



Positioning for Late Cycle with Defensive Equity

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Equities have been on quite the run. In the 10-year period ending October 31, 2018, the MSCI World Index delivered an annualized return of 10.02%, while the annualized return on cash was a mere 34 basis points. This equates to a 9.68% annualized equity risk premium over the past 10 years. Few, if any, investors expect nearly as high an equity risk premium over the next 10 years. In fact, we frequently hear investors categorize the current market environment as “late cycle.” The market events of 2018 have done nothing to assuage the fear that the end of the equity bull cycle is near. We have experienced volatility spikes, increasing trade war rhetoric, and extreme oil price movements, to name just a few concerning episodes. Yet for all of this relative turmoil in 2018, we have also seen signs of economic strength, with the US unemployment rate at its lowest level in almost 50 years, consumer and business confidence at multi-year highs, and impressive corporate earnings growth. The contradictory signals reflect the conundrum investors face when positioning for late cycle. If an investor knew with certainty that we are at the top of an equity bubble, they would position their portfolio as defensively as possible. Conversely, if the same investor knew with certainty that the equity bull market would continue to accelerate into a bubble, they would position their portfolio to be as growth-oriented as possible. This is all easy enough provided an investor can time market cycles with certainty. In reality, precisely timing market cycles is guesswork at best, with wrong guesses negatively impacting an investor’s goal of long-term wealth creation.

We use the dot-com era (1995-2003) as a case study to show the impact of making asset allocation decisions during different phases of a cycle. We compare back-tested results for allocating between a cap-weighted MSCI World Index (MSCIWI) portfolio (risk-on), a simulated, lightly

constrained¹ minimum variance (MV) portfolio (risk-off), and a simulated defensive equity multi-factor (DEMF) portfolio. For purposes of this paper, we define a DEMF portfolio as a portfolio built through a two-step systematic process. The first step systematically selects securities with attractive quality, value, momentum and diversification scores from the MSCI World index. The second step systematically weights these securities using a risk budgeting procedure to form a portfolio that targets balanced risk contribution across sector, countries, and securities. We focus our case study on the dot-com era, as it represents the most recent period with a complete equity market cycle from bull to bubble to burst. We find many similarities, and some differences, between the current environment and the dot-com period. We draw three conclusions from our analysis. First, each of the three portfolios has a particular segment in the cycle where it outperforms. Second, there is great ambiguity in determining where we are in the equity market cycle (bull, bubble, burst). Third, given the difficulty in timing the market cycle, we believe that it is prudent for investors to seek portfolios that potentially offer the most robust results across the entire continuum of the cycle.

Narrow Markets

One of the most distinguishing features of the dot-com bubble was the narrowness of the rally. First, most of the stocks that carried the dot-com bubble came from a single sector (technology). Second, because a large percentage of the dot-com stocks were US companies, the rally was also very narrow from a country perspective. Finally, there were periods in the dot-com era where the largest stocks dominated the indices in which they were included.²

The current bull market is also driven in large part by technology companies (i.e., FAANG: Facebook, Apple, Amazon, Netflix, and Google). For example, over the 18-month period ending in June 2018, the FAANG+ index returned 104%, whereas the broader market (S&P 500) returned only 25%. To gain some perspective on how similarly today's technology sector is behaving relative to the dot-com period, we plot the ratio of index levels for the MSCIWI's Information Technology sector versus the MSCIWI's Utility sector (see Exhibit 1). Since 1995, the current level of outperformance of the Information Technology sector has only been rivaled during the dot-com era.

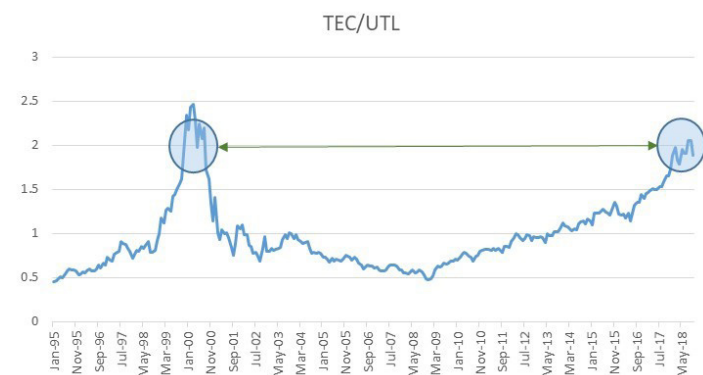


Exhibit 1: Ratio of the MSCIWI Information Technology Sector Price Index vs. The MSCIWI Utility Sector Price Index
Source: Bloomberg

Today's environment is also similar to the dot-com period in terms of relative country performance. Exhibit 2 shows the rank of the 36-month return for the US relative to the other countries in the MSCIWI, where rank 1 is the highest as evaluated by each country's trailing 36-month return. While the US currently ranks as one of the best performing countries, we note that the average rank of the US is 9 over the period from 1995 to 2018.



Exhibit 2: Rank of 36-Month Country Return for the US
Source: MSCI

As a final measure of narrowness, Exhibit 3 shows the rolling 12-month excess return (excess relative to the MSCIWI index return) of the top 10 largest stocks in the MSCIWI. This chart shows that the 10 largest stocks have been the primary drivers of the index's positive performance. This magnitude in return dispersion between the largest stocks and the rest of the index has only been matched in three other periods since 1995. Two of these periods occurred before the dot-com bubble burst in 2000, and the other period occurred after the Global Financial Crisis in 2008.



Exhibit 3: Rolling Cumulative Return of a Value-Weighted Portfolio of the 10 Largest Stocks in Excess of the MSCIWI
Source: MSCI

The large performance dispersion across sectors, countries, and names points to a lack of breadth in the current bull market and is alarmingly similar to what we saw as the dot-com bubble was forming. How similar are today's valuations to those during the dot-com bubble? Valuation ratios in the dot-com era were stretched very thinly by the explosive price appreciation of nascent companies, many of whom had very low or even negative earnings, resulting in staggeringly high price-earnings (PE) and price-to-book (PB) ratios.

Valuations

From the standpoint of the overall market, the current market PE and PB ratios seem to have climbed recently, but still have not risen to match those at the peak of the dot-com bubble. Exhibits 4 and 5 show the US PE and PB ratios over time. The current level of both of these variables appears more in line with the beginning of the dot-com bubble rather than the end of the dot-com bubble

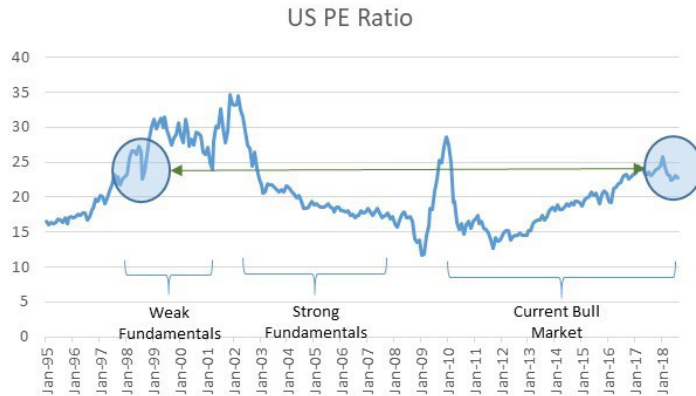


Exhibit 4: PE Ratio for the MSCI US Index

Source: MSCI



Exhibit 5: PB Ratio for the MSCI US Index

Source: MSCI



Index level valuations represent the weighted average valuation for all of the stocks in the index. For the purpose of this analysis, we want to compare the valuations of the largest stocks, which happen to be responsible for driving the market higher in both the dot-com bubble as well as today's current bull market. Exhibit 6 shows the PE and PB ratios of the 10 largest stocks in the MSCIWI through time.

Based on the results shown in Exhibit 6, it does not appear that the valuation ratios of the largest firms in the index are stretched. While they are slightly higher than they were during the credit expansion, they are substantially lower than those seen at the top of the dot-com bubble. This suggests an important distinction between the dot-com era and today. The technology companies driving the market higher during the dot-com era were largely start-up companies on the forefront of a technological revolution. Cash burn was high and their revenue models were largely untested. Even amidst the height of the dot-com euphoria, it wasn't unreasonable to think that some of the Internet start-ups would fail. The stocks at the forefront of today's equity market rally are mature companies with proven revenue models producing healthy cash flow. Despite their strong price appreciation, their fundamental factor characteristics, such as quality and value, remain strong. While the price of Apple's stock may decline at some point in the future, it is hard to imagine the company will fail within the next 10 years.

Extreme performance in growth stocks (technology) and high measures of market narrowness do suggest that the current environment is similar to the dot-com era. However, the current valuations, while increasing, are still not in the range where the dot-com bubble began to burst. These similarities and differences result in great ambiguity as to where we are regarding the current phase of the market cycle. The lack of breadth suggests the equity bull market may be on its last legs, while reasonable factor characteristics like quality and value potentially point to greater upside. Given the uncertainty, many investors are scrambling to build a portfolio that can still participate if the bull market continues, but is defensively positioned in case it does not. In the next section we compare the back-tested results of a simulated DEMF strategy with that of the capitalization-weighted index

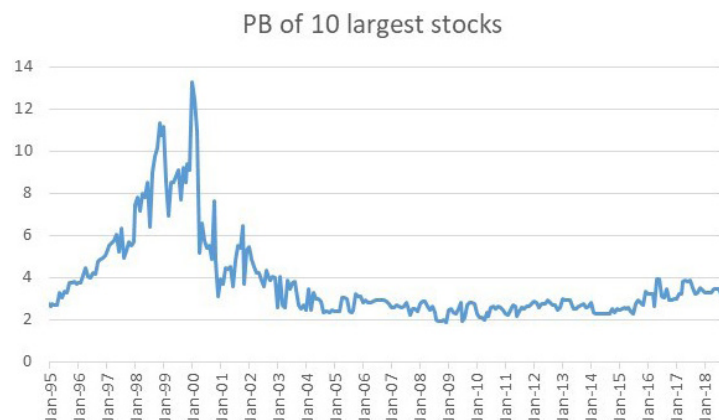


Exhibit 6: PE and PB Ratios for the Top 10 Largest Stocks in the MSCIWI

Source: MSCI

(risk-on) and a simulated minimum variance portfolio (risk-off) during different subperiods of the dot-com era. Given the inherent ambiguity attempting to determine where we currently are in the cycle, we demonstrate that neither cap-weighted nor minimum variance approaches have historically been robust enough to both participate in the upside and protect on the downside throughout the course of an entire market cycle.

Case Study: Dot-com bubble³

Timing the market precisely can be very tricky (perhaps impossible), but recognizing dislocations in the market and structuring your portfolio to avoid unnecessary risk taking is prudent. Our research indicates that investing in risk-on portfolios such as a cap-weighted index is lucrative during rising markets, while investing in risk-off portfolios such as a minimum variance portfolio is valuable during falling markets. However, the reverse is not true. In Exhibit 7 we show the difference between the MSCI World Index and a lightly constrained minimum variance portfolio optimized using a risk model and the constituents of the MSCIWI.⁴

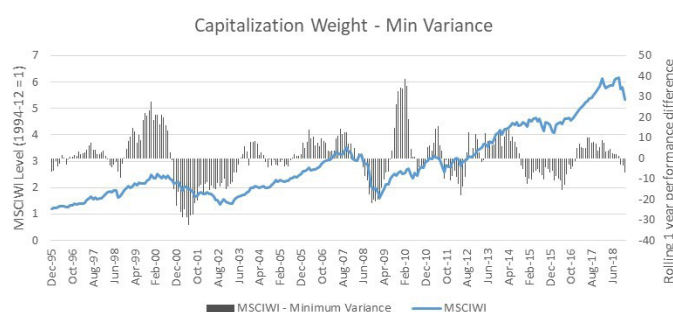


Exhibit 7: Rolling 1-Year Hypothetical Performance Difference Between the MSCI World Index and the Simulated Minimum Variance Portfolio

Source: MSCI and PanAgora

While the pattern of the cap-weighted index's performance and the back-tested results of the simulated minimum variance portfolio appear to be polar opposites, they appear to be similar in at least one significant respect. Both portfolio weighting techniques can lead to unnecessarily high risk concentrations across individual stocks. High risk concentrations can lead to extreme performance patterns. The cap-weighted index has unnecessary risk concentrations in its largest stocks, while the simulated minimum variance portfolio appears to include unnecessary risk concentrations in stocks with the lowest ex-ante volatility (Qian, Alonso, and Barnes 2015). These risk concentrations can lead to instability in return capture across different segments in the market cycle.

The back-tested results generated by a DEMF strategy appear to be less sensitive to market cycles than both cap-weighted and low volatility approaches as a DEMF strategy is designed to offer both upside participation during periods of market strength and downside protection in periods of market weakness. In our opinion, a DEMF portfolio benefits from a two-step systemic build process (asset selection and portfolio construction), with each step designed to offer a differentiated solution. First, in asset selection, a subset of stocks is selected from the universe that has high exposure to compensated risk factors like Quality, Value, and Momentum. In this step, a diversification score is

assigned to each stock with the intent to select a diverse set of stocks with high factor scores without having to rely on arbitrary optimization constraints. Second, in portfolio construction, Risk Parity principles can be applied to balance risk across sectors, countries, and stocks. The resulting portfolio is designed to be a combination of return-enhancing stocks (via targeted factor exposures) assembled in a way that seeks to provide high downside protection (via risk-based portfolio construction).

Exhibit 8 demonstrates the hypothetical performance of a back-tested portfolio utilizing a DEMF strategy in different types of bubble/burst environments. As indicated in Exhibit 8, we have broken up the dot-com era into different time periods.

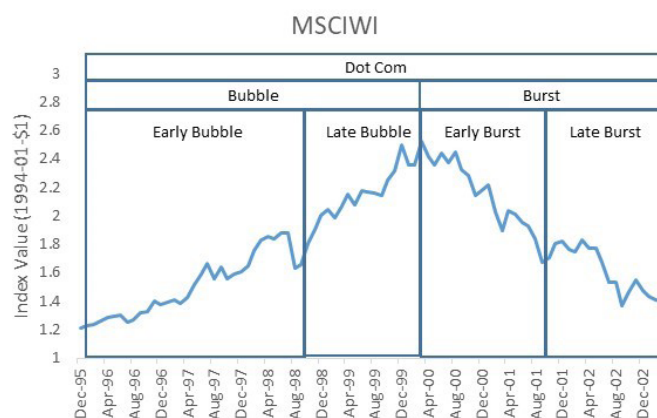


Exhibit 8: Back Tested Results Breaking Up the Dot-Com Era into Subperiods

Source: MSCI and PanAgora

These subperiods represent different phases of a full market cycle, all with different market characteristics. The Late Bubble and Early Burst periods are meant to identify two of the more extreme markets, while the Early Bubble and Late Burst periods are meant to represent less extreme markets. Distilling the entire cycle into subperiods can help identify how each approach performs across different environments. Exhibit 9 compares the subperiod performance for the cap-weighted index against the back-tested results of the simulated minimum variance portfolio and a simulated DEMF portfolio, in all such cases for the period commencing January 1995 through March 2003. Across the four phases of the cycle, the DEMF strategy appears to generate the best results during less extreme or concentrated periods, which happen to be at the very beginning and very end of the cycle. During these periods, diversified portfolios appear to perform better by capturing greater upside in broad rallies and/or offering lower downside capture in broad-based sell-offs. In the Early Bubble phase, the gains in the return data were broader-based across sectors, countries, and names, generally resulting in upside capture across the entire universe of developed market stocks. In the Late Burst phase of the cycle, the losses in the return data were also broadly distributed, with diversification limiting downside capture.

Per our back-tested research, during both the Early Bubble and Late Burst phases, the results generated in respect of DEMF portfolios outperformed the cap-weighted and simulated minimum variance portfolios.⁶ In the Late Bubble phase, the cap-weighted portfolio demonstrated superior performance to the results generated by both the DEMF and simulated minimum variance portfolios, as the market strength was narrowly

	Period Dates	MSCIW I	MV Back test	DEMF Back test	Performance Dispersion
Early Bubble	Jan-95 to Aug-98	14.23	16.58	18.55	2.16
Late Bubble	Sep-98 to Mar-00	31.96	4.62	15.90	13.74
Early Burst	Apr-00 to Sep-01	-23.99	1.70	-5.63	13.23
Late Burst	Oct-01 to Mar-03	-11.17	-2.34	4.13	7.68
Bubble	Jan-95 to Mar-00	19.31	12.84	17.75	3.38
Burst	Apr-00 to Mar-03	-17.83	-0.34	-0.87	9.95
Dot-com	Jan-95 to Mar-03	4.18	7.85	10.60	3.22
Late Bubble Early Burst	Sep-98 to Sep-01	0.90	3.19	4.88	1.99
Full Back test ¹	Jan-95 to Dec-18	7.23	8.18	10.41	1.63

Exhibit 9: Performance/Back Tested Results (as applicable) in Dot-Com Era Subperiods. The Dispersion Column Shows the Cross-Sectional Standard Deviation of Return across Each Portfolio

Source: MSCI and PanAgora

concentrated in the largest stocks. Cap-weighted portfolios have an inherent momentum exposure which is strongly compensated towards the end of the Bubble period. During the dot-com cycle, this momentum was in the largest-weighted stocks in the technology sector. The price appreciation in stocks accelerated through the Late Bubble period, as the annualized return of the cap-weighted portfolio was more than double the annualized returns in the Early Bubble period. In contrast, the results in the Late Bubble period were lower than the Early Bubble period for both the minimum variance and the DEMF simulated portfolios. This further points to the lack of breadth in the rally. During the initial wave of bubble bursting, the results generated by the simulated minimum variance portfolio appears to be superior to both the cap-weighted and DEMF portfolios by delivering a hypothetical annualized return of 1.7%. The initial retracement in the equity market resulted in a sharp momentum crash with the largest stocks experiencing the largest drawdowns.

Per our test, the minimum variance portfolio delivered a hypothetical positive return over this period, as it was concentrated in the lowest volatility and more defensive stocks, which generally avoided sharp drawdowns. In contrast, the cap-

weighted portfolio was concentrated to the highest momentum stocks, resulting in an annualized drawdown of 24% over the Early Burst phase of the cycle. Finally, the dispersion column demonstrates how much variation in return there was across the three different portfolio approaches in our testing. This is particularly true in respect of the inflection points of the cycle as the market transitioned from the peak of the bubble to the beginning of the crash. Although not our primary focus in this paper, Exhibit 9 also shows the performance (or back-tested results in the case of the simulated minimum variance portfolio and the DEMF portfolio) of all three portfolios over the full back test period from January of 1995 through December of 2018. As indicated in our research, the simulated DEMF portfolio outperformed both the cap-weighted and the simulated minimum variance portfolios over the back test period suggesting the robustness of the DEMF strategy even outside of the dot-com period.

Maximizing Upside and Limiting Downside Capture

Despite the fact that all of the portfolios described in this paper started with the same investment universe, the subperiod performance (or back-tested results in the case of the minimum variance and the DEMF simulated portfolios) across portfolios exhibits a remarkable amount of dispersion. Cap-weighted portfolios appear best suited to maximize upside capture, while minimum variance portfolios appear best suited to limit downside capture. In periods where risk-adjusted returns are similar across the universe, the diversification benefit of the simulated DEMF portfolio appears to have added significant value. While these differences are dramatic over the course of the eight-year dot-com cycle, they are largely representative of the natural cycle for equity investors. We believe the most efficient equity portfolios are the ones that can demonstrate a long-term, positive asymmetry between upside and downside capture. Exhibit 10 shows the cumulative performance for the MSCWI and the back tested MV and DEMF strategies from 1995-2018. As expected, the cap-weighted portfolio (MSCWI) captured the best upside participation, but also captured much of the downside. The back-tested results of the simulated minimum variance portfolio appear to provide the best downside protection, but also captured little of the upside during rising equity markets. It is worthwhile to note that the back-tested results of the simulated minimum variance

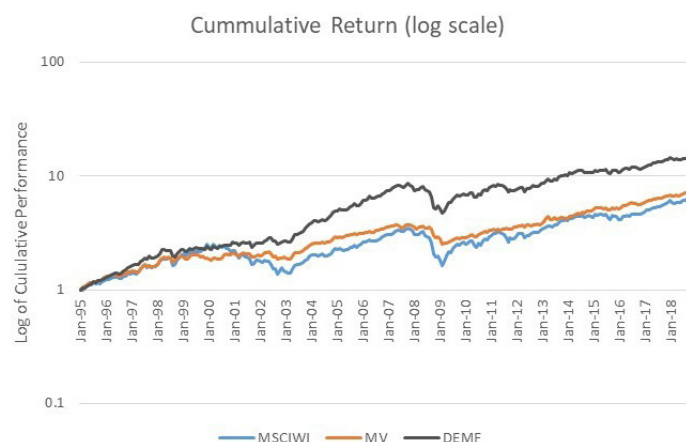


Exhibit 10 Simulated Cumulative Return in Log Scale for MSWI, MV Back Test and DEMF Back Test

Source: MSCI and PanAgora

	MSCIWI	MV Back Test	DEMF Back Test
Return	7.23	8.18	10.41
Risk	14.58	9.41	12.23
Return/Risk	0.50	0.87	0.85
Upside Participation	1.00	0.59	0.91
Downside Participation	1.00	0.36	0.59
Participation Ratio	1.00	1.63	1.53
Participation Difference	0.00	0.23	0.31
Participation Average	1.00	0.48	0.75

portfolio appear to exhibit some positive asymmetry between upside and downside capture, providing empirical support for the low beta anomaly. The back-tested results of the simulated DEMF portfolio appear to achieve the greatest long-term asymmetry between upside and downside capture. As demonstrated in Exhibit 10 below, the simulated DEMF portfolio neither achieves the highest upside capture nor minimizes the lowest downside capture. Rather, such strategy appears to strike a balance between the two objectives. Based on our findings, this balance potentially facilitates more efficient harvesting of equity risk premium when navigating transitions from bubble formation to bubble burst periods, or more generally the natural ebbs and flows of equity market cycles.

Conclusion

The recent equity market turbulence in conjunction with the unprecedented length of the current bull market is tempting investors to predict where we are in the cycle and position their portfolios accordingly. These predictions are difficult to make with precision on an a priori basis. Furthermore, the consequence of inaccurate predictions can be wealth destruction. A cap-weighted investor who mistakenly moves into a minimum variance portfolio in the early stages of a bubble formation may significantly limit their upside capture. A cap-weighted investor who mistakenly rides the wave into the bursting bubble phase can wipe out a significant portion of the wealth they created in the bull market. In this paper, we have presented our findings which we believe demonstrate that a well-designed DEMF strategy has the potential to achieve greater positive asymmetry between upside and downside capture and thus, in our opinion represents a robust and prudent solution over a full market cycle. While we expect a portfolio implementing a DEMF strategy to lag a cap-weighted portfolio in the late stages of a bubble, we expect its targeted exposure to compensated risk factors will help capture a material amount of the equity market's upside. We also expect a portfolio implementing a DEMF strategy to lag a minimum variance portfolio during a sharp decline in the equity market, but we expect a DEMF strategy's risk-based diversification to limit a significant amount of downside capture. A portfolio that can achieve balanced performance across up and down markets via implementation of a DEMF strategy will be less sensitive to equity market transitions between different phases in market cycle. In our view, this consistency makes a well-designed DEMF strategy a potentially attractive solution for investors who are concerned, yet not convinced, that we are approaching the end of a great bull market run.

Disclosure

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Endnotes

1. No constraints other than a non-negativity (long-only) and maximum stock weight of 10%.
2. We have selected the dot-com cycle for our back-testing period in these materials because it represents a recent complete market cycle and because of what we believe to be certain similarities to the current equity cycle. However, our research indicates that the strategies described herein generate similar back-tested results in other market conditions. We would be happy to share our back-tested results for these other cycles upon request. There can be no assurance that the current equity cycle will behave in a manner similar to the dot-com cycle or that any strategy described herein will behave in a manner consistent with the back-tested performance results set forth herein.
3. This case study relies substantially on back-tested results of simulated strategies. Back-tested results are subject to material limitations. For more information, please see the disclaimers at the end of the case study.
4. The simulated minimum variance portfolio is calculated based on the MSCI World Universe. For purposes of this paper, we have applied a non-linear optimization procedure with the objective function of minimizing the portfolio's total variance. We imposed three constraints: 1) the weights must be positive (long-only), 2) the weights must sum to 1 (fully invested), and 3) no single stock weight above 10% (breadth). The back-tested results for the simulated minimum variance portfolio are shown gross of any fees and trading costs, each of which would materially reduce such results.
5. Back-tests are run using all internally available data. Data prior to 1995 is not available due to limitations in our internal database system regarding the storage of stock level information. For a portion of the full back-test period described in this paper (more specifically June 1, 2015 through December 31, 2018), PanAgora managed an account funded with proprietary capital that implemented a variation of the DEMF investment strategy described in this paper. The investment strategy implemented by

such account has evolved since the account's inception as PanAgora's experience and techniques implementing such strategy have been refined over time. The assumptions used to generate the back-tested results set forth in this paper were based on PanAgora's views (as of the date of this paper) on managing a defensive equity multi-factor portfolio. For the period commencing at inception of the proprietary account through August 31, 2017, the actual performance results achieved in such proprietary account underperformed the back-tested results of the simulated DEMF portfolio described in this paper. For the period commencing September 1, 2017 through December 31, 2018, the actual performance results achieved in such proprietary account outperformed the back-tested results for the same period with a convergence of performance results towards the end of such period. Please contact PanAgora for additional information regarding the actual performance results for such proprietary account.

6. Significant care is taken when building a back-test of a systematic strategy. All back-tests are conducted out of sample, gross of fee. None of the back-tests employ any leverage and all back-tests are run using the constituents of the MSCI World Index. There are no changes in the back-test methodology for any of the back-tests presented in this paper over the period for which data covers (1/1995-12/2018). For the MV back-test we use a proprietary optimization procedure to construct a simulated minimum variance portfolio from the constituents of the MSCI World Index. In the MV back-test optimization we include a long only constraint, a fully invested constraint, and a maximum weight constraint for any individual stock of 10%. For the MV back-test we do not account for trading or transaction costs. For the DEMF back-test we select securities from the MSCI World Index that are highly diversifying and have overall high exposures to Value, Quality, and Momentum factors. Once the stocks are selected we calculate weights to each stock such that we balance risk across the portfolio's sectors, countries, and stocks. For this DEMF strategy, we assumed a 150 basis point annual trading cost as a result of market impact, bid/offer spread, and commissions.

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Authors' Bio



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Mr. Alonso is a director within the Multi Asset group. He is responsible for quantitative model research, development and enhancements for PanAgora's Multi Asset strategies. He is also responsible for the development and management of the firm's Defensive Equity strategies, including alternative-beta and factor-based strategies. Mr. Alonso joined PanAgora from Mellon Capital Management (formerly Franklin Portfolio) where he was a Quantitative Analyst primarily responsible for research and management of Market Neutral Equity portfolios.

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Mr. Belton is a Director within the Multi Asset group. Mr. Belton is responsible for research as well as the daily management of the firm's Risk Parity, global fixed income, currency, and commodity portfolios. Mr. Belton is a member of the firm's Directors and Operating Committees.

Prior to joining PanAgora, Mr. Belton was the Investment Portfolio Officer at the Federal Home Loan Bank of Boston. In that role, he was responsible for actively managing and hedging all of the Bank's long-term investment portfolios. Before joining the Federal Home Loan Bank of Boston, Mr. Belton was a Senior Manager at Investors Bank & Trust Company

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Dr. Qian is the Chief Investment Officer and Head of Research, Multi Asset for the firm. His primary responsibilities include investment research and portfolio management in PanAgora's Multi Asset group. He is also a member of the firm's Investment, Operating, and Directors

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Dr. Qian has a distinguished career in investment management as well as academia. A renowned researcher, Dr. Qian's pioneering work, "On the Financial Interpretation of Risk Contribution: Risk Budgets Do Add up", became a cornerstone for what is commonly referred to as "Risk Parity" type investment strategies today. Dr. Qian's research has helped PanAgora become a leader in the area of risk budgeting strategies by launching the first Risk Parity Portfolios earlier this decade. He is the author of the recently published book, *Risk Parity Fundamentals*. Dr. Qian has authored many articles regarding quantitative equity investment techniques as well as co-author of the book, *Quantitative Equity Portfolio Management: Modern Techniques and Applications*.

Prior to joining PanAgora, Dr. Qian was a Portfolio Manager and part of the Asset Allocation team at 2100 Capital, an alternative investments firm. His prior experience includes a role as Senior Asset Allocation Analyst on Putnam Investments' Global Asset Allocation team. Before joining Putnam, he was a fixed-income Quantitative Analyst at Back Bay Advisors.

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