A reprinted article from Volume 14, Number 1, 2013

THE JOURNAL OF
Investment Consulting

IMCA | investment management consultants association

A Governance Framework Designed For Dynamic Asset Allocation

The CERN Pension Fund Model

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Abstract

There is a growing awareness among pension fund fiduciaries that the traditional, static approach to asset allocation may not always protect the fundamental interest of their institutions: preserving capital and ensuring adequate and steady rates of return over time. The CERN Pension Fund innovated by moving away from the traditional framework and by adopting a capital preservation approach based on dynamic risk-driven asset allocation. CERN's implementation of the risk-driven approach gives full flexibility to the investment team in allocating assets, subject to maintaining the fund's total risk under a pre-approved ceiling. Reconciling proper execution of fiduciary duties with the dynamic approach required a new governance framework, spelling out adequate investment principles, and incorporating independent daily risk-control as well as new metrics to measure performance.

Introduction

There is a growing awareness among pension fund fiduciaries that the traditional, static approach to asset allocation may not always protect the fundamental interest of their institutions (Berkelaar 2011): preserving capital and ensuring adequate and steady rates of return over time.

In 2010 the CERN Pension Fund decided to step away from the traditional model toward a dynamic, risk-driven approach. This decision followed an examination of some of the traditional model's basic assumptions, which turned out to be incompatible with the fund's actual situation. The board thus instructed the fund's staff to develop and implement an approach that would seek to align the fund's behavior with the board's priorities. While there was a broad consensus that a change in the investment governance structure was needed, the challenge was to accomplish a truly fundamental transformation with full alignment between the new vision, available skills and capabilities, and decision-making processes.

This paper describes the updated investment governance arrangements of the CERN Pension Fund, which have been in place since 2011. The governance is designed to reconcile two seemingly diverging requirements: on the one hand, the highest possible level of control that can be reasonably implemented at the board level; and on the other, appropriate discretion at the investment team level to allow it to act quickly and effectively in ever-changing market conditions.

Background

CERN, the European Organization for Nuclear Research, based in Geneva, Switzerland, is an intergovernmental organization funded by twenty European member states. It is home to the world's most powerful particle accelerator, the Large Hadron Collider (LHC). The CERN Pension Fund, established in 1955, provides retirement, disability, and survivors' pensions to CERN employees and their families, as well as to staff members of the European Organization for Astronomical Research in the Southern Hemisphere (ESO). As of December 31, 2011, the fund had approximately 3.7 billion Swiss francs in assets. The fund's demographics are typical of a mature pension plan with 71 percent of liabilities attributable to beneficiaries.

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The CERN pension fund is a capitalized Swiss franc defined benefits pension plan. The pensions to which the members and beneficiaries of the fund are entitled are determined by a fixed-formula based on a member's salary and number of years of membership in the plan rather than on the investment return of contributions (as in a defined contribution plan). The benefits are paid from the resources of the fund and not from the annual budget of the organization. The fund's resources derive solely from contributions from members and from the employer organizations, CERN and ESO, and from the return on investments.

The fund is placed under the direct authority and supervision of the council of representatives of CERN's member states. The CERN Council has set up a dedicated structure, separate from that of the rest of CERN, to manage the fund. This structure includes the CERN Pension Fund Governing Board, its investment committee, and the chief executive officer (CEO) of the fund. The governing board is entrusted by the council with the overall management of the fund. The investment committee is the expert body of the governing board on investment matters. Its main function is to determine the asset management process and monitor its implementation. The CEO heads the fund's staff (known as the pension fund management unit), and is responsible for day-to-day management of the fund.

The fund's pre-2009 portfolio qualified as fairly traditional, with 60 percent invested in risk assets and 40 percent in fixed-income and cash. The strategic asset allocation was calculated every three years and based primarily on asset-liability considerations. The fund was allowed to vary asset class allocations within fixed bandwidths, with tactical asset allocation decisions approved by the investment committee at its meetings. The investment approach was focused on measuring performance versus a benchmark composed of a blend of market indexes. Asset performance was measured against the benchmark.[1] This investment approach led the fund to take large amounts of risk, which materialized in the form of substantial losses in 2008, leading to material deterioration of its funding status.

Post-2008 Assessment of Basic Assumptions

The losses experienced by the fund in 2008 generated a strong sense of urgency to reassess its investment principles, starting with a thorough identification and examination of the implicit assumptions on which its legacy investment approach was based.

With its return-driven, static allocation approach, the fund effectively was taking long-term bets on risk assets.[2] In other words, it counted on the certainty of the equity risk premium over a long period. Furthermore, by accepting to have negative performance with the same frequency and amplitude as benchmark assets (e.g., the S&P 500 Index), the fund was de facto assuming that it could afford a long-term horizon (typically ten to twenty years) and withstand short-term risks. Such a stance also assumed cash in- and outflows that were neutral with respect to the fund's actuarial situation.

Those basic assumptions, embedded in the fund's legacy strategy, had been true several decades prior, but by 2009 they had ceased to reflect the fund's reality. At that time, the CERN Pension Fund was suffering from structurally negative cash flows and material underfunding. Prospects for extraordinary remedial contributions were limited. Furthermore, in the face of potentially prolonged market cycles, the practice of relying in large part on the equity premium over a market cycle to meet the fund's needs appeared inappropriate.

Adopting a Dynamic, Risk-Driven Asset Allocation Approach

Making the board fully aware that the fund's investment strategy was based on out-dated assumptions and implicit hypotheses was a truly decisive step in creating a sense of urgency strong enough to drive change in a large complex multinational organization such as CERN. The conclusions of the assessment were unanimous: The fund had to focus its strategy on striving to meet its specific return objectives while actively minimizing the danger of a loss of capital. Relative market outperformance was not sufficient. In other words, instead of a mostly passive approach relying on long-term risk premiums, the fund would seek to minimize capital losses in the medium term and capture sufficient market upside to meet its actuarial return objective—an approach that requires dynamic management of the portfolio's risk and that is referred to as capital preservation. In 2010, the board decided to formally adopt the capital preservation approach, with risk management at the core of the investment process.

The next decision concerned the design of the asset allocation framework, a key element in the risk-management process. The legacy framework, with a static strategic asset allocation and its predetermined tactical bandwidths, was not consistent with the updated investment philosophy of the fund where the focus was to be put on managing the overall risk of the portfolio.[3]

The board decided on a framework that would allow the investment team to take full advantage of the dynamic approach while ensuring the highest level of control possible. The following set of investment principles was defined and documented in the fund's first-ever Statement of Investment Principles:

1. The board would introduce an absolute quantifiable risk constraint as the sole constraint to the dynamic asset allocation process;

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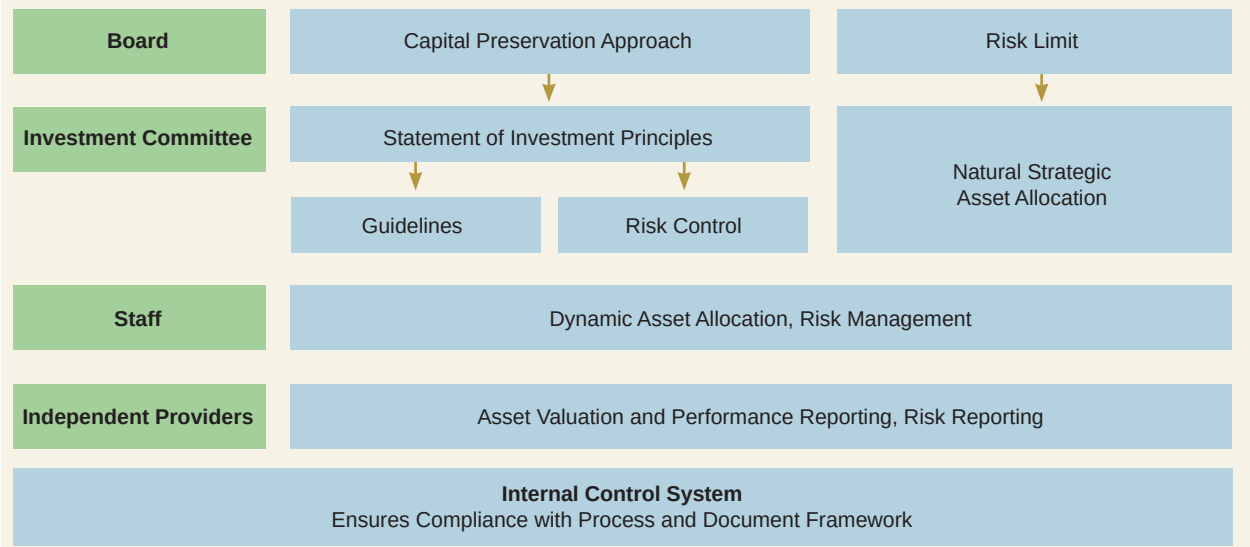
FIGURE 1: CERN PENSION FUND INVESTMENT GOVERNANCE FRAMEWORK



2. The fund's natural strategic asset allocation (NSAA) would only serve to indicate the fund's default positioning, consistent with the risk ceiling, in the absence of other information, at the time that the NSAA is agreed upon;
3. Actual asset allocation can dynamically deviate at any time from the NSAA subject solely to maintaining the fund's total risk under a pre-approved ceiling;
4. The objective would be to minimize actual estimated risk at all times subject to reaching the actuarial return objective;
5. A continuous risk-control process would ensure compliance.

Investment Principles: Clear Definition of Roles and Responsibilities

Reconciling proper execution of fiduciary duties with the dynamic approach described above required a completely new governance framework. The updated investment governance framework, implemented in 2011, is shown in figure 1.

As explained in figure 1, the governance framework starts with the board's decision to adopt a capital preservation approach, and the associated Statement of Investment Principles (SIP).

The SIP further clarifies key processes: 1) the setting of the fund's risk limit, 2) the dynamic asset allocation and risk management processes, 3) the setting of guidelines, and 4) the risk control process, as described below.

Risk Limit

Considering risk as the central element in the capital preservation approach, the asset allocation process starts with the definition of the risk limit. In CERN's case, the risk limit is set annually, and it expresses the board's tolerance for maximum annual loss, taking into account the sponsor's ability to make additional recovery contributions.[4] The limit is expressed as the 5-percent CVaR (Conditional Value-at-Risk) of annual return—it sets the maximum acceptable loss over the coming twelve months, and is expressed in absolute terms (in Swiss francs).

The suitability of the risk limit with regard to the return objective is assessed through the annual NSAA exercise. The purpose of the NSAA is only to confirm the existence of a potential allocation compatible with both the fund's risk limit and the actuarial return objective at the beginning of the year. From a technical standpoint, the NSAA is calculated on an annual basis considering multiple time horizons, accounting for, among others, the liabilities of the fund and assumptions related to asset and market risks. The NSAA is calculated by the fund's risk consultant, reviewed with the investment staff, and subsequently approved by the investment committee. The NSAA calculation applies a frequency domain approach for analyzing historical time series and generating scenarios for the future (Steehouwer 2005).

Dynamic Asset Allocation and Risk Management Processes

In CERN's capital preservation context, risk management aims at maximizing the return-to-risk profile of the fund subject to reaching the actuarial objective. In other words, it seeks to minimize at all times the amount of risk taken to reach the fund's actuarial objective. The investment staff has full flexibility in allocating assets subject to maintaining the fund's total risk under the risk limit, and to following

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guidelines. Investment decisions are evaluated based on their prospective impact on the ex ante return-to-risk profile of the fund.

Dynamic asset allocation is driven by two complementary processes: 1) a top-down macro analysis of the environment, and 2) a risk-driven bottom-up aggregation of potential investment strategies. The purpose of the top-down macro process is to identify market regimes and corresponding opportunities and threats. The macroeconomic analysis relies on four distinct families of factors and how they evolve over time: economic factors, market momentums, risk indicators, and market information.

The fund's chief investment officer, reporting directly to the chief executive officer, implements the dynamic asset allocation process, with the help of optimization tools that aim to maximize the portfolio's capital preservation potential. At any one time, asset allocation is deployed through strategies managed both internally and externally. External managers with a proven expertise in capital preservation strategies contribute their skill through mandates that specify objectives supporting capital preservation. Internally managed portfolios, representing approximately 50 percent of assets, also are managed with a capital preservation objective. The CERN Pension Fund settled on this combination of external and internal skills with the aim of maximizing performance versus cost, within its own organizational constraints. Other sponsors of course have the choice to implement a dynamic asset allocation process through other arrangements, ranging from managing all aspects internally to full outsourcing.

Guidelines

While the investment staff has full authority for portfolio construction and implementation, it is required that they comply with the rules set out in the fund's investment guidelines. Guidelines are defined for the fund as a whole and for different asset classes and are formally approved by the investment committee. The purpose of investment guidelines in the CERN investment governance framework is to list allowable investments and clarify requirements to manage different types of investment-related risks (such as credit risk, counterparty risk, and liquidity). Fund-level guidelines contain no reference to bandwidths or allowable ranges expressed as a percentage of assets.

Risk Control

Since the risk ceiling is the only constraint to actual asset allocation, measurement of the fund's overall risk is central to ensuring compliance. Daily risk measurement for compliance purposes is provided by the fund's administrator. The administrator calculates the fund's total risk and compares it to the risk ceiling. Any excess of risk triggers a review by the investment staff. On a quarterly basis, the time series of daily risk measures together with any corrective action are reported to the investment committee. In addition, also on a quarterly basis, the fund's risk consultant reviews the total estimated risk of the fund and of the NSAA against the risk limit agreed upon by the board, and reports to the investment committee.

The roles and responsibilities of the board, investment committee, and staff, as described above, were designed to maximize effective use of the time and expertise of the each body.[5] In that regard, the framework seeks to maximize benefit from the investment committee's expertise by focusing its time and efforts on defining and controlling the process that leads to the asset allocation. The emphasis is on the process being strategic rather than on the outcome. The framework also recognizes that the expertise for day-to-day investment decisions lies with the staff, and seeks to leverage this expertise to the maximum possible within pre-established and approved guidelines.

Overall, this governance framework focuses the efforts of the investment staff on maximizing the efficiency of investment management, in terms of expected return per unit of risk. Simply put, it can be said to aim at maximizing the fund's Sharpe ratio. While CERN has applied this model to minimize risk at all times (i.e., minimize the denominator of the Sharpe ratio for a constant numerator), this same governance model is also suitable to maximize return (i.e., maximize the numerator of the Sharpe ratio for a constant denominator). This is because the key to success for both approaches is to aim for maximum efficiency and to provide the staff with the tools to achieve it.

Performance Measurement Consistent with the Investment Approach

Measuring performance in a capital preservation context is more than a technical matter. It is a communication issue as well.

The capital preservation approach boils down to positioning the fund to achieve its actuarial return objective[6] (expressed in absolute terms[7]) with the lowest possible level of risk, at all times. Typically, this requires choosing to give up a portion of potential upside in order to protect the fund's downside. The message is simple but can be easily forgotten, especially during market rallies when the fund's performance relative to a 60/40 blend is likely to be lower. Such phases can be very challenging both for the board and for the investment team, unless the implementation has been coupled with a formal a-priori agreement on performance expectations and a supporting communication effort.

The CERN investment team anticipated the challenge and agreed with the investment committee about a set of principles for measuring the performance of the CERN Pension Fund against its capital preservation mandate. These principles recognize that, in contrast to the traditional

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approach, which is focused on a single objective, the capital preservation approach seeks to optimize performance against several objectives. Therefore evaluation of the fund's performance solely against a return benchmark is not sufficient to assess whether the fund met its mandate.

The fund's objectives, which are defined in the SIP, include 1) meeting or exceeding the fund's actuarial return objective (on both short- and long-term horizons), 2) delivering a high quality of returns, and 3) preserving capital. Accordingly, the CERN Pension Fund defined a matrix of objectives, against which it measures its performance (table 1). This matrix includes measures of 1) the fund's return against its actuarial target, 2) the quality of returns, and 3) the fund's ability to preserve capital.

The fund's return is assessed solely against its actuarial return objectives and not on a relative basis against market-based benchmarks (such as a blend of indexes). This decision recognizes that the fund must be managed to achieve its target and that relative returns are not an appropriate measure of ultimate success.

Measures of the quality of returns seek to evaluate how efficient the management of the fund has been at getting to its return objective. Such measures include the Sharpe ratio, as well as measures of upside vs. downside capture. Measurement of the quality of returns is one area where comparisons to market indexes can be meaningful in the context of a capital preservation strategy.

Measures of the fund's ability to preserve capital seek to inform on whether the fund has been (and is likely to be) able to avoid the danger of permanent loss of capital. Such measures include both historical measures (such as drawdowns) as well as forward-looking probability-based measures.

It is important to reiterate here that the single role of the NSAA in the CERN model is to indicate the default positioning of the fund in the absence of other information at the time that the NSAA is agreed upon. In the CERN model, it is perfectly acceptable to have a return less than that of the NSAA if the absolute target is met or exceeded.

Breaking with the measurement paradigm of the traditional approach, which typically evaluates the success of a fund's investment management by focusing on the fund's return relative to a market benchmark, was therefore essential to implementing the capital preservation approach. However, such a break with the past brought with it an obvious communication challenge.

The CERN Pension Fund therefore initiated a comprehensive communication program right from the outset. The program aims at communicating the concept of capital preservation frequently, broadly, and through multiple communication channels. Key requirements are to formulate the message in simple language and make it accessible to a broader audience not necessarily familiar with investments or financial vocabulary. Selected communication channels reflect the large number of stakeholders in the CERN Pension Fund, which include CERN member states, CERN's council and its bodies, CERN and ESO employees, employee associations, and retiree associations. Communication has been a continuous process and will remain in the focus of management activities.

Monitoring, Control, and Quality Assurance

As mentioned above, one of the main implementation challenges of the capital preservation approach was to determine an investment governance framework, which would allow for effective dynamic asset allocation and risk management while providing for the highest affordable level of supervision and control. In other words, the board and the investment committee had to be reassured that the updated framework would integrate tools and processes enabling the two bodies to fulfill their roles of supervision, monitoring, and control.

The requirements of the board were addressed by establishing a transparent and bias-free reporting system based on the principle that data shall be provided by external independent sources with the highest possible level of quality assurance. The system integrates three main reporting processes: 1) risk reporting by the fund's risk consultant; 2) asset value, performance, and performance attribution reporting by the fund's master custodian; and 3) reporting of liabilities by the fund's actuary. The overall control framework is complemented by an internal control system, which includes an annual audit of investment-related processes by an independent qualified auditor.

The role of the fund's risk consultant was defined in such a way as to provide independent assessment of investment-

TABLE 1: MATRIX OF OBJECTIVES, MEASURES, AND BENCHMARKS

Objectives	Measures	Comparison Basis
1. Meet or exceed actuarial return objective	• Return on assets (over various past time periods)	• Actuarial return target (in absolute terms)
2. Deliver high quality of returns	• Sharpe ratio • Upside capture vs. downside capture	• Absolute target and/or an index
3. Preserve capital	• Drawdowns • Conditional Value-at-Risk	• Absolute limit and/or an index • Risk limit

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related risks and to report directly to the investment committee. The main functions of the risk consultant include quarterly risk reporting to the investment committee, assisting the investment committee in definition of the risk limit and of the NSAA, and providing independent risk assessments to support specific investment decisions, such as selection of external managers.

The fund's administrator provides asset value, and risk and performance reporting on a daily basis. The reports are generated on a daily basis and based on valuation data provided by the single master custodian, who relies upon independent sources.

The fund's internal control system (ICS), established in 2011, aims to ensure that the investment guidelines and the risks identified therein are translated into a coherent, efficient, and robust set of processes. The system was designed to implement a Plan-Do-Check-Act quality cycle (Tague 2004).

The set of processes includes the following four phases:

The plan phase includes actions such as making an inventory of investment-related processes, identifying possible process improvements, assessing associated risks, and designing appropriate controls. Process flows, risks, and associated controls are subsequently documented in a database accessible via a Web interface.

The do phase consists of actually implementing the controls and ensuring that evidence-related records are collected.

The check phase provides assurance to the investment committee that risks have been properly assessed, that controls have been designed to be effective and efficient, and that controls actually are implemented and are an integral part of the fund's day-to-day activities. The assurance is obtained through an audit process carried out by an independent auditor specialized in internal controls in the asset management industry.

The review phase follows the audit; it is where audit conclusions are analyzed by the governing board and follow-up actions are initiated.

The implementation of the internal control system was accompanied by a major overhaul of the operations environment. Trade flows were automated to a large extent with data captured in native format as much as possible. The IT infrastructure was updated to reduce spreadsheet workarounds. While operational upgrades usually are tricky to implement because of the continuous nature of the business, the increased efficiency and better control of operational risks justified the effort invested.

The quality assurance framework underlying the internal control system is an example of a successful knowledge transfer from CERN's physics-related activities. The fund's quality assurance procedures and methodologies for assessment of operational risks were modeled after the quality assurance and risk management processes developed for manufacturing, assembly, and installation of the Large Hadron Collider (LHC), the 27-kilometer-long particle accelerator complex at CERN. LHC quality assurance and risk management processes were designed to meet the strict requirements of high-energy physics installations. It is interesting to note that despite the fact that operating a pension fund is indeed very different from building and running a particle accelerator, the respective management requirements for quality and control over operational risks are almost identical. The knowledge developed for the LHC turned out to be perfectly applicable and transferable into an investment management context and permitted the fund to quickly rise up to best practice.

Summary and Conclusion

CERN's implementation of a dynamic, risk-driven asset allocation approach gives full flexibility to the investment team in allocating assets, subject to maintaining the fund's total risk under a pre-approved ceiling. Reconciling proper execution of fiduciary duties with the dynamic approach required a new governance framework, spelling out adequate investment principles, and incorporating independent daily risk-control as well as new metrics to measure performance.

Managing a change of investment governance is a challenge by itself. The challenge is compounded in the case of requiring a concomitant change from a traditional, static, asset allocation approach to a dynamic approach. Meeting this challenge requires an uncompromising stance on aligning governance arrangements with the investment vision, and therefore taking the requirements of a dynamic approach to their logical conclusions.

The CERN Pension Fund adopted a risk-driven capital preservation approach in 2010, followed by a major overhaul of its investment governance structure. The updated governance structure enables a comprehensive control framework at the board level while allowing the investment team to act quickly and effectively in constantly changing market conditions. By conducting a full assessment of the implicit assumptions linked to the fund's legacy strategy it was possible to obtain the board's definite and unanimous commitment to the new vision, an essential condition for the success of subsequent changes. By aiming at consistency at all levels—between the vision and processes, between the vision and indicators used to measure performance, and finally between the vision and the distribution of roles and responsibilities—the fund was able to create a framework where the dynamic approach could fully express its potential.

Last, but not least, the CERN model is not limited to its current capital preservation context. In a nutshell,

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CERN's model aims to maximize investment efficiency. While CERN has chosen to leverage high efficiency toward minimizing risk at all times, other institutions could use the same model to leverage high efficiency toward maximizing returns.

Acknowledgments

The authors want to acknowledge the thought leadership of Gerald Chen-Young, chief investment officer of the United Negro College Fund, from whom they first learned about the concept of a matrix of objectives. The authors also thank the CERN Council and CERN Staff Association for leadership in addressing pension fund governance.

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Endnotes

1 For an explanation of how benchmarking can alter behavior see Montier (2010).

2 See Barrett et al. (2011) for a review of limitations and pitfalls of the static allocation approach.

3 Berkelaar (2011) identifies three different ways to organize the governance structure around dynamic asset allocation.

4 Daniel Kahneman's work provides a useful framework to address the question of risk tolerance. For instance, see Daniel Kahneman, The Human Side of Decision Making: Thinking Things Through with Daniel Kahneman, PhD, interview, *Journal of Investment Consulting* 13, no. 1 (2012): 5–14.

5 According to Watson Wyatt (2004) and Clark and Urwin (2008) the governance budget is composed of three resources: time, expertise, and collective commitment. Clark and Urwin (2010) argue that a fund's risk budget should be closely related to its governance budget and that the governance budget should be seen as an investment in long-term performance.

6 It should be noted that the return objective can be expressed considering either assets alone or relative to liabilities, depending on how a board defines its utility function.

7 The expression "absolute terms" may encompass an absolute target above inflation.

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