations exhibiting momentum in DM Sectors							7
	N=1M, Y=1M.	N =3M, Y=1M.	N =6M, Y=1M.	N =1M, Y=3M.	N =3M, Y=3M.	N=6M, Y=3M.	
Cons. Disc.	54.5%	57.0%	52.5%	52.7%	40.0%	44.4%	
Cons. Staples	55.7%	50.9%	48.8%	54.5%	47.3%	38.9%	
Energy	47.9%	52.7%	50.0%	43.6%	47.3%	57.4%	
Fin.	52.1%	52.1%	53.7%	52.7%	56.4%	53.7%	
Healthcare	51.5%	47.9%	49.4%	47.3%	52.7%	48.1%	
Industrials	49.1%	51.5%	42.6%	45.5%	43.6%	35.2%	
I.T.	50.9%	50.3%	50.0%	54.5%	50.9%	50.0%	
Materials	50.3%	49.1%	51.2%	61.8%	54.5%	61.1%	
Telecom	50.3%	56.4%	51.2%	49.1%	58.2%	44.4%	
Utilities	46.7%	53.3%	51.2%	50.9%	58.2%	55.6%	
MSCI World Net TR	58.7%	57.6%	63.0%	61.8%	61.8%	64.8%	

4 A straightforward EM sector momentum strategy

Following this positive preliminary analysis we apply this principle to a momentum based sector rotation strategy. If sector performance exhibits momentum then a systematic selection of sectors according to their past performance may create an attractive risk-return profile.

Hereafter, we look at the available sector indices in an ETF format (for more details on the selection process and the methodologies used please see the appendix).

4.1 Strategy

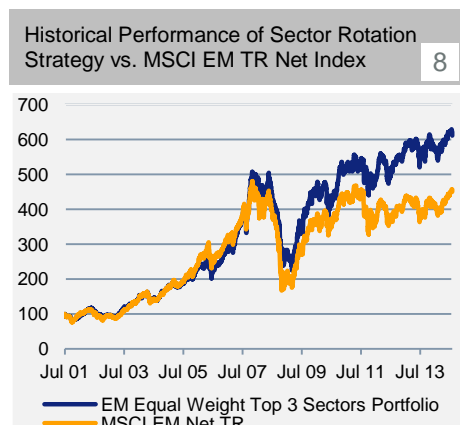
Every month the strategy we consider invest into the three sectors with the highest performance realized over the last three month and their weights are distributed equally between them. This strategy is rebalanced on a monthly basis and a transaction cost of 0.20%¹⁰ is applied at each rebalancing. Historical simulation period is from Jul 2001 to Jul 2014.

⁹ Source: Deutsche Bank, Bloomberg. Historical simulation period: Jul 2000 to Jul 2014.

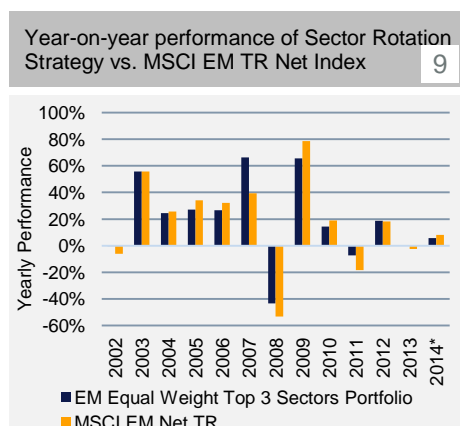
¹⁰ This is deemed to be a conservative estimate of the cost of rebalancing the basket taking into account the average bid-ask on each ETF (observed as of October 2014) as well as their average weights in the portfolio.



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	EM Equal Weight Top 3 Sectors Portfolio	MSCI EM Net TR
Returns	14.8%	12.2%
Volatility	18.0%	20.0%
Sharpe Ratio Rf=1.73%	0.73	0.52
Max. Draw-down	55.7%	65.2%

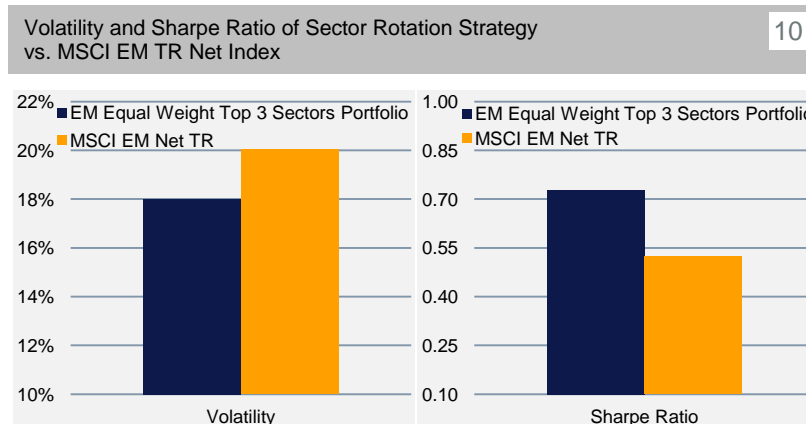


4.2 Simulated Results¹¹

The historical simulation in Figure 8⁹ shows a consistent outperformance of the EM Equal Weighted Top 3 Sectors Portfolio versus the MSCI Emerging Markets Index.

Figure 9¹² shows a historical simulation of the year-on-year performance of the strategy versus the MSCI EM TR Net Index. The strategy exhibits strong resilience during down market (in 2008 and 2011) when compared with the benchmark.

In order to adequately judge the benefits of this strategy, it is probably more relevant to compare the risk-adjusted return (compared to raw returns) realised vs. benchmark indices. Thus, Figure 10⁹ shows, on the basis of simulated data and the analysis conducted so far, a more positive Sharpe ratio as well as a lower volatility for the sector rotation strategy compared to the MSCI EM TR Net Index. The improved Sharpe Ratio was expected as the strategy extracts value from the sector rotation, using the industry momentum effect in the EM universe. However, the extent to which the volatility has been reduced using only 3 sectors is relatively unexpected, and we aim to study this effect further.



4.3 Key Parameters Analysis

To ascertain the efficiency of this sector rotation strategy, it is important to explore the performance of this strategy when some of the important parameters are altered, i.e. the stability of the strategy performance to key parameter changes. Such key parameters here are:

- (a) Observation period (1M, 3M, 6M);
- (b) Rebalancing frequency (monthly, quarterly);
- (c) Number of sectors selected (3, 5, 7, 10 i.e. equal weight).

As shown in Figure 11¹³, this analysis indicates that both the increase of the observation or the rebalancing period have a negative impact on the returns and Sharpe ratio

¹¹ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Jul 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results. For volatility daily returns are used. For risk free rate: ICE Libor USD Overnight rate is used.

¹² Source: Deutsche Bank, Bloomberg. For 2014, performance till end of July is shown.

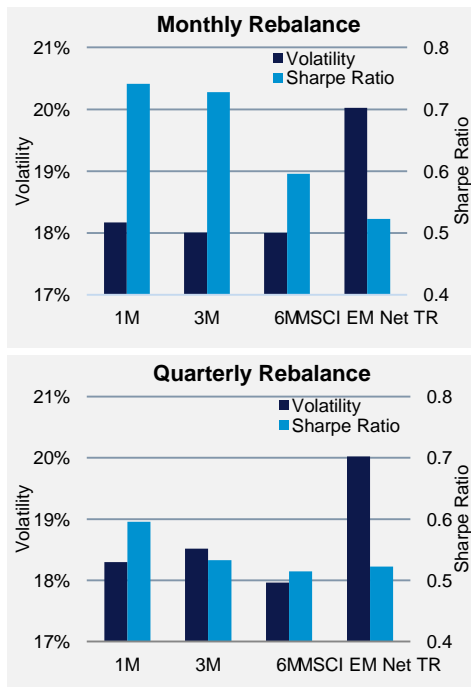
¹³ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Jul 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results. For volatility daily returns are used. For risk free rate: ICE Libor USD Overnight rate is used.



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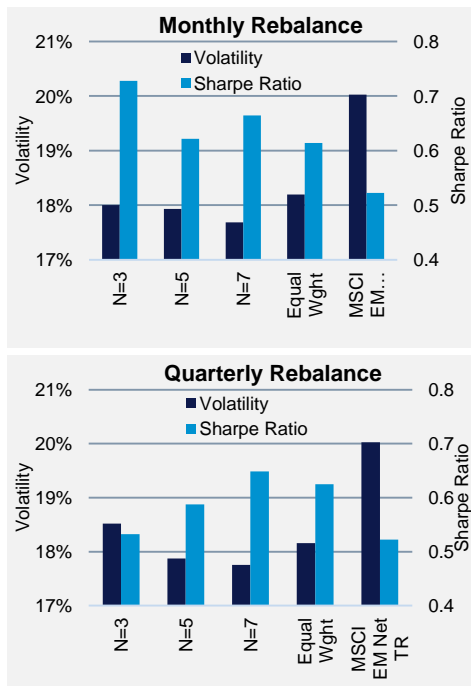
Sharpe Ratio and Volatility for Monthly and Quarterly rebalancings of top three sectors over various lookback periods

11



Sharpe and Volatility for Monthly and Quarterly Rebal for top N sectors over a lookback period of 3-months

12



This would indicate that sector momentum is more of a short term effect. Over the long term, the analysis suggests that both stocks and sectors exhibit a mean reverting effect on the stock performance that conflicts partly with the momentum effect observed on the shorter term. We have already discussed this mean reverting effect in our Passive Insight #3, highlighting that it was deemed to be the one of the sources of the outperformance of an equal weight strategy.

It is interesting to note that Jegadeesh [1990] illustrated, at stock level, a significant negative first-order serial correlation (mean reversion) in 1 month returns and his later work on momentum effect (Jegadeesh and Titman, 1993) was for 3- to 12-month holding periods, that seem to contradict our findings above. However, higher Returns and Sharpe ratio of the strategy N=1M, Y=1M is consistent with the findings of Moskowitz and Grinblatt (1999) where they demonstrate that this mean reversion of 1 month returns disappear in aggregate group of stocks such as country and sectors. They attribute the reversal of stock's 1M performance and momentum of industry's 1M performance to market microstructure effects such as bid-ask jumps and liquidity effects. These effects are shown to be mitigated when sector or industry specific portfolios are formed. We too think that over the past two decades, as market depth has increased, issues of transaction and impact costs have been further mitigated and are less significant when sector/industry portfolios are formed.

Furthermore, it is noteworthy that the volatility of all these strategies is shown to be relatively stable across parameters and remain significantly lower than the benchmark i.e. MSCI EM Net TR Index.

The observations related to the decrease in Sharpe ratio (Figure 11 for three sectors only) for longer rebalancing periods holds even when the strategy is tested on a different number of sectors.

However, for a particular rebalancing period, the results are varied as the number of sectors changes (Figure 12¹²). Nonetheless, if an equal weight strategy serves as a proxy for a mean reversion strategy and if we ascribe choosing three sectors as a proxy for a momentum strategy, then for a shorter rebalancing period (monthly), momentum effect is shown to be predominant and for a longer rebalancing period (quarterly) mean-reversion effect is shown to be predominant.

4.4 Is there a relationship between Volatility and High Momentum?

As discussed previously, the volatility of those portfolios included in this analysis has shown to be unexpectedly low. In terms of diversification, we would expect the volatility to decrease when the number of sectors increases as this would make the equal weight portfolio the least volatile of all the portfolios (see right). However, as illustrated in Figure 12 although the volatility effectively decreases when the number of sectors increases from 3 to 7, the Equal weight portfolio is, in fact, the higher. This pattern suggests that there is a link between the momentum of a sector and its volatility.

In this first analysis, we try to explain why the volatility does not decrease monotonously with an increase in the number of sectors in the portfolio. The explanation could lie with the varying volatility between sectors (since it is neither the correlation nor the number of sectors).



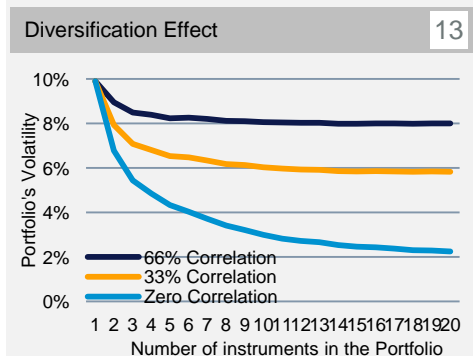
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A few reminders on diversification

Diversification is the reduction of a portfolio's volatility by investing in an increasing numbers of instruments/asset.

Assuming that all assets have the same volatility, the degree of risk reduction is directly dependent on the number of assets and the correlation between those assets (as exhibited in the graph below):

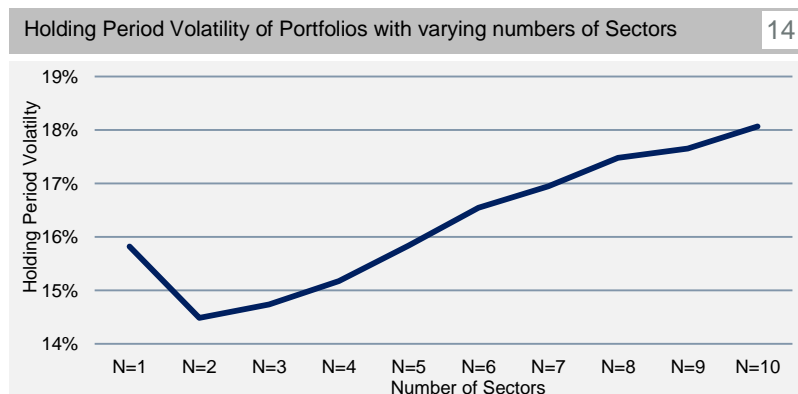
- The greater the number of assets the higher the volatility reduction
- The lower the correlation between the asset the higher the volatility reduction



The graph above illustrates the evolution of the volatility of a portfolio when adding assets with the same volatility for 3 different level of correlation.

In Figure 14¹⁴, we rank the ten sectors according to their realised volatility over the period. We then create ten portfolios in which we invest in an increasing number of sectors according to their volatility. The first portfolio buys and holds the least volatile sector: consumer staples. The second portfolio invests each month in an equal weighted portfolio consisting of the two least volatile sectors. The last portfolio is an equal-weight portfolio rebalanced on a monthly basis.

The main difference between Figure 14 and Figure 13 is that assets being added to the portfolio do not have the same volatility as the previous ones but, in fact, a higher one. This leads to the pattern shown in Figure 14 which exhibits the volatility, at first, going down as the number of sectors increases, reaching a minimum before increasing due to the diversification effect being overpowered by the volatility of the additional sectors. This behaviour is very close to what was observed in Figure 12 indicating that the sectors exhibiting momentum are also, on average, the sectors exhibiting low volatility.



To confirm that this is the case, each month the sectors are ranked according to their momentum strength (1 for the sector with the strongest momentum and 10 for the weakest) and also according to their volatility (1 for the sector with the lowest 1-month volatility and 10 for the most volatile). Then we calculate the average volatility rank of the sector ranked first in momentum, then second and so on. Assuming no link between momentum and volatility, the distribution of these averages we expect to be flat.

However, in Figure 15¹⁵ we observe that the sectors exhibiting the least amount of momentum have the highest ranking in volatility which means that our momentum strategy results in excluding the most volatile sectors. Also, it is noteworthy that the sectors with the strongest momentum are also shown to exhibit relatively high volatility because of higher dispersion in returns while rallying. It was somewhat expected that both high and low momentum sectors exhibit high volatility.

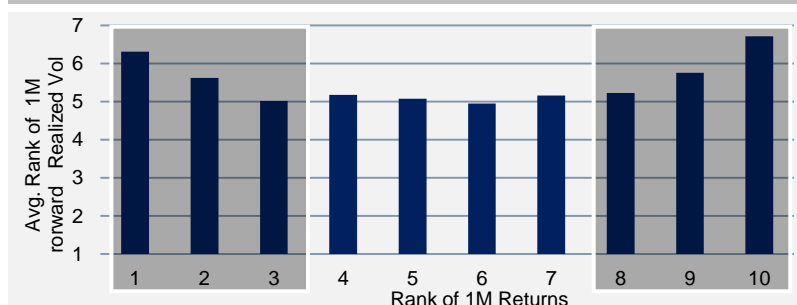
Overall, this analysis suggests that the least volatile sectors are in the middle of the momentum ranking and are therefore included in the strategy portfolios as we move from "N=3" to "N=7", explaining lesser volatility realised for these portfolios.

¹⁴ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Dec 2000 to Jul 2014. For volatility daily returns are used

¹⁵ Source: Deutsche Bank, Bloomberg. Based on calculations performed on an observation window ranging from Dec 2000 to Jul 2014. For volatility daily returns are used



Average Rank of 1M forward Realised Volatility according to Momentum Rank 15



4.5 Turnover Considerations

For any momentum strategy, turnover is an important consideration as transaction costs will create a drag on the returns realised. Turnover, as well as estimated transaction costs, have been illustrated, based on simulated data, in Figure 16¹⁶ and Figure 17¹⁶. It is observed that while the turnover for strategies with monthly rebalancing is higher, the monthly rebalanced strategies have delivered both higher return and Sharpe ratio as compared to the quarterly rebalancing strategies, indicating a successful utilization of momentum prevalent in the sectors based on this analysis.

Turnover of Strategies Rebalancing Monthly Sectors 16

Monthly Rebalance	Turnover One-way	IRR Gross	Transaction Cost incurred Per Annum ¹⁷	IRR Net
Look Back:1M , N=3	791%	18.8%	3.6%	15.2%
Look Back:1M , N=5	560%	16.6%	2.5%	14.1%
Look Back:1M , N=7	346%	16.2%	1.6%	14.6%
Look Back:3M , N=3	433%	16.8%	2.0%	14.8%
Look Back:3M , N=5	329%	14.4%	1.5%	12.9%
Look Back:3M , N=7	204%	14.4%	0.9%	13.5%
Look Back:6M , N=3	356%	14.0%	1.6%	12.5%
Look Back:6M , N=5	239%	13.8%	1.1%	12.7%
Look Back:6M , N=7	160%	14.3%	0.7%	13.5%
Equal Weight	33%	13.1%	0.1%	12.9%

Turnover of Strategies Rebalancing Quarterly 17

Monthly Rebalance	Turnover One-way	IRR Gross	Transaction Cost incurred Per Annum ¹⁶	IRR Net
Look Back:1M , N=3	293%	13.9%	1.3%	12.6%
Look Back:1M , N=5	229%	13.1%	1.0%	12.1%
Look Back:1M , N=7	132%	14.1%	0.6%	13.5%
Look Back:3M , N=3	279%	12.8%	1.2%	11.6%
Look Back:3M , N=5	201%	13.1%	0.9%	12.2%
Look Back:3M , N=7	119%	13.8%	0.5%	13.2%
Look Back:6M , N=3	212%	11.9%	0.9%	11.0%
Look Back:6M , N=5	149%	12.4%	0.6%	11.7%
Look Back:6M , N=7	95%	13.0%	0.4%	12.5%
Equal Weight	22%	13.2%	0.1%	13.1%

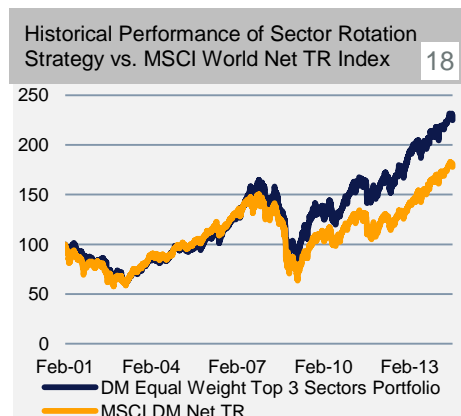
¹⁶ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Jul 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results. Transaction Cost incurred Per Annum is calculated as IRR Gross - IRR Net

¹⁷ This is a deemed to be a conservative estimate of the cost of rebalancing the basket taking into account the average bid-ask on each ETF (observed as of October 2014) as well as their average weights in the portfolio.



Passive Insights

5 A straightforward DM sector momentum strategy



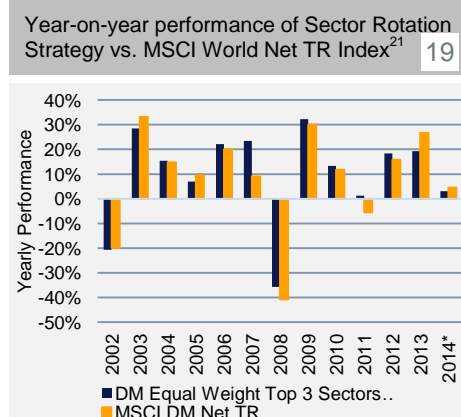
Following the results of the strategy using Emerging Markets sectors, we applied the same sector rotation methodology but this time in Developed Markets.

Hereafter, we look at the available sector indices in an ETF format (for more details on the selection process and the methodologies used please see the appendix).

	DM Equal Weight Top 3 Sectors Portfolio	MSCI DM Net TR
Returns	6.2%	4.4%
Volatility	16.1%	17.0%
Sharpe Ratio Rf=1.73%	0.27	0.15
Max. Draw-down	50.8%	57.8%

5.1 Strategy

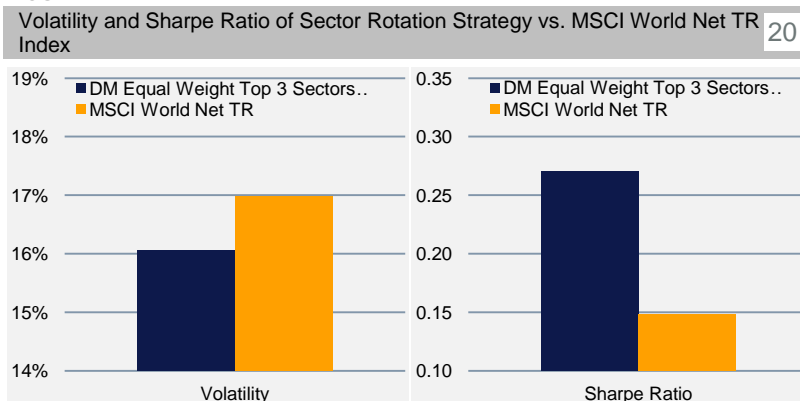
We consider the same strategy as above. It selects, every month, the three sectors with the highest performance over the last three months. Their weights are then distributed equally between them. This strategy is rebalanced on a monthly basis and a transaction cost of 0.20%¹⁸ is applied during rebalancing. Historical simulation period is from July 2001 to July 2014.



5.2 Simulated Results¹⁹

The historical simulation in Figure 18²⁰ shows a fairly strong outperformance of the DM Equal Weighted Top 3 Sectors Portfolio versus the MSCI Developed Markets Index. Below, we take a closer look at the results and, in particular, at the key parameters study, as was the case for the Emerging Market Strategy.

Figure 20¹⁶ shows an improved Sharpe ratio, based on this analysis, for the sector rotation strategy compared to the MSCI World TR Net Index.



¹⁸. This is deemed to be a conservative estimate of the cost of rebalancing the basket taking into account the average bid-ask on each ETF (observed as of October 2014) as well as their average weights in the portfolio.

¹⁹. Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Jul 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results

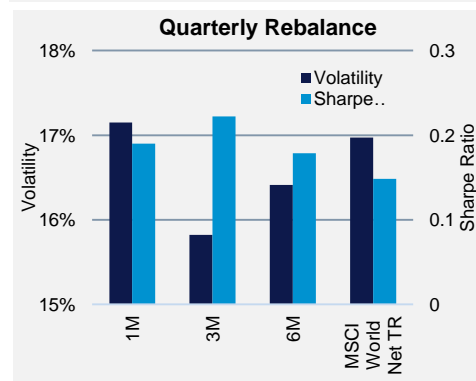
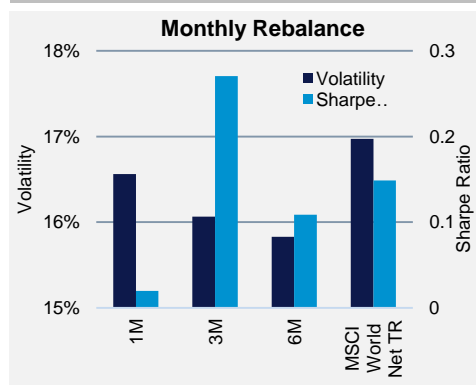
²⁰ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Feb 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results. For volatility daily returns are used. For risk free rate: ICE Libor USD Overnight rate is used.

²¹ Source: Deutsche Bank, Bloomberg. For 2014, performance till end of July is shown.

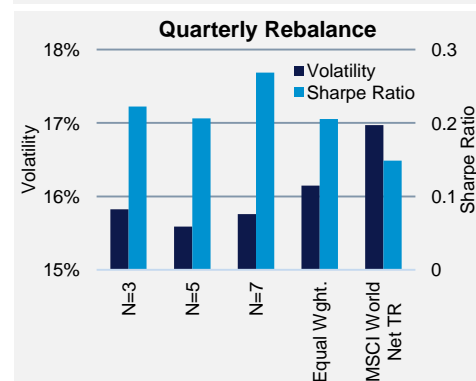
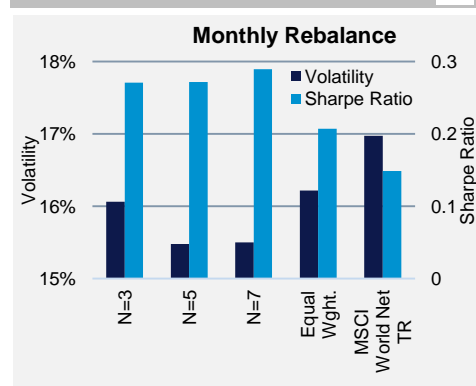


Passive Insights

Sharpe Ratio and Volatility of Monthly and Quarterly Rebalance for top three sectors over various lookback periods 21



Sharpe and Volatility for Monthly and Quarterly Rebal for top N sectors over a lookback period of 3-months 22



5.3 Key Parameters Analysis

We ascertain the stability of the strategy performance to key parameter changes. The key parameters here are:

- (a) Observation period (1M, 3M, 6M);
- (b) Rebalancing frequency (monthly, quarterly);
- (c) Number of sectors selected (3, 5, 7, 10 i.e. equal weight).

Based on this analysis, it appears, in Figure 21¹⁶, that the results of the momentum strategy in the DM universe are less resilient to parameter changes than in the EM universe. This is a seemingly logical consequence to the reduced strength of the momentum.

The strategy is shown to exhibit a lower volatility in most configurations as compared to the MSCI World but to a lesser extent than in EM.

When looking at an increasing number of sectors used in the portfolios (Figure 22¹⁶), we observe the same volatility pattern as in the analysis of EM sectors, i.e. a low volatility of the Top 3 Sector portfolio (even compared to the EW) with even lower volatility when the number of sector increase. This is in line with our findings in the EM universe.

6 Conclusions

In this paper, we explored the concepts and reasons for sector rotation and conducted a full analysis of a momentum based rotation strategy. Results of this analysis have shown that:

- Sector performances are dispersed, on the basis of simulated results, which place them as good potential candidates for rotation strategies. Sector allocation may therefore be a valuable avenue when investing in global equities.
- Momentum-driven sector rotation strategies exhibit a higher risk adjusted return as compared to market cap weighted global stock indices, on the basis of simulated results.
- Results indeed show that the ETF-based EM sector rotation portfolio would have demonstrated, on a simulated basis, a Sharpe Ratio 0.73 versus 0.52 for the MSCI EM Index and a CAGR of 14.8% versus 12.2% for the MSCI EM Index
- Results indeed show that the ETF-based DM sector rotation portfolio would have demonstrated, on a simulated basis, a Sharpe Ratio 0.27 versus 0.15 for the MSCI DM Index and a CAGR of 6.2% versus 4.4% for the MSCI DM Index.
- Sector ETFs may enable the implementation of such a momentum strategy in a straightforward, cheap and liquid way.

7 Passive Insights Series

- Passive Insights #1 – Smart Beta: building low vol portfolios of ETFs
- Passive Insights #2 – Fundamental Scoring for Fixed Income
- Passive Insights #3 – Equal Weighted Portfolios of ETFs
- Passive Insights #4 – Strategic Beta: GDP-Weighted All Countries Portfolio with ETFs



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Appendix 1: ETF Mapping and Treatment

In this study, we focus on the universe of ETFs providing exposure to sectors of the MSCI Emerging Market Index (“EM Index”) and MSCI Developed Market Index (“DM Index”)

Hereafter, we look at the available sector indices in an ETF format. We mapped the sector Indices to the available ETFs (retaining only those ETFs with an available USD share class) in Europe, as well as globally.

Developed and Emerging Markets Sectors

DeAWM’s ETF range provides full coverage of both Developed and Emerging Markets Sectors. To our knowledge, and as far as physical ETFs are concerned, there is no full range of physical ETFs providing exposure to each of the MSCI Emerging Market Sectors.

	Physical ETFs		Swap based ETFs	
	Global ex Europe	Europe	Global ex Europe	Europe
DM CONSUMER DISCRETIONARY	✓			✓
DM CONSUMER STAPLES	✓			✓
DM ENERGY	✓			✓
DM FINANCIALS	✓			✓
DM HEALTH CARE	✓			✓
DM INDUSTRIALS	✓			✓
DM INFORMATION TECHNOLOGY	✓			✓
DM MATERIALS	✓			✓
DM TELECOMM SERVICES	✓			✓
DM UTILITIES	✓			✓

	Physical ETFs		Swap based ETFs	
	Global ex Europe	Europe	Global ex Europe	Europe
EM CONSUMER DISCRETIONARY	✓			✓
EM CONSUMER STAPLES				✓
EM ENERGY	✓			✓
EM FINANCIALS	✓			✓
EM HEALTH CARE				✓
EM INDUSTRIALS				✓
EM INFORMATION TECHNOLOGY				✓
EM MATERIALS	✓			✓
EM TELECOM SERVICES				✓
EM UTILITIES				✓

A challenge faced in this analysis was the relatively short track-record for the ETFs contemplated for inclusion in the portfolio. To overcome this issue we considered the relevant sector Net Total Return Indices (i.e. total return index with withholding tax assumption) as proxies for the respective ETFs. Furthermore, a hypothetical replication cost - in line with the Total Expense Ratio (TER) of the ETF related to that index - was deducted from each index as well as an estimated portfolio rebalancing cost of 20bps²².

²² This is deemed to be a conservative estimate of the cost of rebalancing the basket taking into account the average bid-ask on each ETF (observed as of October 2014) as well as their average weights in the portfolio.



Appendix 2: Additional Figures and Tables related to DM

Below shows the relevant analysis conducted for the developed market sectors universe. As discussed above, these results are similar to the results found for the Emerging Markets Universe.

Yearly performance of DM Sectors shows relative dispersion²³

Yearly performance of Developed Market Sectors											23
Performance during year	Sector Performance: Highest to Lowest Returns										
2001	ML -5.1%	EG -7.2%	CS -8.4%	CD -10.2%	HC -13.3%	IND -15.9%	FIN -16.9%	ULI -22.4%	TS -25.5%	IT -29.6%	
2002	CS -3.2%	ML -4.6%	EG -6.4%	ULI -16.1%	FIN -16.4%	HC -18.8%	IND -22.5%	CD -22.5%	TS -29.9%	IT -38.6%	
2003	IT 48.3%	ML 44.9%	FIN 38.8%	IND 38.1%	CD 37.3%	ULI 28.2%	EG 25.9%	TS 25.2%	HC 19.5%	CS 16.8%	
2004	ULI 28.4%	EG 28.1%	IND 19.3%	ML 17.7%	FIN 17.4%	TS 17.4%	CD 14.9%	CS 11.8%	HC 6.6%	IT 2.5%	
2005	EG 28.7%	ML 19.2%	ULI 13.1%	IND 11.9%	FIN 11.4%	HC 9.9%	CS 5.8%	IT 4.8%	CD 1.3%	TS -9.9%	
2006	ULI 35.8%	TS 31.9%	ML 28.7%	FIN 23.7%	CD 20.9%	CS 20.1%	IND 18.5%	EG 17.9%	HC 10.5%	IT 9.3%	
2007	ML 33.2%	EG 29.8%	ULI 21.5%	TS 21.5%	CS 18.3%	IND 15.3%	IT 15.1%	HC 3.9%	CD -3.2%	FIN -8.3%	
2008	HC -21.5%	CS -23.3%	ULI -29.4%	TS -33.3%	EG -38.1%	CD -41.7%	IND -43.1%	IT -43.9%	ML -50.1%	FIN -54.4%	
2009	ML 61.5%	IT 52.4%	CD 39.6%	FIN 31.1%	IND 26.7%	EG 26.2%	CS 21.7%	HC 18.9%	TS 13.7%	ULI 6.2%	
2010	CD 24.6%	IND 23.3%	ML 21.3%	CS 12.7%	EG 11.9%	IT 10.5%	TS 10.2%	FIN 4.6%	HC 2.4%	ULI -1.3%	
2011	HC 9.5%	CS 8.6%	TS 8.8%	EG 2.2%	IT -2.5%	ULI -3.3%	CD -4.7%	IND -8.2%	FIN -18.5%	ML -19.8%	
2012	FIN 29.4%	CD 24.3%	HC 17.5%	IND 16.1%	CS 13.4%	IT 13.3%	ML 11.3%	TS 6.4%	EG 1.9%	ULI 1.8%	
2013	CD 39.2%	HC 36.3%	IND 32.1%	TS 31.2%	IT 28.7%	FIN 27.3%	CS 21.3%	EG 18.1%	ULI 12.6%	ML 3.4%	

Legend	
CD	Consumer Discretionary (Cyclical)
CS	Consumer Staples (Defensive)
EG	Energy (Defensive)
FIN	Financials (Cyclical)
HC	Healthcare (Defensive)
IND	Industrials (Cyclical)
IT	Information Technology (Cyclical)
ML	Materials (Cyclical)
TS	Telecommunication Services (Defensive)
ULI	Utilities (Defensive)

Inter-sector Correlation is low

Correlation between Total Returns of individual DM Sectors ²⁴											24
	Cons. Disc.	Cons. Staples	Energy	Fin.	Healthcare	Industrials	I.T.	Materials	Telecom	Utilities	
Cons. Disc.	1.00										
Cons. Staples	0.72	1.00									
Energy	0.65	0.68	1.00								
Fin.	0.85	0.73	0.70	1.00							
Healthcare	0.68	0.80	0.65	0.69	1.00						
Industrials	0.91	0.75	0.73	0.88	0.71	1.00					
I.T.	0.78	0.50	0.52	0.67	0.53	0.75	1.00				
Materials	0.77	0.68	0.77	0.78	0.60	0.86	0.57	1.00			
Telecom	0.74	0.67	0.61	0.74	0.64	0.73	0.66	0.66	1.00		
Utilities	0.66	0.77	0.74	0.70	0.70	0.72	0.49	0.71	0.68	1.00	

Correlation between Excess Returns of individual DM Sectors ²⁵											25
	Cons. Disc.	Cons. Staples	Energy	Fin.	Healthcare	Industrials	I.T.	Materials	Telecom	Utilities	
Cons. Disc.	1.00										
Cons. Staples	-0.01	1.00									
Energy	-0.39	-0.02	1.00								
Fin.	-0.11	-0.34	-0.14	1.00							
Healthcare	-0.12	0.63	-0.04	-0.35	1.00						
Industrials	0.26	-0.12	-0.17	0.04	-0.20	1.00					
I.T.	0.13	-0.45	-0.34	-0.24	-0.33	-0.08	1.00				
Materials	-0.09	-0.15	0.28	0.02	-0.29	0.29	-0.34	1.00			
Telecom	-0.07	0.12	-0.17	-0.17	0.07	-0.26	-0.04	-0.17	1.00		
Utilities	-0.19	0.56	0.19	-0.29	0.41	-0.15	-0.44	0.00	0.16	1.00	

²³ Source: Deutsche Bank, Bloomberg. Yearly performance of ten MSCI World Net TR Sector Indices.

²⁴ Source: Deutsche Bank, Bloomberg. Correlation using daily returns for the period: Jul 2000 to Jul 2014.

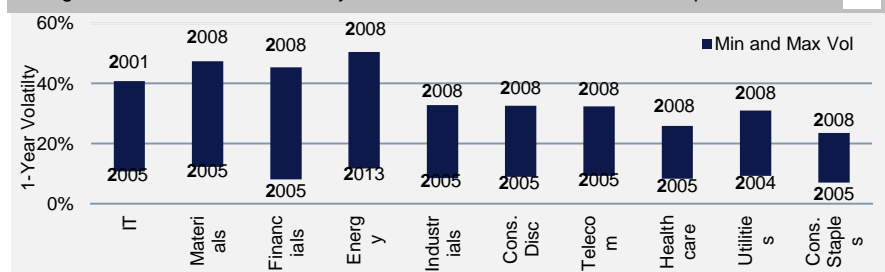
²⁵ Source: Deutsche Bank, Bloomberg. Correlation using daily sector excess returns for the period: Jul 2000 to Jul 2014. Sector Excess Returns: DM Specific Sector Returns minus MSCI World Net TR Returns



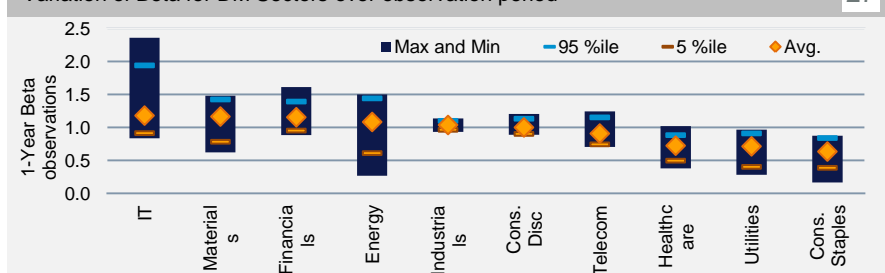
Passive Insights

Cyclical vs Defensive sectors

Range of 1-Year Realised Volatility for DM Sectors observed in various periods²⁶ 26



Variation of Beta for DM Sectors over observation period²⁷ 27



Turnover Considerations²⁸

Turnover of DM Strategies Rebalancing Monthly Sectors 28

Monthly Rebalance	Turnover One-way	IRR Gross	Transaction Cost incurred Per Annum ¹⁷	IRR Net
Look Back: 1M , N=3	827%	5.6%	3.4%	2.2%
Look Back: 1M , N=5	590%	6.1%	2.5%	3.7%
Look Back: 1M , N=7	363%	6.1%	1.5%	4.6%
Look Back: 3M , N=3	453%	8.1%	1.9%	6.2%
Look Back: 3M , N=5	307%	7.3%	1.3%	6.0%
Look Back: 3M , N=7	201%	7.2%	0.9%	6.3%
Look Back: 6M , N=3	349%	5.0%	1.4%	3.6%
Look Back: 6M , N=5	250%	5.4%	1.0%	4.4%
Look Back: 6M , N=7	157%	5.9%	0.7%	5.2%
Equal Weight	25%	5.3%	0.1%	5.2%

Turnover of DM Strategies Rebalancing Quarterly 29

Monthly Rebalance	Turnover One-way	IRR Gross	Transaction Cost incurred Per Annum ¹⁷	IRR Net
Look Back: 1M , N=3	287%	6.3%	1.2%	5.1%
Look Back: 1M , N=5	209%	6.2%	0.9%	5.4%
Look Back: 1M , N=7	134%	5.8%	0.5%	5.2%
Look Back: 3M , N=3	274%	6.5%	1.1%	5.3%
Look Back: 3M , N=5	198%	5.9%	0.8%	5.0%
Look Back: 3M , N=7	112%	6.5%	0.5%	6.1%
Look Back: 6M , N=3	195%	5.6%	0.8%	4.8%
Look Back: 6M , N=5	142%	5.4%	0.6%	4.8%
Look Back: 6M , N=7	92%	5.6%	0.4%	5.2%
Equal Weight	14%	5.2%	0.1%	5.1%

²⁶ Source: Deutsche Bank, Bloomberg. 1-Year volatility using daily returns is calculated at the end of each year. Observation Period: Dec 2000 to Dec 2013.

²⁷ Source: Deutsche Bank, Bloomberg. 1-Year beta using daily returns for the period: Jul 2000 to Jul 2014. Proxy for market: MSCI World Net TR Index. Avg. Beta is calculated with monthly observations of 1-Year beta.

²⁸ Source: Deutsche Bank, Bloomberg. Based on simulations performed on an observation window ranging from Feb 2001 to Jul 2014. Past Performance, actual or simulated, is not indicative of future results. Transaction Cost incurred Per Annum is calculated as IRR Gross - IRR Net



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- The value of an investment in ETFs may go down as well as up and past performance is not a reliable indicator of future performance.
- Investment in ETFs involve numerous risks including among others, general market risks relating to the relevant underlying index, credit risks of the counterparties used by ETFs when entering into OTC derivative transactions, including credit risks on the provider of index swaps utilized in the case of swap-based ETFs, exchange rate risks, interest rate risks, inflationary risks, liquidity risks and legal and regulatory risks.
- ETFs shares may be denominated in a currency different to that of the traded currency on the stock exchange in which case exchange rate fluctuations may have a negative effect on the returns of the ETF. The value of any investment involving exposure to foreign currencies can be affected by exchange rate movements.
- There may be tracking difference between the ETF and the underlying index due to the impact of annual fund management fees. The returns on the ETF may not be directly comparable to the returns achieved by direct investment in the underlying assets of the ETF or the underlying index.
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- The price of ETFs traded on the secondary market will depend, on market supply and demand, movements in the value of the ETFs as well as other factors such as prevailing financial market, corporate, economic and political conditions. However, in certain abnormal market conditions liquidity may be affected.
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- DB Affiliates significant holdings: Investors should be aware that Deutsche Bank or its affiliates ("DB Affiliates") may from time to time own interests in any individual db X-trackers UCITS ETF which may represent a significant amount or proportion of the overall investor holdings in the relevant db X-trackers UCITS ETF. Investors should consider what possible impact such holdings by DB Affiliates may have on them. For example, DB Affiliates may like any other Shareholder ask for the redemption of all or part of their Shares of any Class of the relevant db X-trackers UCITS ETF in accordance with the provisions of this Prospectus which could result in (a) a reduction in the Net Asset Value of the relevant db X-trackers UCITS ETF to below the Minimum Net Asset Value which might result in the Board of Directors deciding to close the db X-trackers UCITS ETF and compulsorily redeem all the Shares relating to the db X-trackers UCITS ETF or (b) an increase in the holding proportion of the other Shareholders in the db X-trackers UCITS ETF beyond those allowed by laws or internal guidelines applicable to such Shareholder
- For further information regarding risk factors, please refer to the risk factors section of the prospectus, or the Key Investor Information Document of the relevant ETF you are considering investing in.
- Please consult your financial advisor before you invest in an ETF since not all ETFs are suitable for all investors.

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