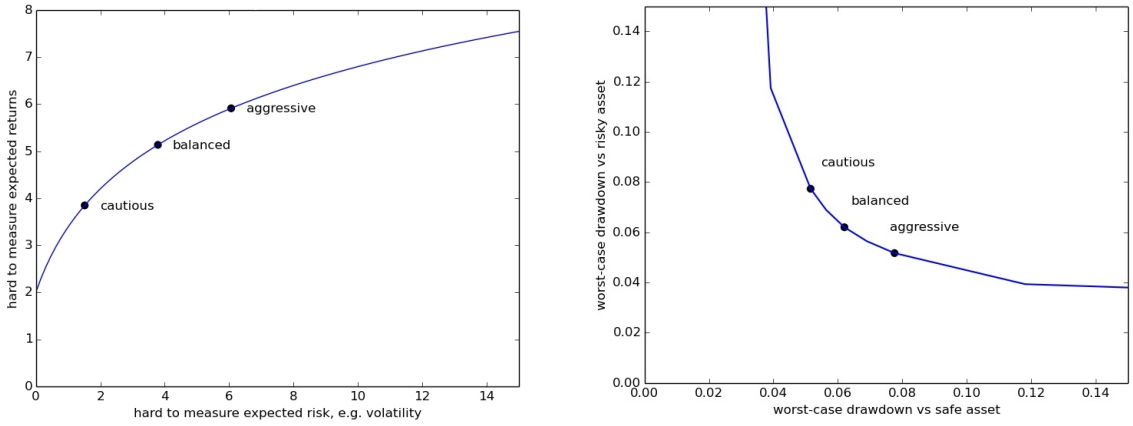
Robust Portfolio Management via MinMax Drawdown Control

based on Chassang (2017), http://ssrn.com/abstract=2727191

Summary. MinMax Drawdown Control (Chassang, 2017) provides a robust, long-term solution to the problem of portfolio construction. It is a systematic, and adaptive framework to make core asset allocation decisions in a changing environment.

Because it makes no assumptions about the underlying process for returns, MinMax Drawdown Control is a natural tool to help integrate new asset classes (e.g. the growing range of smart beta ETFs, crypto-currencies, alternative signals…) in existing portfolios, in a secure and risk-controlled manner.

Approach. Unlike other quantitative approaches to investment — e.g. those of "modern portfolio theory" (MPT, Markowitz (1952)) — MinMax Drawdown Control does not make the assumption that historical patterns of returns are reliable predictors of future returns. It takes seriously the concern that financial markets are constantly changing, and that models which worked in the past may cease to work altogether.



(a) usual portfolio frontier: valid under known uncertainty

(b) prior-free portfolio frontier: valid under unknown uncertainty

Figure 1: MPT and MinMax Drawdown approaches to risk-reward tradeoff.

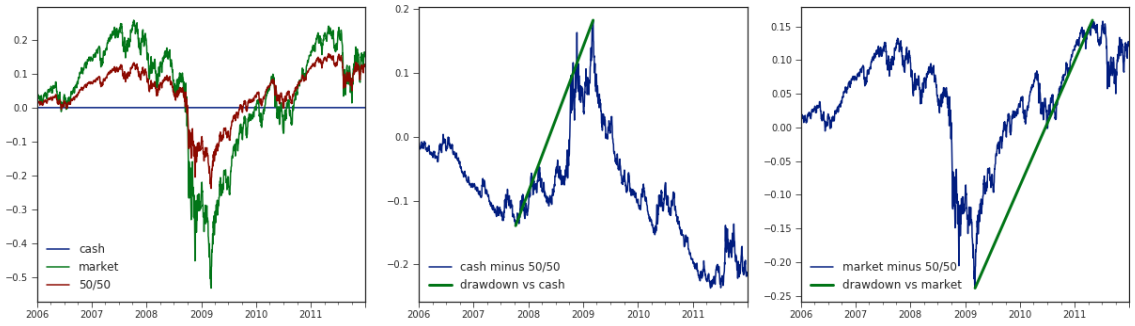


Figure 2: Relative drawdowns of a 50/50 strategy against cash, and the market.

MPT (Figure 1) seeks to optimize asset allocation under the assumption of a known process for returns. As a result, it is highly sensitive to subjective assumptions (Black and Litterman, 1992). *MinMax Drawdown Control uses a game theoretic approach that removes the need for such assumptions.* It treats the market as a strategic adversary, which picks from a set of feasible moves the sequence of returns that has the worst impact on relative portfolio performance – i.e. causes the worst-case drawdowns against reference assets. This may be underperforming a rising market, or experiencing large drawdowns compared to a safe asset (Figure 2).

Prior-free asset allocation strategies are the strategies whose performance is least harmed by adversarial market behavior. Specifically, prior-free efficient portfolios are the dynamic strategies that guarantee minimal worst-case drawdowns versus reference safe and risky assets (e.g. short term treasuries and the S&P 500).

Because it considers all possible market behavior, rather than the one observed in historical records, prior-free asset allocation is more robust than other asset allocation strategies (e.g. CPPI, volatility control) to novel or non-standard market behavior (for instance low-volatility drops in market prices, or high-volatility market gains). *Importantly the risk-reward profile of prior-free asset allocation is asymmetric. It comes at a small performance cost under stationary market behavior, and provides large performance improvements when market behavior is non-stationary.*

Application: Portfolio Allocation Under Rising Rates. Figure 3 illustrates, the striking rise and drop in nominal interest rates that occurred over the last fifty-five years.

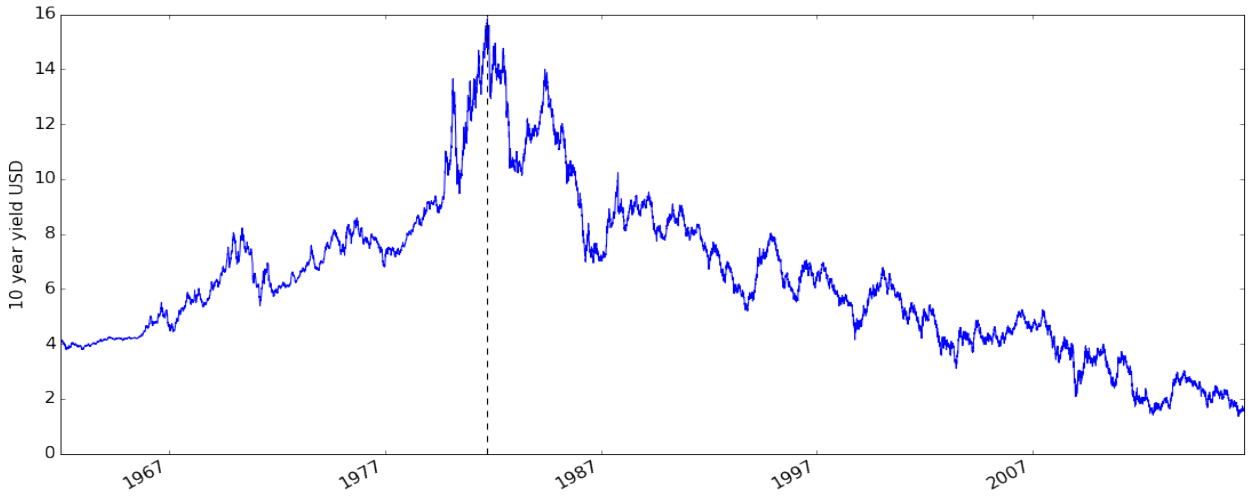


Figure 3: 10 year USD yields (Federal Reserve of St Louis).

Fueled by the Vietnam War, the Oil Shock, and Paul Volcker's battle against inflation, the 10 year USD yield went from 4% to 16% between 1962 and 1981, before initiating a downward trend that became a thirty-five years bull market for bonds.

	net perf/dd	**Sharpe**	**perf**	**dd**	**vol**
risk-parity approach, 1200 days window					
1961–1981	-0.173	-0.560	0.018	0.245	0.076
1981–2016	0.276	0.597	0.097	0.204	0.094
risk-parity approach, 63 days window					
1962–1981	-0.174	-0.656	0.016	0.258	0.068
1981–2016	0.270	0.581	0.092	0.189	0.088
estimated returns approach, 1200 days window					
1962–1981	-0.185	-0.459	0.031	0.158	0.064
1981–2016	.195	0.455	0.085	0.227	0.097
estimated returns approach, 63 days window					
1961–1981	.030	0.053	0.063	0.079	0.045
1981–2016	.099	0.223	0.057	0.166	0.073
MinMax Drawdown Control					
1962–1981	.102	0.162	0.070	0.096	0.060
1981–2016	.337	0.537	0.093	0.155	0.096

Table 1: Portfolio allocation strategies before and after 1981.

As Table 1 illustrates, the best performing allocation strategies are very different pre-1981 and post-1981. Risk-parity approaches give up on estimating expected returns, and

instead focus on balancing sources of volatility. They perform extremely well post-1981 but rather poorly pre-1981. This is because they place a high weight on bonds. Inversely, approaches that attempt to estimate returns using either long or short-windows perform relatively well before 1981, but poorly thereafter. MinMax Drawdown Control offers an attractive compromise between the two.

References

Black, F. and R. Litterman (1992): "Global portfolio optimization," *Financial Analysts Journal*, 28–43.

Chassang, S. (2017): "Mostly prior-free portfolio allocation," *forthcoming, Journal of Risk*.

Markowitz, H. (1952): "Portfolio selection," *The Journal of Finance*, 7, 77–91.