Lazy Momentum with Growth-Trend Timing: Resilient Asset Allocation (RAA)

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Abstract

Resilient Asset Allocation (RAA) is a more aggressive version of our Lethargic Asset Allocation (LAA) strategy. It combines a more robust "All Weather" portfolio with even slower growth-trend (GT) filter and a faster market crash-protection. GT timing goes risk-off only when both the US unemployment (UE) and the US capital markets are bearish. To arrive at RAA, we adapt LAA in three steps. First, the (risky, near-static) portfolio is changed to an even more robust and more diversified "all-weather" portfolio, now with five (instead of four) equal weighted assets and with only bonds as risk-off assets ("cash"). Second, the "canary" technology from our Defensive Asset Allocation (DAA) paper is used for determining the market trend with a faster filter. Third, we change the unemployment trend filter to a slower one, where we simply compare the recent unemployment rate with that of one year ago. As a result, RAA is more aggressive and more robust than LAA, while at the same time nearly as "lazy" with respect to trading and turnover (on average one trading month per year).

1. Introduction

Our Lethargic Asset Allocation (LAA, see Keller 2019) is a very "lazy" asset allocation where we switch between two static portfolios based on Growth-Trend (GT) timing from Philosophical Economics (PE, 2016). The Resilient Asset Allocation (RAA) strategy presented here is an more aggressive and robust version of LAA. For RAA, we combine some elements from other permanent portfolios (like the Golden Butterfly and the All Weather portfolios) and from one of our earlier strategies (Defensive Asset Allocation, DAA, see Keller 2018). This is done in three steps.

First, we will try to make the risky (near-static) portfolio of LAA (with four assets) more robust by switching to a more diversified five asset portfolio (like the Golden Butterfly portfolio, see Portfoliocharts, 2016). We also try to come closer to Ray Dalio's "All Weather" portfolio (see Dalio, 2019) although we will prefer equal weighting. The idea behind the "All Weather" portfolio is to perform robustly in all four economical regimes (rising/falling inflation and idem growth), and to equalize risk weights as much as possible.

To arrive at the (near static, equal weight) 5-asset risky portfolio, we start with the risky portfolio of LAA (QQQ, IWD, IEF, GLD, each 25%). Inspired by the Golden Butterfly Portfolio, we change IWD (US Large Cap Value) to IWN (Small Cap Value) for better diversification. To come closer to the All Weather portfolio, we add the 20-year US treasury asset (TLT) to the mix to arrive at our 5-asset equal weight near-static RAA portfolio QQQ, IWN, IEF, TLT, GLD. To limit turnover, we take both treasuries (IEF and TLT) as "cash", when GT timing goes risk-off.[2]

Second, we change the market trend filter used in GT timing of LAA by the crash protection signal from our DAA paper, using the "canary" assets VWO and BND and a fast trend filter for both assets (see Keller, 2018). To make this filter even faster, we use fast "breadth momentum" (see DAA, Keller 2018) of both asset such that the market trend filter goes bearish when at least *one* of these two canary assets turns bearish (ie. we use B=1 as breadth parameter, see DAA).

[1] I thank Jos vd Berkmortel, Winfried Hallerbach, Jan Willem Keuning, Frank Kuiper, and Steve LeCompte for comments on an earlier draft. All errors are mine.

[2] We will use the term "cash" broadly, including all Treasury Bills/Notes/Bonds as "risk-off" assets

Third, we change the Unemployment trend filter (which was based on SMA12 months in LAA) to a somewhat slower filter, to compensate for increased trading due to the faster market trend filter. The new UE trend filter equals a slow RET12 filter[3] (as compared to the faster SMA12 trend filter in LAA). This implies that the UE trend filter goes bearish once the US unemployment rate (see FRED, 2020) 12 months ago is lower than the most recent one (with a one month publication delay). This also takes yearly seasonality into account like the original (SMA12) specification, but results in less trading.

Most parameter choices made above (B=1, RET12, and IEF/TLT cash) are return/risk (K25) optimal on our in-sample period (Dec 1970 – Nov 1993), with equal periods of increasing and decreasing yields before/after 1983, resp.

The result of these three steps is our *Resilient Asset Allocation* (RAA). As we will show, its (near static) 5-asset equal-weight risky portfolio (QQQ, IWN, IEF, TLT, GLD) is more robust than that of LAA. And the 2-asset (IEF, TLT) equal-weight cash portfolio, the fast "canary" market filter and the slow GT timing helps to arrive at more aggressive returns than LAA but even with more limited risk (in terms of max drawdown).

As with LAA, our new RAA is very "lazy": we are only in cash in 15% of the months (DAA: 45%), while trading (one month a year on average) and turnover (160%) is still much more limited than our previous tactical momentum strategies like DAA and VAA (see Keller 2018, 2017).

2. Step 1a: A more robust risky portfolio

In the first step we will focus on the risky (and cash) portfolio of RAA. Since our RAA strategy (like LAA) will spend most time (85% of the months) in the risky portfolio, this static portfolio is of great importance.

Therefore, we first check to see how robust the static Equal Weighted four-asset (EW4) LAA portfolio (QQQ, GLD, IEF, IWD, all 25%) was over the nearly 50 year full-sample (FS) backtest of Dec 1970 - Nov 2020. Fig. 1 shows the results (with IS= In-Sample, OS= Out-of-Sample, RS2= 20y Recent Sample, RS1= 10y Recent Sample, FS= Full Sample)[4].

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	12.5%	19.8%	10.8%	**4.3%**	1.07	0.0%	0.00%	11.0%
OS	Nov 93	Nov 20	9.6%	26.8%	9.7%	**0.0%**	1.07	0.0%	0.00%	8.6%
RS2	Nov 00	Nov 20	8.5%	26.8%	9.5%	**0.0%**	0.92	0.0%	0.00%	6.9%
RS1	Nov 10	Nov 20	9.7%	8.4%	8.4%	**7.7%**	4.80	0.0%	0.00%	10.3%
FS	Dec 70	Nov 20	10.9%	26.8%	10.2%	**0.0%**	1.05	0.0%	0.00%	9.7%
Parms:	**NR=**	**4**							D=	29.5%

Fig. 1 LAA *static* risky portfolio (QQQ, GLD, IEF, IWD, no GT timing, EW4)

[3] RETx is also called ROCx (Rate of Change) or MOMx, SMAx stands for Simple Moving Average (over x month).
[4] In contrast to LAA, we will focus in this paper on the period from Dec 1970, instead of from Feb 1949 as with LAA. This is done since we already used the pre-1970 period for in-sample optimisation of DAA, which we will use later on. Also, the quality of our data before Dec 1970 is somewhat sub-par, especially for QQQ, IWN, and IWD (all based on Fama-French data, see FF 2019). For more details on our ETF data proxies from Dec 1969, see Keller, 2016. We will use the in-sample (IS) period (Dec 1970 – Nov 1993) later for some parameter optimizations.

In our figures, we use the following symbols: R= annual return (CAGR), D= max (monthly) drawdown, V= yearly Volatility, K25 our own return/risk indicator[5], UPI the Ulcer (2019) Performance Index (similar to the Sharpe ratio but with the Ulcer drawdown index instead of volatility, see Ulcer, 2019) and CF and TTC the "cash" fraction and yearly Total Transaction Cost (based on a 0.1% one-sided transaction fee), and NR the number of risky assets, resp.

We also show the R for the 60/40 (SPY/IEF) benchmark in the column labelled R6040 and it's max drawdown D=29.5% over the full-sample (FS).

So, over the full-sample period Dec 1970 – Nov 2020, the annual return R (CAGR) equals 10.9%, the max (monthly) drawdown D equals 26.8%, while the R and D for 60/40 benchmark equals 9.7% and 29.5%, resp. While the return R is better than the 60/40 benchmark (10.9% vs 9.7%), the max drawdown of our EW4 is rather close to that of the EW2 benchmark (26.8% vs 29.5%). Could we improve the max drawdown of this static (CF=0) portfolio, eg. by using more assets and stronger diversification?

For inspiration, we look at two static portfolios: the "Golden Butterfly" (see Portfoliocharts, 2016) and Ray Dalio's "All Weather" portfolio (see Dalio, 2019). Both are rather robust for all the four classical economical "regimes": growth/recession times inflation/deflation.

The static Golden Butterfly portfolio has equal weights of SPY, GLD, SHY, IEF, and IWN (N=5). Notice that it has two equity assets (SPY and IWN), and two bonds (SHY and IEF) and Gold (GLD) in the mix, all equal weighted (EW5), so each asset gets 20%.

In LAA, we used QQQ (Tech) and IWD (Large Cap Value) for equity, which assets have a large overlap in (large cap) stocks. So, in order to improve diversification (and therefore hopefully robustness), we will replace IWD (US Large Cap Value) in LAA by IWN (US Small Cap Value) from the Golden Butterfly portfolio.

Dalio's All Weather is risk-parity weighted with unequal weights (see also Robbins, 2014):

- US equities (eg. SPY, 30%),
- US Intermediate-term Treasuries (eg. IEF, 15%),
- US Long-term Treasuries (eg. TLT 40%),
- Gold (eg. GLD, 7.5%) and Commodities (7.5%),

Coming from LAA, we will split the US equities into QQQ and IWN (see above), combine gold and commodities into GLD and use equal weights to arrive at QQQ, IWN, IEF, TLT, GLD (N=5), all 20%, similar to the equal weights of the Golden Butterfly portfolio.

Please notice that our total bond fraction for this static EW5 portfolio is equal (ie. 40%) to that of the Golden Butterfly portfolio and the 60-40 benchmark, but smaller than that of Dalio's All Weather portfolio (55%). Fig. 2 shows the (static) results of this EW5 portfolio.

The max drawdown D of this *static* EW5 portfolio equals 17.1% over de last 50 years which is nearly half that of 60/40 (D=29.5%). This is also much better than that of the static EW4 portfolio of LAA (with D=26.8%, see Fig. 1).

[5] K25 = R*(1-2*D/(1-2*D) with K25=0 when D>=25%, see Keller (2018).

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	12.3%	17.1%	10.4%	**5.9%**	1.24	0.0%	0.00%	11.0%
OS	Nov 93	Nov 20	9.5%	14.9%	8.4%	**5.4%**	1.96	0.0%	0.00%	8.6%
RS2	Nov 00	Nov 20	9.0%	14.9%	8.2%	**5.2%**	1.93	0.0%	0.00%	6.9%
RS1	Nov 10	Nov 20	9.2%	5.8%	7.3%	**8.0%**	4.66	0.0%	0.00%	10.3%
FS	Dec 70	Nov 20	10.8%	17.1%	9.4%	**5.2%**	1.62	0.0%	0.00%	9.7%
Parms:	**NR=**	**5**							D=	29.5%

Fig. 2 RAA *static* risky portfolio (with QQQ, GLD, IEF, TLT, IWN, no GT timing, EW5)[6]

3. Step 1b: The cash portfolio

In this section, we will use the same GT timing and filters as with LAA, now for the risky EW5 portfolio of fig 2. According to GT timing (see PE, 2016), only when the market trend (SMA10) of SPY and the UE trend (SMA12) both go bearish, we switch to the cash portfolio. For comparison, Fig. 3 shows the LAA results (see Keller, 2019), for our new periods:

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	12.9%	15.0%	10.2%	**7.4%**	1.40	10.9%	0.03%	11.0%
OS	Nov 93	Nov 20	10.3%	13.9%	8.8%	**6.3%**	1.98	13.2%	0.02%	8.6%
RS2	Nov 00	Nov 20	9.4%	13.9%	8.3%	**5.7%**	1.80	17.4%	0.02%	6.9%
RS1	Nov 10	Nov 20	9.7%	8.4%	8.4%	**7.7%**	4.80	0.0%	0.00%	10.3%
FS	Dec 70	Nov 20	11.5%	15.0%	9.5%	**6.6%**	1.73	12.2%	0.03%	9.7%
Parms:	**NR=**	**4**	**NC=**	**4**	**NP=**	**1**	**GT UE/SPY**		D=	29.5%

Fig. 3. LAA: QQQ+IWD+GLD+IEF (25% each), switched to SHY+IWD+GLD+IEF (25% each) using GT UE/SPY timing[6]

Now, in step 1b towards RAA, in order to complement the (static) EW5 portfolio in Fig. 2 in case of GT timing, we need to choose a cash portfolio. Inspired by 60/40 and in order to reduce turnover, we will simply use the 40% bonds IEF and TLT of the risky EW5 portfolio of Fig. 2 above as our cash portfolio.[7] This implies that when GT timing goes to cash, one should sell QQQ, IWN and GLD and buy additional IEF and TLT to arrive at an equal weight (50/50%) cash portfolio of IEF and TLT (EW2).

So, with the traditional GT timing as in LAA (SMA10/12 filter for SPY/UE, resp), we find (see Fig. 4) for *all* periods better or equal scores for R, D, K25 and UPI as compared to the static portfolio without GT timing in Fig 2. The average Cash Fraction (CF) over time equals 12.2% (at FS) which is of course the same for LAA (fig. 3) in view of the same GT timing (and much lower than that of the 6040 benchmark with CF= 40%).

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[6] Legend (per period): R= annualized Return (CAGR), D= (monthly) Max Drawdown, V= (yearly) Volatility, K25= our return/max drawdown risk ratio, K25 = R*(1-2*D/(1-2*D) with K25=0 when D>=25%, see Keller (2018), UPI= Ulcer Performance Indicator (excess return/Ulcer index), see Ulcer (2019), CF= average Cash Fraction, TTC= (yearly) Total Transaction Costs, R6040 = Return of the 60/40 benchmark per period (with max drawdown D/FS below), NR/NC/NP= Number of Risky/Cash/Protection (=canary) assets. Periods: IS= In-Sample, OS= Out-of-Sample, RS2= 20 years Recent Sample, RS1= 10 years Recent Sample, FS= Full-Sample.

[7] This choice of cash portfolio is also K25 optimal on our in-sample (IS) period when we limit the cash assets to one or more assets of the risky set of Fig. 2.

Compared to LAA (Fig. 3), the returns R of Fig. 4 are better than LAA for all periods (incl. OS & FS) except for the last 10 years (RS1: 9.2% vs 9.7%). By contrast, the drawdowns D are similar to LAA in most periods, and better (5.8% vs 8.4%) for the RS1 period. The return/risk indicator K25 (and UPI) are better in all (but RS1) periods, with UPI/RS1=4.66 being still very respectable (see Fig. 4). Notice that TTC increased (from 0.03% to 0.06%) because of more transactions for the "cash" switch.

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	13.6%	15.1%	10.1%	**7.7%**	2.02	10.9%	0.08%	11.0%
OS	Nov 93	Nov 20	10.4%	13.3%	8.4%	**6.6%**	2.77	13.2%	0.04%	8.6%
RS2	Nov 00	Nov 20	10.1%	13.3%	8.3%	**6.4%**	2.87	17.4%	0.05%	6.9%
RS1	Nov 10	Nov 20	9.2%	5.8%	7.3%	**8.0%**	4.66	0.0%	0.00%	10.3%
FS	Dec 70	Nov 20	11.9%	15.1%	9.2%	**6.8%**	2.43	12.2%	0.06%	9.7%
Parms:	**NR=**	**5**	**NC=**	**2**	**NP=**	**1**	**GT UE/SPY**		D=	29.5%

Fig. 4. QQQ, GLD, IEF, TLT, IWN (20% each), switched to IEF, TLT (50% each), using default GT UE/SPY timing[6]

4. Step 2: Introducing the fast "canary" market filter from DAA

In step two we will replace the traditional (and rather slow) market trend filter of the 10 month Simple Moving Average (SMA10) of SPY in the original GT timing, by our own fast "canary" market trend filter as used in our Defensive Asset Allocation (see our DAA paper, Keller 2018). Remember that, with GT timing, this fast market trend filter is *only* active in case of rising unemployment. So, we will go to "cash" (EW2 of IEF and TLT) when *both* the DAA canary trend *and* the UE (unemployment) trend are bearish.

Therefore we will replace the simple SMA10 SPY trend filter for the market (in the GT timing) by our own "canary" portfolio of VWO and BND and use the fast 13612W filter[8] for both as trend filter, as we did in DAA. To fasten up this bearish market indicator even more, we will use the fast breadth momentum (B=1), so that the market trend goes bearish when at least *one* of the two canary assets (VWO, BND) turns bad[9]. See Fig. 5.

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	13.2%	13.4%	9.7%	**8.3%**	1.82	20.7%	0.21%	11.0%
OS	Nov 93	Nov 20	11.0%	9.5%	8.4%	**8.4%**	3.49	13.5%	0.17%	8.6%
RS2	Nov 00	Nov 20	10.9%	9.5%	8.3%	**8.3%**	3.85	15.8%	0.17%	6.9%
RS1	Nov 10	Nov 20	7.9%	9.0%	7.4%	**6.2%**	3.16	3.3%	0.10%	10.3%
FS	Dec 70	Nov 20	12.0%	13.4%	9.0%	**7.6%**	2.62	16.8%	0.19%	9.7%
Parms:	**NR=**	**5**	**NC=**	**2**	**NP=**	**2**	**GT UE/DAA**		D=	29.5%

Fig. 5 QQQ, GLD, IEF, TLT, IWN (20% each), switched to IEF, TLT (50% each), using GT UE/DAA timing[6]

[8] The 13612W momentum is the average 1, 3, 6, and 12 month lagged return, each weighted to annual return (so with weights 12x, 4x, 2x, and 1x, respectively) . See DAA (Keller, 2018).

[9] This is in contrast with the default DAA B=2 filter where the cash fraction goes to 50% when one of the canary assets turns bearish (see Keller, 2018). Our choice of the parameter B=1 instead of B=2 is also optimal for our return/risk measure K25 on the in-sample (IS) period.

As we see from comparing Fig. 5 (with fast DAA market timing) with Fig. 4 (with slow SPY market timing), the effect of the faster market filter is a better max drawdown D for all but one period (RS1), with D=13.4% over the full-sample (FS) period (vs 15.1% for SPY market timing, see Fig. 4). Also returns R and return/risk indicators K25 and UPI are better than Fig. 4 for most periods (including OS, RS2 and FS).

Notice that the cash assets IEF, TLT are both also part (for 40% total) of the (near static) risky portfolio, reducing trading and turnover, although not as much as with LAA (with only one of the four risky asset different from the four cash assets). This is also reflected in the cash fraction CF on FS (16.8% instead of 12.2% for LAA) and (yearly) Total Transaction Costs TTC (0.19% instead of 0.03% for LAA). Both are the result of introducing a much faster market filter.

5. Step 3: Replacing the UE trend filter by a slower one

As shown in Fig. 5, the *faster* market trend filter (using DAA) results in higher CF and TTC (so more turnover). In this last step three, we will replace the faster SMA12 UE trend filter for the Unemployment by a *slower* one, in order to compensate somewhat for this. Now, we replaced the SMA12 (fast) trend filter by the slower RET12 trend filter for UE[10]. So, this new "UE1" trend filter will signal "bearish" when the monthly unemployment rate (%) is higher than that 12 months before (with a one month publication delay). The result is shown in Fig. 6.

Period	Start	Stop	R	D	V	K25	UPI	CF	TTC	R6040
IS	Dec 70	Nov 93	14.0%	11.8%	9.6%	**9.7%**	2.38	19.6%	0.20%	11.0%
OS	Nov 93	Nov 20	10.8%	11.3%	8.3%	**7.7%**	3.21	12.0%	0.12%	8.6%
RS2	Nov 00	Nov 20	11.1%	11.3%	8.1%	**7.9%**	3.72	15.4%	0.14%	6.9%
RS1	Nov 10	Nov 20	8.5%	5.8%	7.1%	**7.4%**	4.21	1.7%	0.05%	10.3%
FS	Dec 70	Nov 20	12.3%	11.8%	8.9%	**8.5%**	2.83	15.5%	0.16%	9.7%
Parms:	**NR=**	**5**	**NC=**	**2**	**NP=**	**2**	**GT UE1/DAA**		D=	29.5%

Fig. 6 RAA: QQQ, GLD, IEF, TLT, IWN (20% each), switched to IEF, TLT (50% each), using GT UE1/DAA timing[6]

Notice how this slower RET12 UE1 trendfilter (as compared to SMA12 for in Fig. 5 and LAA) improved the max drawdown D over the full-sample (D=11.8% instead of 13.4% in Fig. 5), as well as over IS and RS1. Returns improved full-sample (R=12.3% instead of 12.0% in Fig.5), as well as over all other periods except OS.

Both return risk ratios K25 and UPI on FS improved in Fig. 6 (K25= 8.5% vs 7.6% in Fig. 5, UPI= 2.83 vs 2.62), as well as over IS and RS1. At the same time CF and TTC both improved slightly on FS (CF=15.5% vs 16.8% in Fig. 5, TTC=0.16% vs 0.19%) because of the slower UE1 filter. On average, RAA trading is limited to one month a year on average[11]. We will call this final result the **Resilient Asset Allocation (RAA)**.

[10] RET12 trend filter equals trend UE1(t) = UE(t)/UE(t-12)-1. This parameter switch for the UE filter is also optimal for our return/risk measure K25 on the in-sample (IS) period over all SMAx and RETx filters (x=1..12). That RET12 is a slower trend filter than SMA12 can be seen by the return weighting function, which is equal for all lags for RET12 and decreasing for larger lags for SMA12 (see Zakamulin, 2018).

[11] In our backtest, we rebalance each month to 20% for each asset. But we guess that rebalancing only when switching between the risky and cash portfolio or at least once a year will not make much difference.

6. Summary and conclusions

So, the recipe for the **Resilient Asset Allocation (RAA)** is

1. Calculate each month-end the RET12 trend in UnEmployement by comparing last month's FRED UE rate with that of 12 months ago (both with a one month publication delay).
2. When the UE trend (see 1) is bearish (higher UE% than 12 months ago), calculate the market trend in "canary" assets VWO and BND using the fast 13612W filter[8] (see DAA).
3. When *both* the UE trend (see step 1) and the market trend of one or both assets VWO and BND (see step 2) are bearish, invest in the EW2 cash portfolio (IEF and TLT, 50% each)
4. Else invest in the EW5 static risky portfolio (QQQ, GLD, IEF, TLT, IWN, 20% each)

As it turns out, we found that we should choose a very *slow* (RET12) trend filter for UE combined with a very *fast* DAA filter and *fast* breadth momentum (B=1) for the market trend. The final RAA result is shown in Fig. 6 above. Comparing RAA in Fig. 6 with LAA in Fig. 3, we conclude the following:

Returns R (CAGR) are improved over the full-sample (FS) from R= 11.5% (LAA) to 12.3% (RAA). Returns are better in any period for RAA, except for RS1 (8.5% for RAA vs 9.7% for LAA).

Max (monthly) drawdowns D are also improved over FS from D= 15.0% (LAA) to 11.8% (RAA). Drawdowns are also better for all periods, in particular for RS1 (5.8% for RAA vs. 8.4% for LAA).

Return/risk indicators K25 and UPI are improved over the full-sample (FS) from K25=6.6% (LAA) to 8.5% (RAA) and UPI=1.73 to 2.83. Both indicators are better for all periods except RS1, but with still a very high UPI= 4.21 for RAA on RS1.

As a result of the much faster market filter (of DAA with the 13612W momentum), the cash fraction CF over the full sample (FS) has increased from 12.2% for LAA to 15.5% for RAA, while turnover is fivefold (see the TTC costs, from 0.03% to 0.16%).

Still, both figures (CF and TTC) are very low as compared to eg. DAA-G12 (CF=29%, so nearly double and TTC=1%, ie. 6 times more turnover), so RAA is still very "lazy" as a result of the GT timing. On average, RAA trading is limited to one month a year on average.

Compared to the static 60/40 SPY/IEF benchmark on the 50 year full-sample (FS), the return R is improved (from 9.7% to 12.3% for RAA) as is drawdown D (from 29.5% to 11.8%), which is nearly one third of the benchmark.

Figures 7 and 8 show the equity line and max drawdown of RAA (in red) as compared to the 60-40 benchmark (black). In Fig. 7 we also show the relative price (RAA/6040) in yellow, where it is shown that from 1970-1981 (with increasing yields) and 1999-2010 (decreasing yields) RAA was ahead of the benchmark, while RAA was between 1981 and 1999 in performance slightly behind the 6040 benchmark, and from 2009 nearly the same.

In Fig. 8 we show the drawdowns of RAA (in red) and the 6040 benchmark (black) plus the GT timing periods (grey, where CF=1). This is where RAA really shines and where the drawdown reducing effect of the GT timing (based on both UE and DAA crash protection) becomes clear (see eg. 1974, 1987, 2002, and 2009).

In conclusion, over the 50 years full backtest, RAA shows great yearly returns (12.3% CAGR, compared to 9.7% for 60/40) and reduced max (monthly) drawdowns (12%, compared to 30% for 60/40), while still being one of the laziest momentum strategies: on average only one trading month per year.

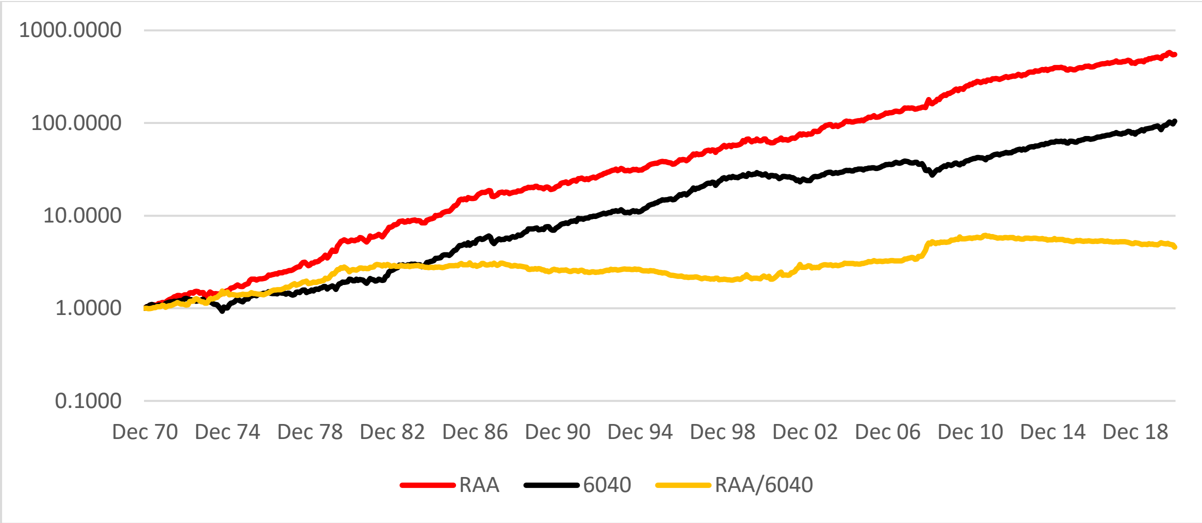

Fig. 7 The RAA equity curve (red, log scale) compared to the 60-40 benchmark (black), plus the relative price (yellow), Dec 1970 - Nov 2020

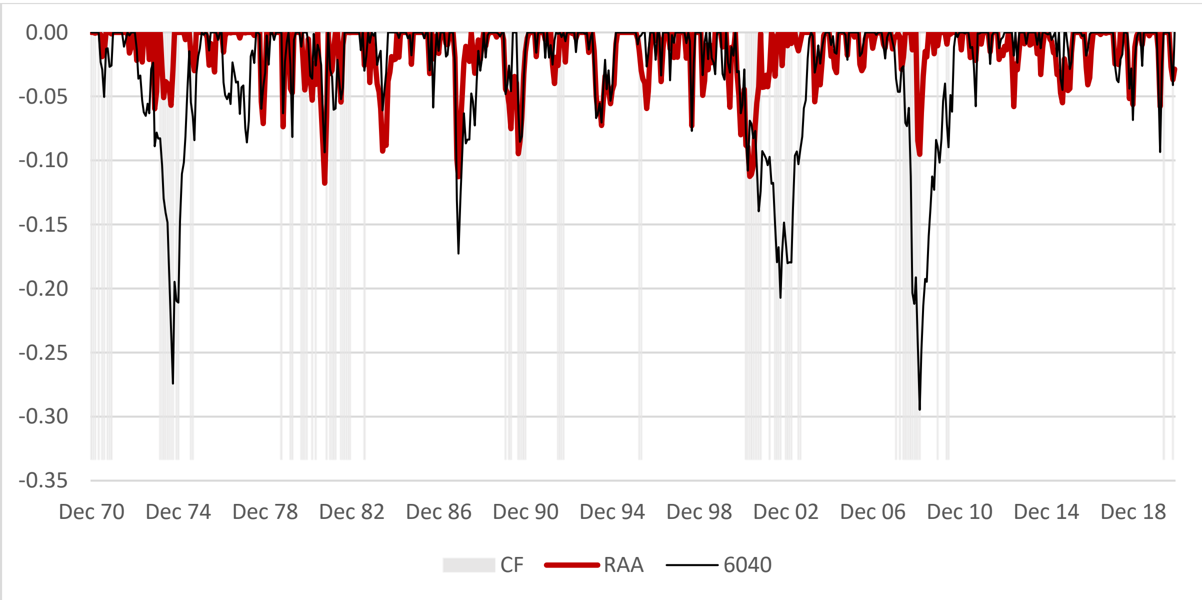

Fig. 8 The RAA drawdown curve (red) compared to the 60-40 benchmark (black), and the cash (CF) fraction (grey, based on GT timing), Dec 1970 - Nov 2020

References

Dalio, R., 2019, All-Weather Portfolio Strategy, https://www.amazon.com/All-Weather-Portfolio-Strategy-ebook/dp/B07SH9NYCN

Fama French (FF), 2019, Data Library, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library/f-f_factors.html

FRED (Fed. Reserve Bank of St. Louis), 2020, Unemployment Rate, https://fred.stlouisfed.org/series/UNRATE

Keller, W.J., and J.W. Keuning, 2016, Protective Asset Allocation (PAA), SSRN 2759734, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2759734

Keller, W.J., and J.W. Keuning, 2017, Vigilant Asset Allocation (VAA), SSRN 3002624, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3002624

Keller, W.J., and J.W. Keuning, 2018, Defensive Asset Allocation (DAA), SSRN 3307823, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3212862

Keller, W.J., 2019, Lethargic Asset Allocation (LAA), SSRN 3498092, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3498092

Philosophical Economics (PE), 2016, In Search of the Perfect Recession Indicator, http://www.philosophicaleconomics.com/2016/02/uetrend/

Portfoliocharts (PC), 2016, The theory behind the Golden Butterfly, https://portfoliocharts.com/2016/04/18/the-theory-behind-the-golden-butterfly/

Robbins, T., 2014, MONEY Master the Game: 7 Simple Steps to Financial Freedom, https://www.amazon.com/MONEY-Master-Game-Financial-Freedom/dp/1476757801

Ulcer index (2019), Wikipedia, https://en.wikipedia.org/wiki/Ulcer_index

Zakamulin, V., and J. Giner, 2018, Trend Following with Momentum Versus Moving Average: A Tale of Differences, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3293521