

Allocating Risk Capital: The Case of New Zealand Superannuation Fund

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This article describes how New Zealand Superannuation Fund (NZSF) allocates risk capital through its strategic tilting program. The process is based on the belief that a disciplined approach to risk allocation is a cornerstone of successfully implementing the Fund's investment strategies and achieving its goals. The three key elements of the risk allocation approach are supportive investment beliefs, strong governance, and the disciplined use of NZSF's active risk tool (ART). The article concludes with a summary of our experience with the approach to date. Other investors who engage in, or are considering engaging in, dynamic asset allocation may benefit from such an approach.

Keywords: Asset Allocation, Dynamic Asset Allocation, Pension Fund, Portfolio Design, Risk Capital Allocation, Tactical Asset Allocation

Origin and Goals of NZSF

The New Zealand Superannuation Fund (NZSF) was established to respond to New Zealand's aging population by smoothing the tax burden between generations of New Zealanders arising from the higher future cost of the national superannuation scheme. This goal is to be achieved by using government contributions and the returns from those investments to finance the higher future cost of the scheme. At a future date, currently from 2030, the government will start to withdraw money from the Fund to help meet the cost of superannuation at a time when those costs are expected to increase sharply, based on the country's demographic profile.

The Fund is legislated to "maximize returns without undue risk to the Fund."¹ Unlike many other institutional funds, NZSF does not employ a strategic asset allocation framework. Two principal elements constitute the overall investment strategy:

1. **Reference Portfolio:** The reference portfolio – a low-cost, passively managed, and broadly diversified portfolio of publicly traded asset classes – is important for several reasons:
 - It represents a balance of risk and return that can reasonably be expected to achieve the Fund's purpose. Because of the Fund's long-term investment horizon, it is weighted in favor of growth assets.
 - It expresses the expectation of the return the Fund should produce over the long term and the associated risk.

- It establishes an important performance benchmark for the value-adding investment activities undertaken within the Fund's actual portfolio.
2. **Value-Add Activities:** A range of public and private market investment strategies that are expected to add value, after costs, to the reference portfolio returns. One of these strategies is "strategic tilting," which is the focus of this article.

The reference portfolio is built on an "equilibrium" concept; that is, it is structured based on our assumptions of the average long-term value of various asset classes over long periods, regardless of what is actually happening to those values in any given market conditions. Strategic tilting, in contrast, is a value-add activity that attempts to identify market-level and asset-class-level valuations, that is, the long-run stable level of the fundamental determinants of price.

At present, NZSF implements tilts in exposures to the following asset classes: global equities, global listed property, global sovereign bonds, global credit, and foreign currencies. We believe there are three key elements to a successful strategic tilting program:

1. Supportive investment beliefs.
2. Strong governance.
3. Disciplined allocation of risk.

Investment Beliefs

The notion that asset prices can be in “disequilibrium” is based on a belief in mean reversion. Although there is always uncertainty about the parameters of the process of mean reversion, NZSF’s long time horizon allows it to bear this uncertainty and withstand the inevitable mark-to-market risk of a “contrarian” strategy. The two key investment beliefs that underpin strategic tilting are the following:

1. Expected returns are at least partly predictable within asset classes, and these returns are subject to a mean reversion process.
2. Investors with a long-term horizon can outperform more short-term-focused investors over the long run.

These beliefs cannot be definitively proven; they are judgments based on our take of the relevant literature, internal research, and investment experience.

Most of the strategies that NZSF pursues rely on a long-term horizon and our belief that investors with a long-term horizon can outperform more short-term-focused investors over the long run. While this belief is based more on economic intuition and observation than on academic research, there is some empirical and theoretical support for the notion that investing with a shorter-term focus tends to be disadvantageous, given that over short horizons the signal-to-noise ratio tends to be very low (Black 1986; Kyle 1984, 1985; Merton 1971; Summers 1986; Shiller 1981, 1984).

Casual empiricism from centuries of financial-market behavior suggests that markets go through boom–bust cycles, or, to put it differently, markets become highly disconnected from their fundamental earnings determinants at times. Academic empirical evidence that long-run returns and risk premia are subject to mean reversion is still inconclusive. For example, the strong predictive power of fundamental valuation metrics for forecasting long-run equity returns claimed in early studies (e.g., Poterba and Summers 1988; Fama and French 1988) was questioned by later work (e.g., Stambaugh 1999).

Governance

It is widely reported that the governance of managed funds often falls short as a result of poor decision processes, inadequate resources, and lack of focus or mission clarity (see Ambachtsheer, Capelle, and Lum 2008). It is our view that successful implementation of the strategic tilting strategy requires robust governance and decision-making processes. The elements that we see as critical to support the implementation of strategic tilting, in particular, are Board commitment and alignment of interests.

Board Commitment

Strategic tilting is a “contrarian” strategy that may produce an extended period of losses relative to the reference portfolio. Being underweight in an asset class in a bull market or overweight in a bear market can bring enormous pressure to unwind the strategy. The worst possible outcome for a fund, however, would be to abandon a position when valuations for an asset class prove extreme *ex post*. For this reason, it is imperative that the Board be strongly committed to the strategy – both in the sense of buying into the investment beliefs behind the strategy and in the sense of being willing to defend the strategy against other stakeholders who may be less committed, particularly during periods when the strategy underperforms.

Alignment of Interests

Strategic tilting is managed internally in NZSF. Therefore, the Board’s commitment to strategic tilting also rests on their confidence in the management of the strategy. We think that internal management of strategic tilting is the best means to avoid problems with alignment of interests, given that the strategy can produce large losses over an extended period of time.

To ensure alignment of incentives, NZSF makes the decision to adjust exposures in line with the risk capital allocation process the default position. As noted, strategic tilting is contrarian by nature, which makes such a path somewhat uncomfortable to follow. However, we should note that having mechanistic rules does not mean there is no room for judgment in the decision-making process; we do allow an override of any signal if we believe that there are important market developments or considerations not taken into account in the tilting model.

Disciplined Allocation of Risk Capital

We believe strongly that a disciplined approach to allocating capital (or risk) at NZSF is an important part of achieving long-term success in the strategic tilting program. This section explains the rationale for our belief. All investors are solving the same basic problem: How much needs to be saved, and how it should be invested, to ensure a sufficiently high chance of having enough money to achieve some goal in the future? Typically, institutional investors solve this problem through a policy portfolio (or strategic asset allocation). The policy portfolio is a long-term plan, based on long-run relationships among asset class returns and the investor’s liabilities. In a behavioral context, the policy portfolio provides an anchor for the investor to avoid following short-term market trends and fads that could create undesirable levels of portfolio risk.

For many years, institutional investors have followed the policy portfolio concept. There are generally accepted methods

of formulating long-run asset-class relationships and translating these into policy portfolios. NZSF's version of the policy portfolio is the reference portfolio. There are differences however. The reference portfolio does not include any alternative asset classes; it maintains a fixed allocation to public asset classes over many years, and does not attempt to identify periods of asset class over- and undervaluation. The strategic tilting program is one of the value-adding strategies that tries to do better than a simple, static mix of asset classes. But how much better, and how much additional risk should be allocated to the program?

Answering this question usually involves specifying a target level of additional returns (above the benchmark) and additional risk (in excess of the benchmark risk). Are these target expectations realistic? What processes are followed to meet them? Typically, investors would rely on the history of asset-class returns to formulate an expectation of future performance of a program like NZSF's strategic tilting program. And in determining ways to allocating risk across asset classes and markets, allocation rules may be formulated by historical back-testing, with the implicit assumption that future market conditions will mirror the past. Portfolio managers may then use these allocation rules with qualitative judgment based on current market conditions; in some cases, they may employ an entirely qualitative approach to determining the size of an allocation to asset classes and markets, based on the assessed degree of over- and undervaluation.

Enter ART

NZSF's active risk tool (ART) is at the core of our formalized process and mechanism for translating valuation signals into asset-class and market allocations. The aim of the ART approach is to ensure discipline in allocating to asset classes and markets and to be more objective, avoiding the temptation to deploy "gut feel." In deciding on the use of ART, we are also mindful of the following:

- History may be a questionable guide to the future. Using historical returns may be a good starting point, but future market conditions will most likely differ from the evolution of past returns for each asset class and market.
- The allocation to any asset class and market should be consistent with achieving the target level of active risk and return we expect over long periods.
- The allocation approach and process should be transparent in terms of how any given over- or undervaluation translates into consistent positioning of risk across asset classes and markets.

We do not claim that the ART approach is superior to other strategic tilting approaches when allocating capital over time. We do believe, however, that under the ART approach, the

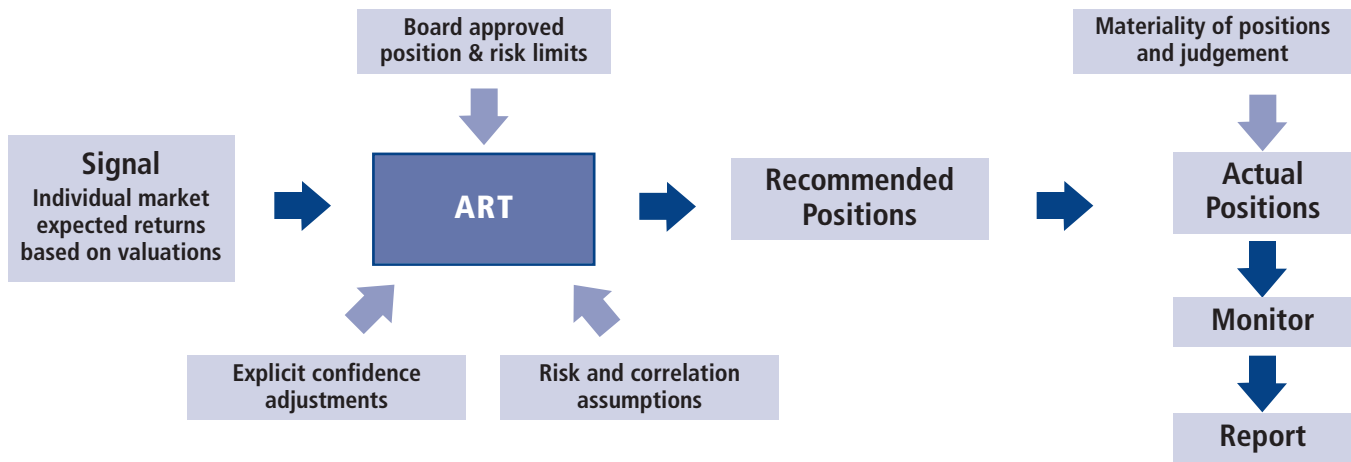
allocation to an asset class or market is fully transparent in terms of the signal (the differences between the market's assessment of value – the market price – and our assessment of value) and how that signal is translated into the allocation of capital in a disciplined manner that is consistent with the contribution to the targeted level of additional return and risk above the benchmark.

Explaining ART

Figure 1 provides an overview of the strategic tilting process. Its key elements are:

- **Signal:** The expected excess returns for each asset class and market, based on our valuation models, which estimate how far each asset class or market is away from value, combined with how long we believe it will take for price to revert back to value. Excess return is defined here as the additional return above the long-run return for the asset class; in other words, when price is equal to fair value, the excess return will be zero.
- **Risk Assumptions:** The long-run risk assumptions for each asset class and market. Risk assumptions are necessary to help us adjust the excess return for the risk of each market. Equity markets have higher excess returns than bond markets. When comparing the relative attractiveness of bonds and equities, for example, the excess returns for each must reflect for their different riskiness.
- **Confidence:** The degree of confidence we can have in our estimates of value. In making estimates of value that differ from the market price, we are explicitly forecasting whether the market price will revert to our estimate of value. For instance, if we have no confidence in our estimate of value at all, we are saying that we would not rely on our estimate of the excess return for a market and therefore would not take any active position. It is essential that there be some degree of information in our estimate of value. That is, if the price does not, at some point in the future, revert to our estimate, the strategic tilting program would probably not improve the Fund's long-term risk and return profile.
- **Board Limits:** Board limits, expressed in terms of long and short position limits in various countries, aggregate equities, bonds, and currencies, provide another governance measure for the tilting program.
- **Actual Positions:** The suggested allocations will be implemented subject to materiality thresholds. Changes to a position for any asset class or market will need to be significant enough to justify the transaction and operational costs involved.
- **Monitor and Report:** The positions are monitored daily, while performance and position reporting are provided to both the Investment Committee and the Board for oversight.

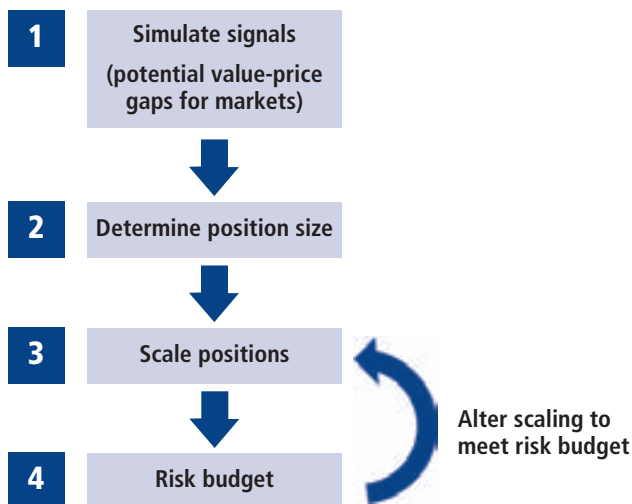
Figure 1: Overview of Strategic Tilting Process



Calibrating ART

ART must be calibrated to meet the desired risk budget over time before it can be used for real-time capital allocation. The calibration process is shown in Figure 2.

Figure 2: Calibration of ART



The four steps are elaborated below.

(1) Simulate Signals

A simulation of the potential price–value gaps, and hence expected excess returns, for each market is undertaken. *Excess return* is defined here as the additional return above the long-

run or fair return for the asset class; in other words, when price is equal to fair value, the excess return will be zero. Essential to the simulation is the assumption that price reverts to value over time. The degree of mean reversion and the riskiness of each market will determine how far price can deviate from fair value. To illustrate the effect of mean reversion, we show the results from a single simulated history of value-price gaps of global equities with and without mean reversion.

As Figure 3a illustrates, without mean reversion, the value-price gap could increase over time; there are no limits on the value-price gap dispersion. This simulated outcome will be inconsistent with our investment experience and investment beliefs. By contrast, with mean reversion, as illustrated in Figure 3b, the same simulation now exhibits a strong central tendency. The average value-price gap is close to zero, and the dispersion of the value-price gap is limited on both the upside and the downside.

However, the dispersion of value–price gaps for each market cannot be determined through a statistical exercise alone; it must be supplemented with investment experience, expertise, and judgment. Since estimates of fair value are not observable, we rely on the experience of our portfolio managers at NZSF and advisor William Blair in determining the value–price dispersion for each market. Ultimately, risk capital allocation with ART is about a *disciplined approach to risk capital allocation*, rather than merely a quantitative approach. Investment judgment is an integral part of the calibration process. And while ART could be used regardless of how the signals are generated (e.g., signals can come from momentum, market sentiment, and/or valuation), NZSF employs a fundamental valuation approach to signal generation.

Figure 3: Simulated Value–Price Gaps

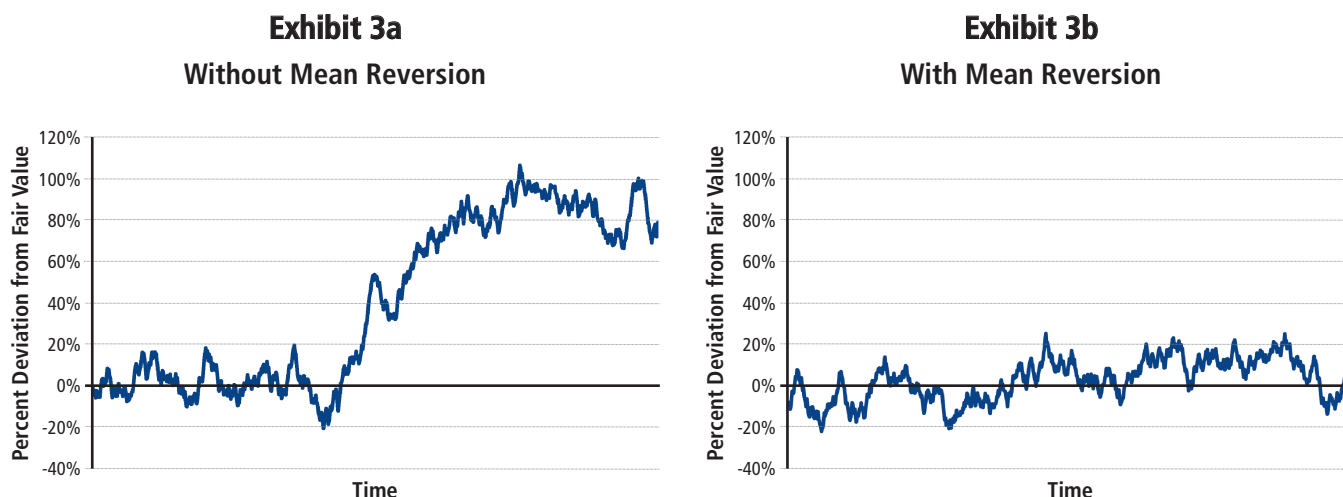


Table 1 shows a sample of simulated value–price dispersions of NZSF’s tilted asset classes. An overvaluation is given by a negative value–price gap (value/price – 1). The 1st percentile of global large-cap equities means that in 1% of all instances, global large-cap equities are overvalued by at least 40% (that is, value corresponds to 60% of the price). Likewise, the 99th percentile of global large-cap value–price gap means that in 1% of all instances, global large-cap equities are undervalued by at least 79% (that is, value corresponds to 179% of the price).

Table 1: Volatility and Distribution of Value–Price Gaps Asset Class

| Asset Class | Risk | Value–Price Percentile | |
|-------------------------|------|------------------------|-----|
| | | 1% | 99% |
| Global large cap | 16% | –40% | 79% |
| Global listed property | 16% | –30% | 42% |
| Investment-grade credit | 6% | –14% | 16% |
| Sovereign bonds | 4.5% | –12% | 12% |

Note that the maximum and minimum values may be much further away than the 1st and 99th percentile.

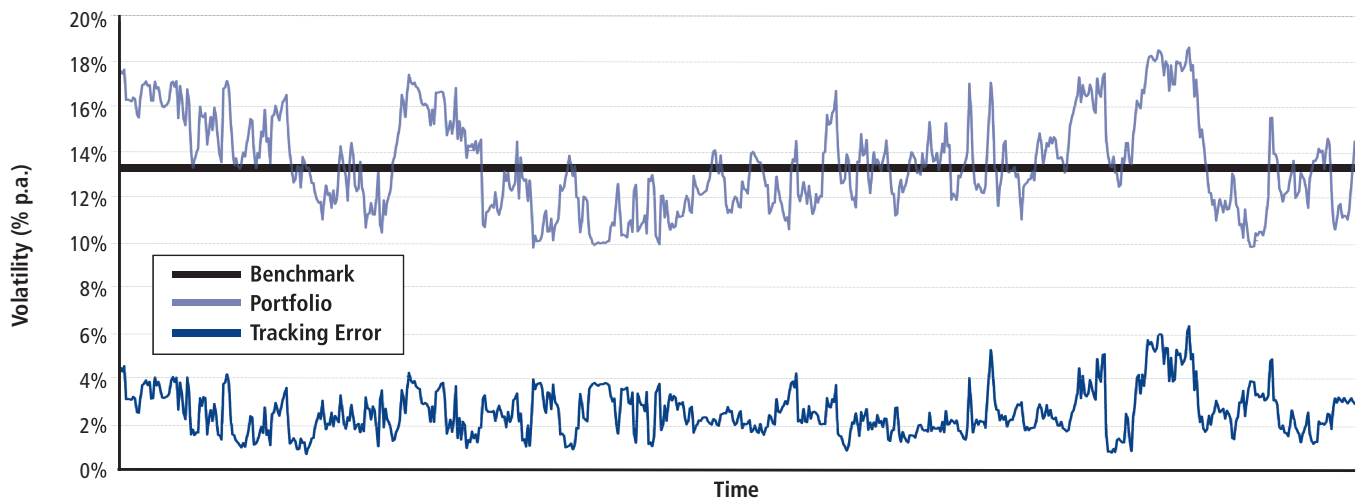
(2) Determine Position Size

The position-sizing rule is determined by the differences in excess returns and the risk of and confidence in those returns.

As an example, using equities and bond asset classes,

$$\text{Position size equities vs. bonds} = \frac{[(\text{equities excess return} - \text{bond excess return})]}{\div \text{relative risk}} \times \text{confidence} \quad (1)$$

- **Excess Returns:** The estimates of excess returns are based on how long we think it will take for price to revert to value. Value is based on discounted cash flow (DCF) models. This allows significant transparency around the key inputs. For example, in the equity models, we spend most of our time developing the best possible estimate of normalized (trend) earnings which change only slowly through time. We also tend to rely on the same approach for evaluating asset classes, which allows for consistency in applying our parameter estimates across valuations.
- **Relative Risk:** Risk assumptions are necessary to compare the excess returns from each market. When comparing the relative attractiveness of bonds versus equities, for example, we must take into account their differential riskiness in conjunction with the differential excess return. For further details about risk measures, see [Staub \(2011\)](#).
- **Confidence:** The excess return forecasts are “raw” in the sense that we have not made any attempt to adjust them for the different degrees of confidence we have in the signals. Any confidence-adjustments will tend to pull the excess returns down to the long-run return.

Figure 4: Absolute and Relative Risk over Time**(3) Scale Positions**

Scaling is a way to move all pairwise position sizes up (or down) by the same proportion to achieve a risk budget. The adjustment to the position size would be as follows:

$$\text{Position size equities vs. bonds} = \frac{[(\text{equities excess return} - \text{bond excess return}) \div \text{relative risk}] \times \text{confidence} \times \text{scalar}}{(2)}$$

The impact of scaling can be determined only by examining the outcomes from the simulation. We focus mainly on active risk (or tracking error) as the metric for the risk budget.

An example of such an exercise is illustrated in Figure 4, which shows that the average simulated portfolio volatility is 13.4% pa and the relative risk is 2.5% pa. If we were aiming for a target relative risk of 3% pa, then we would scale all relative positions up accordingly until the target was met. The process of calibrating position sizes to meet the risk budget is iterative and requires several simulations.

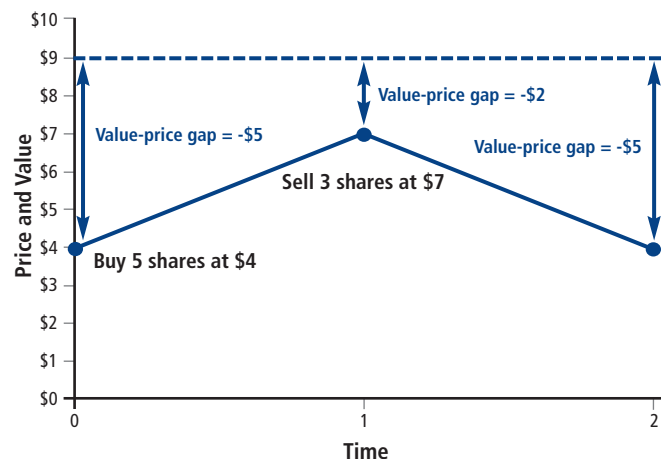
(4) Meet the Risk Budget

We focus mainly on risk relative to benchmark, but other criteria can also be used. For example, we could set the scalar such that the probability of the total forward-looking portfolio risk or the resulting forward-looking relative risk not to exceed some specified threshold over time, or we could set a limit on the probability of a constraint's being breached.

Below we provide additional comments on two important aspects of the strategic tilting program. The first concerns the disciplined allocation of capital based on valuation signals; the second concerns the role of judgment in the process.

Allocating to the Signal

In practice, the tilting program changes the active risk position in a market according to changes in the excess return signal. To be precise, ART allocates capital proportional to the magnitude of the signal.² This approach means that positions are put on and taken off as signals move up and down. Such an approach allows us to enhance the active return per unit of active risk (i.e., the information ratio). To illustrate this effect, we present an example in Figure 5.

Figure 5: Proportional Allocation

At time 0 (T0), price = \$4, value = \$9, and we buy an amount proportional to the value–price gap. For simplicity, we assume that we buy or sell 1 share for every \$1 in value–price gap. Thus, we buy 5 shares at time 0, since the market is undervalued by \$5. Between T0 and T1, the price increases to \$7, and the value–price gap closes to \$2. That is, the market has become less undervalued, and therefore we sell 3 shares. Finally, between T1 and T2 the price of the market moves back to \$4. Consequently, at T2, we buy 3 shares again. The net gain of \$15³ arises because we have a larger exposure when the price increases (we make a gain) than when the price decreases (we make a loss). This is a general result, and the order of the price movement (i.e., whether the price moves up–down–up–down or up–up–down–down) does not matter. All that is required is that the price reverts to fair value over some time period.

By more frequently trading the fluctuations in a market, we reduce the cost of building a position when markets are moving further away from value. This also means that if the tilting program is in a losing position, it can still generate profits, even though the market remains some distance from value. Aside from the need to manage transaction costs, there is a natural desire to avoid adding and removing positions when there is a perceived momentum component to the signal. This is a natural behavioral reaction, but in the context of running a disciplined tilting strategy, it will ultimately be a drag on performance over long periods (of course, it can work well some of the time). When a signal “comes on” and we put a position on, we generally want it to prove a winner as soon as possible, so that we can book the profit and wait for the next opportunity. However, it may actually be better for long-term performance if the initial position loses money and we add to the position incrementally in a disciplined manner.

If we believe that momentum is running strongly against a value-based signal, we should still put the incremental position on. We do not know if our view on momentum will prove correct; we might be wrong, and momentum could fade away. But by avoiding the discomfort of putting on a position in the face of momentum working against our position, we also risk incurring the opportunity cost of not exploiting the signal. The key is to allocate risk incrementally, in a disciplined manner, in response to changes in expected returns.

The Role of Judgment

The process described here may appear mechanical and quantitative, but this is not the case. Judgment is formalized in our approach. The valuation models have many embedded judgments. There are judgments about the underlying determinants of “fair value” of an asset class, including judgments about all future cash flows and the appropriate valuation of those cash

flows now and in the future. The valuation of the cash flows reflects a judgment on the appropriate risk premium and the future evolution of the risk-free rate. The risk premium itself is based on our assessment of the future volatilities of, and correlations with, a broad number of assets. Anything that is not in the model but could be reasonably argued to be a potential influence on the asset’s expected performance is also a judgment, which could be applied in deciding whether to or not to deviate from a position recommended by the model.

Experience to Date

As our focus in this article is on the disciplined approach to risk capital allocation, we confine our comments about our experience to this aspect of the strategic tilting program. In other words, while the roles of good governance, oversight, communication, reporting, and investment beliefs are also important in operating a program such as strategic tilting, it is the central role of disciplined risk management that we are focusing on here. We strongly believe that having a clear and transparent link between the tilt positions held at any given point and the target level of active risk expected to be met over time is essential for running a tilting program.

This ART approach has recently been implemented by NZSF. Our experience to date can be summarized as follows:

- The implementation of ART has enabled NZSF to broaden the range of markets in our tilting program and the additional complexities that come with determining allocations across many markets.
- ART has enabled NZSF to explicitly incorporate assumptions about confidence and scale tilt positions to meet our risk budget.
- The transparency in our assumptions and in how signals are translated into active positions under ART enhances oversight and governance of the tilting program, allowing the Investment Committee and the Board to better discharge their governance obligations. For instance, when the Investment Committee or Board has doubts about the current tilting positions, we can pinpoint which underlying assumption(s) it disagrees with and find out the reasons for the disagreement. Would changing the assumption(s) be reasonable and consistent with the program’s long-term horizon and the Fund’s investment beliefs? ART allows management to examine the impact of a change to any underlying assumption on the additional expected return and risk of the program.
- The disciplined approach of altering position sizes in accordance with changing signals has been a source of added value; it has helped produce some trading profits during challenging times when positions are “out of the money,” which has also helped to instill further confidence in the risk management of the program.

Applicability to Other Funds

We believe that the approach to risk management outlined here is applicable to any fund that currently operates, or wishes to operate, a program similar to our strategic tilting program. It is an active risk allocation approach that can be applied to any policy portfolio. For example, a defined benefit plan may operate a static policy portfolio or employ a “liability responsive” approach, which alters the asset mix as the funding ratio changes. In either case, a disciplined approach to active risk allocation, whether applied under the banner of dynamic asset allocation or of tactical asset allocation, can add value to the asset management of the plan by helping to increase the probability of achieving the plan’s objectives.

However, we should emphasize that the ART approach on its own is not sufficient to ensure the success of any tilting program. As mentioned earlier, the organization must also have full buy-in from its stakeholders on the set of investment beliefs that underlies tilting, as well as having a strong governance structure in place, before implementing such a program.

Discipline Is Key

NZSF employs formal, disciplined risk capital allocation in its strategic tilting program. The advantages of such an approach are that it allows us to

- calibrate the amount of risk we take, given the opportunity set, to meet an active risk budget over time;
- make a clear and transparent link between our estimates of the valuation gap of any market, our confidence in the estimates, the inherent riskiness of the positions, and the overall risk budget of the tilting program; and
- make the investment process behind the tilting program transparent and, as a result, strengthen the governance of the program.

We believe that a disciplined approach to risk allocation is key to successfully managing the strategic tilting program and helping the fund fulfill its long-term purpose. We believe other investors that engage in, or are considering engaging in, dynamic asset allocation may benefit from such an approach.

Endnotes

1. The NZ Superannuation and Retirement Income Act 2001, s58.
2. This is the so-called proportional allocation rule (PAR). See [Staub \(2007\)](#) for further details; for a practical example in the context of an active stock portfolio, see [Staub \(2006\)](#).
3. We buy 5 shares at \$4, we sell 3 shares at \$7, and hence have left 2 shares at \$7. That is, we spent \$20, cashed in \$21, and have left \$14, which adds up to a gain of \$15.

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