When Market Neutral Isn't: Alternative Risk Premia and Equity Exposure

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Abstract
As part of a quest to improve returns and better diversify portfolios, many investors have explored so-called Alternative Risk Premia strategies. One of the primary selling points of Alternative Risk Premia is the supposed low correlation to traditional portfolio investments since they are 'market-neutral'. However, as we demonstrate in this short paper, market neutrality does not always insulate a portfolio from traditional sources of risk.

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Alternative Risk Premia, Crisis Risk Offset, Diversification

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1. Introduction

Alternative Risk Premia (ARP) strategies, also known as 'factor strategies' or 'style premia' strategies, seek to earn returns by investing in specific return drivers – often called factors – across global markets and multiple asset classes. ARP strategies are gaining in popularity in part due to their perceived *market-neutral* nature. Most ARP strategies are *cross-sectional*, meaning they involve balancing long and short positions in each asset class in such a way that, in theory, the overall portfolio should be neutral to secular asset-class-level market movements (hence 'market-neutral'). However, as we will show, it can be inaccurate to use cross-sectional and market-neutral synonymously.

In particular, investors with significant equity exposure may allocate to these supposedly market-neutral ARP strategies with the assumption that they will offset losses in equity drawdowns. In this paper we discuss why this assumption may be problematic for the following three reasons:

- While cross-sectional ARP strategies don't necessarily add to equity risk in the long run, nor do they subtract from it.
- Cross-sectional ARP strategies can add to equity risk in the short term, and in undesirable ways.
- Certain cross-sectional ARP components like FX carry demonstrate positive long-run equity correlation.

Throughout this paper, we will use a generic risk premia strategy[1] as a benchmark for cross-sectional ARP strategies.

2. Zero Correlation ≠ Negative Correlation

ARP strategies typically form cross-sectional portfolios within each asset class, in an attempt to remove the overall portfolio's 'beta' sensitivity to broad asset-class-level return drivers. In theory, this is quite simple: You go long some markets in each class, go short others, and balance the longs and shorts such that the beta exposure to the overall market is zero.

In this regard, these strategies are, on average, successful. For example Figure 1 shows average monthly returns of the cross-sectional ARP benchmark across the quintiles of the S&P 500 monthly return distribution. The benchmark returns show no discernible relationship to the quintiles, which we would expect from a strategy with 0.07% monthly correlation to the S&P 500.

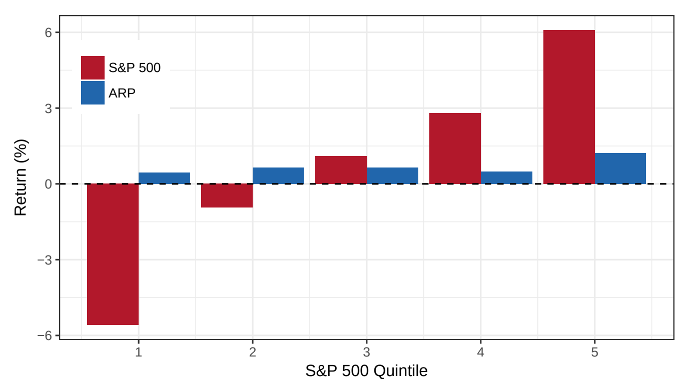


Figure 1. Performance of the cross-sectional ARP benchmark across quintiles of S&P 500 performance.

However, having a zero correlation is not the same as having a negative correlation. Because on average our cross-sectional ARP benchmark doesn't make any more money in bear markets than in bull markets, it doesn't offset downside risk in any significant way over time.

Moreover, these returns are only averages. To consider how well cross-sectional ARP offsets equity risk, we can examine what could happen in circumstances that are far from average. Figure 2 shows the returns for the cross-sectional ARP benchmark when the S&P 500 is in its worst quintile of performance. While the average benchmark return is slightly positive, there is a considerable likelihood historically of significant losses on the order of -3% or more.

[1] Graham Capital Management Research Note, *Directional and Cross-Sectional Risk Premia: Implications for Your Portfolio*, October 2017

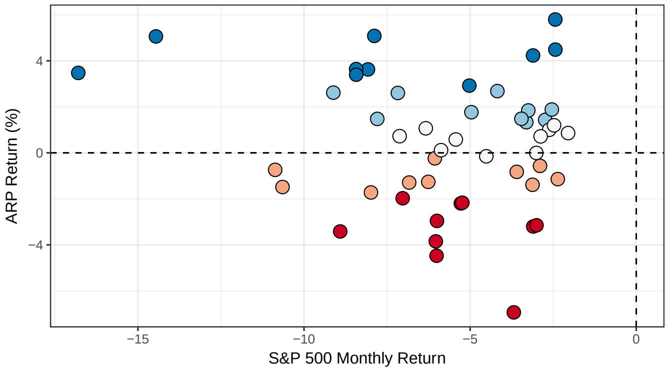


Figure 2. Returns of the cross-sectional ARP benchmark in the worst months for the S&P 500.

3. Market Neutrality is Difficult

While market (beta) neutrality is simple in theory; in reality, one does not know the market betas necessary to construct the portfolio with certainty, so they must be estimated. However, at times these betas can be very difficult to predict accurately, and any estimation errors will result in a portfolio that is not entirely market neutral.

These errors can, in turn, be magnified further by the leverage inherent in most cross-sectional ARP strategies. Often, cross-sectional ARP strategies determine leverage by employing a fixed volatility target; therefore the strategy may be more likely to increase leverage (and thus beta exposure) when it incorrectly estimates market beta to be near zero (see Appendix for a technical discussion).

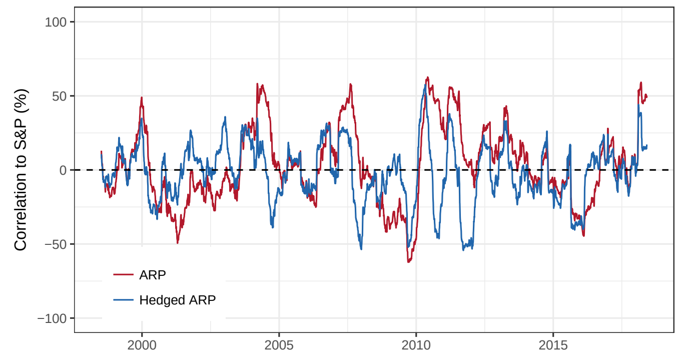
We do not wish to cast unfair aspersions on all cross-sectional ARP strategies. After all, every kind of portfolio can sometimes under-estimate risk. It is instead to say that the investor should be aware that cross-sectional ARP strategies come with the threat of periodic departures from market neutrality with the impact exacerbated by the leverage used in the portfolio.

Just how significant is this departure? Figure 3a shows the rolling six-month realized correlation of the cross-sectional ARP benchmark to the S&P 500. While the long-run monthly correlation is nearly zero, that correlation varies widely over time. It is not uncommon for the correlation to exceed $\pm 50\%$.

Furthermore, it's no easy task to remove this excess non-zero beta. Figure 3b shows the same information, but now includes an additional strategy that explicitly attempts to hedge the beta out. We estimate the rolling six-month beta of each of the factor portfolios to the S&P 500, and then buy or sell the required amount of S&P notional to move the overall portfolio beta back to zero. The correlation of the resulting hedged portfolio still varies considerably, and at times it can fluctuate even more than the unhedged portfolio. Of course, a manager may employ a more nuanced means of hedging beta, but the point remains that it is not as straightforward as simple theory would suggest.

To look at the impact of beta estimation error, we can look at a recent example, February 2018. Figure 4 shows the cross-sectional ARP benchmark's ex-ante beta to the S&P 500, which is estimated from market positions on each day, using historical correlations and volatilities. The beta to the S&P 500 rose as the

(a) ARP benchmark vs the S&P 500.



(b) ARP benchmark and hedged version vs the S&P 500

Figure 3. Rolling six-month correlation of the cross-sectional ARP benchmark and the S&P 500.

S&P rallied 7.5% through January 26. In this case, fortuitous beta errors helped the strategy. Unfortunately, the beta continued to rise even as the S&P began to drop precipitously at the beginning of February, helping drive significant losses. Finally the beta settled near zero even as the S&P 500 rallied part way back, meaning the strategy did not take part in the subsequent relief rally. Overall, this benchmark cross-sectional ARP strategy lost about 6.5% in February excluding transaction costs, while the S&P 500 lost about 3.7%.

4. Structural Factor Beta

Beta estimation error is not the only potential source of hidden equity market risk in a cross-sectional ARP strategy. Specific factors may have positive structural exposure to equity risk that can be difficult to identify and remove. One example is FX carry, a component of many cross-sectional ARP strategies.

In its most straightforward implementation, cross-sectional FX carry involves going long currencies with high interest rates, and shorting currencies with low interest rates: effectively lending at higher interest rates in one country and borrowing at lower interest rates in another. Since there is little net directional FX exposure, people frequently refer to the strategy as market-neutral.

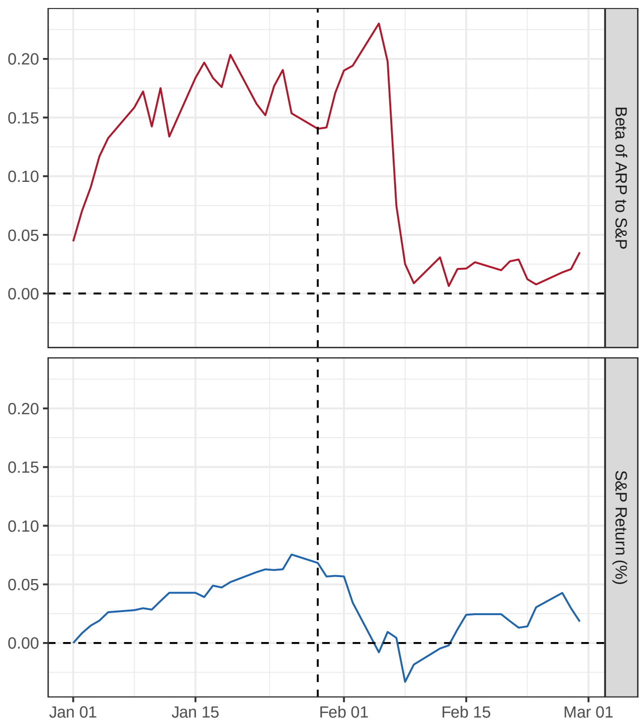


Figure 4. Beta of the cross-sectional ARP benchmark compared to S&P 500 return in February 2018.

Broadly, countries with high (low) growth rates have high (low) interest rates, meaning FX carry tends to load positively on growth expectations. However, equities show similar sensitivities to growth expectations. Consequently, cross-sectional FX carry tends to exhibit a positive correlation to equities[2].

Figure 5 shows the rolling six-month correlation of FX carry to the S&P 500, compared to that of ARP as a whole. The correlation is almost always positive, especially over the last 10 years, and the overall monthly correlation of FX carry to the S&P 500 is 30%.

If one component of a cross-sectional ARP portfolio has a persistently positive equity correlation, yet the portfolio tends over the long run to have no significant correlation, then that implies the other components yield negative equity correlation.

We find that this is indeed the case. Figure 6 shows monthly S&P 500 correlation by of each component in the cross-sectional ARP benchmark used in this paper, including both the FX subcomponent of carry and carry overall. The overall portfolio doesn't achieve zero correlation by merely setting each factor portfolio's equity correlation to zero. Instead, the portfolio plays off the negative momentum and value correlations against the positive carry correlation. The result is a cross-sectional ARP portfolio where the beta exposure can depend not only on how well it estimates the betas of each market in the portfolio, but how well it balances any structural market sensitivities that may leak

[2] An additional explanation offerred in support of this observation is that since FX carry is at its heart leveraged lending, it has often been inversely related to investor risk aversion. As investors become more risk-averse, they tend to pare back FX carry positions, and the strategy can experience losses causing the strategy to lose money. Equities show similar sensitivities to investor risk aversion.

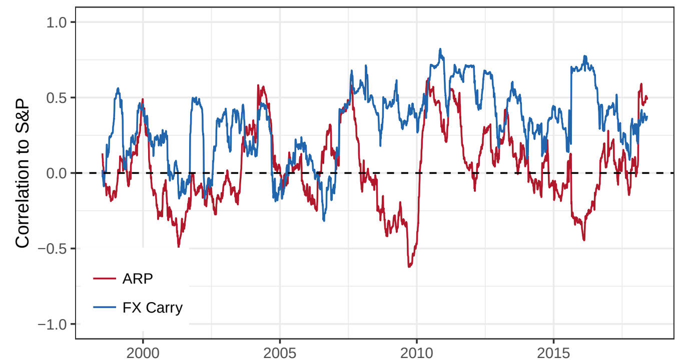


Figure 5. Rolling 6-month correlation of our ARP index and the individual FX carry factor to the S&P 500.

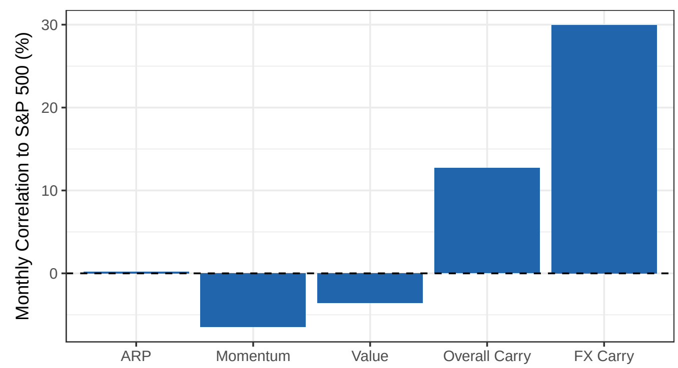


Figure 6. Average monthly correlation of different factors to the S&P 500.

into the specific components as a whole. For example, a portfolio with a greater allocation to cross-sectional FX carry would exhibit a significantly higher correlation to equities.

5. Conclusion

Cross-sectional ARP strategies may allow investors access to diversifying exposures that were previously unavailable. However, we find that cross-sectional ARP strategies do not tend to exhibit substantial positive returns during periods of weak equities performance. Further, we observe that they may show significant short-run equity correlation due to misestimation of market beta exposure. Finally, specific individual factors like FX carry may exhibit a structural long-run positive equity correlation, meaning a cross-sectional ARP strategy has to correctly balance such elements with others that have negative equity correlation to achieve overall market neutrality.

Appendix

In certain cases, a mis-estimation of beta may cause an ARP strategy to actually increase its leverage and its true beta to the market. A stylized model will illustrate. Consider there are only two independent sources of risk in the world, a market source of volatility (aka beta), and a non-market (that is, cross-sectional). The market source has volatility σ_{market} and the non-market source σ_{non_market}. Suppose the ARP manager estimates his or her beta to the market source as $\hat{\beta}_{market} = 0$, and $\hat{\beta}_{non\_market} \neq 0$, while the true sensitivities are $\beta_{market} > 0$ and $\beta_{non\_market} = \hat{\beta}_{non\_market}$, so that the manager correctly estimates non-market risk, but incorrectly estimates market risk as being zero. The manager's expected un-levered volatility would then be:

$$\hat{\sigma}_{port} = \sqrt{\hat{\beta}^2_{market}\sigma^2_{market} + \hat{\beta}^2_{non\_market}\sigma^2_{non\_market}} = \left|\hat{\beta}_{non\_market}\right| \sigma_{non\_market}$$

The manager then levers the portfolio so the total expected volatility is equal to some target $\sigma^* > \left|\hat{\beta}_{non\_market}\right| \sigma_{non\_market}$:

$$L = \frac{\sigma^*}{\hat{\sigma}_{port}} = \frac{\sigma^*}{\left|\hat{\beta}_{non\_market}\right| \sigma_{non\_market}} > 1$$

Where L is the leverage employed. While the manager's expected volatility is now σ^*, the true volatility is actually:

$$\sigma_{port} = \frac{\sigma^*}{\hat{\sigma}_{port}} \sqrt{\beta^2_{market}\sigma^2_{market} + \hat{\beta}^2_{non\_market}\sigma^2_{non\_market}} > \sigma^*$$

Further, the portfolio manager's expected market beta is $L\hat{\beta}_{market} = L \cdot 0 = 0$. However, the true market beta is $L\beta_{market} > 0$. In this case, not only is the portfolio over-levered relative to the risk target, but the true non-zero beta has also been levered.

What if the manager had known the true beta β_{market}? In this case, he or she would correctly estimate

$$\sigma_{port} = \sqrt{\beta^2_{market}\sigma^2_{market} + \hat{\beta}^2_{non\_market}\sigma^2_{non\_market}}$$

In this case, the correct leverage is calculated as:

$$L_{true} = \frac{\sigma^*}{\sigma_{port}} < \frac{\sigma^*}{\hat{\sigma}_{port}} = L$$

Consequently, the overall portfolio beta would have been $L_{true}\beta_{market}$ instead of $L\beta_{market}$. It follows that the actual portfolio beta $L\beta_{market}$ is greater than the beta $L_{true}\beta_{market}$ that would have been achieved had the manager not incorrectly estimated $\hat{\beta}_{market} = 0$. That said, correctly estimating this $\hat{\beta}_{market}$ is far from simple.

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