

Momentum and Reversion

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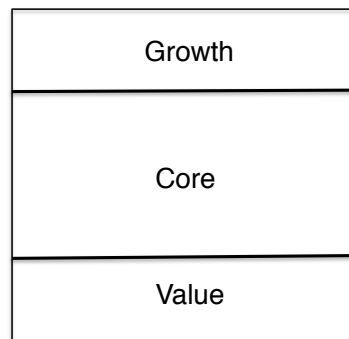
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Abstract

Momentum and Reversion have always been seen as independent of each other and never as a composite. This study explains how the two behaviors are not only connected but also get transformed into each other. This dynamics drives not only stock market systems but all natural systems. One reason researchers did not see this composite behavior is because of the focus on independent components (asset prices) rather than a group of components (a collection of stock prices) and because of a lack of adequate framework to illustrate the two key behaviors together. Based on the author's previous work on the 'Mean Reversion Framework', which explains how natural systems witness reversion and divergence simultaneously across different periods of time, this paper re-examines the framework for absolute trends. The trends are defined as the percentage number of components that transform themselves out of their original framework classification as Value, Core or Growth. All the three bins exhibit a consistency in transformation over time. More than 70% of all the components in the three bins transform out of their original position to other states. The absolute trends confirm that the Framework is not only a good proxy for understanding group behavior, but is also the reason why momentum gets transformed into reversion and vice versa. This opens up a new approach to construct investment portfolios, as a combination of momentum and reversion extends to a combination of trend - counter trend, fundamental value - growth, low-high beta, small-big size, low-high book value and various other styles.

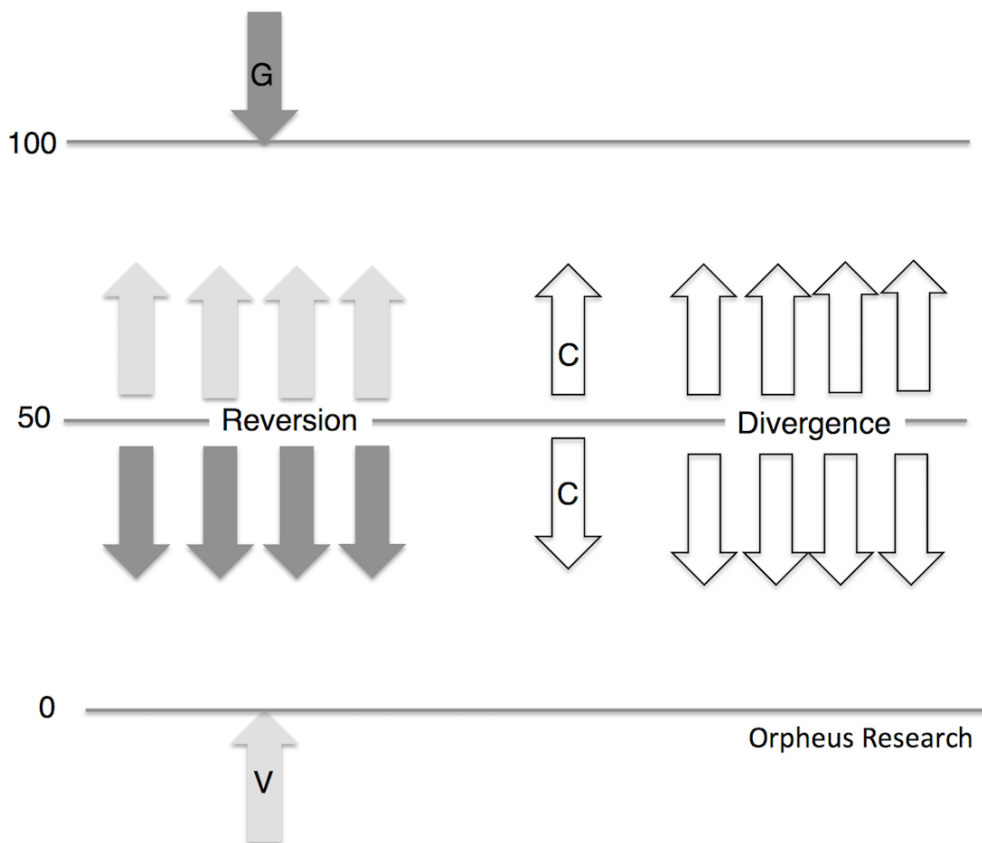
The Mean Reversion Framework

The framework as explained in 'Mean Reversion Framework', Pal, 2015 is the relative price performance proxy consisting of five bins. The bottom 0-20 percentile bin is considered value, 80-100 percentile is considered growth and the rest of the core (middle) bins are considered transition bins 20-40, 40-60 and 60-80.



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The illustration below explains how the 'Framework', consists of both reversion and divergence. The V value bin (light grey) and G growth bin (dark grey) components have a tendency to move above the relative 50 percentile mean ranking and below 50 rankings respectively. An average of nearly 50% value and growth components move above and below the 50 mean. This was the Galtonian mean reversion. It's the section on the right hand side marked 'Divergence' that completes the Galtonian observation. The number of components in the 40-60 Core ranking move toward 0-20 Value bin at the bottom extreme and 80-100 Growth at the top extreme. This case of divergence illustrates that just like reversion, there are components in the proxy that illustrate divergence from the mean. The summary illustration suggests that the proxy experiences both reversion and divergence, a classic expression in all natural systems.



Current model limitations

The framework is a new way of looking at natural systems, group behavior. The current models have the following limitations. First; Momentum and reversion (M&R) is not just a price return characteristic but a natural behavior and hence can be observed outside price returns. Relative percentile performance rankings also expresses the M&R behavior. Second; There have been various tests to detect M&R in stock market datasets. However, previous research has focused on studying behavior at stock/price level rather than on a group level. The current paper illustrates the behavior of a group of components defined by the mean reversion framework. Third; Because the available models don't have group thinking, the idea of extremes (boundaries) reversion, where relative outliers tend to revert back to relative mean could be a surprise. Fourth; The lack of group approach of available models also give them a myopic view of natural systems (markets).

The behavior of reversion and divergence in a stock market proxy is consistent across regions, suggesting that stock market systems can be understood better using the dynamic framework, which not only replenishes itself but also allows for different risk preferences to co-exist in the same ecosystem. The current models are static in their view. Fifth; The lack of composite approach of the available models also obscures their view regarding the transformation of reversion into momentum and vice versa and how both momentum and reversion are inseparable.

Dataset

Five stock markets; S&P100, FTSE100, NIKKEI225, STOXX50 and STOXX50Banks were tested for daily data over five time durations (1, 3, 5, 10 and 14 years). 14 rolling periods for each period were generated and an average of 70 portfolios for each of the five time durations were generated and tested.

‘Value UP’ plus ‘Growth DOWN’ is part of the ‘Reversion’ behavior

The number of components leaving the respective bin is recorded over time. The value - core - growth are expected to behave differently. The core is expected to diverge out and contribute to value and growth bins. While the value and growth are expected to revert towards core and even further in the respective opposite directions. This means towards growth for reverting value and towards value for reverting growth. Since all bins are relatively ranked on a scale of 0 - 100, value is expected to only revert up in time (Value UP), growth is expected to revert down in time (Growth Down) and core is expected to diverge out in both directions, up and down (Core OUT). Both ‘Value Up’ and ‘Growth DOWN’ constitute reversion. Move up were the percentage of stocks that were placed in value bin at time t_0 and were found in a higher bin at time t_k . Move down were the percentage of stocks that were placed in growth bin at time t_0 and were found in a lower bin at time t_k .

Percentage ‘Value UP’ plus ‘Growth DOWN’ is ‘Reversion’ at ‘Group’ level

The absolute number of stocks moving divided by the total number of stocks in the bin is the percentage change recorded. Along with the bin level changes, portfolio (group) level changes are also recorded. The number of ‘Value UP’ and ‘Growth DOWN’ components as a percentage of total components in the group is considered the ‘Reversion’ percentage at a portfolio (group) level.

Divergence

The ‘Core UP’ creates divergence. Absolute number of core components moving out compared to the total number of stocks in the portfolio (group) is considered ‘Divergence’ at a portfolio level. Core is the percentage of stocks that were placed in core bin at time t_0 and were found in a different bin at time t_k .

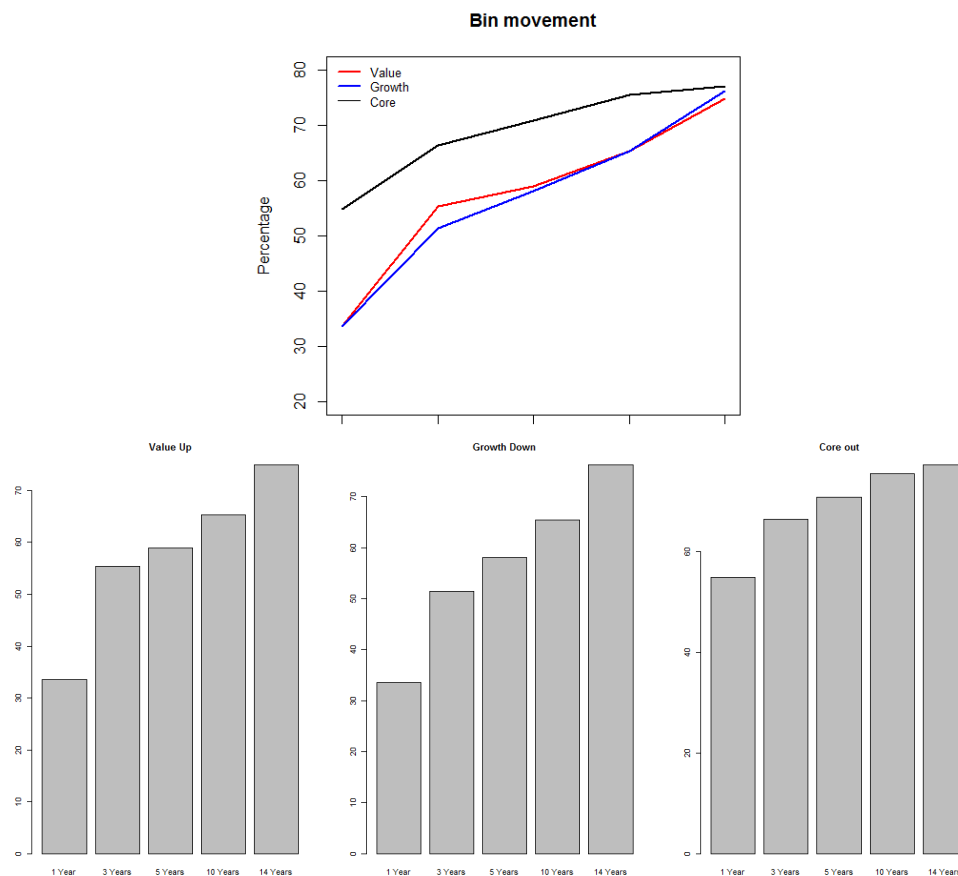
Absolute Trends

A high proportion of bin components exhibit reversion and that proportion increases with time. This proves that not only the group is dynamic but also the bin components inside the group undergo transformation. This strengthens the case of a non-random behavior inside the ‘Framework’. Reversion at a portfolio (group) level was at 30%, suggesting that about a third of the market pushes away from the positive and negative extremes i.e. ‘Growth DOWN’ and ‘Value UP’. Considering our total value and growth is 40% of the total group (0-20 and 80-100), most of the growth and value can be considered prone to reversion. From a time duration aspect; in 3 years more than half of value and growth change their bin state. This is what the author refers to as ‘Extreme Reversion’. The 3 year duration also sustains the value outperforming growth observation mentioned in De Bondt and Thaler, ‘Does the stock market overreact?’ (1985).

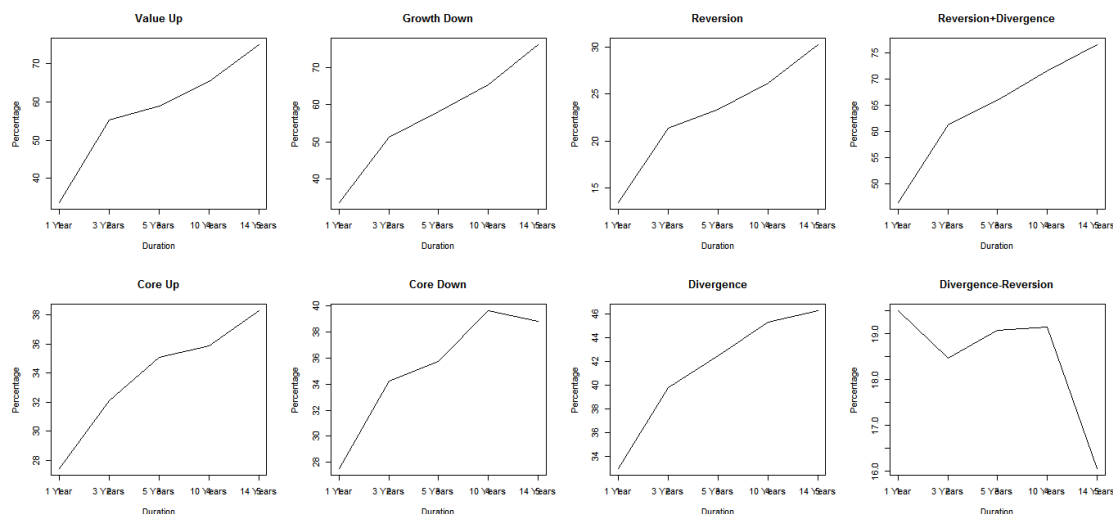
Since we are talking about a group with relative boundaries, momentum inside the group can not emerge on its own but is a precursor to reversion. We can not have reversion in absence of momentum or a counter trend in absence of a trend. High growth can't sustain its outperformance and consequently reverses. Moreover it's the divergence at the portfolio level, which keeps the repetitive cycle running. 60% of the core moves out of its original state, pushing in both upwards and downwards direction towards the extremes. From a time duration aspect, in 1 year more than half of the core diverged towards value or growth bins transforming the relative position of components intra group.

'Diversion vs. Reversion'; At a portfolio (group) level, divergence is higher than reversion across durations with 50% diverging by 14 years compared to just 30% reverting out of value and growth extremes. This is a similar behavior the author illustrated in the 'Markov and the Mean Reversion Framework', Pal (2015). This persistence in behavior of value and growth gives the specific characteristics to the bins, and makes value and growth different from core. Their is a stickiness, persistence in growth and value compared to the core. The table below illustrates not only the presence of reversion and divergence, but the difference in their character based on the classification of the original bin state.

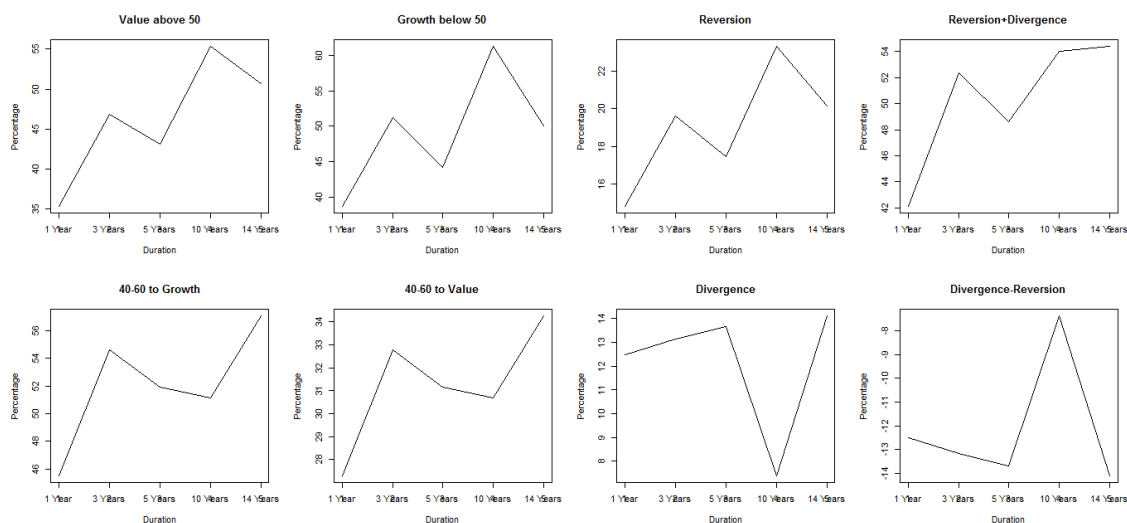
	1 Year	3 Years	5 Years	10 Years	14 Years
Value up	33.61	55.34	58.89	65.33	74.89
Growth down	33.58	51.37	58.11	65.39	76.17
Value and Growth (R)	13.44	21.34	23.40	26.14	30.21
Core up	27.40	32.12	35.08	35.86	38.30
Core down	27.50	34.23	35.72	39.62	38.80
Core out (D)	32.94	39.81	42.48	45.29	46.26



The 'Value UP', 'Growth DOWN', 'Reversion plus Divergence' all reach above 70% absolute change. This is nothing short of a complete transformation insider the framework. 'Divergence net of Reversion' reaches a maximum of near 20% and drops to near 16% over time. This means duration less than 10 years, divergence keeps pumping out components outside core into value and growth both of which respond by reverting. The trend marginally weakness in time, but divergence overall still remains stronger than reversion.

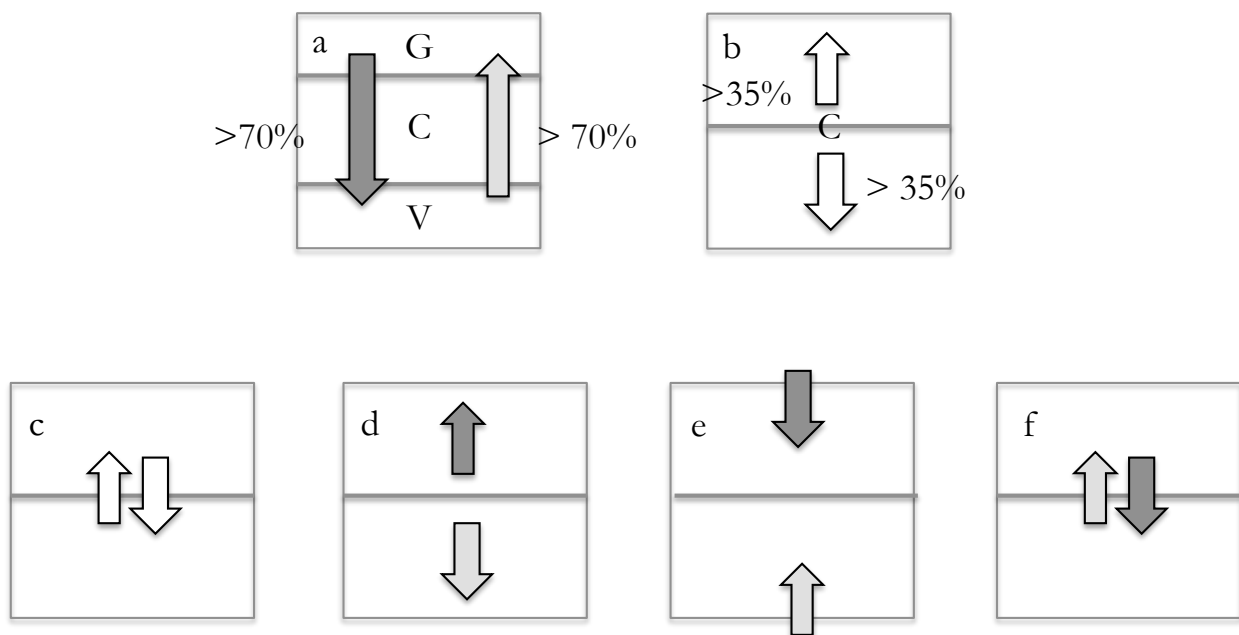


The image below illustrates that nearly 50% of 'Value UP' and 'Growth DOWN' pushes all the way to the relative mean at 50. The trends peaks out at 10 years. This means that almost half of value and growth components travel almost half way in their respective relative rankings. This indicates that a growth stock has an overhang against it and odds are against it to stay at the top. Similarly value components have odds in their favor and are positioned to not only revert out of value into core, but half of them can go all the way above 50 mid ranking. This proves that causation stories of growth and value don't mean much, in the long run odds are against Growth and in favor of Value.



Momentum and Reversion

Divergence and reversion in relative rankings creates a system, where core throws out components, why reversion causes the opposite action. The core acts as a buffer. On one side it pushes components to take the place of reverting components (stocks), and on the other side the components in reversion from a growth bin are either pushed into further negative momentum or core gives a push back to the respective component (stock) back upwards into growth. A similar process happens when value is reverting up. The core either assists the component (stock) to gather further positive momentum or pushes it back into growth. Meanwhile it also replenishes the value bin by pushing new components to replace the old ones. The cycle of momentum - reversion -momentum continues to repeat.



- a) Value Up; Growth Down
- b) Core Up; Core Down
- c) Divergence process begins from Core;
- d) Divergence process drives Momentum;
- e) Momentum reaches extremes
- f) Extremes Revert; cycle restarts

Conclusion

'Reversion and Divergence' process can hence be understood as a dynamic mechanism which allows for something in momentum to either get further positive (negative) momentum or undergo the inevitable reversion process. Reversion and divergence coexist. And dynamic behavior in the 'Framework' transforms the performance structure inside a group.

Though simple in its function, the framework is capable of creating complexity at a component level. It's harder to predict which component is going to move from value to core or to growth or in any other order, but it's easier to understand that odds are more in favor for value to go higher and odds are more against growth in the long run to underperform and fall in rankings. The functioning of the core is where randomness is the highest, not only because of its transition status and buffer status to replenish and abort or intensify ongoing trends, but also because of its bi-directional symmetry, which allows for dissipation both up and down.

Though the reversion is also a matter of size, smaller groups will see a faster tendency to move from one extreme to another, but even smaller groups show consistent and increasing transformation of a bin state in time. The consistency of the behavior will not change with group size, as the framework has a duration dependency. As the duration changes, some investment processes or strategies will work and some will fail to work. Since both value and growth show persistence, there are periods when long growth-long value will work, periods when long growth-short value will work and periods where short value - long growth will work. Study of the framework further allows for comprehension of durations, explaining how investment risk and returns are duration dependent.

'Reversion' is the driver for 'Momentum' and vice versa. A trend is a continuation of a counter trend and vice versa. Investors looking at either momentum or reversion separately are missing the composite picture, exposing themselves to duration risk. Every winner is continuing to win in the short term and then lose. Winners are not designed just to lose or just to win. Similarly losers are prone to lose in the short term and move higher and win in the longer term. Losers are not designed just to win, or just to lose. The framework challenges the old belief that fundamental value, fundamental growth and other factors drive returns. According to the 'Framework', every fundamental, statistical, technical, sentimental or natural factor is driven by the momentum and reversion process, which happens because of the balance between reversion and divergence inside the 'Framework'.

This 'Framework' suggests a universality that has huge potential applications in and out of the capital markets. Innovations built on the universal proxy should bring out an original way to look at markets (groups) and its components. Since the proxy is primarily a data innovation, the pattern is domain agnostic, suggesting a data universality. The behavior is similar across domains like sports, politics, finance, auto, health, and anything data. The proxy should be able to anticipate probabilistic growth and decay trends in groups components across different periods of time.

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