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United States Equity Markets

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Part III: Methods for Controlling Systemic Risk within Modern Portfolio Theory (MPT) – Elaboration of the CEFA Approach

I. Introduction

On Friday July 10th Tom Lauricella on the front page of the WSJ wrote that:

> 'Asset allocation, a bedrock of investing for decades, appeared t fail miserably in 2008. The conviction shared by most investors –that they should spread their money across myriad asset classes to minimize losses—was shaken as nearly all markets tumbled in unison….At Ibbotson Associates, a Chicago firm specializing in asset-allocation strategies for big investors such as pensions and mutual funds, chief economist Michele Gambera also has gone back to the drawing board. It's been a topic on his mind for the past two years but 2008 heightened his scrutiny. "There have been reasons to question diversification, no doubt about that," he says. "It's been humbling."

It is this hole that Philip Miller at SISR attempted to close. We observed what happened to NASDAQ based portfolio's in the crash of 1999 to 2001. We understood the risk of diversified portfolios, with all markets and assets going down. From that point we developed an APT type approach that would alert us prior to the decline in earning where the trouble signs were and in good times where the growth is. In this respect our entire focus at NES is on the macro picture, but not in a traditional manner but with a complete focus on sectors and sector performance.

The work of Philip Miller while at SISR and currently at NES has been directed exclusively at this problem. SISR in fact was founded on the belief that there are limitations in MPT and its modification to deal with systemic risk the various modifications that come under the heading of Arbitrage Pricing Theory (APT). Miller coined the acronym CEFA (Cross section Economic Factor Analysis) as the APT modification to deal directly with the issue of systemic risk in transition period and isolation out the

growth areas in normal times. The first published attempt at this exercise was the working paper report entitled: "Failure of the Analyst in the Collapse of Intel 2001." That report laid out the early theoretical foundation for what has become identified the CEFA approach of using a relative strength approach to tracking sector growth within the economy.

Instead of using the high level Macro indicators like inflation, expected inflation, employment new orders, etc. we use these same variable not at the macro level but at the sector level to determine that rate of expansion of approximately 60 subsectors. The analysis uses the North American Industry Classification System Code System (NAISC) in contrast much more popular Global Industry Classification Standard (GICS) as created by Standard and Poor's. The NAISC codes are much closer to the actual data and it is our goal at NES to work with investors and to show the added value of the NAICS codes in contrast to the GICS which is much more universally used.

II. Theoretical Foundation

From the work of Harry Markowitz in the late 1950's to the introduction of Arbitrage Pricing Theory (APT) in the late 1970's, these approaches were major catalysts for the expansion of: 1) Hedge Funds in the 1980 and 1990's, and 2) to an entire industry of investors, working on ways to create portfolios that are as risk free from both market risk and systemic risk. MPT or more specifically the Capital Asset Pricing Model (CAPM) and its extension and modifications like APT, are approaches to reduce risk for well diversified portfolios. CAPM strove to reduce risk by reducing the risk of a particular portfolio based on its Beta and its covariance to other assets. While this approach was intended to capture both market risk or portfolio risk and systemic risk, it performs better on portfolio risk and much worse the more sever the systemic risk becomes, because at the extremes all asset correlations approach one (1).

APT, interestingly was developed as a way to measure systemic risk by using multifactor models which went beyond the covariance of a given asset and or it's Beta. MS Barra is one of the more success participants in what had become an attempt to interpret the risk of a portfolio and developed a highly successful compliance business around the evaluation of managed portfolio risk. The main difference between APT and CAPM is that APT does a better job than CAPM on systemic risk. The problem with APT is that it is more limited and needs a highly efficient and liquid market to work. Even then APT really has not been very successful.

A. <u>The Discounted Cash Flow approach:</u>

Security analysts from virtually all the major Wall Street firms including the coveted CFA Institute Members often begin with various bottoms up valuation metrics with the most common and developed approaches being the discounted cash flow (DCF) valuation model. While at SISR we began with this approach because it so clearly highlights the limitation in the work of so many analysts. The DCF approach we have argued assumes that one has knowledge of the "expected" cash flow to the firm beyond t_1 in period t_2 to t_n. The standard DCF model calculates the value of a firm based on the expected cash flow to the firm in period t_1 over the Weighted Average cost of Capital.

$$\text{Value of Firm} = \sum_{t=1}^{t=\infty} \frac{\text{CF TO FIRM}}{(1 + \text{WACC})^t}$$

Where: CF to the Firm $_{t=}$ expected Cash flow to Firm in period t
WACC = Weighted Average Cost of Capital

For our purposes the critical component here is the requirement to correctly forecast "expected cash flows for the firm on a forward-looking basis." The standard ways is to discern information from news releases from the firm as to their projections, derive a model based on past performance, project the discount rate and the risk free rate of return, look at competitive factors such as changes in market share, the relative performance of different divisions within the firm and the relative profit margins and expected growth rates within those divisions.

These kinds of calculations in fact are the standard fair for most analysts. For this approach to be able to deal with systemic risk there needs to be a clear distinction between valuation and forecasting. DCF can value an existing asset, a house, a diamond ring, a stock, but ultimately it has to make assumptions about the future based on the past. The crisis and inability of traditional analysts to anticipate a major event in large part is a consequence of their use of CAPM models, which today is the cornerstone of so much of current all evaluation work.

B. The Critique of CAPM Models:

CAPM models are dependent upon past price movements staying constant. Most CAPM models attempt to project revenue streams based on the expectation that past events serve as a guide for future returns. The difference between the risk free and the risk premium are calculated based on past expectations. Highly successful securities analysts, however, generally work from these CAPM models.

They begin with the assumption that every asset has a value that can be determined. The problem is that anyone can go to a stock page or the Internet and see what the market price of a company is. Is this a fair price or not depends on their assumption about the future potential revenue stream for that company. The price that someone is willing to pay is the value of the asset or in more formal terms its enterprise value (EV) which is its market capitalization plus debt less cash and cash equivalents. The market capitalization of course is dependent on the expected revenue stream, which in turn depends on the assumptions of past value projected forward. However, within this model how can we explain unanticipated events that fall outside of the expected range of anticipated events? Whether one employs a DCF, or DDM model, to project future revenues and income of a company they are primarily assuming continuity with past events.

This assumption is endemic to even the more complex approaches of Markowitz and Sharpe's CAPM models where they take the covariance matrix of past returns as a guide to future risk. Fama and French were correct to extend their critique of CAPM models: when they contend: "many of the CAPM average-return anomalies are related" and one cannot explain return anomalies based on CAPM models (Fama French p. 55 1996), concentrating also on the cross section limitations of the CAPM model.

Campbell, Lo, and Mackinlay, conclude their discussion of CAPM models by stating that:
We have shown that there is some statistical evidence against the CAPM in the past 30 years of US stock-market data. Despite this evidence, the CAPM remains a widely used tool in finance. There is controversy about how the evidence against the model should be interpreted. Some authors argue that the CAPM should be replaced by multifactor models with several sources of risk. (C. L. M. *The Econometrics of Financial Markets* p. 217)… We summarized empirical evidence indicating that the

CAPM beta does not completely explain the cross section of expected asset returns." (C.L.M. p 219). Multi-factor models were an attempt to explain cross section anomalies limitation of the CAPM models.

C. Arbitrage Pricing Theory (APT): The Multi-Factor APT Approach

In many ways the work spearheaded by Roll and Ross; MSBarra; Fama & French, Chen, Blin and Bender are all attempts to fill this gap. These approaches have different objectives. First, Roll and Ross conceptualized this cross section problem with their development of arbitrage pricing theory (APT), which became applied by two groups the Blin and Bender, and MSBarra. Blin and Bender recognized the arbitrage and pairs trading possibilities and called their company and approach arbitrage pricing theory (APT). MSBarra, alternatively, saw the risk and compliance possibilities and developed risk compliance models. Second, beginning with Fama and French, from the academic perspective there was an attempt to understand these cross section anomalies more directly (Fama & French 1992, Chen, Roll, Ross 1991).

The standard APT factor model postulates that a linear relationship exists between the realized returns of the assets and the K factors common to those assets, or

$$\mathbf{R_{it} = E\,(R_i) + \Sigma\, b_{ik}\ F_{kt} + \epsilon_{it}} \qquad k = 1$$

Where:

R_{it} denotes the rate of return for asset i;
$E(R_i)$ denotes the expected return for asset I;
B_{ik} denotes the sensitivity (or exposure) of asset i to factor k;
F_{kt} denotes the return of factor k with $E(F_{k)} = 0$; and
ϵ Denotes the residual (or specific) return of asset I, i.e. the share of the return that is not explained by the factors, with $E(\epsilon_i) = 0$.

The factors k in this regression or difference equation model determine the return to asset, index, sector, or security i. This model then predicts stock prices based on the ability to forecast future unanticipated rates of inflation, production, some have preferred various consumption metrics (Roll, Ross, & Chen). Roll and Ross originally developed this critique, which is often identified as an arbitrage pricing theory (APT) factor model approach. It is identified with arbitrage theory in that they are attempting to understand cross section anomalies in market or portfolio returns thus creating what may be considered arbitrage possibilities. They argue that CAPM models measure risk on a single number the "asset's beta." They contend that: "an asset's riskiness, its average long-term return, is directly related to its sensitivities to unanticipated changes in four economic variables – (1) inflation, (2) industrial production, (3) risk premiums, and (4) the slope of the term structure of interest rates (Roll & Ross 1984 p.14).

Blin and Bender were one of the early groups to pick up fully on the arbitrage potential and concentrated on risk neutral portfolios attempting to balance away some of the risk to create an artificially higher portfolio with the characteristics of a risk free portfolio, but with a series of risky assets. They also developed various pairs trading models keying in on this arbitrage of anomalies as developed by Roll

and Ross. The MSBarra group took this enterprise one step further and saw the compliance possibilities with respect to risk evaluations, and has developed a highly successful business around these measures. Fama and French, from a purely academic perspective pushed the question of anomalies into their now classic article that developed a 3 factor model attempting to explain various cross section anomalies. These factors are: "(1) the excess return on a broad market portfolio; (2) the difference in the return on a portfolio of small stocks and the return on a portfolio of large cap stocks; and (3) the difference between the return on a portfolio of high-book-to market vs. the return of low-book-to-market stocks." (Fama & French 1996 p. 55). Each of these multi-factor models has a major limitation. None of these approaches are capable of making forward-looking projections.

D. The Critique of these Multi-Factor Models:

The three groups all working from a slightly different perspective have all emerged from a similar core, a core that itself may contain limitations. Campbell et al, correctly address this critique. They argue that factor models:

> Provide an attractive alternative to the single-factor CAPM, but users of such models should be aware of two serious dangers that arise when factors are chosen to fit existing data without regard to economic theory. First, the models may over fit the data because of data-snooping bias; in this case they will not be able to predict asset returns in the future. Second, the models may capture empirical regularities that are due to market inefficiencies or investor irrationality; in this case they may continue to fit the data but they will imply Sharpe ratios for factor portfolios that are too high to be consistent with a reasonable underlying model of market equilibrium (CLM p. 251).

Campbell et al go on to argue that what is needed is: "what forces determine the risk less interest rate (or more generally the rate of return on a zero-beta asset) and the rewards that investors demand for bearing risk?" (C.L.M. *ibid* p. 291). They go on to argue that:

> In the CAPM the riskless interest rate or zero-beta return and the reward for bearing market risk are exogenous parameters; the model gives no account of where they come from. In the APT the single price of market risk is replaced by a vector of factor risk prices, but again the risk prices are determined outside the model (CLM ibid 291).

As a means toward creating this type of forecasting model Campbell et al go on to develop a consumption based model arguing that consumption and preferences leads the stock returns. They even go on to an example where commercial paper index growth leads the sectors index growth. They go on to contend that there is: "strong evidence that the real commercial paper rate is forecastable, and weaker evidence that the real stock return is forecastable" (CLM *ibid* p. 313). Is this not what Kumar really did with Semiconductor shipments and the new order data, and can we go beyond the single variable forecasting model and go into a multi-dimensional forecasting framework?

By taking the factor model approach and using data available to specific sub sectors of the economy one can use the sub sector data as the independent variables and build forecasting models by sub sector. While Roll and Ross used inflation and industrial production, suppose we looked at ppi for semiconductors, shipments and new orders for semiconductors, labor force and hours worked by

semiconductor worker when attempting to understand the semiconductor sector. This study will use the factor model approach attempting to extent Chen, Roll and Ross to asset forecasting. This will be attempted by using information that is often neglected by the Wall Street securities analyst, while challenging also the central assumption of the efficient market hypothesis. It will strive to establish that information distortions exist, and the primary explanation may well be found in the biases of approaches used by the Wall Street Analysis's.

E. FINANCIAL FORECASTING

The starting point for many forecasting models is the models and tools utilized by the conference board in forecasting the GDP of the economy. One of the problems encountered with these measures is that the objective of the conference board and those of the finance community are rather different. The conference board in their projections in fact even uses as one of their primary measures the S & P 500 stock index, under the presumption that the index itself is a leading indicator. How then can one use the leading economic index as a measure of stock prices? This takes us to the very heart of the issue between financial forecasting and economic forecasting. The objective of course is financial forecasting and attempting to project the market and the economy, two very different activities. Economists have been using Governmental economic data since their inception. They have even been at the forefront in the development of the data collection process.

Most economists, however, rarely use the data to the full extent of its current availability. Economists are concerned with national economic trends and to lesser extent differential growth patterns of sectors such as manufacturing, financials, technology, and commodity prices. However, they rarely utilize the information at the level of the sub-sector.

Analysts alternatively concentrate on data from firms like accounting data, news releases, competitor's behavior, and the like. Their use of economic data from government reports is similar to that of the economist, to determine trends in the overall economy. Neither the economist nor the analyst appears to drills down into this data to develop forecasts at the level of the sub-sector.

In order for the government to collect the GDP data at the macro level, they must first collect this data at a micro level. This is why the census department, a division of The Department of Commerce, collects so much of the economic data. The Census department has created over 40 single spaced pages of sub categories of business activity. They have coded each of these business activities into a 6 digit NAICS code. Each company can be assigned a single or multiple 6-digit codes.

This data in turn is reported by significant sub sector, such as: iron and steel, semiconductors, computers, aluminum, heating and ventilation, department stores, etc, etc. This data is collected for new orders, sales, inventories, at the manufacturing level; sales, and inventories at the retail and wholesale level, ppi, cpi by sub-sector; hours worked by sub-sector and number of workers by employed by sub-sector; as well as capacity utilization by sub-sector. The data comes out monthly, and is 3to 5 weeks old, but earnings are often are reported 8 weeks after the first monthly report of the sub-sector, giving the analyst enough time to anticipate problems within a given sub-sector way before earning warning begin.

III. Applying the Model –The Relative Strength Approach

The CEFA approach begins by carefully analyzing each of the daily reports as they are provided from the various sources. We report on these in our morning notes. In those morning notes we start to look for sector trends irrespective of whether it comes from the manufacturing, wholesale, retail, finance, housing, or energy sectors. Once we have noticed a particular trend we attempt to confirm it in various ways. An excellent example of this approach involves looking at the Durable goods report from the Commerce Department. This data can be viewed in various ways:

1. In Figure I we report the raw data for rate of change by sector on a three month moving average to eliminate some of the noise in this sector. We do this for one month change, three month change, 6 month change, and y/y change, enabling us to see the second derivative for this sector.
2. In Figure II we rank order Table 1 by sector to see which sectors are growing relatively the fastest and which are growing the slowest with the same time frame breakdown to see changes in these sectors relative growth rates.
3. In Figure III we do a relative strength analysis based on a 3 month percentage change but also showing the standard deviation in this data. This is the most visibly pleasing and provides some real clarity, but is not as informative as Figures I and II because it is a static table whereas Figures I and II show more dynamic movement.

For the past several years we have garnered many of our thoughts on sector trends in the manufacturing sector from the monthly Commerce Department Report on Manufactures Shipments, Inventories and New Orders. We have found this report absolutely invaluable and when overlapped with the PPI report tracking the same industry groupings, we have over the years reported on numerous of these trends with what we believe to have been a high degree of confidence.

The Commerce Department report contains 56 industry groupings by the North American Industry Classification System (NAICS) Codes. Each sub industry has a 6 digit code with the report being a grouping of various codes. We have selected 25 of these groupings that we have found over the years to have a high degree of utility. The advantage of this grouping as opposed to the GICS is that the CIGS are not pure groupings and they do not speak directly to the data, whereas the NAICS Codes are the codes that are used by the Commerce Department a division of the U.S. Census to survey the companies in question. Over the years we have found that the purity of this data is amazingly good in that the Commerce Department Surveys these companies and there does not appear any reason for bias when the Government asked these companies for their monthly shipments, new orders, inventories and unfilled orders, since their reporting is grouped with many other companies and in principle their information appears invisible. However, we have devised a methodology that we have identifies as CEFA (Cross-Sectional Economic Factor Analysis) that we have used in various reports to econometrically track via factor analysis the relationship between large companies in the given sector to the shipments and new orders, in an attempt to determine how well this data speaks to those companies.

Our objective in this report is quite a bit more modest. We are simply attempting to introduce 25 important Industries in 6 Sector groupings. We look at the relative strength of each of these 25

industries, and provide our projected weighing (overweight, underweight, neutral) for each industry in Table 4 based on the relative performance of their shipments for the past month, three months, six months, and one year. These four data points allow us to surmise the rates of growth of the industries and the second derivative of the rate of growth of these industries, over the past year.

Figure I: June Sector Growth Rates Based on M/M, 3M, 6M & Y/Y Percent Change

Sector - Industry	M/M % Δ	3 Month % Δ	6 Month % Δ	Y/Y % Δ	Average
Basic Materials	0.52	3.94	3.66	2.47	2.65
Wood	-0.02	4.11	3.67	3.49	2.81
Nonmetallic Mineral Products	0.13	2.77	-2.07	-6.31	-1.37
Iron & Steel	1.79	8.35	14.36	12.82	9.33
Aluminum	0.16	0.52	-1.34	-0.11	-0.19
Farm and Food	0.68	1.93	4.02	16.07	5.67
Farm Machinery	2.12	3.64	4.54	17.96	7.07
Pesticides , Fertilizers	-0.48	2.39	5.30	28.05	8.82
Grains and Seeds	1.25	1.43	6.55	15.60	6.21
Meat & Poultry	1.44	4.01	5.14	7.18	4.44
Dairy Products	-0.93	-1.82	-1.45	11.54	1.84
Petrolum	1.73	10.65	18.61	30.44	15.36
Mining, Oil and Gas Equipment	-0.86	5.03	10.06	15.75	7.50
Petroleum Refineries	4.32	16.26	27.16	45.13	23.22
Computers & Communication	0.72	-4.07	-3.69	-2.64	-2.42
Computers	-3.85	-14.79	-15.74	-9.67	-11.01
Storage	0.47	10.28	18.32	22.49	12.89
Peripheral Equipment	2.00	-0.82	-1.58	1.45	0.26
Semiconductor	3.49	-17.69	-16.14	-20.35	-12.67
Communication	-0.35	0.19	1.87	1.78	0.87
Industrial Machinery	0.77	-4.64	-5.35	-9.60	-4.71
Audio Video Equipment	2.36	-6.07	-12.86	-16.67	-8.31
Electromedical, Measur & Control	0.87	0.95	1.94	9.43	3.30
Defense	0.49	9.11	18.21	18.52	11.58
Traditional	0.90	14.85	25.09	27.60	17.11
Communication	0.08	3.37	11.33	9.43	6.05
Construction	-1.11	-2.52	-1.63	5.95	0.17
Construction Machinery	-0.47	0.27	-1.51	18.58	4.22
Paints, Coating & Adhesives	0.24	-4.65	-7.29	-3.30	-3.75
HVAC	-5.61	-3.65	3.49	1.55	-1.06
Turbines	1.41	-2.03	-1.22	6.98	1.29

Source: Department of Commerce, SISR

We have divided the 25 industries into 6 Sectors:

1. Basic Materials which encompasses wood products, nonmetallic mineral products, iron & steel and Aluminum.
2. Farm and Food encompasses farm machinery, pesticides and fertilizers, grains and seeds, meat & poultry, and dairy products.
3. Petroleum encompasses mining, oil, and gas equipment, and petroleum refineries.

4. Computers and Communication equipment encompasses computers, storage, peripheral computer equipment, semiconductors, communication equipment, industrial machinery (a bit of a misnomer since the biggest category is semiconductor equipment), audio and video equipment, and electro-medical, measuring and Control equipment.
5. Defense is made up of a grouping of four categories. For communication defense we have grouped defense communication equipment and defense search and navigation equipment. For Traditional defense we have grouped defense air and space and the residual of all other defense which includes ships and boats, and missiles which for obvious reasons are not broken out.
6. Construction encompasses construction machinery, paints, coatings and adhesives, HVAC, and turbines (which are used in construction trucks as well as for backup energy).

Figure I which was from June of 2008 shows clearly how weak so many of the basic sectors already were at that time. Except for food, and Petroleum most of the economy was in negative territory. We must remember in this chart also that by June 2008 the first stimulus program had already issued many of the checks so we can see a bit of a pop in the retail space.

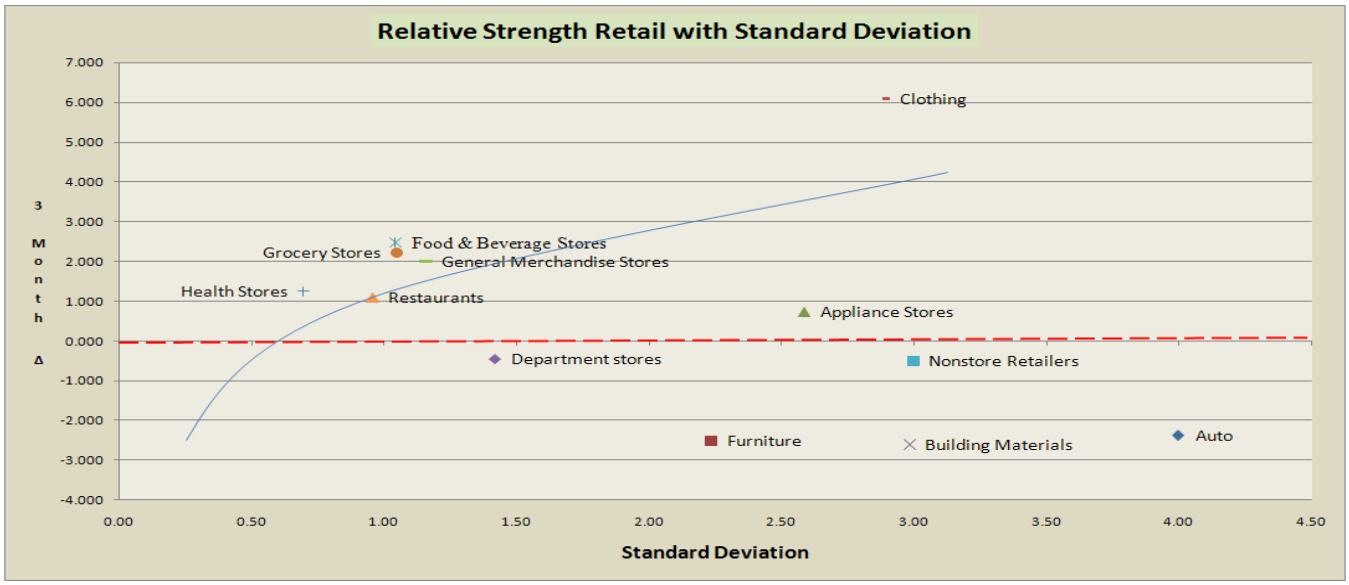
Figure II: June 2008 Sector Ranking Based on the Rate of Growth

Sector - Industry	M/M % Δ	3 Month % Δ	6 Month % Δ	Y/Y % Δ
Basic Materials	13.8	8.5	12.8	15.8
Wood	18	6	11	15
Nonmetallic Mineral Products	16	10	20	21
Iron & Steel	6	4	4	9
Aluminum	15	14	16	18
Farm and Food	12.8	11.2	10.2	7.8
Farm Machinery	4	8	10	6
Pesticides , Fertilizers	21	11	8	2
Grains and Seeds	9	12	7	8
Meat & Poultry	7	7	9	13
Dairy Products	23	18	17	10
Petrolum	11.5	3	3.5	4
Mining, Oil and Gas Equipment	22	5	6	7
Petroleum Refineries	1	1	1	1
Computers & Communication	11.1	17.8	17.8	17.9
Computers	24	24	24	23
Storage	13	3	3	4
Peripheral Equipment	5	17	19	18
Semiconductor	2	25	25	25
Communication	19	16	14	16
Industrial Machinery	12	21	21	22
Audio Video Equipment	3	23	23	24
Electromedical, Measur & Control	11	13	13	11
Defense	13.5	5.5	3.5	7.5
Traditional	10	2	2	3
Communication	17	9	5	12
Construction	16.75	19	16.8	14.0
Construction Machinery	20	15	18	5
Paints, Coating & Adhesives	14	22	22	20
HVAC	25	20	12	17
Turbines	8	19	15	14

Source: Department of Commerce, SISR

Figure II provides the same data but in this instance we see the rank order of the various sectors. From this table we find that fertilizer and pesticides went from a y/y rank of 2 to a m/m rank of 21 with a continuous pattern of decline. It was based on this information that we at SISR recommended a short on Mosaic when the stock was selling at $150. Mosaic subsequent to this report went from a high as $160 to below $30 within the next few months. Many of the major brokerage houses still had strong buys on this stock and $200 price targets.

Figure III: Relative Strength Sector View March 2009 from Retail Report



Source: Department of Commerce, SISR

Figure III looks at the different data in a slightly different manner. This table is also produced for the durable goods and wholesale sectors. This figure however unlike figure I and II is a static table looking only at one period in time and as a consequence is not dynamic. This table is easier on the eyes and clearer, but in other ways is more limited. From this table we began to recommend the clothing retailers Aeropostale (ARO) and Ralph Lauran (RL) and we also added the restaurants of Darden (DRI) and Cheese Cake Factory (CAKE). In January and February clothing and restaurants were outperforming much of the economy. This figure is from March 2009.

IV. Conclusion

We began this report with a WSJ quote regarding the problems with asset allocation during periods of systemic risk. We tried to show both theoretically and empirically how the work of Philip Miller over the past half decade has been a direct attempt to address two critical issues:

1. During transition period: The method sets off alarms regarding weakening sectors during downturn and the early growth sectors during recovery periods.
2. During the mid cycle it sends out signals regarding which sectors appear to be outperforming the economy and which are lagging behind.

We concluded with various empirical examples of how this data successfully made early calls on particular sectors, stocks, and the economy in general.

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Price Chart:

A price chart, with changes of ratings and price targets in prior periods, is included above, for all securities covered in this report.

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1. acting as a financial advisor,
2. manager or co-,manager in a pending transaction
3. 1% or other ownership, long or short
4. compensation for certain services
5. types of client relationships
6. managed/co managed public offerings in prior periods
7. directorships
8. market making and/or specialist role.

These disclosures are included in the company-specific disclosures above for any of the above disclosures that are required.

