ADAPTIVE STRATEGIES DESIGNED TO THRIVE IN CHANGING ENVIRONMENTS

Future Market Directions and How to Profit from the Chaos
Thought Leaders: over 200 articles, Quantitative Focused Podcast, Wiley published book, Several Whitepapers and nearly 300k engagements

Passionate educators, Adam, Mike and Rodrigo have authored the book *Adaptive Asset Allocation - Dynamic Global Portfolios Designed to Profit in Good Times and Bad* published by Wiley, as well as several whitepapers that rank in the top 1% of most downloaded research on the academically renowned SSRN network. The team is also responsible for the popular GestaltU.com investment blog.

Source: Social Science Research Network (SSRN). SSRN compiles rankings of Authors in their system based on a number of relevant measures, such as downloads and citations. To be ranked, an author must have at least one publicly available scholarly full-text paper on SSRN, and only the data for those full-text papers are used in the rankings. Privately available papers are not considered in these rankings. SSRN compiles rankings of all authors in SSRN and of authors in selected disciplines. As of September 6, 2019 The lead Author, Adam Butler, ranked 767 in total new downloads (2.6 percentile) and 972 in total downloads (3.2 percentile). Also ranked 39 in total downloads per paper (0.13 percentile). This is out of 29,914 total authors.
Where do Markets Go from Here?
What type of economic regime should we expect from here?

- **Stagflation** (SLOWING GROWTH + RISING INFLATION)
- **Deflationary Bust** (SLOWING GROWTH + RISINING INFLATION)
- **Inflationary Boom** (ACCELERATING GROWTH + RISING INFLATION)
- **Dis-inflationary Boom** (ACCELERATING GROWTH + RISING INFLATION)
A diverse investment universe contains assets fundamentally designed to thrive in each major economic regime.

**Asset Class Behaviours in Different Inflation & Growth Regimes**

**Inflationary Stagnation**

- Slowing growth
- Slowing inflation
- Inflation protected bonds
- Emerging bond spreads
- Gold

**Deflationary Bust**

- Long duration Treasuries
- Gold
- Emerging bond spreads
- Inflation protected bonds

**Inflationary Boom**

- Developed corporate bond spreads
- Treasuries
- Developed real estate
- Developed equities

**Deflationary Bust**

- Infl Real Estate
- Gold
- Commodities

**Disinflationary Boom**

- Emerging equities

Source: ReSolve Asset Management. For illustrative purposes only.
Empirical examples of secular trends in different regimes

Average Yearly Returns for Global Asset Classes

Source: ReSolve Asset Management. Data from Tiingo. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS.
These dynamics also play out in shorter cycles

### Global Asset Class Ranked Market Returns in USD (2000-2018)

Covid-19 Crash is no exception to these dynamics

2020 YTD Returns (to April 13)

-27%
-23%
-17%

Source: ReSolve Asset Management. Data from Tiingo. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS.
Takeaway

Different asset classes are designed to thrive under different growth and inflation dynamics.

If you can’t predict future asset class movement then **preparation is key**.

Don’t favor one asset class above others.
How to Best Capitalize on Diversification
Holding structurally diverse asset classes in Risk Parity can create better balance (SIMULATED PERFORMANCE)

Average Yearly Returns for Global Asset Classes vs Risk Parity

RISK PARITY RESULTS ARE BASED ON SIMULATED OR HYPOTHETICAL PERFORMANCE RESULTS THAT HAVE CERTAIN INHERENT LIMITATIONS. UNLIKE THE RESULTS SHOWN IN AN ACTUAL PERFORMANCE RECORD, THESE RESULTS DO NOT REPRESENT ACTUAL TRADING. ALSO, BECAUSE THESE TRADES HAVE NOT ACTUALLY BEEN EXECUTED, THESE RESULTS MAY HAVE UNDER-OR OVER-COMPENSATED FOR THE IMPACT, IF ANY, OF CERTAIN MARKET FACTORS, SUCH AS LACK OF LIQUIDITY. SIMULATED OR HYPOTHETICAL TRADING PROGRAMS IN GENERAL ARE ALSO SUBJECT TO THE FACT THAT THEY ARE DESIGNED WITH THE BENEFIT OF HINDSIGHT. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THESE BEING SHOWN.

Analysis by ReSolve Asset Management. Data from Tiingo. SIMULATED PERFORMANCE. PAST RESULTS ARE NOT INDICATIVE OF FUTURE PERFORMANCE. This hypothetical performance does not represent the return to an actual fund or trading account that an investor could directly participate in and is for illustrative purposes only. These results account for borrowing costs but do not account for any management fees. These results show the growth of $100 assuming the purchase and sales of securities were executed at end of month closing price. Profits are reinvested and the simulation does not reflect any transaction costs of buying and selling securities. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. Please read disclaimer at the end of this presentation for more information.
A focus on preparation through risk balance can lead to significantly less extreme portfolio movements during crises.

Source: ReSolve Asset Management. Data from Tiingo. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS.
Takeaway

- Maximize diversification by ensuring the *maniacs aren’t taking over the asylum*

- Allocate to asset classes so that each one contributes the same amount of risk to the portfolio

- Prioritize preparation over prediction
Pushing the Diversification Boundaries
Can we improve performance outcomes by diversifying across macro factors?

Diversified Macro Factors
For Illustrative Purposes Only

- **Seasonality**: Alpha sources that derive returns from persistent seasonal return effects
- **Counter-Trend**: Alpha sources that derive returns by trading against extreme dispersions to long term averages/expectations
- **Carry**: Alpha sources that derive returns from under-pricing markets with high payouts

**Pairwise Correlation Between Alpha Groups**

<table>
<thead>
<tr>
<th></th>
<th>Carry</th>
<th>Seasonality</th>
<th>Counter-Trend</th>
<th>Momentum/Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carry</td>
<td>1</td>
<td>0.38</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Seasonality</td>
<td>0.38</td>
<td>1</td>
<td>0.31</td>
<td>0.2</td>
</tr>
<tr>
<td>Counter-Trend</td>
<td>0.2</td>
<td>0.31</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Momentum/Trend</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pearson Correlation**

Numerically, the Pearson correlation coefficient is used in linear regression; ranging from -1 to +1. A value of +1 is the result of a perfect positive relationship between two or more variables. Conversely, a value of -1, represents a perfect negative relationship.

**SIMULATED PERFORMANCE**
Please read disclaimer at the end of this presentation for details. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology and the underlying market data. Please review the disclosures at the end of this document for more information.
Which Factors should we emphasize in the next phase?

There’s a belief that we can reliably predict the character of macro factors during different economic regimes.

For instance: Trend is the best option to profit in bear markets.
Which Factors should we emphasize in the next phase?

Macro Factors During Different Market Crashes and their Recoveries

**SIMULATED PERFORMANCE - For Illustrative Purposes Only**

These results are based on simulated or hypothetical performance results that have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual trading. Also, because these trades have not actually been executed, these results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated or hypothetical trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to these being shown.

Analysis by ReSolve Asset Management. Data from CSI Data and Bloomberg. This hypothetical performance does not represent the return to an actual fund or trading account that an investor could directly participate in and is for illustrative purposes only. These results account for borrowing costs but do not account for any management fees. These results assume the purchase and sales of securities were executed at their daily closing price. Profits are unrealized and the simulation does not reflect any transaction costs of buying and selling securities. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. Please read disclaimer at the end of this presentation for more information.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carry</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Carry</strong></td>
</tr>
<tr>
<td>72.28%</td>
<td>45.07%</td>
<td>12.64%</td>
<td>740.99%</td>
<td>182.18%</td>
<td>44.23%</td>
<td>43.11%</td>
<td>39.86%</td>
</tr>
<tr>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Trend</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Carry</strong></td>
</tr>
<tr>
<td>97.61%</td>
<td>24.18%</td>
<td>12.6%</td>
<td>620.07%</td>
<td>-162.31%</td>
<td>36.66%</td>
<td>19.92%</td>
<td>-31.36%</td>
</tr>
<tr>
<td><strong>Trend</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
</tr>
<tr>
<td>50.62%</td>
<td>11.54%</td>
<td>2.33%</td>
<td>496.8%</td>
<td>159.87%</td>
<td>35.05%</td>
<td>0.97%</td>
<td>21.93%</td>
</tr>
<tr>
<td><strong>Seasonality</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
</tr>
<tr>
<td>12.19%</td>
<td>1.61%</td>
<td>0.51%</td>
<td>468.68%</td>
<td>49.15%</td>
<td>2.42%</td>
<td>-1.55%</td>
<td>2.87%</td>
</tr>
<tr>
<td><strong>US Equities</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Trend</strong></td>
<td><strong>Seasonality</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
</tr>
<tr>
<td>2.61%</td>
<td>-1.39%</td>
<td>-2.15%</td>
<td>463.96%</td>
<td>-3.81%</td>
<td>2%</td>
<td>-5.63%</td>
<td>0.88%</td>
</tr>
<tr>
<td><strong>Mean Reversion</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Trend</strong></td>
<td><strong>US Equities</strong></td>
<td><strong>Trend</strong></td>
<td><strong>Carry</strong></td>
<td><strong>Mean Reversion</strong></td>
<td><strong>Trend</strong></td>
</tr>
<tr>
<td>-9.19%</td>
<td>-1.25%</td>
<td>1.43%</td>
<td>-9.06%</td>
<td>-6.15%</td>
<td>-24.06%</td>
<td>-6.67%</td>
<td>-6.71%</td>
</tr>
</tbody>
</table>

1. These results account for borrowing costs but do not account for any management fees. These results assume the purchase and sales of securities were executed at their daily closing price. Profits are unrealized and the simulation does not reflect any transaction costs of buying and selling securities. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. Please read disclaimer at the end of this presentation for more information.
Bet Sizing Under Heightened Uncertainty
Pricing Model Uncertainty Hypothesis

- Volatility increases when investors have a hard time mapping new information onto prices; as a result prices overshoot both to the upside and downside.

- Extreme uncertainty - due to the COVID-19 pandemic, economic crisis and subsequent government interventions - makes it much harder to establish the true price of an asset.

Conclusion: higher volatility leads to less reliable price discovery → bet sizes should adjust to this reality.
Volatility Targeting

- Create portfolio

- Measure Portfolio’s expected volatility

- If portfolio volatility > target then decrease portfolio exposure pro-rata to cool down and hit the 12% volatility target

- If portfolio volatility < target then increase portfolio exposure pro-rata to hit the 12% volatility target

- Reassess daily
Keeping portfolio volatility in check by adjusting portfolio exposures

12% Volatility Target vs. Global Balanced
Simulated Results (For Illustrative Purposes)

Rolling 252 day annualized volatility of Portfolio at a 12% Volatility Target
Rolling 252 day annualized volatility of Vanguard Balanced Fund

Source: ReSolve Asset Management. Data from Tiingo. Simulated Performance. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology and the underlying market data. Please review the disclosures at the end of this document for more information.
Volatility targeting helps to reduce the left fat tail (black swan events) common in Equity Markets.


- **Multi-Asset Momentum: 10% Volatility (SIMULATED)**
- **Vanguard All Stock US Index Fund**

**Much smaller left tail**

**Slightly fatter right tail**

*Source: ReSolve Asset Management. Data from Tiingo. Simulated Performance. Past results are not necessarily indicative of future results. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology and the underlying market data. These results are for illustrative purposes only and not based on any actual portfolios ReSolve manages. Please review the disclosures at the end of this presentation for more information.*
Bet sizing during uncertainty is key

- Properly applied bet sizing reduces negative tail events

- Big bold bets at this level of uncertainty are probably a bad idea

- Maximum asset class & factor diversification + Volatility targeting is likely a better approach
Conclusion

Under heightened uncertainty we need to prioritize:

1. Maximum asset class diversification

2. Maximum strategy diversification

3. Reduce your bet sizes and adjust as volatility subsides
Appendix: Risk Parity In a Bond Bear Market
Risk Parity Myth

Risk Parity is just a levered bond portfolio; when bonds do poorly Risk Parity will suffer more than traditional portfolios.
At first blush a Risk Parity portfolio seems unreasonably overweight bonds.

Simple Risk Parity
Theoretical Capital Allocation at 200% leverage
For Illustrative Purposes Only

- Bond Capital Allocation: 120%
- Inflation Assets Capital Allocation: 20%
- Equity Capital Allocation: 60%

Source: ReSolve Asset Management.
Given how bonds suffered a four decade drawdown from 1941 – 1981. Clearly Risk Parity should suffer commensurately- Right?

Cumulative Real Returns of US Treasuries

- **1928- July 1941**
  - Real Return: 5.61%
  - Max Loss -4.58%

- **July 1941-Sept 1981**
  - Real Return: -2.68%
  - Max Loss -60.37%

- **Sept 1981 - 2016**
  - Real Return: 5.59%
  - Max Loss -13%

Source: ReSolve Asset Management. Data from Global Financial Data. PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS. Please read Chart disclaimer for information on index data used for the performance numbers of this table.
But remember: it’s the risk contributions that matter. From a risk perspective Risk Parity is in perfect balance.

### Simple Risk Parity

**Theoretical Risk Contributions at 200% leverage**

*For Illustrative Purposes Only*

- **Bond (Low Growth) Risk Contribution**: 66%
- **Inflation Assets Risk Contribution**: 66%
- **Equity (Strong Growth) Risk Contribution**: 66%
As such, a levered Risk Parity portfolio simulation targeting 9% volatility outperformed traditional balanced portfolios with positive real returns.

### Real Return Analysis Risk Parity at 9% Volatility Target
August 1941 – September 1981

**SIMULATED PERFORMANCE - FOR ILLUSTRATIVE PURPOSES ONLY**

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Levered Risk Parity</th>
<th>US Balanced</th>
<th>US Treasuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Return</td>
<td>3.66%</td>
<td>2.76%</td>
<td>-2.28%</td>
</tr>
<tr>
<td>Risk</td>
<td>8.85%</td>
<td>9.09%</td>
<td>5.64%</td>
</tr>
<tr>
<td>Drawdown</td>
<td>-27.61%</td>
<td>-37.19%</td>
<td>-60.37%</td>
</tr>
</tbody>
</table>

The results are based on simulated or hypothetical performance results that have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual trading. Also, because these trades have not actually been executed, these results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated or hypothetical trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those being shown.

Analysis by ReSolve Asset Management. Data from Global Financial Data. SIMULATED PERFORMANCE. PAST RESULTS ARE NOT INDICATIVE OF FUTURE PERFORMANCE. The hypothetical performance does not represent the return to an actual fund or trading account that an investor could directly participate in and is for illustrative purposes only. These results account for borrowing costs but do not account for any management fees. These results show the growth of $100 assuming the purchase and sales of securities were executed at end of month closing price. Profits are reinvested and the simulation does not reflect any transaction costs of buying and selling securities. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. Please read disclaimer at the end of this presentation for more information.
Were equities a better option? Targeting equal volatility to equities, Risk Parity Simulation at 14% target Volatility did better with lower drawdowns.

### Real Return Analysis Risk Parity at 14% Volatility Target
August 1941 – September 1981
SIMULATED PERFORMANCE - FOR ILLUSTRATIVE PURPOSES ONLY

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Risk Parity at Equity Volatility</th>
<th>US Equities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return</td>
<td>6.26%</td>
<td>5.84%</td>
</tr>
<tr>
<td>Risk</td>
<td>14.05%</td>
<td>13.98%</td>
</tr>
<tr>
<td>Drawdown</td>
<td>-36.26%</td>
<td>-50.54%</td>
</tr>
</tbody>
</table>

These results are based on simulated or hypothetical performance results that have certain inherent limitations. Unlike the results shown in an actual performance record, these results do not represent actual trading. Also, because these trades have not actually been executed, these results may have under-or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated or hypothetical trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to these being shown.

Analysis by ReSolve Asset Management. Data from Global Financial Data. SIMULATED PERFORMANCE. PAST RESULTS ARE NOT INDICATIVE OF FUTURE PERFORMANCE. The hypothetical performance does not represent the return to an actual fund or trading account that an investor could directly participate in and is for illustrative purposes only. These results account for borrowing costs but do not account for any management fees. These results show the growth of $100 assuming the purchase and sales of securities were executed at end of month closing price. Profits are reinvested and the simulation does not reflect any transaction costs of buying and selling securities. Any strategy carries with it a level of risk that is unavoidable. No investment process can guarantee or achieve consistent profitability all the time and will necessarily encounter periods of extended losses and drawdowns. Please read disclaimer at the end of this presentation for more information.
Get In Touch

ReSolve Asset Management Inc.
1 Adelaide Street East, Suite 2100
Toronto, Ontario M5C 2V9

Phone: +1 (416) 572-5474
Toll-free: 1 (855) 446-4170

Website: www.investresolve.com
Twitter: @InvestReResolve, @GestaltU