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What´s behind portfolio construction tools 2.0?

¿Qué hay detrás de las herramientas de construcción de carteras 2.0?

SUMMARY

Although "Modern Portfolio Theory" (MPT) has been around since the 1950´s, its full implications continue challenging academicians and market practitioners. At the core of MPT, we find the market portfolio. As a proxy, we have been using market capitalization indexes. Is this the best we can do? In this paper we explore new portfolio construction tools and smart beta concepts. We first review the unbundling of the asset allocation and portfolio construction process. Optimal asset allocation requires a three-step process consisting of risk diversification, risk hedging, and risk insurance. Next, we look at the challenges of constructing well-diversified portfolios. How do we actually construct a well-diversified portfolio? In practice, the costs of estimation error may entirely offset the benefits of optimal portfolio diversification. Finally, we look at the empirical implications of alternative portfolio construction methodologies and the drivers of their improved efficiency.

Keywords – Portfolio Construction, Performance-Seeking Portfolio, Smart Beta
JEL Classification: G11

RESUMEN

Aunque la "Teoría Moderna de Carteras" (TMC) fue planteada hace ya 60 años, el desarrollo completo de sus implicaciones sigue retando a la comunidad académica y profesional. En el corazón de la TMC nos encontramos con la cartera del mercado. Como aproximación a esta cartera, solemos utilizar índices ponderados por su capitalización bursátil. ¿Es esta aproximación satisfactoria hoy por hoy? En este trabajo exploramos las nuevas herramientas de construcción de cartera y los nuevos conceptos de Betas inteligentes. En primer lugar, procedemos a desagregar el proceso de asignación de activos del proceso de construcción de carteras. La asignación óptima de activos exige de un proceso de tres fases consistentes en la diversificación del riesgo, la calibración del

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riesgo, y la cobertura del riesgo. A continuación, examinamos los retos de construir carteras bien diversificadas. ¿Como construimos una cartera bien diversificada? En la práctica, el impacto de los errores de estimación de parámetros puede llegar a exceder de los beneficios de crear carteras matemáticamente óptimas. En último lugar, analizamos la evidencia empírica de metodologías alternativas de construcción de carteras y los factores subyacentes generadores de su mayor eficiencia.

Palabras clave – Construcción de Carteras, Teorema de Separación de Fondos, Beta Inteligente.
Código JEL: G11

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PORTFOLIO CONSTRUCTION 2.0 - THEORETICAL FRAMEWORK

Although "Modern Portfolio Theory" (MPT) has been around since the 1950´s, its full implications continue challenging academicians and market practitioners. At the core of MPT, we find the market portfolio. As a proxy, we have been using market capitalization indexes. Is this the best we can do?

Academia continues taking on board this challenge and exploring new solutions. EDHEC-Risk Institute, for example, continues pushing the frontiers of portfolio construction. Noel Amenc et al (2010) make the point that "meeting the challenges of modern investment practice involves the design of novel forms of investment solutions … customized to meet investors´ long-term objectives while respecting the short-term constraints they have to face … Such new forms of investment solutions should rely on the use of improved performance-seeking building block portfolios as well as on the use of improved dynamic allocation strategies"

A new paradigm - Portfolio Construction 2.0 - is evolving that recognises that the art and science of portfolio management consists of constructing dedicated portfolio solutions where asset allocation and portfolio construction decisions appear as the main source of added value by the investment industry. "Asset allocation and portfolio construction decisions are intimately related to risk management. In the end, the quintessence of investment management is essentially about finding optimal ways to spend risk budgets …Traditional static strategies without dynamic risk-controlled ingredients inevitably lead to under-spending investor´s risk budgets in normal market conditions and over-spending their risk budgets in extreme market conditions" (Noel 2010).

Optimal allocation of risk budgets requires that we unbundle the asset allocation and portfolio construction process into better building blocks (BBB) and advanced asset allocation decisions (AAA). More specifically, optimal allocation requires a three-step process:

- Risk diversification,
- Risk hedging, and
- Risk insurance.

RISK DIVERSIFICATION

At a recent Yale School of Management – EDHEC-Risk Institute seminar on strategic asset allocation and in-

vestment solutions, EDHEC¨s Scientific Director Lionel Martellini (2014) explained that "diversification is the risk management technique that allows investors to efficiently extract long-term risk premia out of performance seeking portfolios (PSP). Investors need to hold well-diversified policy portfolios to generate the highest reward given available risk budgets".

Diversification, however, will fail exactly when it is needed the most. Diversification is not designed to hedge and insure portfolios against downside risks. Downside risks have to be managed separately from the process of constructing diversified portfolios. Otherwise, an investor will either not be protected for tail risks or incur in large opportunity costs from having a too large allocation to low risk assets.

While the benefits of diversification are intuitively clear, what exactly is a well-diversified portfolio is a bit mysterious, just like the prudent man´s idea of just not putting all your eggs in one basket. How many baskets are needed? Actually, what is a basket?

RISK HEDGING

One of the cornerstones of asset pricing theory is the Fund Separation Theorem (FSM). The FSM states that "risk and performance are two conflicting objectives that are best managed separately" (Martellini). In an asset-only context, the FSM implies investment in a common risk-free asset and a common optimal risky portfolio, the PSP.

The Capital Market Line shows a clear trade-off between an increase in performance due to a higher allocation to risky assets and a decrease in performance due to a lower reward for each dollar invested.

Whereas in the Risk Diversification stage we ask in how many baskets do we take the eggs to the market, in this stage we ask how many eggs do we actually take to the market.

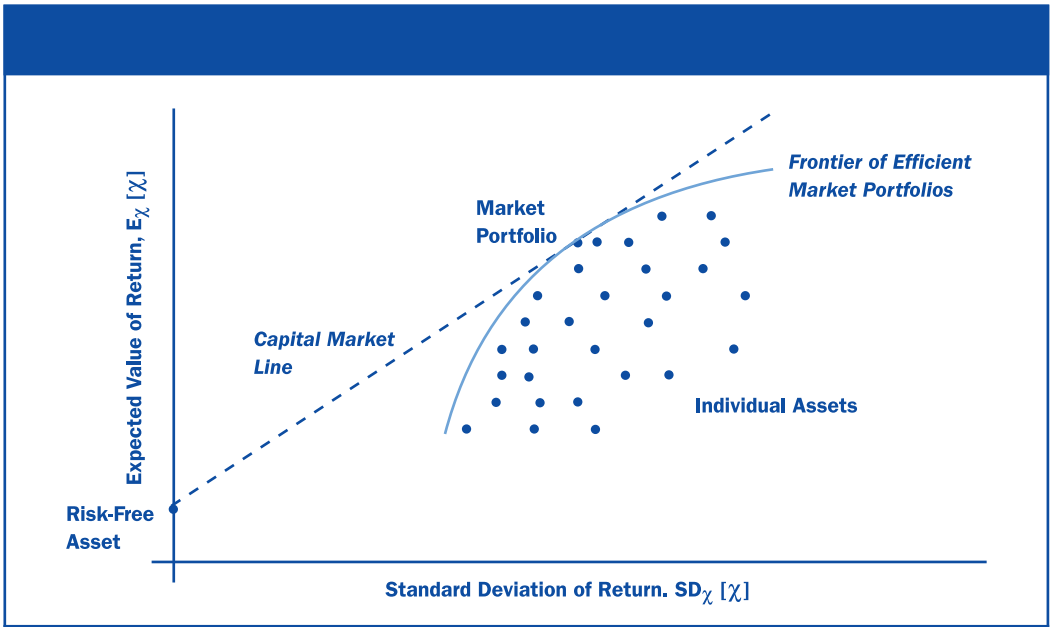

FIGURE 1

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RISK INSURANCE

Hedging allows investors to reduce risk exposures. A very risk averse investor would invest most of the wealth in bonds matching his investment and consumption horizon. The problem, however, is that the upside potential is very limited.

"Risk insurance strategies differ from risk hedging strategies in that they focus on achieving the highest possible upside potential while respecting risk budgets" (Martellini). Coming back to the question of the eggs, the punch line in risk insurance is that leaving some eggs at home is way too expensive. We are better off taking all of them to the market and taking the risk but, simultaneously, insuring some or all of the risks. The cost of insurance is small as compared to not having taken all the eggs to the market.

Early examples of risk controlled strategies are constant-proportion (CPPI) and option-based portfolio insurance. The option can be dynamically replicated or "bought either separately or as a package … in both cases, the option will be dynamically hedged/replicated by someone" (Martellini) in the market. To implement successfully a risk insurance program, we first need to understand carefully what are the risks that we want to hedge. Is CPPI a product or a solution? For what problem? If we hit soon the floor, we are stuck invested in cash with the fees and costs accruing every day.

Risk insurance should come after the other two building blocks, Risk Diversification and Risk Hedging, have been implemented. Insurance should come after diversification because a put on the PSP is cheaper than a put on the equity portion of the PSP. Insurance should also come after Risk Hedging because you may not need to hedge the entire PSP portfolio just simply because you are not fully invested in the PSP.

All-in, risk insurance allows for the management of short-term constraints through dynamic risk budgeting rather than through the choice of unnecessarily conservative investment policies. Disentangling long-term risk aversion from short-term loss-aversion leads to better investment decisions.

A WELL-DIVERSIFIED PORTFOLIO

A well-diversified portfolio is the basis of the PSP that sits at the centre of the Diversification-Hedging-Insurance paradigm. How is such a well-diversified portfolio to be constructed? This is a question that N. Amenc and F. Goltz (2013), both of EDHEC-Risk Institute, address in "Smart Beta 2.0"

Modern Portfolio Theory has a straightforward prescription to answer this question. According to Amenc and Goltz (2013) " … every investor should optimally combine risky assets so as to achieve the highest possible Sharpe ratio. Implementing this objective, however, is a complex task because of the presence of estimation risk for the required parameters, namely expected returns and covariance parameters. In practice, the costs of estimation error may entirely offset the benefits of optimal portfolio diversification … In this context, an investor interested in designing maximum Sharpe ratios (MSR) benchmarks may be better off investing in heuristic portfolio strategies, such as an equal-weight (EW) portfolio that can be constructed without having to estimate either expected returns or covariance parameters. … Similarly, an investor may be better off … investing in the global minimum variance (GMV) portfolio or the equal risk contribution (ERC) portfolio, which only require estimates for covariance parameters."

Amenc and Goltz (2013) further explain that … "the choice in risk and return parameter estimation for efficient diversification is between "trying", which has a cost related to estimation risk … or "giving up", which has a cost related to optimality risk … The trade-off between estimation risk and optimality risk occurs because using objectives that involve fewer parameters leads to a smaller amount of parameter risk but a higher amount of optimality risk, … Different portfolios are intuitively expected to incur more estimation risk or more optimality risk. For example, investing in cap-weighted (CW) or equal-weighted (EW) benchmarks involves no estimation risk (because no parameter estimates are required) but arguably a large amount of optimality risk (because these benchmarks are not expected in general to be close to the true MSR portfolio). Hence holding

EW or CW portfolios … involves an opportunity cost related to the fact that their Sharpe ratios may be dramatically inferior to the Sharpe ratio of the true MSR. On the flip side, investing in a GMV or ERC benchmark involves more estimation risk, because covariance parameter estimates are needed, and possibly less optimality risk if it turns out that these heuristic benchmarks are closer to the optimal MSR benchmarks. Finally, investing in MSR benchmarks involves even more estimation risk, because … expected return parameters are used in addition to covariance parameters."

DIVERSIFICATION AND HEDGING IN A REAL LIFE CONTEXT

As market practitioners, however, we face the challenge of understanding what these new frontiers in thinking and portfolio construction mean for the actual work we undertake with real life investors. How can we develop best practices on the basis of these insights? How are we to construct portfolios, the PSPs, and set the overall risk levels?

To answer these questions, we start with a forecast of expected rates of return and a 10 year historical volatility and correlation matrix. We take the last two from Ibbotson´s Encorr data set. Expected rates of return are derived from historical relationships between asset classes, current yields to maturity, dividend yields, expected credit losses and expected growth in EPS – roughly GDP minus 2%, as follows:

OPTIMIZATION INPUTS							
ASSET CLASS - SEPT 2013	EXPECTED RETURN	STANDARD DEVIATION	MM	RF	RV	HF	CM
Money Markets - MM	0.7%	0.5%	1.0				
Fixed Income - RF	2.9%	4.3%	0.0	1.0			
Equities - RV	5.4%	15.4%	-0.4	0.3	1.0		
Hedge Funds - HF	4.2%	4.6%	-0.4	0.3	0.7	1.0	
Commodities - C	2.7%	19.1%	-0.2	0.3	0.5	0.7	1.0

TABLE 1

We can use these parameters to derive efficient frontiers including and excluding money markets:

EFFICIENT FRONTIER

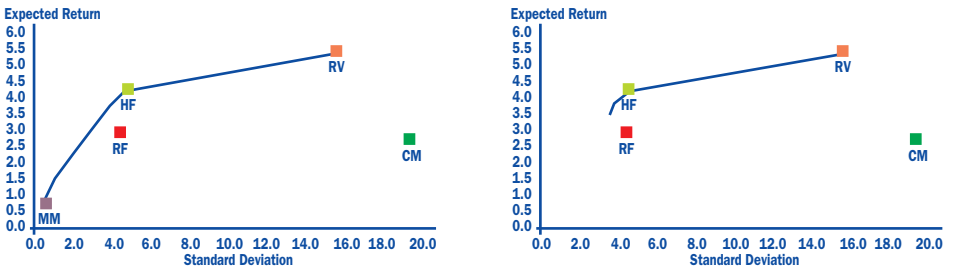

FIGURE 2

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We next study the results derived from a straightforward optimization including these five asset classes versus those obtained from first constructing a PSP with the four growth assets and then creating linear combinations with the risk free rate, the MM.

To define a PSP, we look at four options:

- EW – Equal Weights
- ERC – Equal Risk Contributions
- GMV – Global Minimum Volatility
- MSR – Maximum Sharpe Ratio

The weights of the four asset classes in these four PSP are:

PORTFOLIO WEIGHTS

PSP	Bonds	Equities	Hedge Funds	Commodities	Expected Return	Standard Deviation
EW	25%	25%	25%	25%	3.8%	8.9%
ERC	41%	12%	38%	9%	3.7%	5.5%
GMV	55%	0%	45%	0%	3.5%	3.6%
MSR	34%	0%	66%	0%	3.8%	3.8%

TABLE 2

These four portfolios can be represented in the following risk-return space:

EFFICIENT FRONTIER

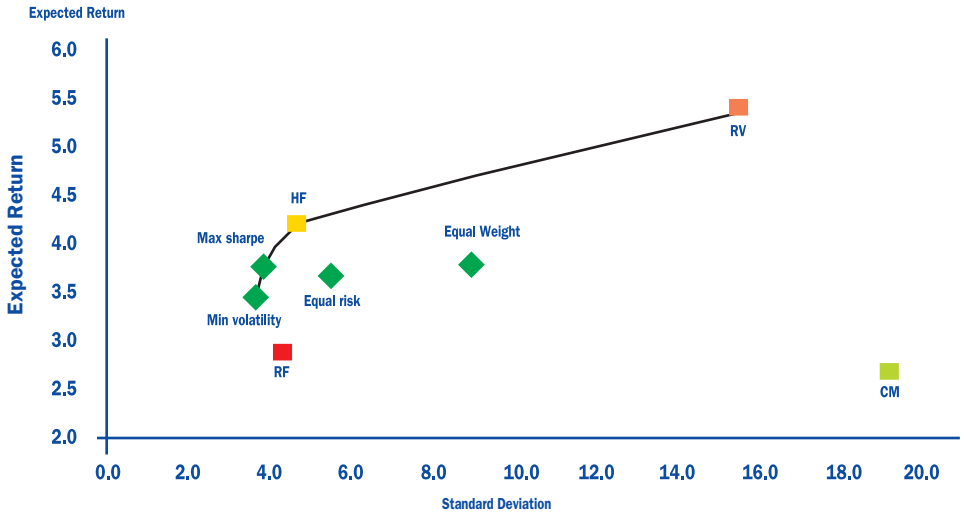

FIGURE 3

We next derive linear combinations of the RFR with each of these four PSP and compare results among these combinations and with the results obtained by optimizing the five asset classes simultaneously.

These results can be plotted as illustrated next:

RISK RETURN PAYOFFS

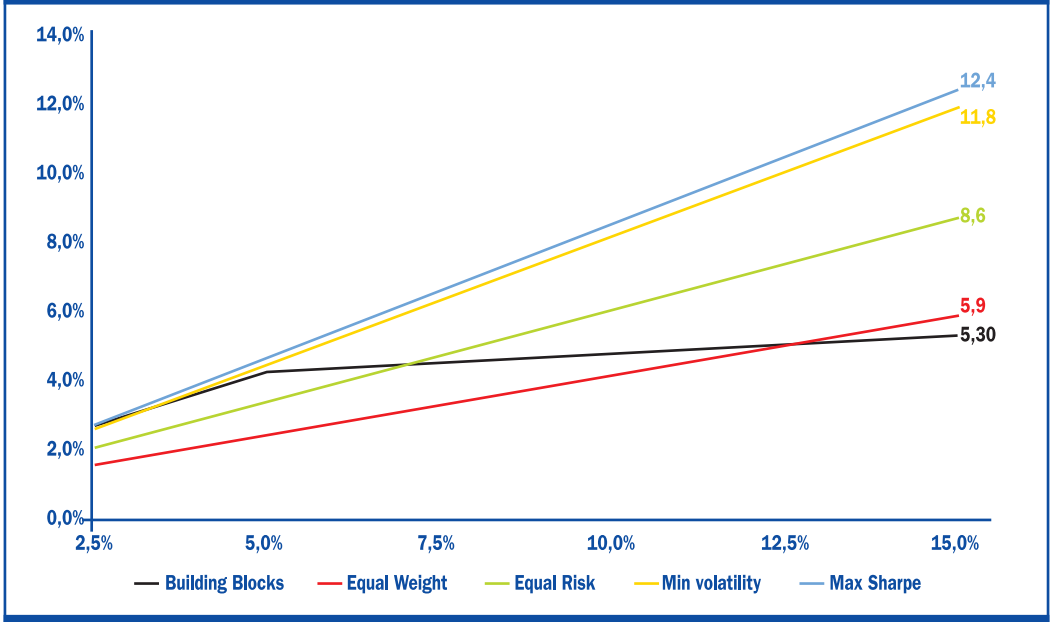

FIGURE 4

The actual data underlying this graph is summarized in the following table:

EXPECTED RETURNS					
Standard Deviation	**Building Blocks**	**Equal Weight**	**Equal Risk**	**Minimum Volatility**	**Maximun Sharpe**
2.5%	2.8%	1.6%	2.1%	2.6%	2.7%
5.0%	4.3%	2.5%	3.4%	4.5%	4.7%
7.5%	4.6%	3.3%	4.7%	6.3%	6.6%
10.0%	4.8%	4.2%	6.0%	8.2%	8.5%
12.5%	5.1%	5.0%	7.3%	10.0%	10.4%
15.0%	5.3%	5.9%	8.6%	11.8%	12.4%

TABLE 3

These results are fascinating. MSR and GMV quickly start outperforming the five asset-class building block optimized portfolio. As we move in the risk spectrum, even EW and ERC provide better returns for a set volatility number.

Have we, thus, found a much better approach for constructing portfolios and dealing with the current low return environment? Is this really the way to go to define investment policies once we have established a risk threshold acceptable to a client? Numbers aside, we have to ask ourselves an im-

portant fundamental bottom up question. How could we obtain these results if all of these four PSP have a substantially lower weight in equities, which is the higher expected rate of return asset? We move out of equities into fixed income and hedge funds and end up with higher return portfolios? Is this the alchemy of modern finance?

A close analysis of the underlying portfolios along the Capital Market Line reveals the source of this improved risk-return payoff: Leverage! It is through leverage that these strategies end up delivering a better risk-return payoff:

LEVERAGE (Debt/Initial Investment)				
Standard Deviation	**Equal Weight**	**Equal Risk**	**Minimum Volatility**	**Maximum Sharpe**
2.5%	0%	0%	0%	0%
5.0%	0%	0%	36%	30%
7.5%	0%	35%	102%	93%
10.0%	12%	79%	168%	156%
12.5%	40%	124%	234%	218%
15.0%	67%	168%	301%	281%

TABLE 4

To illustrate, investors would have to borrow €168 for every €100 of initial assets in the portfolio to derive a GMV portfolio with a standard deviation of 10% and an expected return of 8,2%.

These results can also be plotted, as follows:

LEVERAGE

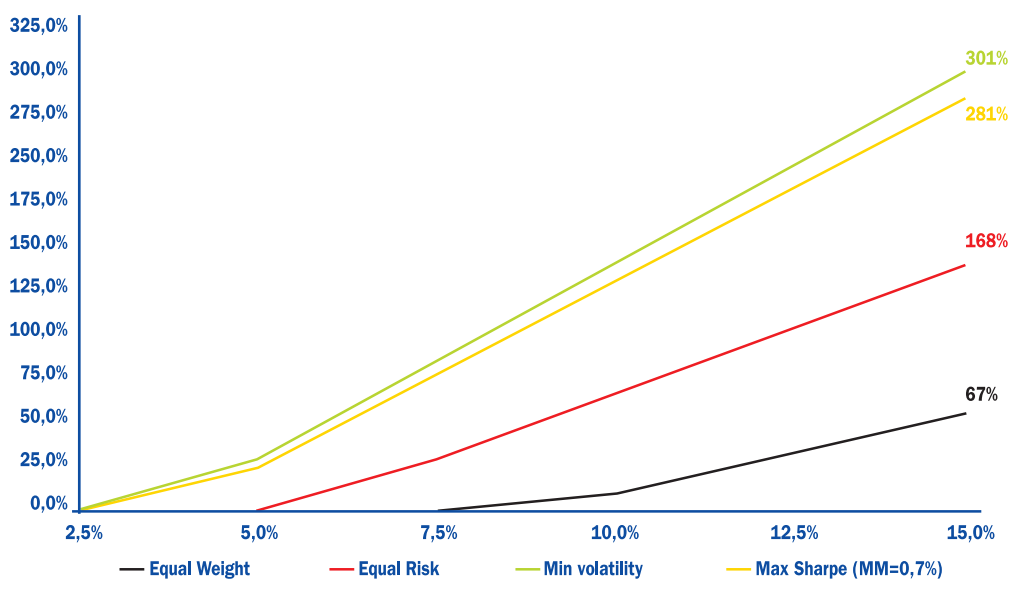

FIGURE 5

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But let me ask a question to close this paper. Who would dare to present to the Trustees of a Pension Plan in the UK the idea that they borrow £168 for every £100 in their pension plan and use the total £268 to invest in a portfolio consisting of 55% bonds and 45% hedge funds, particularly at a time when there was a very strong consensus in the street about the direction of interest rates? Look at the following chart by Barry Ritzhold (2014).

Back in early 2014 there was a uniform consensus that equities world outperform and fixed income underperform:

2014 Cross Asset Research

Equities vs Fixed Income 2014 Outlok

	BAML	Barclays Capital	Black Rock	BNP Paribas	CITI	Credit Suisse	Deutsche Bank	Goldman Sachs	HSBC	Jefferies	JP Morgan	Morgan Stanley	UBS
Global Equities													
Global Fixed incorne													

Overweight (Green) Neutral (Grey) Underweight (Red)

TABLE 5

Only academics can daydream with all these fancy models. The rest of us have to settle for whatever is possible.

Canner et al (1997), in "An Asset Allocation Puzzle", come to the view that although "popular advice on portfolio allocation among cash, bonds, and stocks is inconsistent with the separation theorem, which states that all investors should hold the same composition of risky assets, … the cost of this money illusion is small, as measured by the distance of the recommended portfolios from the mean-variance efficient frontier".

SUMMARY

Optimal allocation of risk budgets requires that we unbundle the portfolio construction process into a three-step process - risk diversification, risk hedging, and risk insurance.

In the risk diversification stage we construct a performance-seeking portfolio, identical for all investors. Here, we ask in how many baskets should we take the eggs to the market. In the risk hedging stage, we create linear combinations between the performance seeking portfolio and the risk free rate to determine efficient portfolios. Here we ask how many eggs we should actually take to the market. In the risk insurance stage, finally, we look at how best to modify the expected distribution of our returns and the exposure we face to tail events. Considering that we will take all of our eggs to the market, how do best mitigate risks?

Mathematically, the unbundling of the diversification and hedging decisions leads to better risk adjusted portfolios. The challenge, of course, is making sense of these results from a practitioner's point of view. We undertake to explore what would portfolios look like if we were to follow this portfolio construction process.

Results are a serious source of concern as optimality is achieved through leverage. We again find that there are no shortcuts or free lunches. Smart Beta solutions may rely on hidden leverage.

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