

Active Investment Management -

Assessing Return on Activity

*An Exploration of the Levels of Active Management and the Returns
of a Global ETF Trading System*

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Abstract

Investment managers of today face a number of unique challenges. Turmoil in the financial markets during the last year and a half has further underscored the need for active management. Even portfolios of diversified asset classes have exhibited historically large drawdowns that must be actively managed. Investment managers also face a number of challenges in their practices. There are many demands on their time - including the acquisition of and servicing of clients. Finding the most productive level of activity for active investment management becomes a critical factor in the success and growth of the practice and in the success of its clients. This can be particularly true for small, growing advisory firms.

Three dimensions can be generalized in an exploration of the process of active management and its application to trading systems -

- 1.** Issue selection
- 2.** Market timing
- 3.** Position sizing and risk control

With these major areas in mind, the following questions can then be posed -

- How often is it productive to rotate and upgrade issues in portfolio?
- Also, how frequently should a portfolio be hedged or taken to cash or other investments in a negative market environment?
- And, what sort of risk control should be applied to the investment program to handle unforeseen events?

Although market timing has been at the forefront of recent concerns due to the global recession, the evolving financial markets have also demonstrated the need for attention to issue selection. In fact, attention to selection can serve two major purposes. In addition to driving performance, it can also insulate the portfolio against less than perfect timing.

The primary question relating to issue selection is one of activity. What is the optimal level of active management that allows the manager to devote time to other activities of the advisory practice? This question relates not only to the level of activity in issue rotation and upgrading. It also impacts the number of issues to hold in the portfolio, since this will directly affect the number of trades.. The answers to these questions also relate to the nature of the portfolio, number of asset classes, and level of aggressiveness, but generally apply to all active programs.

This paper will explore the levels of active management and the associated returns in two global trading systems –

- A portfolio of domestic asset classes and broad international index ETF's – 9 issues
- A portfolio of domestic asset classes and specific country ETF's – 26 issues

Relative to the systems, two questions will be explored in detail -

- Does a greater number of issues and greater specificity of those issues yield higher returns
- Does more frequent rotation yield higher results

These systems will be used as examples to illustrate the optimal point of activity, but more importantly, this paper will attempt to show that it may be possible to rotate and upgrade less frequently and on a scheduled basis. Such a finding could simplify the issue selection and rotation activities of an aggressive investment program in an advisory practice. It would also be important to the active manager in order to enable fewer changes to selected issues, and the ability to schedule the analysis on fixed dates rather than checking for changes daily.

As a second step, very basic timing will be applied to the selection result. This paper will investigate the improvement resulting from applying a simple timing system to see if a small number of trades can significantly improve results.

The third dimension of active management, position sizing and risk control, will not be investigated in depth in this paper. Its applicability to this example is limited due to the focused nature

of the presented selection and timing systems. Note will be made, though, of future possibilities, however remote, that may require additional attention to this area.

Lastly, note that this paper will also make frequent use of charts, in addition to the use of summary tables. These are mixed with the narrative rather than in an appendix in order to facilitate the reading of this paper. The primary reason for the use of these charts is that experience has shown that patterns and additional insights can be gained from the graphical presentation of time-varying information. Tabular snapshots are useful, but represent points in time, and often, important information can be obscured or overlooked in a numerical presentation.

Global Trading System Overview

The last several years has seen the growth of many international investment products. This has included both managed funds and exchange traded funds. ETF's, in particular, have become increasingly popular due to the perceived advantages of real-time pricing and low trading costs. Although there can be some logistical problems associated with ETF trade execution in an advisory practice, particularly one with small accounts, the attractiveness of ETF's continues to grow.

This relatively recent growth of ETF's is a double-edged sword. It has certainly provided liquidity and wealth of information and analysis. Although many ETF's are tied to long-existing indices, though, some are not. This makes longer term backtesting problematic. This can be an issue, in particular, with ETF's related to emerging markets.

So, from a pragmatic viewpoint, this poses a problem for a system designer. Should a designer consider systems based on ETF's that have a longer history, or systems that can be directly tied to an index with a longer history? Or, should the designer accept the use of ETF's that have been through bull and bear markets, and design appropriate risk control into the system in order to deal with abnormal performance? There is, of course, no correct answer. On balance, I would favor the latter alternative, and that is the basis of this paper.

In this example, two trading systems are contrasted –

- AB_SGM1A - A single position rotation among 6 domestic styles plus international developed markets, emerging markets and Latin America.
- AB_WEM3A - A three position rotation among country ETF's plus domestic style and broad index ETF's

Within the context of these two systems, we will also look at the results specific to various rotation frequencies to determine is more frequent rotation yields additional return. These frequencies are –

- Continuous
- Weekly

- Semi-monthly
- Monthly

There are a number of constant parameters in these tests. They are as follows –

- The backtest period is from 2/1/2001 to 3/12/2010.
- For calendar based rotations, these will occur on the day after the start of the period

Note that the start date is a compromise of sorts. It allows the domestic ETF's to yield early results.

The goals are to determine if there is any advantage to holding country funds vs. international index funds, and also to determine the most effective rotational period.

Trading System Backtesting Methodology

Before presenting the results of the trading system analysis, it would be appropriate to explain the methodology used in the rotational trading system and in the analysis. This is important in order to allow other researchers to test and build on these results. The trading system is based on a modified Sharpe score and ranking. This score and rank then drives the rotation based on the rotational frequencies. There are two refinements to a basic Sharpe score and ranking –

1. The Sharpe ratio is adjusted by a return factor based on the annualized return over a lookback period.
2. The final score is smoothed via an average in order to reduce “ranking noise”.

Both of these refinements will be explained in detail below. In addition, a unique form of compounded annual return comparison will be used –

3. Reverse CAR will be charted to allow focus on both recent comparisons and longer term trends in returns

1. Scoring adjustment

The scoring system that is used in these tests is based on a Sharpe Ratio with a lookback period of 126 days. The Sharpe ratio produces a risk-adjusted return that balances the investment return minus the risk free rate against the standard deviation of the returns. This metric is well-understood and works well for diversified portfolios. It can also be used for non-diversified portfolios, but if a slightly more aggressive system desired, a momentum scoring adjustment can be used. This adjustment is also useful if it is anticipated that equity timing or a timing overlay will be utilized. In effect, more volatility can be “bought” in bull markets.

This adjustment can take many forms that range from simple to complex. For the purposes of this paper, a simple approach will be taken. The adjustment will be calculated in two steps. First an annualized return factor will be derived for the lookback period. In this case, the adjustment lookback is 63 days. Thus, in annualizing a return factor over that period, it is raised to the power of $(252/63)$ or four (4).

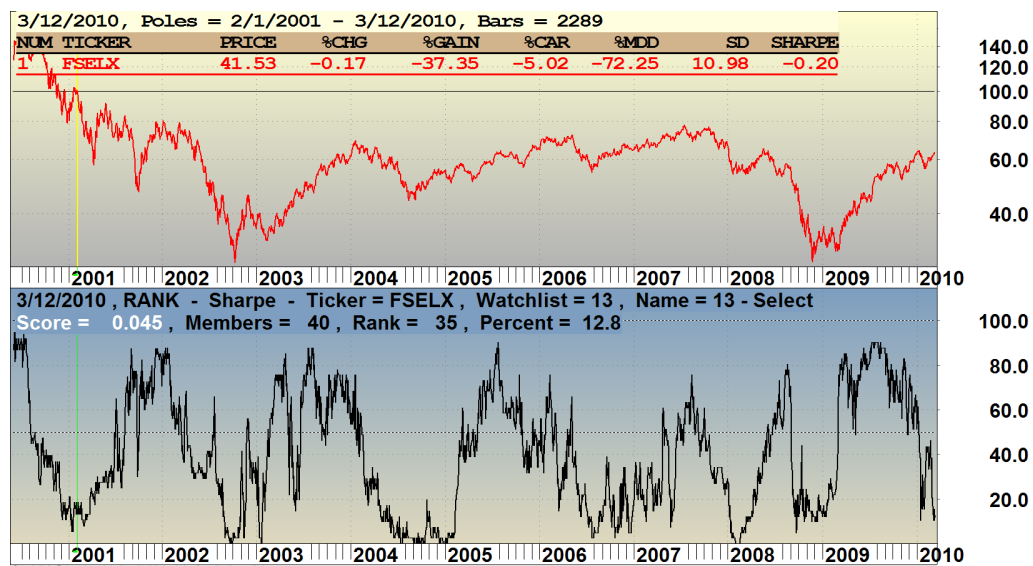
This adjustment is further modified based on the sign of the Sharpe ratio. A brief explanation will explain the reasoning. In principle, adjustment factors > 1 indicate a period gain and it is desired to “improve” the score. On the other hand, adjustment factors < 1 indicate a period loss and it is desired to “penalize” the score. There are 4 possibilities –

- Score positive, adjustment factor > 1 , the multiplication result is used and the score is increased.
- Score positive, adjustment factor < 1 , the multiplication result is used and the score is reduced.
- Score negative, adjustment factor > 1 , a reduction in the absolute value of the negative score is desired, so $(2 - \text{adjustment factor})$ is used. For example $-1.0 * (2 - 1.2) = -0.8$.
- Score negative, adjustment factor < 1 – an increase in the absolute value of the negative score is desired, so $(2 - \text{adjustment factor})$ is used. For example $-1.0 * (2 - 0.8) = -1.2$

2. Rank smoothing

There are many ways to score issue performance for the purpose of selection and upgrading. It is beyond the scope of this paper to explore the merits of the ones in common use and the effects on optimization, walk-forward analysis, and the sensitivity analysis of system parameters. For simplicity, a Sharpe ratio of 126 trading days (one-half year) has been chosen. The main augmentation is that it is adjusted by a CAR factor representing the annualized return of the issue over a separate calculation window. This allows, in effect, the recent activity of the issue to be factored in, and provides the ability to weight recent performance. There are many approaches that can be utilized to achieve this effect. Some are much more complex – such as weighted rankings of several performance metrics, but this simplified approach has been shown by extensive testing to be effective.

As an aside, though, note that some care must be taken in calculating a score for ranking purposes. For example, let's consider the Fidelity Selects. Although it is not known for out-performance, it is used to illustrate this point primarily because it is a well-known list of sector funds with a long history, and it is a list of 42 funds. On a 0-100 percent ranking scale, that means, that a change of one position in rank has a percentage change of a little less than 2.5%. Consider the following charts –



The top pane is the return of Fidelity Select Electronics from January 2001 through March 2010. The bottom pane is the ranking of the 126 day Sharpe ratio of FSELX in the Fidelity Selects. This ranking is normalized to a percentage between 0 and 100. The important take-away is the inherent “noise” in the ranking – even during periods of significant bull moves such as 2003 and 2009. If this “noise” is not filtered out, it will result in changes in a fund rotation trading system that may be unneeded, costly, and might negatively impact performance.

There are two approaches to filtering this ranking “noise”. One is to filter the score via straightforward moving average techniques. The other is to filter the resulting ranking. It is beyond the scope of this paper to explore the merits in detail, but experiments have shown that it is sufficient in most all cases to apply a low-lag moving average to the score – which is Sharpe in this case.

3. Compounded Annual Return

The Issues -

With any system, most managers would like to see the results stated as a compounded annual return, also known as CAR. Simply stated, this is the compounded rate at which an initial investment grows to a final value over a given period. If the CAR is not stated, or some other metric such as “average annual return” is utilized, it can and should be cause for caution and concern.

Even when a single compounded return is stated, many system developers will pick the start date of the analysis to be a significant dip in the equity curve as the starting point. This gamesmanship is understandable, as it optimizes the final CAR number. Although accurate, it doesn't show the expected value of CAR.

The first alternative is to utilize the desired start date and show the compounded annual return at every date subsequent to the start date. This is known as *forward CAR*. Space will prevent a detailed exposition of this technique, but note that the primary drawback is that, over a longer period, recent returns are muted by the longer term calculations and resulting convergence to a final value.

Another alternative is to show a *rolling CAR* of some period, one year for example. This can be done as a graph, but will have significant peaks and valleys that correspond to market action. Even with equity timing, there is significant variation in such a representation. And, also from a business perspective, most managers would like to stress the long term performance of their programs.

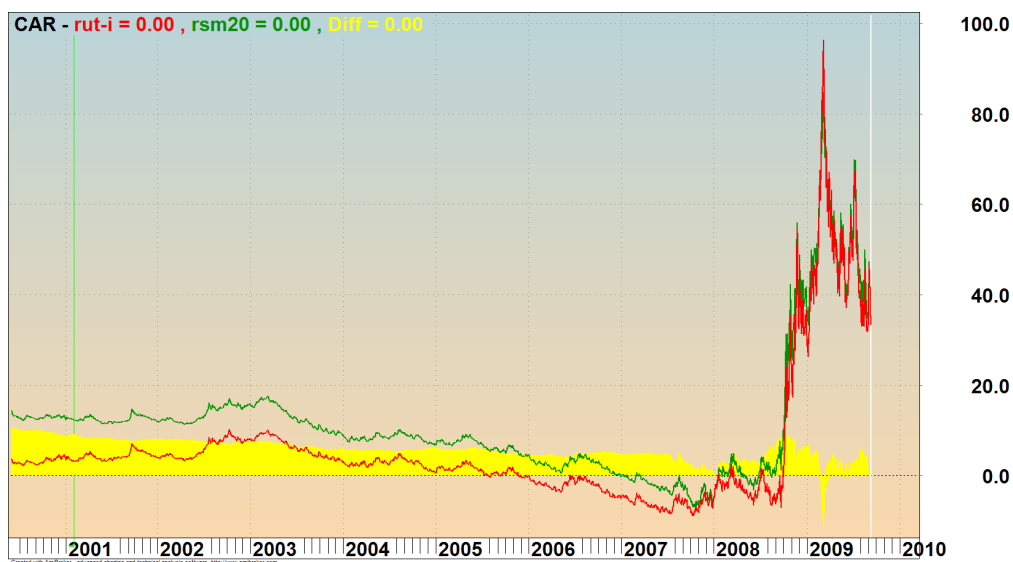
So, the issue is how to represent this compounded annual return, over varying periods. One solution that is in common use is to state 1, 3, and 5 year compounded returns. This is certainly fine at a minimum, but can often mask dips and variations in the CAR.

One way to overcome some of the issues mentioned in this section is to introduce the idea of a *reverse CAR*.

Reverse Compounded Annual Return -

This metric, known as reverse CAR, is calculated by setting the end date to the current date, and deriving the compounded annual return of the gain from every prior date to the end date. This, in effect, walks in reverse from the present, and calculates CAR at each date in the past. As a practical matter, the most recent “N” days are masked due to the varying nature of the annualized value of the short-period return. The advantage of this technique, though, is that it highlights historical performance, as well as the recent performance – which is what tends to be the natural focus of comparison.

Here is an example of this technique when applied to an analysis of a basket of 20 top-performing small-cap funds compared to the Russell 2000 (dividend adjusted).



This is primarily shown as a reference for the technique, but it also demonstrates a couple of interesting points. The green line represents the reverse CAR of the top 20 small-cap funds rotated monthly from a universe of no-load, small-cap funds. The red line represents the dividend-adjusted Russell 2000. The yellow histogram represents the difference. The large variation in computed CAR

during the last 15 months is mainly a byproduct of the financial problems of late 2008 and the subsequent up move in the equity markets.

There are a number of items of note that can be gleaned from this graph. Two will be briefly review –

- Note that the advantage of managed funds has been narrowing over time. This can be seen by the generally declining spread between the green and the red line. This is also represented by the yellow histogram. This “declining Alpha” is worthy of a detailed analysis, but for now, it is enough to note that by 2008 the advantage was significantly less.
- Performance during the last year has shown a small advantage to managed funds, but probably not enough to justify the limitations and restrictions that are generally associated with these funds – particular during such a strong rebound.

Global Trading System Results

The list of fund used in the AB_SGM1A rotation is as follows. The backtest has been run over the designated period with 1 position.

- IWD - Russell 1000 Value
- IWF - Russell 1000 Growth
- IWS - Russell Mid-Cap Value
- IWP - Russell Mid-Cap Growth
- IWN - Russell 2000 Value
- IWO - Russell 2000 Growth
- EEM - MSCI Emerging Markets
- EFA - MSCI EAFE Markets
- ILF - Latin America

The results of this backtest are listed below and the trading system details for the monthly frequency of rotation are listed in APPENDIX A.

	Trades	CAR	MDD	Std. Dev.	Sharpe
Daily	150	15.1	-53.05	9.45	0.45
Weekly	96	14.73	-51.19	9.44	0.47
Semi-Monthly	64	18.49	-56.97	9.04	0.52
Monthly	40	18.29	-57.41	8.59	0.53
Quarterly	18	16.05	-71.58	8.81	0.53

The monthly result has been highlighter and appears to be the best when all factors are considered.

Now, to show the effect of holding 3 country funds the following list was used for the AB_WEM3A system. It is composed of the 6 domestic style ETF's plus 20 country funds. The backtest has been run over the designated period with 3 positions –

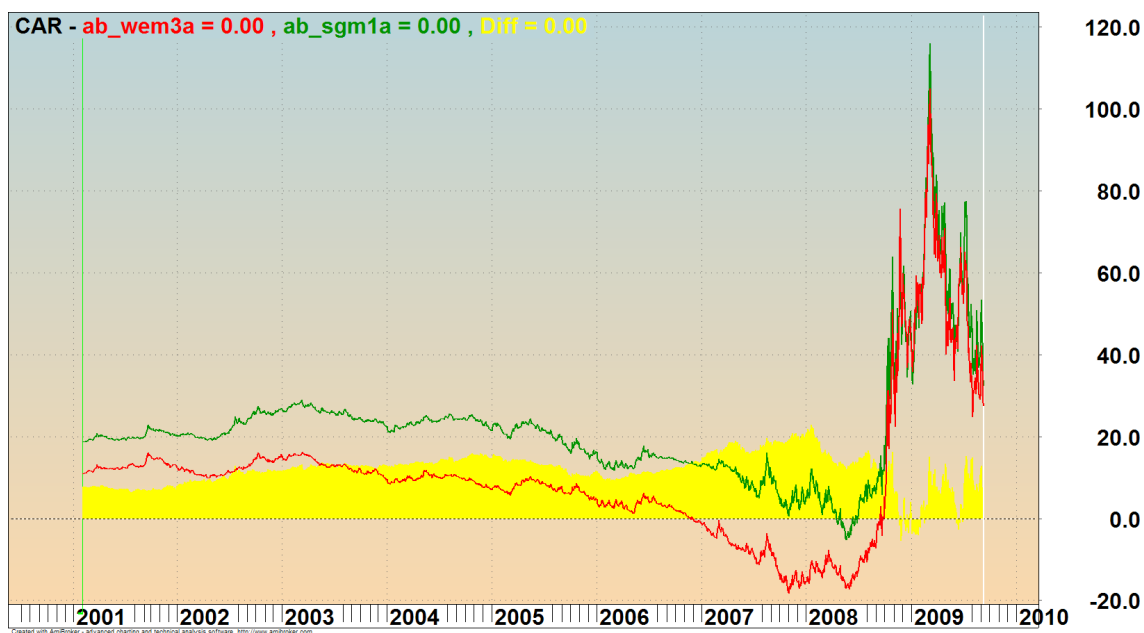
- IWD - Russell 1000 Value
- IWF - Russell 1000 Growth
- IWS - Russell Mid-Cap Value
- IWP - Russell Mid-Cap Growth
- IWN - Russell 2000 Value
- IWO - Russell 2000 Growth
- EWA - Australia
- EWC - Canada
- EWD - Sweden
- EWG - Germany
- EWH - Hong Kong
- EWI - Italy
- EWJ - Japan
- EWK - Belgium
- EWL - Switzerland
- EWM - Malaysia
- EWN - Netherlands
- EWO - Austria
- EWP - Spain
- EWQ - France
- EWS - Singapore
- EWT - Taiwan
- EWU - United Kingdom
- EWW - Mexico
- EWY - South Korea
- EWZ - Brazil

The results of the backtests are listed below, and again, the monthly rotation appears to be the best -

	Trades	CAR	MDD	Std. Dev.	Sharpe
Daily	624	6.41	-67.85	8.64	0.16
Weekly	337	9.71	-67.71	8.72	0.27
Semi-Monthly	221	10.96	-66.21	8.57	0.30
Monthly	140	10.90	-69.93	8.53	0.32
Quarterly	73	9.64	-69.57	8.58	0.31

Finally, comparing the monthly results from both systems, it can be seen that except for very short periods in late 2008 and early 2009, the advantage goes to the first rotation which holds 1 ETF and trades much less frequently. In the following chart, which represents the monthly results, the green

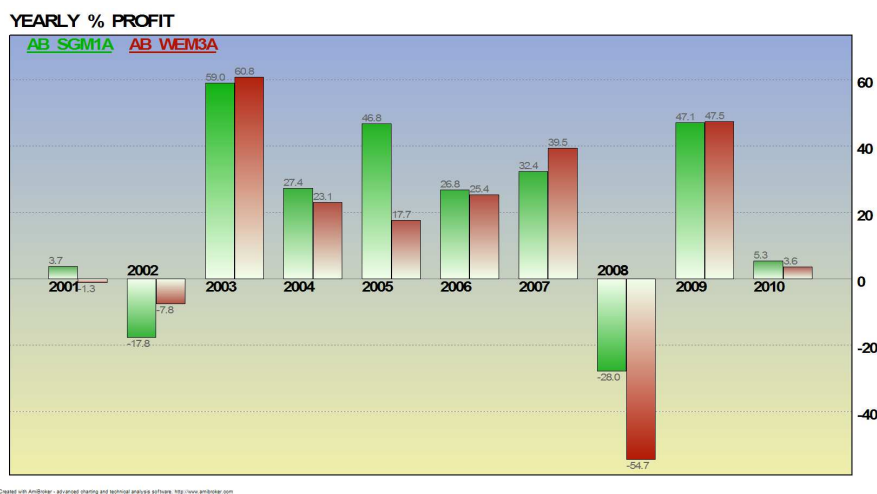
line is the return of the first system, the red line is the return of the second system, and the yellow histogram is the difference between the two.



In tabular form, this comparison can be seen as –

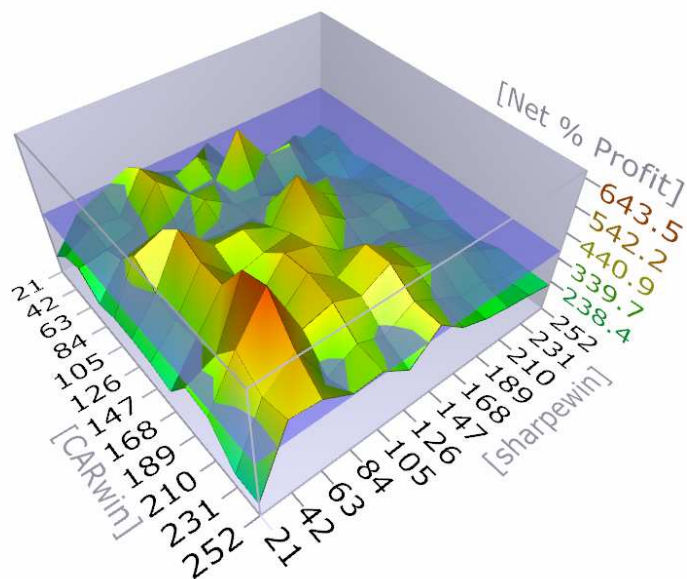
	Trades	CAR	MDD	Std. Dev.	Sharpe
AB_SGM1A	40	18.29	-57.41	8.59	0.53
AB_WEM3A	140	10.93	-69.57	8.58	0.31

For a more traditional view of returns by here, reference the following chart –



A Note on Optimization in the Selection Process

Virtually every system has parameters that can be optimized. The discussion of degree of fit and optimization is beyond the scope of this paper, but a brief look at the issue is in order. In this rotational system, the primary parameters are related to the scoring algorithm – the Sharpe Ratio and the scoring adjustment windows. One way in which to get a sense of how robust a system might be in the future is to look at the sensitivity of the primary parameters. Ideally, this would be done in addition to a complete walk-forward analysis. This will not be possible within the constraints of this paper, but we can glean important information from the following 3D chart of the Sharpe and adjustment window. With a SharpeWin window of 126 and a CARwin adjustment window of 63, we can see that those points are in the valley between surrounding peaks. This means that peaks that would maximize the profit have NOT been chosen.



Equity Timing

A number of commercial system vendors, and also some advisors, attempt to include cash or near-cash issues in the rotation in order to handle bear markets. This technique sounds initially attractive, but can prove less so in practice. The rotational algorithms can be slow to pick up the downturn, and delay in rotating to the near-cash investments. In addition, this delay impacts the return when a rebound occurs, as the algorithms can be slow to come out of near-cash investments. The end result is that the downturn is “muted”, but not dealt with as effectively as desired. This can be seen in some well-known commercial systems that achieved lower than market drawdowns in 2008, but did not participate in the early bounce in 2009. An example of this is the ETFTide system at www.etftide.com.

Two alternatives are in common use. One is a timing signal that is applied to the equity curve. The other is a strategic overlay that may be based on simple or complex market analysis. Both of these can be effective. Since strategic overlays tend to be more complex and take into account multiple factors related to markets, for this paper a timing signal based on the equity curve will be used. It will be applied to the AB_SGM1A result that has been demonstrated to be simpler and have better un-timed returns.

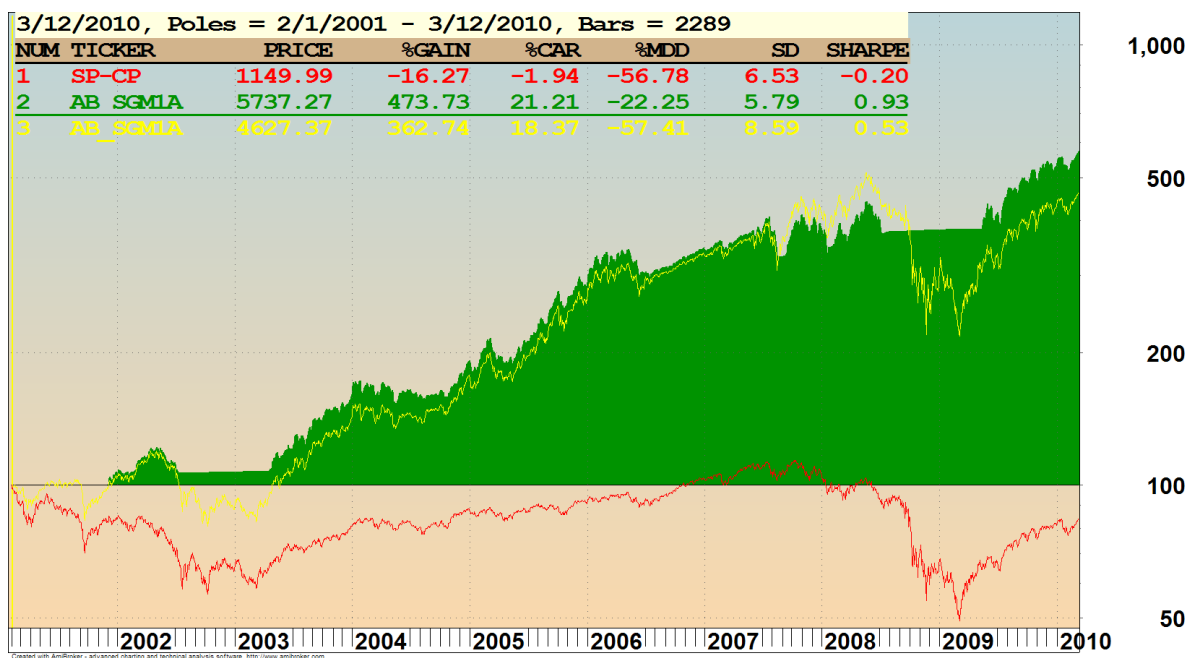
The goal of applying timing the AB_SGM1A equity curve is to show that it is possible utilize relatively simple techniques on the result of selection systems to modestly improve returns and to reduce drawdown. One should not expect tuned and maximized results from simple techniques. The goal is rather to show that a small number of trades can be used to make a significant difference.

With this in mind, a simple 20/150 EMA crossover system is applied to the AB_SGM1A equity curve. The result is taken to money market when this signal is on a sell and is, of course, in the rotational result when the signal is on a buy.

The system summary is shown in APPENDIX B. This results in the following statistics comparing the selected rotational system to the timed equity result -

	Trades	CAR	MDD	Std. Dev.	Sharpe
AB_SGM1A	0	18.29	-57.41	8.59	0.53
Timed	8	21.21	-22.25	5.79	0.93

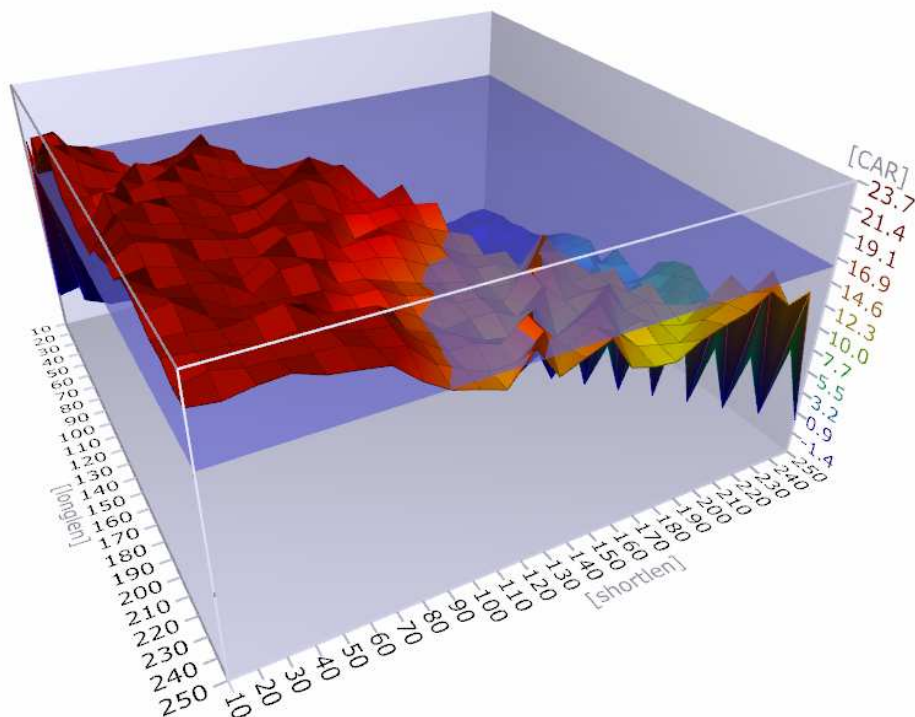
This can be seen in graphically in the chart below. The green histogram is the timed equity result and the yellow line is the un-timed rotational result. Note that the flatter areas of the green histogram represent the periods that the crossover signal is on a sell.



Note that the resulting equity CAR is improved by almost 3%. More importantly, the maximum drawdown is essentially cut in half. This is critical for two reasons –

- Not losing money avoids the well known problem of a higher resulting gain being needed to recover a given drawdown
- Drawdowns are a major cause of an investment system being abandoned and/or a client withdrawing assets.

Lastly, in order to show that the simple system is also reasonably robust, the following represents a sensitivity analysis of the two EMA lengths. Although certainly not a plateau, the surface around the “shortlen” of 20 and the “longlen” of 150 could be described as rolling with no extreme peaks. This indicates that other values of the two EMA lengths will also yield significant improvements. As importantly, changes in the equity characteristics that would cause movement in the filter values would probably be tolerated within a significant range.



Summary and Conclusions

First, consider the following brief review of the major points of the analysis presented in this paper relative to the two systems -

- A system that trades 6 domestic index styles plus 3 broad international index ETF's outperforms a system that trades specific international country ETF's and trades less.
- Monthly rotation occurring on the day after the first market day of the month outperforms more frequent trading. This allows portfolio change review to be less frequent and more easily scheduled.
- In total, 40 trades over 9 years results in approximately 4.5 trades / year.
- In working with rotational systems, smoothing of the scoring function can reduce ranking "noise" and reduce trading frequency.
- Adjustment of the Sharpe scoring function by recent momentum can prove useful in aggressive systems.
- A novel graphical approach to evaluating return, dubbed reverse CAR, can yield additional insights into short-term and long-term system performance.
- Although not an alternative to walk-forward analysis, sensitivity analysis of parameters in Amibroker can yield insights into the robustness of a system
- Optimizing this example system for risk adjusted return enabled the use of a simple equity trading approach to reducing drawdown.
- It is possible to develop systems, such as the one detailed in this paper, that make efficient use of an advisor's time and produce out-performance.

Future Directions

The analysis in this paper has shown that broad international index ETF's have proven useful and more effective than a more focused country ETF rotation. The possibility that this condition reverses in the future should be considered. There could be several reasons behind such a condition. For example, the current global recession could worsen and result in a greater differentiation between the valuations of stocks in countries that are in bad shape verses good shape. Whatever the reason, it is probably reasonable to run the AB_WEM3A system in parallel and monitor its performance compared to the AB_SGM1A system. Changes in the behavior of both systems should also be taken as a sign that a careful review of the system parameters and the underlying assumptions.

Another possibility is to investigate the use of a strategic overlay on the AB_SGM1A system. In order to get a sense of the payback of such work, it is possible to look at a commercial timing system and assess its benefits when applied to AB_SGM1A. A detailed analysis of such a system is beyond the constraints and scope of this paper. For example, though, in looking at the actual, historical trades of the TimingCube system applied to the AB_SGM1A system, it can be seen that one of the main benefits is an additional, significant reduction in maximum drawdown. Given the importance of drawdown reduction, this merits further investigation.

APPENDIX A – Detailed Results for System AB_SGM1A

Statistics			
	All trades	Long trades	Short trades
Initial capital	1000.00	1000.00	1000.00
Ending capital	4627.37	4627.37	1000.00
Net Profit	3627.37	3627.37	0.00
Net Profit %	362.74 %	362.74 %	0.00 %
Exposure %	99.46 %	99.46 %	0.00 %
Net Risk Adjusted Return %	364.70 %	364.70 %	N/A
Annual Return %	18.29 %	18.29 %	0.00 %
Risk Adjusted Return %	18.39 %	18.39 %	N/A
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All trades	44	44 (100.00 %)	0 (0.00 %)
Avg. Profit/Loss	82.44	82.44	N/A
Avg. Profit/Loss %	4.49 %	4.49 %	N/A
Avg. Bars Held	53.02	53.02	N/A
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Winners	27 (61.36 %)	27 (61.36 %)	0 (0.00 %)
Total Profit	6734.64	6734.64	0.00
Avg. Profit	249.43	249.43	N/A
Avg. Profit %	11.12 %	11.12 %	N/A
Avg. Bars Held	54.30	54.30	N/A
Max. Consecutive	5	5	0
Largest win	1328.49	1328.49	0.00
# bars in largest win	233	233	0
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Losers	17 (38.64 %)	17 (38.64 %)	0 (0.00 %)
Total Loss	-3107.27	-3107.27	0.00
Avg. Loss	-182.78	-182.78	N/A
Avg. Loss %	-6.04 %	-6.04 %	N/A
Avg. Bars Held	51.00	51.00	N/A
Max. Consecutive	2	2	0
Largest loss	-1054.42	-1054.42	0.00
# bars in largest loss	45	45	0
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Max. trade drawdown	-1731.30	-1731.30	0.00
Max. trade % drawdown	-40.02 %	-40.02 %	0.00 %
Max. system drawdown	-2943.25	-2943.25	0.00
Max. system % drawdown	-57.41 %	-57.41 %	0.00 %
Recovery Factor	1.23	1.23	N/A
CAR/MaxDD	0.32	0.32	N/A
RAR/MaxDD	0.32	0.32	N/A
Profit Factor	2.17	2.17	N/A
Payoff Ratio	1.36	1.36	N/A
Standard Error	519.23	519.23	0.00
Risk-Reward Ratio	0.83	0.83	N/A
Ulcer Index	16.88	16.88	0.00
Ulcer Performance Index	0.79	0.79	N/A
Sharpe Ratio of trades	0.53	0.53	0.00
K-Ratio	0.0454	0.0454	-1.#IND

Trades

Trade list

Ticker	Trade	Entry	Exit	% change	Profit	Shares	Pos. value	Cum. profit	# bars	Profit/bar	MAE/MFE	Scale In/Out
IWD	Long	2/5/2001 49.3246	4/4/2001 44.3244	-10.14%	-101.37 -10.14%	20.2739	1000.00	-101.37	42	-2.41	-12.03% 0.18%	0/0
IWN	Long	4/4/2001 32.1103	8/5/2002 31.9898	-0.38%	-3.37 -0.38%	27.9495	897.47	-104.74	333	-0.01	-7.36% 33.42%	0/0
EFA	Long	8/5/2002 27.9718	11/5/2002 28.9968	3.66%	32.81 3.66%	32.0058	895.26	-71.93	66	0.50	-9.64% 10.75%	0/0
IWF	Long	11/5/2002 35.4896	1/6/2003 35.4985	0.02%	0.23 0.02%	25.7578	914.14	-71.70	42	0.01	-5.17% 2.89%	0/0
IWP	Long	1/6/2003 25.8946	4/3/2003 25.4498	-1.72%	-15.69 -1.72%	35.2689	913.28	-87.39	62	-0.25	-11.04% 0.92%	0/0
ILF	Long	4/3/2003 6.72132	7/3/2003 8.02491	19.39%	177.00 19.39%	135.778	912.61	89.61	64	2.77	-1.45% 19.82%	0/0
IWO	Long	7/3/2003 47.0533	9/4/2003 54.1302	15.04%	163.88 15.04%	23.1568	1089.61	253.48	44	3.72	-0.41% 15.04%	0/0
ILF	Long	9/4/2003 8.89161	11/5/2003 9.3904	5.61%	70.20 5.61%	140.747	1251.47	323.69	45	1.56	-2.21% 6.43%	0/0
IWN	Long	11/5/2003 45.6001	12/3/2003 46.3126	1.56%	20.68 1.56%	29.0282	1323.69	344.37	20	1.03	-2.93% 3.18%	0/0
EEM	Long	12/3/2003 15.5699	1/6/2004 17.3945	11.72%	157.54 11.72%	86.3443	1344.37	501.91	23	6.85	-1.49% 13.00%	0/0
ILF	Long	1/6/2004 11.2315	2/4/2004 10.7227	-4.53%	-68.04 -4.53%	133.723	1501.91	433.87	21	-3.24	-6.64% 1.85%	0/0
EFA	Long	2/4/2004 39.6027	3/3/2004 40.7755	2.96%	42.47 2.96%	36.2065	1433.87	476.34	20	2.12	0.00% 5.52%	0/0
ILF	Long	3/3/2004 11.2441	4/5/2004 11.5863	3.04%	44.93 3.04%	131.299	1476.34	521.27	24	1.87	-6.39% 3.04%	0/0
IWS	Long	4/5/2004 29.1458	5/5/2004 27.9863	-3.98%	-60.23 -3.98%	51.9368	1513.74	461.04	22	-2.74	-5.79% 0.00%	0/0
EFA	Long	5/5/2004 40.9783	6/3/2004 39.8923	-2.65%	-38.53 -2.65%	35.4825	1454.01	422.51	21	-1.83	-8.02% 0.00%	0/0
IWD	Long	6/3/2004 50.8577	7/6/2004 51.4114	1.09%	15.49 1.09%	27.9704	1422.51	438.00	22	0.70	0.00% 2.84%	0/0
IWS	Long	7/6/2004 28.7896	8/4/2004 28.311	-1.66%	-23.91 -1.66%	49.9485	1438.00	414.09	22	-1.09	-3.15% 0.27%	0/0
ILF	Long	8/4/2004 10.6797	9/3/2004 11.1796	4.68%	66.18 4.68%	132.409	1414.09	480.27	23	2.88	-2.13% 5.52%	0/0
IWS	Long	9/3/2004 29.2564	10/5/2004 30.0971	2.87%	42.54 2.87%	50.5967	1480.27	522.81	22	1.93	-0.28% 2.99%	0/0
ILF	Long	10/5/2004 12.4946	4/5/2005 14.8197	18.61%	283.38 18.61%	121.877	1522.81	806.19	126	2.25	-5.00% 31.42%	0/0
IWS	Long	4/5/2005 33.9446	5/4/2005 33.5788	-1.08%	-19.45 -1.08%	53.1577	1804.42	786.74	22	-0.88	-4.47% 0.84%	0/0
ILF	Long	5/4/2005 15.3164	4/5/2006 26.8195	75.10%	1328.49 75.10%	115.49	1768.89	2115.23	233	5.70	-3.62% 76.23%	0/0
IWO	Long	4/5/2006 77.9968	5/3/2006 77.7527	-0.31%	-9.67 -0.31%	39.6248	3090.61	2105.55	20	-0.48	-3.22% 1.77%	0/0
EFA	Long	5/3/2006 61.6592	7/6/2006 58.5417	-5.06%	-157.02 -5.06%	50.3664	3105.55	1948.53	45	-3.49	-13.36% 2.84%	0/0
IWD	Long	7/6/2006 67.11	2/5/2007 77.921	16.11%	470.03 16.11%	43.4773	2917.76	2418.57	147	3.20	-2.83% 16.25%	0/0
IWS	Long	2/5/2007 47.4607	6/5/2007 50.8332	7.11%	242.92 7.11%	72.0294	3418.57	2661.48	84	2.89	-4.21% 7.94%	0/0
ILF	Long	6/5/2007 40.3448	9/6/2007 40.3167	-0.07%	-2.55 -0.07%	90.7547	3661.48	2658.93	66	-0.04	-15.88% 8.20%	0/0

EEM	Long	9/6/2007 42.6919	10/3/2007 47.5231	11.32%	408.00 11.32%	84.4508	3605.36	3066.93	20	20.40	-2.26% 14.79%	0/0
ILF	Long	10/3/2007 44.919	11/5/2007 47.4787	5.70%	231.76 5.70%	90.5393	4066.93	3298.69	24	9.66	0.00% 11.33%	0/0
EEM	Long	11/5/2007 49.1777	1/4/2008 46.2584	-5.94%	-255.18 -5.94%	87.4113	4298.69	3043.51	42	-6.08	-9.12% 3.99%	0/0
ILF	Long	1/4/2008 45.7012	8/5/2008 45.8833	0.40%	16.11 0.40%	88.477	4043.51	3059.62	148	0.11	-9.86% 26.79%	0/0
IWO	Long	8/5/2008 76.6442	9/4/2008 75.4292	-1.59%	-63.84 -1.59%	52.546	4027.35	2995.77	22	-2.90	-1.59% 5.07%	0/0
IWN	Long	9/4/2008 66.3879	11/5/2008 48.8692	-26.39%	-1054.42 -26.39%	60.1883	3995.77	1941.36	45	-23.43	-35.06% 8.26%	0/0
ILF	Long	11/5/2008 25.2689	1/6/2009 28.3553	12.21%	359.26 12.21%	116.402	2941.36	2300.61	42	8.55	-25.37% 12.21%	0/0
IWN	Long	1/6/2009 49.2018	3/4/2009 33.6922	-31.52%	-998.67 -31.52%	64.3906	3168.13	1301.94	40	-24.97	-32.44% 0.00%	0/0
IWD	Long	3/4/2009 35.082	4/3/2009 42.4852	21.10%	479.65 21.10%	64.7895	2272.94	1781.60	23	20.85	-5.21% 21.10%	0/0
EEM	Long	4/3/2009 26.9074	7/6/2009 31.5882	17.40%	477.47 17.40%	102.005	2744.69	2259.06	64	7.46	-3.51% 26.65%	0/0
ILF	Long	7/6/2009 33.5662	8/5/2009 39.3009	17.08%	556.80 17.08%	97.0936	3259.06	2815.86	23	24.21	-4.75% 17.08%	0/0
EEM	Long	8/5/2009 36.1702	9/3/2009 35.4165	-2.08%	-79.08 -2.08%	104.912	3794.71	2736.78	22	-3.59	-5.90% 0.16%	0/0
EFA	Long	9/3/2009 51.2468	10/5/2009 52.9415	3.31%	121.16 3.31%	71.4961	3663.95	2857.95	22	5.51	0.00% 7.93%	0/0
ILF	Long	10/5/2009 42.9457	1/6/2010 49.56	15.40%	585.89 15.40%	88.5792	3804.10	3443.84	65	9.01	-2.26% 15.40%	0/0
IWF	Long	1/6/2010 50.51	2/3/2010 48.73	-3.52%	-156.26 -3.52%	87.7865	4434.09	3287.58	20	-7.81	-5.74% 0.97%	0/0
IWS	Long	2/3/2010 36.78	3/3/2010 38.56	4.84%	207.50 4.84%	116.574	4287.58	3495.08	20	10.38	-3.78% 4.84%	0/0
IWP	Open Long	3/3/2010 46.77	3/15/2010 48.15	2.95%	132.29 2.95%	95.861	4483.42	3627.37	10	13.23	0.00% 2.95%	0/0

APPENDIX B – Trading Results for Dual Crossover Equity Trading

Trades

Trade list

Ticker	Trade	Entry	Exit	% change	Profit	Shares	Pos. value	Cum. profit	# bars	Profit/bar	MAE/MFE	Scale In/Out
AB_SGM1A	Long	11/30/2001 981.611	7/9/2002 1046.51	6.61%	66.12 6.61%	1.01873	1000.00	66.12	151	0.44	-0.29% 22.10%	0/0
AB_SGM1A	Long	4/21/2003 955.597	8/13/2004 1392.74	45.75%	487.70 45.75%	1.11566	1066.12	553.82	333	1.46	0.00% 60.08%	0/0
AB_SGM1A	Long	8/18/2004 1456.55	6/28/2006 2818.21	93.49%	1452.59 93.49%	1.06678	1553.82	2006.41	470	3.09	-0.68% 119.27%	0/0
AB_SGM1A	Long	6/30/2006 2958.94	8/17/2007 3221.02	8.86%	266.28 8.86%	1.01604	3006.41	2272.69	285	0.93	-3.14% 33.89%	0/0
AB_SGM1A	Long	9/11/2007 3651.46	1/24/2008 3827.23	4.81%	157.54 4.81%	0.896267	3272.69	2430.22	94	1.68	-0.18% 24.00%	0/0
AB_SGM1A	Long	2/5/2008 3875.46	2/7/2008 3920.16	1.15%	39.56 1.15%	0.885113	3430.22	2469.79	3	13.19	-0.21% 1.15%	0/0
AB_SGM1A	Long	2/12/2008 4091.74	7/21/2008 4373.06	6.88%	238.56 6.88%	0.847998	3469.79	2708.35	111	2.15	-2.03% 25.29%	0/0
AB_SGM1A	Open Long	5/14/2009 3083.66	3/16/2010 4627.37	50.06%	1856.42 50.06%	1.20258	3708.35	4564.77	212	8.76	-0.91% 50.06%	0/0

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