CENTRALE BANK VAN SURINAME

Strategic Asset Allocation for a Savings and Stabilization Fund
The case of Suriname

Daniëlla Wondel

dwondel@cbvs.sr

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Abstract

This paper discusses an asset and liability management (ALM) framework and its effectiveness in generating optimal returns for Sovereign Wealth Funds (SWFs), with special reference to the Saving and Stabilization Fund of Suriname (SSFS). It proceeds in three steps. First, it considers that ALM complies with the investment and risk management guidelines as dictated by the General Accepted Practices and Principles (GAPP), the regulations that set out best practices for SWFs. Second, with the case of Trinidad and Tobago we argue that with appropriate good governance, sound investment and risk management practices that result in a sound strategic asset allocation (SAA)[1] and thirdly, we construct an investment strategy for the SSFS. To test this, we use several risk tolerance scenarios to thereafter. The results show, that the main sources of funding for the SSFS will be windfall transfers from mining revenues.

[1] The SAA provides optimal returns against an acceptable level of risk.

Contents

1. Introduction

Investment behaviors of Sovereign Wealth Funds (SWFs) have received increased attention, since these funds have become important factors in the management of foreign reserves and current account surpluses in many countries, particular among commodity exporters. The total holdings of all SWFs sum up to approximately US$7.4 billion as of September 2017 and their impact on financial markets is expected to increase substantially. An SWF is a state-owned investment fund, mostly funded out of fiscal surpluses originating from mineral resource exports. This fund could be considered a government financial investment vehicle denominated in foreign currency. Investments in this study are financial asset allocations. The portfolio of an SWF mostly consists of assets such as equities, corporate bonds, hedge funds, direct real estate, and in some cases infrastructure.

In the last two decades, mineral and non-mineral assets have increased significantly, due to high average commodity prices and robust economic growth. Several emerging countries are now in a position of managing wealth rather than debt (Johnson-Calari, 2008). Policy makers are actively debating wealth management issues and setting up new institutions to enhance returns. These countries seek to diversify government revenues and expand national wealth. SWFs have become important investment vehicles to achieve this. They have increasingly been utilizing asset and liability management techniques to manage these funds so as to maximize returns and minimize risk.

The fast growth of the SWF industry has brought to light the importance of a better understanding of the optimal investment policies and risk practices of SWFs. In spite of their huge assets size and diversified portfolio, there is no consensus on the investment management approach of these funds (Ducoulombier, Loh, & Stoyanov, 2012). During the last 10 years, almost 20 countries have set up such funds and over half a dozen more, including Suriname, have shown interest in establishing an SWF.

Meanwhile, a stabilization and saving fund has been approved by the Parliament of Suriname. This fund, which is commodity based, has two main objectives, namely to function primarily as a stabilization tool and later on as a savings mechanism for future generations. The stabilization objective aims to mitigate the volatility of government mining revenue flows, which will facilitate a more stable expenditure path. By saving for future generations, part of the current wealth is preserved for future consumption. This fund has a long-term investment horizon and, as such, it is necessary to take into consideration the possibility of creating a long term investment vehicle to manage the funds' endowments and in the process maximize its returns. A framework of asset and liability management (ALM) can serve these operations. The ALM concept is a process of planning, organizing and monitoring of the asset and liability volumes, maturities and yields in a way that minimizes risk and maintains an optimal level of return. Indeed documentary evidence suggests that the framework has become a useful analytical tool to determine an appropriate investment strategy of SWFs (see (Ducoulombier, Loh, & Stoyanov, 2012). The objective of this paper is to examine to what extent an ALMapproach could lead to optimal returns of the Saving and Stabilization fund of Suriname (SSFS).

The paper will utilize an ALM framework in order to ensure an optimal allocation of strategic assets of the approved SWF of Suriname. In order to adopt this, it is necessary to understand the fund's purposes, the nature and timing of future spending, and the implied risk associated with this process. It is also important to consider the implicit liabilities of the fund as well as to define a specific liability profile (Currie & Velandia, 2002). The implicit liabilities may arise from the fact that it may be necessary to support future government budgetary shortfalls from the fund.

Another objective in utilizing an ALM framework is to reduce risk and increase return, in order to maximize shareholders value. It achieves this objective by facilitating easy application of risk reducing tools such as matching liabilities and hence protecting the investments from adverse financial events. The two main risks of note are market interest rate and liquidity risk. The first occurs f.i. due to changes in the interest rates that could lead to changes in the value of both assets and liabilities. The second concerns the liquidity of markets and the ease at which assets can be transferred into cash. Risk management techniques are commonly used by diverse financial institutions such as banks, pension funds, insurance companies, hedge and mutual funds.

The remainder of the paper is organized as follows. Section two, which is in twofold, follows with a theoretical discourse of the ALM framework and SAA of SWF in general. Section 3 presents the methodology in more detail and introduces the macroeconomic and financial data utilized in the analysis while the section 4 elaborates on the best practices of the SWF of Trinidad and Tobago. Section five conducts an empirical review for the case of Suriname. This consists of the macroeconomic context in which the proposed SSFS will operate and the institutional issues regarding the setup and structure of the SSFS. Section 6 discusses the results of an ALM framework for the SFFS.. The final section provides some conclusions and policy implications.

2. Asset and liability management (ALM) framework for Sovereign Wealth Funds (SWF)

This paper is based on three interrelated concepts: Asset and liability management, strategic asset allocation (SAA), and optimal returns of SWF. Technically, the ALM is a financial analytical decision making tool used to mitigate risk in asset management and the asset allocation process of investors. This tool could be seen as an integrated management model that sets out to find an optimal investment strategy by simultaneously considering the assets and liabilities on the (future) balance sheet. The SAA is a strategy that involves setting allocations for various asset classes[i] with a long horizon. This strategy takes into account the changes that might occur in the value of these assets due to market conditions, hence allowing the investor to rebalance a portfolio when these assets deviate significantly from their initial settings. The intention is to create an optimal balance between the expected risk and return of a portfolio.

An optimal portfolio is a combination of asset classes that provides the most satisfaction and optimal return for an investor, based on his tolerance for risk. Each investor must decide how much risk they can handle and then allocate (or diversify) their portfolio according to this decision. An optimal portfolio is expected to deliver an optimal return. In this paper returns are perceived as optimal to the extent where they can cover total liabilities

especially with regard to intergenerational savings (see also: (Binsbergen van & Brandt, 2014), (Chhaochharia & Laeven, 2009).

SWFs have been accepted as well-established institutional investors and important participants in international monetary and financial markets. Total assets under management of these funds grew rapidly over the last two decades. For instance, these assets under management which ranged between US$1.8 trillion and US$2.4 trillion by the end of 2008 grew to approximately US$6.5trillion in 2016. The growth of these funds partly reflects the emergence of global current account imbalances prior to the financial crisis of 2007-2009. Several Asian and other oil exporting countries faced large current account surpluses arising from increased exports of manufactured products and a the sharp increase in oil prices during 2000-2008 and favorable business cycle. This caused savings to expand much faster than their domestic investment needs, leading to saving-investment imbalances and accumulation of vast international reserves by these countries' central banks. Given the reserves accumulation, they became significant net creditors instead of net debtors. (Kozack, Laxton, & Srinivasan, 2010).

Several issues about the impact of SWFs on the functioning of the international monetary system have been raised in response to the rapid growth of SWFs. These range from issues concerning their funding, growth, the purposes of their investments, governance structure, and transparency. The focus of most of the recent studies has been on transparency, size, and approaches to risk management practices, investment strategies, and the possible political motives of the funds' investments. Truman (2007) for instance raised the issues of transparency and accountability. In his opinion, government-controlled international investments of these funds have expanded to such scale and scope that an internationally agreed standards to govern their operations is urgent.

In addition, the International Monetary Fund (IMF) also expressed its concerns about these institutional investors. The interest of the IMF in these funds stems from the nature of two of its key mandates, macro-economic and financial stability surveillance, which seek to ensure the effective functioning of the international monetary system. Furthermore, the objectives and investment practices of SWFs have also been of concern, since one of the core mandates of this multilateral organization is to ensure that cross- border investment flows occurs in a fair and transparent manner. In this regard, the Fund established an "International Working Group" (IWG) with the task to identify and draft a set of accepted principles and practices called the General Accepted Practices and Principles (GAPP)[1] or Santiago Principles that properly reflect the investment practices and objectives of countries that manage SWFs .

The GAPP states that investment strategies of SWFs should be set out in an investment mandate. This investment mandate provides the investment committee or investment manager the limits within which risk should be handled. Furthermore, the GAPP underlines the need for sound and transparent investment policies

[1] This was established by the IMF and its recommendations were signed and accepted in October 2008.

and risk management framework for SWFs (see appendix 1). When this is the case, ALM complies fully with the investment and risk management provisions of the GAPP. This framework[2] provides insight into assets and liabilities as well as the risks associated with the liabilities.

According to Binsbergen van & Brandt (2014), ALM is the most appropriate instrument for the management of fixed income investments. The ALM framework jointly evaluates risks and benefits of assets and future liabilities. By managing these liabilities, risks such as liquidity, credit, and market risk are mitigated and thereby enable a SAAthat optimizes investment returns. Risks arise from the possibility that assets are not sufficient to meet short term obligations, as is the case with liquidity mismatch. SWFs should for prudential reasons invest initially and mostly in conservative financial instruments, which by definition are fixed income securities[3]. It is therefore logical that ALM would also be appropriate in the management of SWFs. ALM may be considered as the portfolio choice problem of an investor that uses the principal and investment returns on assets to refinance future liabilities, like the way pension funds operate such as pension funds used to do (Binsbergen van & Brandt, 2014).

ALM frameworks are distinguished in single and multi-period frameworks based on four general models[4] (Rosen & Zenios, 2006):

- Single-period static models: are used to hedge against small, well defined changes in the current state of the variables such as interest or exchange rates.
- Single-period stochastic models: describe the distribution of returns of assets and liabilities due to random market movements. These models explicitly incorporate and quantify risk.
- Multi-period static models: are applied in environments where investors rebalance their portfolio over several periods.
- Multi-period stochastic models: are models that allow both asset and liabilities to evolve randomly over a certain time following a probability distribution.

Single-period models are often used to estimate optimal investments over a single time horizon. It allows investors to rebalance their portfolios over a single period as a result of changes in market conditions or new investment goals. Although the strategies of single period models perform well in some settings, they are in general too restrictive for most practical applications (Romanyuk, 2010). Multi-period models, especially dynamic stochastic models, allow investors to rebalance their portfolios over several periods as a result of changes in market conditions or new investment goals.

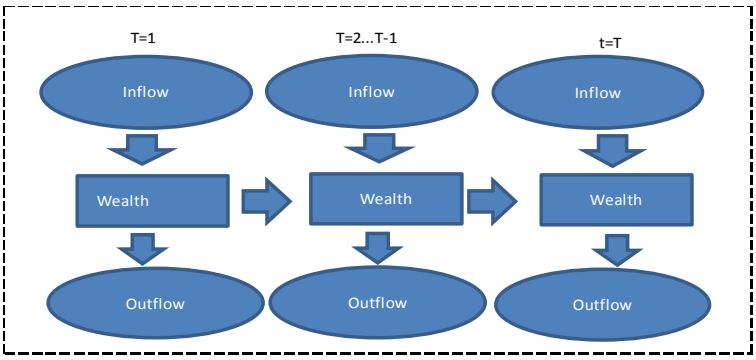
[2] Another framework in this regard is the conventional Asset-Only investment strategy. This strategy differs with ALM in its coverage and scope, because it only focusses on asset performance, without looking into risk exposure.

[3] E.g. The HSF of Trinidad and Tobago, see chapter 3.

[4] The literature on stochastic and static models as well as optimization of portfolio allocation strategies in an ALM framework is extensive, see for instance, Romanyuk, [2010], Rosen & Zenios, [2006], Ziemba and Mulvey [1998], Bogentoft, Romeijn, & Stanislav, [2001].

Appendix 2 provides an overview of these models and the associated risk measures. Most ALM[5] strategies are based on cash flow and risk matching approaches [ii]. The cash flow matching approach is commonly used by defined benefit pension funds, while risk matching approach is often used by insurance companies and banks. Figure 2.1 shows a general ALM framework generated in a multi-period stochastic model that is applied to pension funds, hedge funds, and funds of individuals. Bogentoft, Romeijn, & Stanislav, (2001), argue that stochastic models in a multi period setting are well suited models to solve asset allocation problems.

Figure 2.1: ALM framework



Source: Asset and Liability Handbook (p.199) and author's editing

Since the structure of SWFs is more or less similar to that of pension and hedge funds, the cash flow matching approach in a stochastic environment could be applied for a SWF. The only difference between SWFs and pension funds is that the beneficiaries of the former are the governments in a short term horizon[6] and future generations in a long term horizon, while those of the pension fund consist of the employers and employees. Ducoulombier, Loh, & Stoyanov, (2012), adopted an ALM framework as applied in the pension fund industry to the unique characteristics of SWFs. The authors suggested a dynamic ALM model for SWFs in order to guide asset allocation and risk management decisions. By analyzing the investment policy of an SWF in a stochastic (dynamic) ALM framework, it enables the monitoring of the investment and consumption objectives (Ducoulombier, Loh, & Stoyanov, 2012).

Before setting up an ALM framework for an SWF, it is important to describe the structure of the ALM as illustrated in figure 2.1.

- **Inflows (assets) may consist of:** an initial investment of the government (t=1),
- periodic ad-hoc or structured transfers from the government or a government-related entity,
- part of the mineral windfalls,
- returns on assets,
- revenues from assets sold.

[5] The conservative and traditional asset and liability management departs from the above mentioned approaches. Recent studies talk about a "Liability driven –investments (LDI)" instead of ALM.

[6] Government is seen as a beneficiary since part of the mining revenue into the fund may be transferred to the government to overcome budget shortfalls due to declining commodity prices.

Outflows (liabilities) consist of:

- operation fees to the fund managers,
- payments for assets bought by the fund,

Implicit liabilities include:

- expected transfers to the government required by the SWF charter, such as transfers to cover budget shortfalls,
- saving for future generations,
- Expected transfers to specialized funds, e.g., a national calamity fund or an investment fund.

Wealth consists of accumulated inflows plus returns on the invested inflows minus past outflows. Net wealth represents wealth less liabilities. ALM aims to maximize overall wealth in the medium and long terms while controlling for uncertainties like risk that affect both assets and liabilities. Through ALM, accumulated wealth is maximized by taking into account current and future liabilities. Risk to the process may arise from possible loss of investment or the inability to meet the implicit liability. In addition risk could originate from the asset classes in which the Fund will invest. Other risk factors that may impact the windfall deposits in the SWF are related to global economic growth, inflation and changes in the currency rate.

Specification of an ALM model

The concepts and their relationships of an ALM framework may be presented in a formal model as expressed in equations 1 and 2. This model generally follows the pension fund model of Bogentoft, Romeijn, & Stanislav (2001), which is shown in appendix 4 (App.4). However, to make the model applicable for a SWF purposes, equation (1) includes a variable IL_t (implicit liability). This variable represents a possible shortfall in time t, such as a budget shortfall as a result of declining commodity prices. Moreover, the previous model captured a premium paid variable ($y_{n,t}$), which is not applicable in the case of SWFs. Unlike pension funds, these funds have no contribution rates but only gain windfalls. All other variables in the model are random variables, while $x_{n,t}$ is a decision variable that represents the amount of deposits in the Fund that is invested in a particular asset n. T denotes the time horizon and the decision moments (t = 0,…,T). This implies that at any time an investment decision can be made to allocate, deposit to or withdraw assets from the SWF. Therefore the selected formal ALM model for SWF is as follows:

The Sum of All investment of the SWF

$$\sum_{n=0}^{N} X_{nt} = A_t + Wr_t - (l_t + IL_t + L_t) \quad t = 0,\dots T\text{-}1, \qquad (1)$$

Where,

A_t → value of all assets owned by the fund at time t;

Wr_t → the mining revenue windfalls at time t;

$l\,t$ → Payments made by the fund for transaction cost (management fees, government investment income, etc.);

$x_{n,t}$ → amount invested in assets n at time t;

L_t → Stream of future liabilities at time t (future generations saving)

IL_t → Stream of future implicit liabilities at time t (budget shortfalls or required transfers to specific funds)

This model equates the sum of all investments (X_{nt}), with the total value of all assets owned by the fund at time t (A_t), plus the value of the windfall allocated to the fund (Wr_t)[7], net of transaction costs (l_t), implicit liabilities (IL_t) and savings for future generations (L_t).

The sum of all assets owned by the fund (A_t) is represented as follows:

$$A_t = \sum_{n=0}^{N} x_{n,\,t-1}(1 + r_{n,\,t}) \quad (1a)$$

Where $x_{n,\,t-1}$ denotes the amount of assets invested in the previous period and $r_{n,t}$ denotes the return on investment in asset n at period t; so A_t represents the total sum of the amount of assets invested at $_{t-1}$ plus the returns received from the amount invested in the previous period. This adds up to the amount of assets invested in the current period.

Risk control in an ALM framework involves many aspects. Important are the overall performance[8] and underfunding[9] of a fund. In the case of pension funds, risk management in an ALM framework involves the funds' performance subject to underfunding. As for the SWF, risk management in an ALM framework involves the fund's performance while mitigating uncertainties and maximizing returns (more so wealth). Return is maximized, while risk is kept at an acceptable tolerance level.

$$\min_x - \mathrm{E}[\mathrm{R}(x_{n,t})], \;\; \sigma(x) \leq \beta, \; x \in X \quad (2)$$

According to this equation, the investment manager attempts to minimize the expected negative returns or losses of investments in assets $(\min_x - E[R(x_{n,t})])$, subject to the constraint that risk σ cannot exceed the acceptable risk tolerance level (β) ($\sigma(x) \leq \beta$). This has been shown to be equivalent to maximizing total wealth while ensuring that risk is minimized to the expected level β (Krokhmal et al, 2001). The equation defines a possible set of return and risk of an efficient portfolio. In general, the efficient portfolio[10] is represented on the efficiency frontier, which as indicated in the equation above, represents the best combinations of risk and return of a portfolio (see example in figure 2.2). The frontier improves as new investments opportunities (assets) are added, which allows for a greater diversification (Berk & DeMarzo, 2011, 2007). Note that for an SWF the efficiency frontier is determined by 2 variables: the risk appetite, which is defined in the investment strategy and often in the charter or law of the SWF, and the time horizon of the investment.

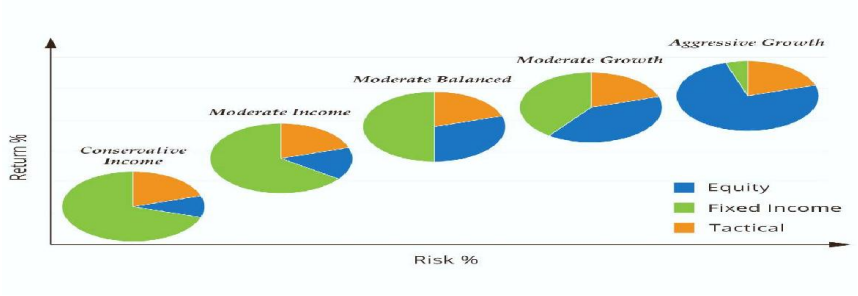
[7] Note that windfalls denoted as Wt. has a positive relationship in the stochastic process.

[8] Overall performance is measured by taking into account all possible outcomes of the portfolio.

[9] Underfunding concerns the possibility where liabilities were not met

[10] Is a portfolio that offers the highest possible expected return for a given level of risk (σ).

Figure 2.2: Possible set of risk and return on an efficient frontier



Source: http://worthadvisors.com/portfolio-management/

It is of utmost importance for the fund manager to rebalance the funds' portfolio during the investment period. The manager may wish to adjust the asset allocations in line with updates from market information. In this regard, the current strategy may not be optimal any more since the situation on the market changes.
In a multi-period model, decisions are made at the beginning of each period. If T is the time horizon then the decision stages are denoted by t=0,…,T.

This implies that a decision is made at each t on the units of each asset invested in and the amount of liquid assets held in the portfolio. This is based on the state of the total wealth and the forecast of the performance of assets[11] at that time. Rebalancing of assets takes place beyond stage t where the asset returns and liabilities are known. It's worth to know that asset returns, liabilities, and cash deposits are subject to uncertainty.

Strategic asset allocation of SWFs

According to the GAPP, the design of investment policies for SWFs should incorporate strategies that set out an investment mandate and appropriate and explicit risk tolerance levels. This is needed in order to ensure a consistent risk-bearing capacity over time and help to promote accountability for the chosen investment strategy. Technically, this can be achieved as the optimal decision variables X_{nt} obtained via the constrained maximization problem as set out in equation 3 in the previous section. This paragraph elaborates on the steps to formulate investment strategies for SWFs.

Step 1: The investment mandate

The investment policy[12] is set out in an investment mandate and sets the scope within which risk can be handled. The investment mandate is a statement that arranges the investment policy guidelines for the SWF. This sets the objectives and limitations within which the Fund is supposed to invest and which investment policy to follow. Two determinants required to set an appropriate investment mandate are; i) the fund's objective and ii) its risk-bearing capacity. The first determinant reflects the investment strategy of an SWF and serves as a guide to set out this strategy and objective. The second gives an

[11] This decision process could also be captured in an event tree, especially when the random factors follow discrete distributions.

[12] Investment policy of SWFs is set out by the owner of such a fund, usually the Ministry of Finance, which takes place in conjunction with an investment committee or board and the fund's stakeholders.

indication of the risk tolerance level of the fund. Stabilization funds for instance have a low risk return profile while a saving fund has a higher risk return profile.

Step 2: The risk tolerance level

The risk tolerance level depicts the degree of variability in an investment return that investors are willing to withstand. This could be seen as a hypothetical line between acceptable and unacceptable investment outcomes and should reflect the ability to take risk. Setting an appropriate risk tolerance level is one of the most important aspects in investing. Risk tolerance level of a SWF depends on the sources of the funds' assets (Jen, 2010). If these assets are derived from commodities, it is not advisable to invest these assets in similar industries. The investor may need to diversify the portfolio away from these industries in order to maximize returns.

Risk measurement of an investment strategy cannot be explained by only one indicator (Al- Hassan, Papaioannou, Skancke, & Chih Sung, 2013). For instance, risk measures for SWFs are the probability of failing to meet the predetermined investment policy objective or the type of investment strategy to be followed. The latter can be a decision whether to invest in low risk fixed income portfolio (long term) to benefit future generations or in low return fixed income portfolio (short to medium term) to meet future liabilities in a defined benefit scheme (e.g. pension fund).

According to Al- Hassan *et al.* (2013), while volatility of returns is a useful indicator of measuring risk, it is by far not the most relevant one. Indeed, this measurement has its limitations, as it implicitly assumes that returns are normally distributed. Al-Hassan et al. (2013) show that returns on assets are generally not normally distributed. This point was underlined by Longin (2005) and Bank (2011); they claim that the normality assumption underestimates the impact of the extreme returns contained in the distribution tails. Outliers in the return on assets can result in skewness of the mean and fat tails in the distribution.

SWFs especially at the start are risk-averse and usually invest in fixed income instruments in practice. One such fixed income instrument is the long-term bond which is more sensitive to interest rate changes than its short term version. Since interest rates do not change frequently, especially not in the short run, it is assumed that returns from short-term bonds are stable and relatively normally distributed. However, empirical evidence suggests that even returns from fixed income instruments are not normally distributed (Darbha, 2001; The World Bank Treassury, 2013).

Risk bearing capacity of SWFs and their objectives are fundamental when constructing a number of asset classes and combining those classes. The combinations of these asset classes are usually known as a SAA that sets a target allocation to asset classes within the investment universe. Strategic asset allocation could be defined as a policy based asset mix that combines the expected returns of different asset classes over a defined period while taking into account changes that might occur in the values of these assets arising from changes in market conditions. When this occurs, the investor gets the opportunity to rebalance its portfolio in order to meet the objective. SAA in general is about the decision of how to weight assets such as stocks, bonds and cash in a

portfolio given that each of these assets carry different kind of risks.

The investment horizon is an important factor in determining a SAA. Kunzel *et al*. (2010), depart from the theoretical background of the SAA of SWFs. According to them the type of SWF, its investment horizon and the funding source and other balance characteristics play an important role when setting up the strategic asset allocation.

SWFs with a stabilization objective have a different investment horizon compared with SWFs that save for future generations. An SWF with a stabilization objective is expected to have more or less the same investment horizon as that of central bank reserves. Thus, they invest a large share in liquid assets such as cash or liquid low-risk securities in order to meet unexpected outflows without running severe losses.

A long investment horizon, as in the case of an SWF with a saving-for-future-generations objective, can be associated with the ability to take more risk (Kozack, Laxton, & Srinivasan, 2010). Such SWFs are likely to seek higher returns with higher risk, and therefore prefer to maintain a larger share of equities over bonds (Jen, 2010).

The portfolio theory suggests diversifying a portfolio when the funding of this portfolio is highly dependent on one source[13]. When constructing their portfolio, fund investors do not invest in asset classes that are highly correlated with the funding source. Assets that are highly correlated move together and are affected by similar economic events, which results in high correlated risk. Diversification should be in such a manner, that the financial asset has a negative or preferably a very low correlation with the real asset (Kunzel, LU, Petrova, & Pihlman, 2010).

3. Methodology & data analysis

This paper attempts to answers the research question in several steps. First, the provisions made with respect to strategic asset allocation of SWFs in Trinidad and Tobago will be discussed. This should give an idea of how the assets of this fund are allocated and which investment policy was used. Through this method a strategic asset allocation strategy is developed in a framework which simultaneously manages the assets and liabilities of the saving and stabilization fund of Suriname (SSFS), in a way that maximizes the net accumulated assets of the Fund, bearing in mind the risk that comes along with the investments. Second, a data set will be created for Suriname to be used in a simulated exercise to examine the possible return profile of the SSFS under a number of scenarios. A data range of 20 years is used for the cash flow development of the Fund's endowments. The investment strategies of the scenarios are based on the transfers and withdrawing rules of the approved SSFS.

Data

Data used in this paper can be divided in macroeconomic and financial time series. Annual data ranged from 1970–2019, and includes projections for the period 2014–2019. The macroeconomic data was extracted from the statistical compendium of the Central Bank of Suriname (CBvS), International Monetary Fund (IMF), and the World Bank online databases. In addition to the Surinamese data, data series on government revenue, real

[13] In this context, diversification is used as a mean to reduce risk.

GDP and inflation figures of the United States of America (USA) were also used for the analysis. The financial data, which consist of government securities and stocks, originate mainly from the Federal Reserve Bank (FED), the European Central Bank (ECB), and A. Damodarans'[14] (1998), an open online database. This data was used to create a portfolio that consisted of returns of several asset classes such as U.S. Treasury Bonds (TBO), U.S. Treasury Bills (T-bills) and equities in the S&P500 index. The data has been obtained from secondary sources, which are highly reputable databases from financial institutions that meet international data quality standards. Prior to the forecasting, some data analysis is done based on the summary statistics and some diagnostics tests. Definitions of variables used in the forecasting analysis are modified below:

- **Dividend (div) represents** the yield of the market value weighted S&P500 index. Each stock's weight is in proportion of its market value.
- **U.S. Treasury bond at constant maturity (TBO)** represents the real return of the long term (10 years) bond.
- **Treasury bill rate (T-Bills)** represents the short term nominal interest rate and is defined as the log return of 3 months Treasury bill
- **U.S. real GDP (RGDPUS)** is the percentage change in real GDP which implies the economic growth of the US economy and is defined as the log of gross domestic product (GDP). This is employed as an indicator in order to forecast stock return in a later phase of this chapter.
- **Inflation (I01)** is the increase in the general level of prices of goods and services in the U.S. economy. Inflation is defined as the change in the log of CPI. In the medium term, variations in inflation can be attributed to business cycles. An increase in the expected rate of inflation lowers the expected real return of a bond. This will be employed as an indicator to forecast real bond returns.
- **Producer Price Index (PPIACO)** is the change in selling prices of all commodities received by domestic producers in the United States and is defined in its log natural form. For investors, the PPI is of great importance, because of its ability to predict CPI, since it is expected that cost increases that are experienced by producers will ultimately be passed on to customers. In this regard it is a better tool to forecast long-term inflation.
- **Unemployment rate (Unrate)** represents the number of unemployed in the U.S. as a percentage of the labor force.

The main variables used to derive the initial scenario are the dividend yield of the S&P500index, the yield of the 10-year U.S. Treasury bond and the 6-month U.S. Treasury bill rate. In app. 3 the descriptive statistics of the variables are presented.

It should be noted that the S&P 500 moves opposite to the U.S. dollar, as depreciation tends to improve the profitability of U.S. companies. As such, currency risk falls when you increase equities.

[14] See: http://pages.stern.nyu.edu/~adamodar/

The yields of the Treasury bill and Treasury bond reached an average of 5.1 and 6.7 %, respectively during 1970-2014. This yield peaked in the 1980s, while the lowest yields were noted in 2012 and 2014. The Yield of the S&P 500 index was on average higher during this period (see appendix: app. 3). Returns of this stock index reached a peak in 2014, while the lowest was noted during the 1970s. Volatility, as it is measured by the standard deviation of the T-Bill and U.S. Bond yield are more or less the same while the yield of S&P500 is about 9 % during 1970-2014. This measurement also gives indication of the amount of risk that is associated with these variables.

Forecasting Methods

According to Eychenne, Martinetti, & Roncalli, (2011), long run asset returns are determined by long run fundamentals of the economy. As such, forecasting of the variables was executed through two methods: the naive and stochastic model forecasts.

The yields of the bond and T-bill variables were estimated using the naive forecasting method and the yields of both increases with the average mean annually. All other factors that could influence these yields are considered constant.

The return on equities was estimated with the following stochastic model:

$$Ldiv_{(t)} = c + \beta RGDP_{(t)} + \beta Ldiv_{(t-1)} + \beta ppiaco_{(t)} + \beta Ldiv_{(t+1)} + \varepsilon_t$$

Where,

- Ldiv, the log of dividend yield, thus growth in dividend per share at time t,
- RGDP, as stated in the previous section,
- $Ldiv_{(t-1)}$, is the dividend paid in the previous year,
- PPIACO, as stated in the previous section,
- $Ldiv_{(t+1)}$, is the dividend expected to be paid in the next year.

In this case it is assumed that dividend yield growth follows the same path as economic growth in the long run, together with the producers' price index (PPIACO), and the dividend of the previous year; please note that expectations of dividend in the next year and market speculation are captured in an error term.

4. Best practices of established SWFs: Trinidad &Tobago

Trinidad and Tobago, a highly energy dependent country, established the Heritage and Stabilization Fund (HSF) in March 2007. The HSF was set up as a macroeconomic stabilization and saving mechanism with the purpose to save and invest surpluses of petroleum revenues[15] in order to achieve a number of objectives. First, to insulate fiscal policy and the economy from volatile international prices of oil and gas and thereby cushion the impact on public expenditure during periods when revenues declined during falling prices. Second, to accumulate savings from revenues received from oil and gas in order to maintain certain level of government expenditure

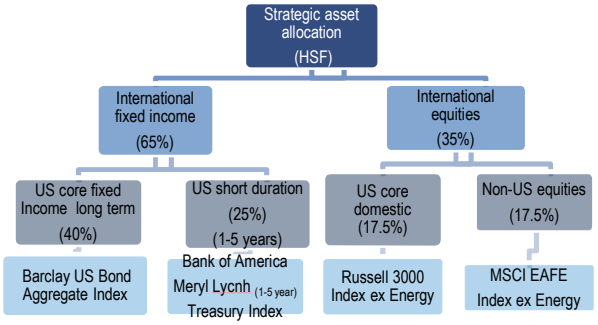
[15] Petroleum revenues in the case of HSF are the aggregate supplemental petroleum tax, petroleum profits tax and royalties collected under the Petroleum act.

over the long term. Third, to provide a buffer from excess petroleum revenues for future generations (Annual report, 2013). The HSF was preceded by the Interim Revenue Stabilization Fund (IRSF) which was established to promote fiscal discipline and to smooth out the counter cyclical impacts on the budget and the economy. The HSF started in March 2007 with a balance of US$1.4 billion[16]. The value of the HSF increased from US$1.8 billion by the end of September 2007 to US$5.7 billion as of June 2015.

At the beginning, the portfolio was conservatively managed in terms of the risk to which the assets were exposed. The SAA was determined in a way that balanced risk and returns to maximize asset growth. The asset mix consisted of a combination of fixed income securities and equities with a short term horizon.

The 2008 global turmoil had its impact in the development of these guidelines, especially the implementation of the full SAA. During this period the Fund focused primarily on preserving capital instead of optimizing returns. The initial portfolio consisted of 20% international equities, 41% international fixed income, and 39% money market deposits. The SAA was approved in January 2011 (see figure 4.1).

Figure 4.1: Approved SAA of the HSF



Source: *Central Bank of Trinidad and Tobago (CBTT) and author*

The HSF was risk averse in its operation until 2008, as was reflected in the portfolio composition in 2007. The credit risk to which the portfolio was exposed to was managed by the establishment of minimum credit rating criteria that must be met by the money markets counterparts. The interest rate and liquidity risks were managed by investing in short term deposits which can be easily converted to cash at a minimum cost. In order to mitigate changes in the portfolio due to exchange rate changes, the portfolio was denominated only in U.S. dollars. However, this exposed the HSF to a currency risk, especially in the period 2007-2009.

The approved SAA after 2008 reflects a higher rate of return along with a corresponding moderate to high level of risk tolerance. The SAA was designed to meet a long term real rate of return of about 1.8 % per annum while considering the short term fluctuations on the market. It is known that equities have a higher rate of return along with a high level of risk. Therefore, the board agreed on a portfolio mix of fixed income and equities to maximize the rate of return of the portfolio.

Most of the risk that the HSF was exposed to stemmed from developments in the stock, bond, and money markets. The HSF's risk management focuses on:

- **Credit risk**: the HSF is exposed to credit risk on the money market and the fixed income market.

[16] This balance was transferred from the Interim Revenue Fund (IRF) into the Heritage and Stabilization Fund.

- Money market: the credit risk is minimized by setting certain strict standards; for instance, all the market counterparties should have at least an A1 credit rating of Standard and Poor (S&P) or P1 Moody's. This is further intensified by implementing a maximum exposure limit for the counter parties.
- Fixed income: the credit risk is mitigated by having a strict credit concentration limit as well as a minimum credit rating. The HSF requires the managers for the core fixed income to invest in bonds that have an investment grade rating by S&P, Moody's, and Fitch.

- **Interest rate risk**: interest risk is mitigated through the use of a weighted average duration limit on each individual asset in the portfolio. The duration may range between one year longer or shorter than the weighted average duration of the respective benchmark.
- **Diversification / concentration risk**: in order to reduce this risk the HSF' assets are invested across various types of asset classes except commodity related.
- **Currency risk:** this is mitigated by investing a 10 % portion in securities denominated in currencies other than the U.S. dollar. Currency hedging up to 15 % of the market value of the portfolio is allowed for the non- US core international equity to mitigate this type of risk.

5. An empirical review of the Saving and Stabilization Fund of Suriname[17]

Macroeconomic context

During the mid-1940s until 2004, the Surinamese economy heavily relied on the bauxite industry. This sector was of great importance for the economy, as is reflected in the three key indicators that the mineral dependency index (MDI) comprises of (see table 5.1). In addition, its significance is also visible in the contribution to the international reserves. Moreover, parts of these transfers were used to finance imports of goods and services.

Table 5.1: Macroeconomic indicators matrix 1987-2013

	Bauxite in % of			Oil in % of			Gold in % of			MDI in %
	Tot Exp.	Tot.GOV rev	GDP	Tot Exp.	Tot.GOV rev	GDP	Tot Exp.	Tot.GOV rev	GDP	
1987 -1991	85.5	7.5	5.5	4.6	n.a	1.5	0.0	0.0	0.0	27.0
1992 -1996	85.6	15.5	6.5	2.9	6.9	10.5	0.0	0.0	0.0	33.2
1997 -2001	79.0	15.3	9.9	6.0	5.6	11.7	0.0	0.3	2.0	29.5
2002 -2007	60.4	11.1	13.5	9.3	12.5	11.8	33.3	2.4	6.5	49.6
2008 -2013	22.1	2.7	n.a	12.2	24.7	13.1	57.2	10.0	10.7	51.2

Source: (Leading Sector of Suriname: The Impact of Mining, Agriculture and Tourism Activities on the Economy 1970-2012, 2014)

Developments in the mining sector since the 1980s led to a shift in three main commodities' share in exports, GDP, and government revenue (see table 5.1). Despite declining commodity prices during 1980-2000, as indicated by the study of Mungroo et al (2014), mineral dependency of the Surinamese economy remained well

[17] Government revenue numbers in this exercise are based on estimations and previous budgets.

above 20% . According to UNCTAD and the World Bank, Suriname was ranked the 5th most non-fuel mineral dependent country of the world in 2010.

Economic activity in emerging economies, led by China soared in 2000-2006. This led to increased demand and rising prices for commodities. The associated increase in export value resulted in surpluses in the current accounts of the balance of payments and government budgets. Fiscal deficits fell to around 1 % of GDP from 8.8% of GDP during 1987-2000 as a result of increased revenues from oil exports. In addition, the balance of payments registered large capital inflows in the financial account and significant increases in international reserves.

The emergence of oil and gold around 2004 diversified and expanded the mining sector. The oil and gold sectors became important as the share in export and government revenue as well as total output increased. During 2004-2013, gold registered the largest share in total exports, averaging 57.2 %, followed by bauxite and oil with an average share of 22.1% and 12.2 %, respectively. However, oil is the largest contributor to government revenues (almost 25% of total revenues) and to GDP (13%). Eventually, the stock of international reserves rose above US$1 billion. Mining activities benefited from major investments and favorable commodity prices.

In sum, Suriname has benefited from the recent boom in global commodity markets until 2012. A significant share of the 4.4% growth of the economy in 2012 was fueled by large scale investments and exports in the mining sector. However, volatility in mining revenues from exports and in the associated contribution to government revenue has come at a substantial macroeconomic risk. Government revenue and expenditure remain strongly linked to volatile commodity prices. It is hoped that the established SSFS would help to bring stability to the macro economy and government operations.

The SSFS is expected to operate as a saving and stabilization mechanism to save and invest surpluses of mining revenues. This should achieve three main objectives:

- To cushion the impact of volatile international commodity prices on fiscal policy and the economy, and to sustain public expenditure during periods of declining revenue as a result of declining commodity prices.
- To accumulate savings[18] from revenue received from mining activities, particularly during periods of increasing or high commodity prices.
- To help diversify government revenue and sustain government spending in times of depleting non-renewable resources.

Governance structure and transparency

The governance structure of the SSFS as set out in the SSFS Act provides for the appointment of a Management Board. The Board is expected to consist of five members, which include representatives from the Ministry of Finance, Ministry of Natural Resources, and the Central bank of Suriname (CBvS). The chairperson of the Board will be appointed by the Government. The SSFS Act prohibits individuals who hold political office from serving as a member of the Board. It also sets out a clear division of roles and responsibilities among the various

[18] The accumulated savings should help provide an alternative stream of income for future generations.

stakeholders such as the Parliament, Ministry of Finance, the Board, and the Central Bank of Suriname. The Board of Governance will develop and establish operating management guidelines for the SSFS as well as decide on and publish investment objectives and strategies for the SSFS. The Central Bank shall act as fund manager at least during a three year term.

This SSFS Act also includes requirements with regard to transparency and accountability such as disclosure of information. It also provides for an annual audit to be done by internal and external auditors. The deposit and withdrawal rules are also set out in this SSFS Act.

The initial resources for the SSFS will come from sources such as the initial funding set aside by the government, mining revenues as set out in article 4 of the Act, and revenues and returns on assets from investments made by the SSFS. The SSFS is there to help on the downward and upward part of the cycle by taking out funds that would otherwise flow into the country unmitigated leading to sharp expenditure increases and unwarranted currency appreciation.

The deposits are formalized in the law in such a form that all revenue goes to the SSFS, except for a formula-driven part that goes to the budget. This prevents annual political interference into the SSFS deposits, which has ruined many SWFs in other countries. The deposit rules as set out in the SSFS Act are described below:

Deposit rules

The budgeted mining revenue is the level of revenues that the government needs in order to cover budgeted expenditures. According to the act, it is based on the revenue of the previous year plus a predetermined percentage[19]. Windfalls will only be transferred to the SSFS when actual revenues turn out to be higher than budgeted revenues. Table 5.2 illustrates how the deposit rule[20] will function in principle.

Table 5.2: Deposit rules of SSFS

in millions US-dollars	2012 Act.	2013 Act.	2014 Est	2015 Proj.	2016 Proj.	2017 Proj.	2018 Proj	2019 Proj.	2020 Proj.
Actual mining revenues (r_a)	460.4	330.4	226.3	238.4	**213.3**	**290.0**	**313.3**	**400.0**	**346.9**
Budgeted mining revenue (r_b)	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7	394.0
Δ% in mining revenues		-28.2	-31.5	**5.4**	-10.5	35.9	**8.0**	27.7	-13.3
Fixed percentage change if[1)]									
Increase	0	0	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Transfers to the fund (DT_i) =(r_a)-(r_b)	0.0	0.0	0.0	5.4	0.0	**70.3**	14.6	**77.3**	0.0

Source: Author & figures based on FPP and CBvS Statistical Compendium

* Act.: Actual, Est.: Estimation, Proj.: Projections

1) if actual mining revenues > budgeted mining revenues, then use increase else use decrease

Case a: An assumed increase of mining revenue in 2017

Assuming mining revenue in 2017 is expected to increase, then these revenues are estimated as mining revenues of 2016 (r_a) increased by 3 percentage points (table 5.2). If actual mining revenue exceeds the

[19] The predetermined percentage is based on the calculation of the average long term growth of the Surinamese economy over the last 5 years. This was estimated to be 3 %.

[20] It was at first assumed that the initial transfer to the fund would have been made in 2012.

budgeted revenue, then the difference will be transferred as windfall to the SSFS. This scenario is illustrated in the following example.

As depicted in table 5.2, in 2017 mining revenues are expected to increase by almost 36% compared to 2016. In this case, the budgeted mining revenue (r_b) for 2017 will be calculated as: $(r_{bt+1}) = (r_{at}) * 1.03$

where,

r_{at-1} stands for actual mining revenues for the previous year (2016),

r_{bt+1} stands for budgeted mining revenues in 2016 increased by the fixed 3 percentage points, e.g. $(r_b)_{2017} = 213.3 * 1.03$, this works out to be US$ 219.7 million for 2017 as budgeted mining revenues as illustrated in table 5.2.

In the example, actual mining revenue[21] in 2017 (r_a) turns out to be higher than what was budgeted for 2017 (r_b). The difference between the actual and budgeted mining revenues (US$70.3 million) will be transferred into the SSFS (Ti_t) in 2017. This could be quantified in the following simple equation as:

$$(T_{i\,t+1}) = (r_{a\,t+1}) - (r_{b\,t+1})$$

where;

$T_{i\,t+1}$ ➔ Represents the transfers made to the SSFS. For example:

$Ti = 290.0 - 219.7$, this results in US$ 70.3 million transfer to the SSFS.

Case b: An assumed decrease of mining revenue in 2016

According to the table, mining revenues are expected to decline (by 10.5 %) in 2016. As such, 1.5 percentage[22] points will be subtracted from the actual mining revenues ($r_{a\,t-1}$) of the previous year, 2015, to obtain the budgeted revenue for 2016, which is US$234.9 million (table 5.2). Transfers to the SSFS will not take place since actual revenue (US$213.3 million) is lower than the budgeted revenue.

Withdrawal rules

Withdrawals take place when budget shortfalls attributable to declining commodity prices or a natural disaster arise. These factors, as described in the SSFS Act are as follows:

- Shortfalls in the budget arise when actual mining revenue is less than the budgeted mining revenue. In order to mitigate the effects of the shortfall, transfers will be made out of the SSFS to the budget. However, according to the SSFS Act, only 5 % of total assets can be used for stabilization purposes. Therefore, in the first five years of operations the SSFS is not able to fulfill its stabilization obligation. This makes it difficult for the government to use resources from the Fund to cover budget deficits that may occur in the first five years. The rules mandate

[21] For the analysis the actual mining revenues over the period 2016 are calculated separately based on IMF data and adjusted by recent international commodity price movements. These were then plugged in the table. The same goes for the projected period 2015-2020.

[22] The predetermined percentage is based on half of the long term growth of the Surinamese economy (See footnote 21).

that only half of the shortfall can be covered by transfers from the SSFS. The other half should be financed through expenditure cuts.

- A national calamity arises when the President declares a state of emergency in the wake of a national disaster that may adversely affect the economy. Half of the estimated cost will be paid for by the SSFS, while expenditure cuts will supplement the other half.

The table 5.3 below illustrates how the withdrawal rules will function, especially in periods of budget shortfalls.

Table 5.3: Withdrawal Rules of the SSFS

in millions US-dollars	2012 Act.	2013 Act.	2014 Est	2015 Proj.	2016 Proj.	2017 Proj.	2018 Proj	2019 Proj.	2020 Proj.
Actual mining revenues (r_a)	460.4	330.4	226.3	238.4	**213.3**	**290.0**	**313.3**	**400.0**	**346.9**
Budgeted mining revenue (r_b)	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7	394.0
Δ% in mining revenues		-28.2	**-31.5**	5.4	-10.5	35.9	8.0	**27.7**	-13.3
Fixed percentage change if[1]									
Decrease	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Transfers out of the fund[2] **(WT_o) =1/2*[(r_a)-(r_b)]**	**0.0**	**0.0**	**49.6**	**0.0**	**10.8**	**0.0**	**0.0**	**0.0**	23.5

Source: Author & figures based on FPP and CBvS Statistical Compendium

1) if actual mining revenues > budgeted mining revenues, then use increase else use decrease

* Act.: Actual, Est.: Estimation, Proj.: Projections

Case c: An assumed decrease in actual mining revenue in 2014, but no transfers to the Fund.

If mining revenue is expected to decrease then the budgeted revenues are calculated as the value of the mining revenues of the previous year minus 1.5 percentage points. According to the SSFS Act, within a grace period of two years after establishment, there should be no transfers out of the Fund. Although actual mining revenues declined by 31.5% in 2014 compared to 2013(see table 5.3) there will be no withdrawals from the Fund to the government budget. This rule was incorporated in the Act in order to give the Fund a grace period to accumulate and build up reserves.

Case d: An assumed decrease in actual mining revenue in 2020.

The withdrawal rule applies in 2020, when mining revenue declines by 13.3%. In this case, actual mining revenue is lower than budgeted, which result in transfers out of the SSFS. The SSFS Act sets out a 50% rule, in order to prevent a depletion of funds in the SSFS and to encourage government to adjust to some extent to a mining revenue shortfall. This outflow of funds is calculated as follows: $(T_o) = \frac{1}{2} * (r_a - r_b)$ where,

T_o represents the amount that is transferred out of the SSFS in order to finance budget shortfalls of government. In the example:

$(T_o) = \frac{1}{2} * (346.9 - 394.0)$, this works out to be US$23.5 million that is transferred to the government budget.

Another potential outflow from the SSFS is an additional income stream arising from returns of the SSFS' investments which will be added to the mining revenue going to government budget. In the SSFS Act, it is set out that 25% of all the investment income generated by the SSFS will be transferred in to the government budget.

Investment Strategies of the SSFS

The investment strategies are based on the SSFS Act, determined in consultation with and approved by the Board of Governance. This SSFS Act does not include specific investment strategies, as these should be defined by the SSFS management itself. Article13 paragraphs 1-5 deals with the operational management aspects of the SSFS which is carried out by the Central Bank of Suriname. Usually, reserve management by central banks is conservative and risk adverse, and aims to maximize returns within very rigid risk and liquidity criteria. As such, reserve holdings are generally invested in fixed income securities with an A–rating.

As mentioned earlier, the Central Bank of Suriname will be responsible for the asset management of the SSFS, at least during the first 3 years. Therefore, it can be assumed that in the absence of formal SSFS investment policies, the assets in the SSFS will be managed very similar to the management principles of international reserves (IR). However, the objectives and horizon of the SSFS are different from that of the international reserves and therefore merit different investment principles for managing its funds. The IR has mostly a short term horizon[iii] while assets in the SWF are invested mostly long term. The IR assets are mostly liquid and short term, as the CBvS is required to stand ready to finance imports and defend the exchange rate. These needs are potentially a much larger percentage than the possible outflows from the SSFS, which can also be calculated more precisely and with significant anticipation. Therefore, the SSFS can invest a much larger percentage of its assets in longer maturities and more volatile assets, which have higher average returns.

Although there is no formal investment guideline for the SSFS, the SSFS Act stipulates that funds will not be invested in equity shares or in debt obligations of private or public companies active in Suriname, including state-owned companies that are already financed through the general budget. Furthermore, funds of the SSFS should not be invested in asset classes, which are highly correlated with commodities or derivatives, related to commodities. Allocations to financial derivative instruments are also prohibited unless these may lower the risk ratio of another asset.

6. A Strategic Asset Allocation for the SSFS in an ALM framework: A scenario analysis

The main objective of this chapter is to undertake a hypothetical scenario analysis of the SFFS within an ALM framework to maximize total return of the SSFS while minimizing risk (low risk tolerance level), to maintain current and future implicit liabilities. This is done in two steps. First, a hypothetical investment strategy is set up for the SSFS based on the SSFS' law, which should direct strategic allocation of the SSFS' assets.

The inflows and outflows for the SSFS are based on the deposit and withdrawal rules as explained in section 4.2. The additional investment returns to the government will be transferred on a periodic basis.

This framework is based on a multi-period stochastic (dynamic) model, presented in chapter 2. Several scenarios are examined; one scenario presents the case where the investor, in this case the SSFS takes into account only

the assets (asset-driven investment), while other scenarios presents an investment strategy where the investor takes into account the assets and liabilities with different risk tolerance level profiles.

Hypothetical Investment strategy for the SSFS

It is assumed that the SSFS was established in 2012 and it started to accumulate assets during 2012-2015. A hypothetical portfolio constructed for the SSFS consists of stocks (35%), bonds (40%) and short term government papers (25%). Based on this portfolio, the following table illustrates a tentative SAA for the SFFS (2015-2019).

Table 6.1: Proposed Strategic Asset Allocation (SAA)

	2015	2016	2017	2018	2019
Expected Return on portfolio	**1.85**	**2.00**	**6.29**	**5.53**	**6.03**
Expected return on Bond	-0.24	0.00	2.12	-0.13	0.50
10 year Tbond (euro)	0.00	0.00	0.00	0.00	0.00
10 year Tbond (US)	-0.24	0.00	2.12	-0.13	0.50
10 year Corp bond (US)	0.00	0.00	0.00	0.00	0.00
Stocks /equity	2.09	2.00	4.16	5.64	5.51
S&P500	2.09	2.00	4.16	5.64	5.51
Expected Short term gov pap	0.00	0.01	0.01	0.02	0.02
T-bill (3 months)	0.00	0.01	0.01	0.02	0.02
Source: A. Domadarans (1998) & own calculations					

In order to estimate the optimal return of this portfolio, a calculation of the expected asset returns is necessary. The expected return of an asset (also excess return) is calculated as the sum of the risk-free rate and a risk premium. The table below illustrates the expected return of the assets' stocks and bonds for the period 2015-2019.

Table 6.2: Components of Expected Return of Assets

	Risk premium S&P 500	Riskfree rate 10 yr Bond	Expected Return	Excess return on Assets
2015	0.24	-0.02	0.21	0.26
2016	-0.01	0.04	0.03	-0.05
2017	0.06	0.05	0.11	0.01
2018	0.11	-0.15	-0.04	0.25
2019	-0.01	0.06	0.04	-0.07
Source: A. Domadarans (1998) & own calculations				

The risk free rate implies the 95% probability of achieving a certain return obtained over a certain horizon. An empirical study by Eychenne, Martinetti, & Roncalli, (2011) suggests that the risk free rate in a short term horizon equals the short term rate (interest rate), while the bond yield is used as the risk free rate for a longer horizon. The risk premium is the required return of an investor in excess of the risk free return. In periods of

economic expansion, the risk premium decreases, as investors become less risk averse, and are willing to accept a lower excess return. In times of economic downturns or recessions the risk premium increases, as investors become partially adverse to buy assets that cannot be utilized to hedge against uncertainties. In this case we assume the difference between the S&P500 index and the 10 year Treasury bond rate to be the risk premium while the 10 year Treasury bond is set as the risk- free rate.

We calculate several scenarios. First, only assets are managed. Thereafter, we assume the simultaneous management of assets and liabilities, given different risk profiles. With these scenarios we illustrate the impact of using the ALM framework. The table below presents an overview of several risk tolerance levels.

Table 6.3: Risk tolerance levels

Risk profile	Equities	Short Term Fixed Interest	Long Term Fixed interest	Total
Verry low risk		60	40	100
Low risk	40	30	30	100
Medium Risk	60	10	30	100
Medium to high Risk	70	10	20	100
High Risk	90	5	5	100
Source: C. Corcoran & own calculation				

In the first two scenarios, it is assumed that the SSFS management takes a risk-neutral[23] approach towards the allocation of assets in the first two years (2015-2017). As in Trinidad and Tobago, the SSFS is assumed to focus on preserving capital instead of optimizing returns. This is also included in the SSFS draft law. Thereafter, it will have a low to moderate risk tolerance level which is reflected in a higher risk premium. This premium is equal to the historical standard deviation of annual returns of the S&P500 and is about 172 %, while standard deviation of the government bond is about 9.7%. The historical standard deviation of the S&P 500 is in this case a benchmark which implies the amount of risk that the SSFS tolerates.

Table 6.4: Assets-only scenario

[23] SSFS management is indifferent to risk. So in this case risk is ignored when making investment decisions

US$ millions	2012	2013	2014	2015	2016	2017	2018	2019
Mining revenues								
Actual mining revenues	460.4	330.4	226.3	238.4	213.3	290.0	313.3	400.0
Budgeted mining revenue	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7
Δ% in mining revenues	0	-28.2%	-31.5%	5.4%	-10.5%	35.9%	8.0%	27.7%
Inflow patterns								
Total Asset	**0.0**	**0.0**	**0.0**	**27.2**	**23.9**	**100.4**	**50.3**	**119.0**
Accumulated Capital (AT)	20.0	20.0	20.0	21.8	23.9	30.1	35.7	41.7
Intial capital stream	20.0							
Expected Return on portfolio	0.0	0.0	0.0	1.8	2.0	6.3	5.5	6.0
Windfall Tranfers to the fund (Wt) =(1)-(2)	0.0	0.0	0.0	5.4	0.0	70.3	14.6	77.3
Asset of Allocation								
Expected Return on portfolio	**0.0**	**0.0**	**0.0**	**1.85**	**2.00**	**6.29**	**5.53**	**6.03**
Expected return on Bond				-0.24	0.00	2.12	-0.13	0.50
10 year Tbond (US)				-0.24	0.00	2.12	-0.13	0.50
Stocks /equity				2.09	2.00	4.16	5.64	5.51
S&P500				2.09	2.00	4.16	5.64	5.51
Expected Short term gov paper				0.00	0.01	0.01	0.02	0.02
T-bill (3 months)				0.00	0.01	0.01	0.02	0.02
Source: A. Domadarans (1998) & own calculations								

Table 6.5 illustrates a scenario where management of the SSFS only considers the assets. It is assumed that in 2012, US$ 20.0 million was deposited by the government into the SSFS as initial capital. Accumulated capital in the SSFS consisting of the initial capital and expected returns on portfolio transferred amounted to US$21.8 million. Based on the investment structure, returns on the invested assets ranged from US$1.8 million (2015) to US$6.0 million in 2019. These returns stems mainly from returns on equity of US$2.1 million and negative returns of US$ 0.4 million on the 10-year bonds. In addition, mining revenue increased and as such windfalls (US$5.4 million) were transferred into the fund in 2015. As a result, the total inflows into the SSFS were US$27.2 million.

In the previous case the short term constraints (such as liabilities) were not accounted for, which represents an incomplete picture for SSFS management. It assumes that the total assets are at the fund's disposal, which is not the case. The next scenario includes liabilities.

Table 6.5: Asset & Liability scenario

US$ millions	2012	2013	2014	2015	2016	2017	2018	2019
Actual mining revenues								
Actual mining revenues	460.4	330.4	226.3	238.4	213.3	290.0	313.3	400.0
Budgetted mining revenue	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7
Δ% in mining revenues		-28.2%	-31.5%	5.4%	-10.5%	35.9%	8.0%	27.7%
Inflow patterns								
Total Asset	**0.0**	**0.0**	**0.0**	**27.2**	**23.9**	**100.4**	**50.3**	**119.0**
Accumulated.Capital (AT)	20	20	20	21.8	23.9	30.1	35.7	41.7
Intial capital stream	20.0							
Expected Return on portfolio	0.0	0.0	0.0	1.8	2.0	6.3	5.5	6.0
Windfall Tranfers to the fund (Wt) =(1)-(2)	0.0	0.0	0.0	5.4	0.0	70.3	14.6	77.3
Allocation of funds								
Expected Return on portfolio	**0**	**0**	**0**	**1.8**	**2.0**	**6.3**	**5.5**	**6.0**
Expected return on Bond				-0.2	0.0	2.1	-0.1	0.5
10 year Tbond (euro)				0.0	0.0	0.0	0.0	0.0
10 year Tbond (US)				-0.2	0.0	2.1	-0.1	0.5
10 year Corp bond (US)				0.0	0.0	0.0	0.0	0.0
Stocks /equity				2.1	2.0	4.2	5.6	5.5
S&P500				2.09	2.00	4.16	5.64	5.51
Expected Short term gov paper				0.00	0.01	0.01	0.02	0.02
T-bill (3 months)				0.00	0.01	0.01	0.02	0.02
Outflows patterns								
Tranfers out of the fund				**47.1**	**89.0**	**22.4**	**22.2**	**63.7**
Liabilities (lt)				*0.8*	*0.8*	*1.9*	*1.7*	*1.8*
o.w. Investment income to Gov. Budget (25%)				0.5	0.5	1.6	1.4	1.5
Management fees				**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Transaction cost				0.2	0.2	0.2	0.2	0.2
Implicit Liabilities (ILT)				20.5	88.2	20.5	20.5	61.9
Shortfalls coverd by SSFS				0.0	67.7	0.0	0.0	41.4
National Calamity Fund				20.5	20.5	20.5	20.5	20.5
Saving for future generation (L)(resid)	0.95			**25.8**	**22.7**	**95.4**	**47.8**	**113.1**
Sum of all investments (Xnt)				-19.9	-65.1	78.0	28.1	55.3
re- invested				-1.0	-3.3	3.9	1.4	2.8
Stabilisation benchmark	0.05			1.4	1.2	5.0	2.5	6.0
Source: A. Domadarans (1998) & own calculations								

Table 6.6 represents a scenario where management decides to take into account not only the assets, but also its liabilities. SSFS management is aware that not all of total assets are at its disposal and therefore attempts to insulate the SSFS against risks and uncertainties related to liabilities.

The assumptions about the initial capital in 2012 and deposit in 2015 remain the same as in the first scenario. Accumulated capital in the fund remains the same and composed of the sum of the initial capital and returns on portfolio.

The expected returns on portfolio range from US$1.8 million in 2015 to US$6.0 million in 2019 as a result of returns from investments mainly in equities (in our case, a security that mirrors the S&P500 index). The expected returns on invested assets were reduced by 25%, which is investment income for the government, plus administration fees, to an amount of US$2.2 million.

Implicit liabilities are taken into account to validate whether the SSFS has sufficient funding to cover its liabilities. Suppose that the government registered a mining revenue shortfall in 2016 that is assumed as amounting to US$150 million.[24] This shortfall is a result of an assumed decrease in mining revenue by 10.5% caused by declining commodity prices. In accordance with legislation, half of the estimated mining revenue shortfall will be financed through transfers from the SSFS.

Combined with the accumulated capital and windfall transfers totaling US$5.4 million, the SSFS would not able to cover total liabilities in 2015 and 2016. This indicates that the SSFS would incur a certain degree of liquidity

[24] Budget shortfall in 2016 is expected to be around US$135.4 million equivalent of SRD453.6 million

risk. In order to contain this risk the fund manager could decide to rebalance its portfolio, so that higher returns are received. In that case rebalancing implies a shift from a risk neutral to a low risk profile (see table 6.7). This is done by expanding equity and short term government paper investments at the expense of ten year bond.

Table 6.6: Asset & Liability (low risk profile scenario)

US$ millions	2012	2013	2014	2015	2016	2017	2018	2019
Actual mining revenues								
Actual mining revenues	460.4	330.4	226.3	238.4	213.3	290.0	313.3	400.0
Budgetted mining revenue	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7
% Δ in mining revenues		-28.2%	-31.5%	5.4%	-10.5%	35.9%	8.0%	27.7%
Inflow patterns								
Total Asset	**0.0**	**0.0**	**0.0**	**27.6**	**24.5**	**101.1**	**51.5**	**120.6**
Accumulated.Capital (AT)	20	20	20	22.2	24.5	30.8	36.9	43.3
Intial capital stream	20.0							
Expected Return on portfolio	0.0	0.0	0.0	2.2	2.3	6.4	6.1	6.4
WindfallTranfers to the fund (Wt) =(1)-(2)	0.0	0.0	0.0	5.4	0.0	70.3	14.6	77.3
Allocation of funds								
Expected Return on portfolio	**0**	**0**	**0**	**2.2**	**2.3**	**6.4**	**6.1**	**6.4**
Expected return on Bond				-0.2	0.0	1.6	-0.4	0.1
10 year Tbond (euro)				0.0	0.0	0.0	0.0	0.0
10 year Tbond (US)				-0.2	0.0	1.6	-0.4	0.1
10 year Corp bond (US)				0.0	0.0	0.0	0.0	0.0
Stocks /equity				2.4	2.3	4.8	6.4	6.3
S&P500				2.38	2.28	4.75	6.44	6.30
Expected Short term gov paper				0.00	0.01	0.01	0.02	0.02
T-bill (3 months)				0.00	0.01	0.01	0.02	0.02
Outflows patterns								
Tranfers out of the fund				**47.5**	**96.7**	**23.0**	**23.0**	**64.5**
Liabilities (lt)				*0.9*	*1.2*	*2.5*	*2.5*	*2.6*
o.w. Investment income to Gov. Budget (25%)				0.6	0.9	2.2	2.2	2.3
Management fees				**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Transaction cost				0.2	0.2	0.2	0.2	0.2
Implicit Liabilities (ILT)				20.5	95.5	20.5	20.5	61.9
Shortfalls coverd by SSFS				0.0	75.0	0.0	0.0	41.4
National Calamity Fund				20.5	20.5	20.5	20.5	20.5
Saving for future generation (L)(resid)	0.95			**26.2**	**25.5**	**100.5**	**56.0**	**124.3**
Sum of all investments (Xnt)				-19.97	-69.80	82.80	36.00	66.30
re- invested				-1.00	-3.50	4.10	1.80	3.30
Stabilisation benchmark	0.05			1.4	1.3	5.3	2.9	6.5

Source: A. Domadarans (1998) & own calculations

In contrast to the risk neutral scenarios, table 6.7 illustrates a portfolio with a low risk profile in accordance with the distribution of the assets presented in table 5.4. In general, SWFs have low risk profiles at the beginning[25] of their horizon. The expected return on portfolio increased by 19.3 % to US$2.2 million (2015) and grew further to US$6.4 million in 2019 as a result of increasing investments in equities. Equities rose by 14.3 % in 2015 when compared to the risk neutral scenario and remains constant in the following years.

In order to monitor if the SSFS has sufficient funds to cover its liabilities, the same assumption about the initial capital in 2012 and deposit in 2015 remain the same as in the first scenario. Combined with the accumulated capital and windfall transfers, the SSFS was not able to cover its liabilities in 2015 and 2016. This is not uncommon, since it is generally expected that there be a grace period between the time of investments and the returns on these investments. However, the sum of all investments improves during these two periods.

[25] See Investment Strategies of the HSF of Trinidad in chapter 3.

Table 6.7: Asset & Liability (medium risk scenario)

US$ millions	2012	2013	2014	2015	2016	2017	2018	2019
			Actual mining revenues					
Actual mining revenues	460.4	330.4	226.3	238.4	213.3	290.0	313.3	400.0
Budgeted mining revenue	460.4	330.4	325.4	233.1	234.9	219.7	298.7	322.7
Δ% in mining revenues		-0.3	-0.3	0.1	-0.1	0.4	0.1	0.3
			Inflow patterns					
Total Asset	**0.00**	**0.00**	**0.00**	**28.7**	**26.8**	**105.8**	**59.0**	**130.8**
Accumulated Capital (AT)	20.00	20.00	20.00	23.4	26.8	35.5	44.4	53.5
Initial capital stream	20.00							
Expected Return on portfolio	0.00	0.00	0.00	3.4	3.4	8.7	8.9	9.1
Windfall Tranfers to the fund (Wt) =(1)-(2)	0.00	0.00	0.00	5.4	0.0	70.3	14.6	77.3
			Allocation of funds					
Expected Return on portfolio	**0.00**	**0.00**	**0.00**	**3.40**	**3.43**	**8.72**	**8.85**	**9.11**
Expected return on Bond				-0.18	0.00	1.59	-0.82	-0.35
10 year Tbond (euro)				0.00	0.00	0.00	0.00	0.00
10 year Tbond (US)				-0.18	0.00	1.59	-0.82	-0.35
10 year Corp bond (US)				0.00	0.00	0.00	0.00	0.00
Stocks /equity				3.58	3.42	7.13	9.67	9.45
S&P500				3.58	3.42	7.13	9.67	9.45
Expected Short term gov paper				0.00	0.00	0.01	0.01	0.01
T-bill (3 months)				0.00	0.00	0.01	0.01	0.01
			Outflows patterns					
Tranfers out of the fund				**49.0**	**96.4**	**22.4**	**22.3**	**63.8**
Liabilities (lt)				*1.1*	*0.9*	*1.9*	*1.8*	*1.9*
o.w. Investment income to Gov. Budget (25%)				0.8	0.6	1.6	1.5	1.6
Management fees				**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Transaction cost				0.2	0.2	0.2	0.2	0.2
Implicit Liabilities (ILT)				20.5	95.5	20.5	20.5	61.9
Shortfalls coverd by SSFS				0.0	75.0	0.0	0.0	41.4
National Calamity Fund				20.5	20.5	20.5	20.5	20.5
Saving for future generation (L)(resid)	0.95			**27.3**	**23.3**	**96.1**	**48.9**	**114.6**
Sum of all investments (Xnt)				-20.2	-71.9	78.7	29.2	56.8
re- invested				-1.0	-3.6	3.9	1.5	2.8
Stabilisation benchmark	0.05			1.4	1.2	5.1	2.6	6.0

Source: A. Domadarans (1998) & own calculations

In this scenario, it is assumed that the investment manager rebalances the portfolio towards a medium risk tolerance level by increasing the share of equities in the portfolio. Compared to the low risk scenario, the expected return increases on average by 45.8 % in the 2015-2019 periods. Returns ranged from US$3.4 million (2015) to US$9.1 million (2016). As a result, the total return improves significantly by around 16.7 % in 2019. Therefore, the SSFS was able to meet current and future liabilities with its total assets.

With these scenarios, the focus lay mainly on the difference between assets and liabilities. In this analysis liquidity risk is mainly considered. Other equally important types of risks that were not taken explicitly into account are currency and market risks.

The Fund is exposed to currency risk, since a majority of the portfolio is invested in US denominated assets. It would be advisable that SSFS management consider investments in assets denominated in other currencies to mitigate this risk (e.g. Euro, see 10 yr. T-Bond in table 6.2).

Market risk could also jeopardize the stability of the Fund since a majority of assets is invested in one single market (e.g. US stock exchange market) This can be mitigated by diversifying into uncorrelated assets or setting higher standards for investments outside of fixed income securities.

Conclusions and recommendations

This paper deals with the implementation of ALM for SWFs in general and the SSFS in particular. Despite the fact that a substantial part of the literature describes ALM frameworks for pension funds, this paper concludes that it is also well suited for SWFs. We adapted a standard ALM model for pension funds to be used in the case of a SWF for Suriname.

ALM provides the possibility to allocate assets in a way that highest feasible returns are achieved against an acceptable level of risk. The results demonstrate that when liabilities are considered, SWFs are able to better allocate their assets strategically. In other words, assets are invested in such a way that returns on investments are likely to be enough to cover liabilities, against acceptable risk levels (historical standard deviation of the S&P500 of 17.2%). These results were illustrated in a set of two scenarios where the investor has a low risk profile and can rebalance its portfolio to one with a medium risk profile.

A country case of Trinidad and Tobago was used to illustrate proper investment policies that resulted into a SAA despite the fact that neither has a clear asset and liability management framework. We have learned that the SWF of this country was compliant with the tenets of the GAPP. The GAPP incorporates clear and sound investment and risk management guidelines. The outcome in the paper shows that the ALM framework is in line with the investment guidelines of the GAPP. As argued, these guidelines shaped the investment strategies of the HSF that led to an excellent governance and asset allocation track record. This was one of the main reasons to adapt the HSF investment strategies for the SSFS.

The case of Suriname, illustrated by several scenarios, reveals that in order to obtain optimal returns, the fund manager needs to invest in a portfolio that is constrained by a maximum acceptable risk level. In general, the medium level of risk scenario results in higher returns when compared with low risk level scenario. In this regard, the Fund's assets are found to be sufficient to cover its (future) liabilities. Furthermore, the results show that in the first periods of operation, the Fund is unable to cover liabilities only from return on investments. The results also show that, at a low level of total assets the stabilization ceiling (5%) of the Fund, will not be sufficient to cover future budget shortfalls.

We have learned from several scenarios that strategic asset allocation and portfolio diversification of the Fund is guided by its purpose and global market developments. On one hand, the main objectives of revenue stabilization and saving for future generations are the basis of the investment decisions. On the other hand, changes in the global economy that may lead to changes in asset prices and risks are also viewed as important determinants for the portfolio structure.

One may also conclude from the results, that the main source of funding for the SSFS will probably be windfall transfers from mining revenues. Earnings from investments will not be sufficient, at least not in the first periods of operations. In line with this, it is recommended that the period in which one may not withdraw from the Fund, should be increased from three to five years.

The findings in this paper should be regarded as a stepping-stone in the attempt to develop an ALM framework for the SSFS within which assets can be strategically allocated. Hence, future research with a focus on

quantitative techniques and their implementation could enhance this study's ALM framework and calculations. Furthermore, implementing this framework provides a better understanding of the investment policy and risk management in practice.

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http://www.federalreserve.gov/releases/h15/data.htm

http://www.investopedia.com/university/releases/ppi.asp

http://www.investopedia.com/articles/08/performance-measure.asp

http://www.investopedia.com/terms/m/mutualfundtheorem.asp

http://worthadvisors.com/portfolio-management/

[i] Assets classes are defined as a group of securities or investments that tend to react similarly in different market conditions.

[ii] The former approach is where assets are invested in fixed income securities as such that the coupon and principal payments match the liabilities both in terms of timing and magnitude thereby eliminating risk. Whilst, ALM matches the risk profile, specifically interest rate and liquidity risk, in the second approach.

[iii] The portfolio of the reserve holdings at the Bank are divided into a liquidity portfolio and an investment portfolio. In the first portfolio a small amount is held to do daily foreign transactions. The second is divided in different asset classes such as term deposits, fixed income securities and equities with a short term horizon. The investment portfolio consists of assets denominated in both Euro and US- dollar currency. The strategy used to undertake reserve management by the Bank is the so called buy and hold strategy. This strategy, when compared with reserve management strategies in other countries' is very passive.

Appendices

App. 1 Main areas covered by the General Accepted Principles and Practices (GAPP)

Areas	Covered by the GAPP
Legal framework, objectives and coordination with macroeconomic policies	
Need for sound and clear legal frameworks that are publicly disclosed and clarify the SWFs relationships with other state bodies	1
Clearly defined and publicly disclosed policy purpose of the SWF	2
Need for close coordination between SWFs activities and macro-economic policy formulation	3
Clear rules on the SWF general approach to Funding, withdrawal and spending rules and their public disclosure	4
Provision on data to national statistics agencies for inclusion in macro-economic data sets	5
Institutional framework and governance structure	
Allocation and separation of responsibilities	6-9 &16
Need for stringent internal auditing procedures and standards and an independent external audit	12
Need for an annual report and accompanying financial statements	11
Need for disclosure of a SWFs financial information to its owners and regulators in recipient countries	23 & 15
Need to publicly disclose relevant financial information including asset allocation, benchmark and appropriate historical data on the Funds rates of return	17
Investment and risk- management framework	
Need for greater clarity and sound investment policies and risk- management frameworks	18
Need for SWFs to operate on economic and financial grounds	19
Encourage SWF to review their existing arrangements and assess the implementation of the principles on an ongoing basis	24
Source: Author & Das, Mazarei and Stuart	

App. 2 ALM models and Risk Measurements and Strategies

Approaches	ALM strategies	Risk Measures	Institution used
Single –period static models	immunization, dedication, gap/surplus management	duration convexity	banking insurance industries
Single-period stochastic models	(Idem as in a) but takes count for random market movements and uncertainties	absolute deviation semi- variance downside formula (Conditional)value at risk	
Multi-period static models	Rebalancing of an portfolio over several periods with well- defined factors that drives variables in the model to change	Duration convexity	
Multi- period stochastic models	Decision rules Scenario analysis/ simulation Stochastic optimal control Stochastic programming		Pension fund Hedge fund
Source: Author's based on Rosen & Zenios, Enterprise- wide Asset-Liability management: Issues, Institutions, and Models, (2006) and Romanyuk,(2010)			

App.3 Descriptive Stats

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	J-B stats (P-value)
	Financial variables							
T-Bill	5.142	5.130	13.810	0.060	3.307	0.319	2.853	0.785843 (0.675)
TBO	7.529	7.878	14.910	1.451	3.409	0.130	1.977	2.041161 (0.360)
TBO01	6.761	6.505	13.920	1.800	2.896	0.519	2.883	2.002246 (0.063)
DIV	14.264	12.829	38.570	3.165	9.129	0.866	3.098	5.523237 (0.063)
	Macro-economic variables							
PPIACO	120.087	118.050	205.392	38.108	45.401	0.172	2.450	0.772193 (0.679)
I01	4.107	3.257	11.887	0.701	2.737	1.445	4.388	18.84245 (0.000)
RGDPUS	2.840	3.236	7.259	-2.776	2.076	-0.656	3.368	3.404329 (0.182)
Source: authors own calculation								

App. 4The Sum of all investments of a Pension Fund

$$\sum_{n=0}^{N} X_{nt} = A_t + W_t y_t - l_t \quad t=0,\ldots, T-1,$$

Where the model parameters are defined as,

A_t → value of all assets owned by the Fund at time t;

W_t → wages earned by active members of the workforce at time t;

y_t → contribution rate, i.e. the premium rate by the sponsor and /or active employee as a fraction of (a suitable part of) their wage at time t;

$l\ t$ → Payments made by the Fund to retirees at time t;

$x_{n,t}$ → amount invested in assets n at time t;

$r_{n,t}$ → return on Investment in asset n at period t;

L_t → Liabilities (i.e., measure of the stream of future liabilities) of the fund at time t

Source: Bogentoft, Romeijn, & Stanislav, 2001

App. 5 Key developments of the HSF

2000:	***Establishment of the IRSF***
2007:	***HSF act. 2007 adopted and establishment of the HSF***
2008:	***Postponement transition towards the SAA due to the global financial turmoil***
2009:	***Finalizing of the operational and Investment Policy document and partially implementing SAA***
2012:	***Review of the HSF act. / full implementation of the target SAA***
2013:	***Withdrawal rule: floor of the Fund adjusted from US$ 1billion to US$ 3.5 billion in accordance with recommendations in the policy proposal document of 2012***

Source: http://finance.gov.tt/page/2/?s=heritage+and+stabilisation+fund

App. 6 Historical and estimated returns on assets 1970-2019

	S-P500 Div. Yield	S-P500 Div. Growth rate	T-Bond Riskfree-rate	Equity Risk-premium	Tot.Assets Expected return		S-P500 Div. Yield	S-P500 Div. Growth rate	T-Bond Riskfree-rate	Equity Risk-premium	Tot.Assets Expected return
1970	0.03		0.06	-0.03	0.03	**1996**	0.02	0.05	0.06	0.01	0.07
1971	0.03	-0.01	0.06	-0.04	0.02	**1997**	0.02	0.04	0.06	0.00	0.06
1972	0.03	0.01	0.06	-0.03	0.04	**1998**	0.01	0.04	0.05	0.01	0.05
1973	0.04	0.12	0.07	0.09	0.16	**1999**	0.01	0.03	0.06	-0.02	0.04
1974	0.05	0.03	0.07	0.01	0.08	**2000**	0.01	-0.03	0.05	-0.07	-0.02
1975	0.04	0.00	0.08	-0.04	0.04	**2001**	0.01	-0.03	0.05	-0.07	-0.02
1976	0.04	0.12	0.07	0.09	0.16	**2002**	0.02	0.02	0.04	0.00	0.04
1977	0.05	0.14	0.08	0.11	0.19	**2003**	0.02	0.08	0.04	0.05	0.10
1978	0.05	0.06	0.09	0.02	0.11	**2004**	0.02	0.11	0.04	0.08	0.13
1979	0.06	0.14	0.10	0.09	0.20	**2005**	0.02	0.13	0.04	0.10	0.15
1980	0.05	0.08	0.13	0.00	0.13	**2006**	0.02	0.11	0.05	0.08	0.13
1981	0.06	0.06	0.14	-0.02	0.12	**2007**	0.02	0.11	0.04	0.09	0.13
1982	0.05	0.02	0.11	-0.04	0.07	**2008**	0.03	0.02	0.02	0.03	0.05
1983	0.04	0.03	0.12	-0.05	0.07	**2009**	0.02	-0.24	0.04	-0.26	-0.22
1984	0.05	0.09	0.12	0.02	0.14	**2010**	0.02	0.01	0.03	0.00	0.03
1985	0.04	0.05	0.09	0.00	0.09	**2011**	0.02	0.05	0.02	0.05	0.07
1986	0.03	0.00	0.07	-0.04	0.03	**2012**	0.02	0.08	0.02	0.08	0.10
1987	0.04	0.11	0.09	0.06	0.15	**2013**	0.02	0.13	0.03	0.12	0.15
1988	0.04	0.11	0.09	0.06	0.15	**2014**	0.02	0.20	0.02	0.20	0.22
1989	0.03	0.14	0.08	0.09	0.17	**2015**	0.02	0.27	0.03	0.26	0.29
1990	0.04	0.05	0.08	0.01	0.09	**2016**	0.02	0.44	0.02	0.43	0.46
1991	0.03	0.05	0.07	0.01	0.08	**2017**	0.02	0.47	0.02	0.46	0.49
1992	0.03	-0.03	0.07	-0.07	0.00	**2018**	0.02	0.46	0.04	0.43	0.48
1993	0.03	0.00	0.06	-0.03	0.03	**2019**	0.02	0.45	0.04	0.43	0.47
1994	0.03	0.05	0.08	0.00	0.08						

Source: http://www.damodaran.com & authors own calculations

App. 7 Historical annual Returns on Investment 1970-1999 database

	Annual Returns on Investments in			Compounded Value of $ 100			Equity premium				Annual Returns on Investments in			Compounded Value of $ 100			Equity premium		
	S&P 500	*3-month T-Bill*	*10-year T-Bond*	Stocks	T-Bills	T-Bonds	Stocks-Bills	Stocks-Bonds	Historical risk premium		*S&P 500*	*3-month T-Bill*	*10-year T-Bond*	Stocks	T-Bills	T-Bonds	Stocks-Bills	Stocks-Bonds	Historical risk premium
1970	3.56	6.69	16.75	3,510.49	234.66	318.41	-3.12	-13.19	5.90	1993	9.97	2.98	14.21	44,483.33	1,134.84	2,181.77	6.98	-4.24	4.90
1971	14.22	4.54	9.79	4,009.72	245.32	349.57	9.68	4.43	5.87	1994	1.33	3.99	-8.04	45,073.14	1,180.07	2,006.43	-2.66	9.36	4.97
1972	18.76	3.95	2.82	4,761.76	255.01	359.42	14.80	15.94	6.08	1995	37.20	5.52	23.48	61,838.19	1,245.15	2,477.55	31.68	13.71	5.08
1973	-14.31	6.73	3.66	4,080.44	272.16	372.57	-21.03	-17.97	5.50	1996	22.68	5.02	1.43	75,863.69	1,307.68	2,512.94	17.66	21.25	5.30
1974	-25.90	7.78	1.99	3,023.54	293.33	379.98	-33.68	-27.89	4.64	1997	33.10	5.05	9.94	100,977.34	1,373.76	2,762.71	28.05	23.16	5.53
1975	37.00	5.99	3.61	4,142.10	310.90	393.68	31.01	33.39	5.17	1998	28.34	4.73	14.92	129,592.25	1,438.70	3,174.95	23.61	13.42	5.63
1976	23.83	4.97	15.98	5,129.20	326.35	456.61	18.86	7.85	5.22	1999	20.89	4.51	-8.25	156,658.05	1,503.58	2,912.88	16.38	29.14	5.96
1977	-6.98	5.13	1.29	4,771.20	343.09	462.50	-12.11	-8.27	4.93	2000	-9.03	5.76	16.66	142508.98	1590.23	3398.03	-14.79	-25.69	5.51
1978	6.51	6.93	-0.78	5,081.77	366.87	458.90	-0.42	7.29	4.97	2001	-11.85	3.67	5.57	125622.01	1648.63	3587.37	-15.52	-17.42	5.17
1979	18.52	9.94	0.67	6,022.89	403.33	461.98	8.58	17.85	5.21	2002	-21.97	1.66	15.12	98027.82	1675.96	4129.65	-23.62	-37.08	4.53
1980	31.74	11.22	-2.99	7,934.26	448.58	448.17	20.52	34.72	5.73	2003	28.36	1.03	0.38	125824.39	1693.22	4145.15	27.33	27.98	4.82
1981	-4.70	14.30	8.20	7,561.16	512.73	484.91	-19.00	-12.90	5.37	2004	10.74	1.23	4.49	139341.42	1714.00	4331.30	9.52	6.25	4.84
1982	20.42	11.01	32.81	9,105.08	569.18	644.04	9.41	-12.40	5.10	2005	4.83	3.01	2.87	146077.85	1765.59	4455.50	1.82	1.97	4.80
1983	22.34	8.45	3.20	11,138.90	617.26	664.65	13.89	19.14	5.34	2006	15.61	4.68	1.96	168884.34	1848.18	4542.87	10.94	13.65	4.91
1984	6.15	9.61	13.73	11,823.51	676.60	755.92	-3.47	-7.59	5.12	2007	5.48	4.64	10.21	178147.20	1933.98	5006.69	0.84	-4.73	4.79
1985	31.24	7.49	25.71	15,516.60	727.26	950.29	23.75	5.52	5.13	2008	-36.55	1.59	20.10	113030.22	1964.64	6013.10	-38.14	-56.65	3.88
1986	18.49	6.04	24.28	18,386.33	771.15	1,181.06	12.46	-5.79	4.97	2009	25.94	0.14	-11.12	142344.87	1967.29	5344.65	25.80	37.05	4.29
1987	5.81	5.72	-4.96	19,455.08	815.27	1,122.47	0.09	10.77	5.07	2010	14.82	0.13	8.46	163441.94	1969.84	5796.96	14.69	6.36	4.31
1988	16.54	6.45	8.22	22,672.40	867.86	1,214.78	10.09	8.31	5.12	2011	2.10	0.03	16.04	166871.56	1970.44	6726.52	2.07	-13.94	4.10
1989	31.48	8.11	17.69	29,808.58	938.24	1,429.72	23.37	13.78	5.24	2012	15.89	0.05	2.97	193388.43	1971.42	6926.40	15.84	12.92	4.20
1990	-3.06	7.55	6.24	28,895.11	1,009.08	1,518.87	-10.61	-9.30	5.00	2013	32.15	0.07	-9.10	255553.31	1972.72	6295.79	32.08	41.25	4.62
1991	30.23	5.61	15.00	37,631.51	1,065.69	1,746.77	24.62	15.23	5.14	2014	13.48	0.05	10.75	289995.13	1973.77	6972.34	13.42	2.73	4.60
1992	7.49	3.41	9.36	40,451.51	1,101.98	1,910.30	4.09	-1.87	5.03										

Source: http://www.damodaran.com