Sovereign Wealth and Risk Management

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Context

- A difficult environment for Sovereigns
  - Strong increase in Government and Central Banks Balance Sheets
  - New demographic risks and thorny problems of pension management
  - Need to transform natural resources flows in a lasting source of income

- How countries should manage their resources and wealth has come under the spotlight
  - Central Bank Reserves, SWF, Pension fund or social security system management
  - Debt management

Context

- The academic work and usual practice views funds as independent entities with separate objectives
  - Bernardell et al. (2004), Beck and Rahbari (2008) on central banks' foreign exchange reserves allocation
  - Scherer (2009), Brown et al. (2010), Martellini and Milhau (2010) consider exogenous liabilities for the SWF

- Recent crisis shows that **all sovereign liabilities** should be taken into account and **all assets can be used**
  - Liabilities: not only debt but also contingent liabilities (guarantees to the corporate or banking sector)
  - When a government is short of liquidity to meet its obligations, SWFs' or public pension funds' assets are used
  - Ex: Russia, Ireland, Kazakhstan and Qatar used SWFs or public pension fund assets to invest in banks or shore up equity markets

Table of Contents

The Conceptual Framework for Sovereign Wealth and Risk Management

- Sovereign entity: Government + Monetary authorities
  - Objective is to maximize Social Welfare (function of level and volatility of present and future consumption) subject to the constraint of not falling into default
- Usual analytical tools of the Sovereign (flows of funds, accounting balance sheets) are insufficient to measure risk
- Necessary to consider **risk-adjusted balance sheet** of the Sovereign (Gray Merton Bodie, 2007)
  - Assets and liabilities measured at their current market values
  - Sensitivities to "shocks" in underlying market or economic risk factors

Simplified Economic Balance Sheet of the Sovereign

	ASSETS ($Bn)	LIABILITIES ($Bn)	
	Foreign Reserves, Gold, Special drawing rights	Base Money Local and Foreign Currency Debt	
Taxes →	Pension Fund assets	Pension Fund liabilities	Debt payments, Benefits →
	SWF	Contingent Claims: Implicit guarantees (to banks etc.)	
Other Sovereign Revenues →	Other public sector assets (state-owned companies, real estate, etc.)	Present value of expenses on economic and social development, security, government administration, benefits to other sectors	→ Pension Fund payments …
	Present value of future taxes, fees, seignoriage	Present value of target wealth to be left to future generations	
	TOTAL	TOTAL	

Balance Sheet Sensitivity

- **Decrease in natural resources prices (assets shock)**

ASSETS ($Bn)	
Foreign Reserves, Gold, Special drawing rights	0
Pension Fund assets	0
SWF	0
Other public sector assets (state-owned companies, real estate, etc.)	0
Present value of future taxes, fees, seignoriage	-100
TOTAL	-100

LIABILITIES ($Bn)	
Base Money Local and Foreign Currency Debt	0
Pension Fund liabilities	0
Contingent Claims: Implicit guarantees (to banks etc.)	0
Present value of expenses on economic and social development, security, government administration, benefits to other sectors	-100
Present value of target wealth to be left to future generations	0
TOTAL	-100

Balance Sheet Sensitivity

- **Increase in foreign currency debt (liability shock)**

ASSETS ($Bn)	
Foreign Reserves, Gold, Special drawing rights	0
Pension Fund assets	0
SWF	0
Other public sector assets (state-owned companies, real estate, etc.)	0
Present value of future taxes, fees, seignoriage	+100
TOTAL	+100

LIABILITIES ($Bn)	
Base Money Local and Foreign Currency Debt	+100
Pension Fund liabilities	0
Contingent Claims: Implicit guarantees (to banks etc.)	0
Present value of expenses on economic and social development, security, government administration, benefits to other sectors	0
Present value of target wealth to be left to future generations	0
TOTAL	+100

Asset/Liability Management of the Sovereign Balance Sheet

- The optimal asset allocation problem of the sovereign can be viewed as an ALM exercise for the Sovereign entity
- Should take into account the sovereign financial wealth and « hidden » assets generating sources of revenues for the Sovereign, and their risk
- Should consider the risks sourrounding the future expenses (liabilities) of the Sovereign
- Derives the optimal hedging demand for these risks considering the global balance sheet of the Sovereign
- Determines the % of future revenues to be « saved » in the SWF

Substitution effect and hedging demand

- Hidden assets lead to **a substitution effect** in the global Sovereign portfolio
  - A sovereign with higher risks on its hidden assets (ex: natural resources) should invest less in risky assets for its SWF

- Liabilities lead to **a hedging demand**
  - A sovereign subject to specific risk in its flows of expenses (ex: inflation risk, commodities) will need assets to hedge it

Substitution effect and hedging demand

- Example: Suppose a country « Oiland » with one unique source of revenue: oil

- Oiland has a single liability: its social security system
  - allowing citizens to keep their living standard during retiree
  - equivalent to a Purchasing Power Unit Linked Bond (free of default risk)

- How can the SWF help managing the oil price volatility and service the Sovereign liabilities ?

Substitution effect and hedging demand

- Oiland wants to minimize its risk
  - Enters a total return swap contract to exchange oil exposure into a PPU-linked Bond + invest all its assets in PPU-linked Bond
  - Suboptimal solution: invest in a portfolio of assets with lowest correlation with oil and highest correlation with PPU-linked Bonds
- Oiland wants to achieve higher returns for a certain level of risk
  - Mix a hedging portfolio (commodity swaps + PPU-linked bonds) and a World Market Portfolio

From Theory to Practice

- Estimation of a Simplified Sovereign Balance Sheet with the Merton model

ASSETS ($Bn)		LIABILITIES ($Bn)	
Foreign Reserves, Gold, Special drawing rights		Base Money + Local Currency Debt	
Pension Fund assets - liabilities		Foreign Currency Debt	
SWF			
Other public sector assets (state-owned companies, real estate, etc.)			
Present value of future taxes, fees, seignoriage – Present value of expenses – Present value of target wealth to be left to future generations			
TOTAL		TOTAL	

From Theory to Practice

- Local currency liabilities are the sum of base money and local debt, expressed in foreign currency

$$LCL_{\$} = \frac{(M_{LC}e^{r_d T} + B_d)e^{-r_f T}}{X_F}$$

- Local currency liabilities can be seen as a call option on the value of sovereign assets, with a strike price equal to the default barrier, derived from foreign debt

$$LCL_{\$} = V_{\$Sov}N(d_1) - B_f e^{-r_f T}N(d_2)$$

$$d_1 = \frac{\ln(\frac{V_{\$Sov}}{B_f}) + (\mu_{\$Sov} + \frac{\sigma^2_{\$Sov}}{2})}{\sigma_{\$Sov}\sqrt{T}} \qquad d_2 = d_1 - \sigma_{\$Sov}\sqrt{T}$$

From Theory to Practice

- To solve the problem and find the values of the two unknowns *V*$*Sov* and its volatility, we use a second equation, linking the volatility of the sovereign asset to that of the junior claim (local currency debt):

$$LCL_{\$}\sigma_{\$LCL} = V_{\$Sov}\sigma_{\$Sov}N(d_1)$$

The Example of Chile

- Chile has two SWFs.

- The Social Stabilization Fund (ESSF)
  - launched in early 2007 and derived from the old Copper Stabilization Fund.
  - Its goal is to stabilise fiscal spending. It aims at reducing the budget's dependency on global business cycles and the volatility of revenue derived from fluctuations of copper prices and other sources.
  - Budget reductions originating in economic downturns or copper price declines can be financed in part with resources from the ESSF, reducing the need to issue debt.
  - The fund received contributions in 2007 and 2008 but financed the budget deficit in 2009 and 2010.

The Example of Chile

- The Pension Reserve Fund (PRF)
  - created at the end of 2006 in response to Chile's new demographic scenario.
  - It serves as a supplementary source for the funding of future pension contingencies.
  - Its objective is to support financing of government obligations arising from the government's guarantee to basic old-age and disability solidarity pensions.
  - PRF has a fixed accumulation rule. During its four years of existence, it received regular contributions from the budget.

The Example of Chile

- The central bank's reserves
  - Their purpose is to guarantee secure and efficient access to international liquidity
  - They are an instrument to **safeguard currency stability** (Chile has a floating exchange rate regime) and the normal functioning of domestic and external payment systems.
  - They are invested in **liquid foreign assets** and are intended to permit intervention in the foreign exchange market in times of crisis.
  - Reserves are invested in assets under two main portfolios.
    - **The Investment Portfolio** (73.3% of the total reserves) includes short- and long-term foreign currency assets (with an average duration of 13 months) used to respond to unforeseen contingencies and long-term requirements
    - **The Liquidity Portfolio** is designed to cover requirements foreseeable in the short term. The structure for this portfolio corresponds to the currencies and maturities of programmed disbursements.

The Example of Chile

- Composition of the 2 SWFs

Table B1: Benchmark composition of the ESSF and PRF

Benchmark Composition	Percentage of Total Portfolio
Money Market	**30.00%**
Merrill Lynch 6 Month Average	15.00%
Merrill Lynch Treasury Bills Index	15.00%
Nominal Sovereign Bonds	**66.50%**
Barclays Capital Global Treasury: U.S. Bond Index	31.50%
Barclays Capital Global Treasury: Germany Bond Index	28.00%
Barclays Capital Global Treasury: Japan Bond Index	7.00%
Inflation-Indexed Sovereign Bonds	**3.50%**
Barclays Capital Global Inflation-Linked: U.S. TIPS Index 1-10 years	3.50%

Data provided by the Chilean Ministry of Finance, 2010.

The Example of Chile

- Composition of the central bank's reserves

Table B2: Composition of Foreign Exchange Reserves by Portfolio and Currency

	Composition			
Type of Portfolio	USD	EUR	Others	Total
Investment Portfolio	46.8%	25.5%	1.0%	73.3%
Liquidity Portfolio	20.4%	0.0%	5.1%	25.5%
Other assets	-	-	-	1.2%

Data provided by the Central Bank of Chile, 2010.

The Example of Chile

- Estimation of Chile Balance Sheet with the Merton model, 2008

ASSETS (bn $)			**LIABILITIES (bn $)**		
Balances of:	Assets	Volatility	***Balances of:***	Liabilities	Volatility
INVESTMENTS	**22.7**	**4.8%**	**FOREIGN CURRENCY GVT DEBT**	**2.0**	**6.6%**
Stabilization Fund (ESSF)	20.2		(senior claim)		
Pension Reserve Fund (PRF)	2.5				
CURRENCY AND OTHER RESERVES	**23.2**	**3.8%**	**MONETARY BASE + LOCAL CURRENCY GVT DEBT** (junior claim)	**146.1**	**10.1%**
PRESENT VALUE OF FISCAL SURPLUS - GUARANTEES TO BANKS AND NON BANKS	**102.2**				
TOTAL ASSETS	**148.1**	**10.1%**	**TOTAL LIABILITIES**	**148.1**	**10.1%**

Sovereign Wealth Management in Chile

- Present value of fiscal surplus estimation

- Simplifying Hypothesis :
  - No contingent liabilities
  - Fiscal surplus proxied by receipts indexed on inflation, copper prices and equities and spending indexed on inflation

$$P_{fiscalsurplus} = \left[\sum_{i=1}^{\infty} \frac{R_i}{(1+r)^i}\right] - \left[\sum_{i=1}^{\infty} \frac{E_i}{(1+r)^i}\right]$$

$$E_i = RR_i(1+\pi_i) \qquad R_i = RR_i(1+\beta_{inflation} * \pi_i + \beta_{copper} * r_i^{copper} + \beta_{equity} * r_i^{equity})$$

Sovereign Wealth Management in Chile

- Sovereign's optimal asset allocation
  - Minimization of the Global Sovereign Surplus (GSS) volatility for a target rate of return

$$Min_w \ \sigma_{GSS}$$

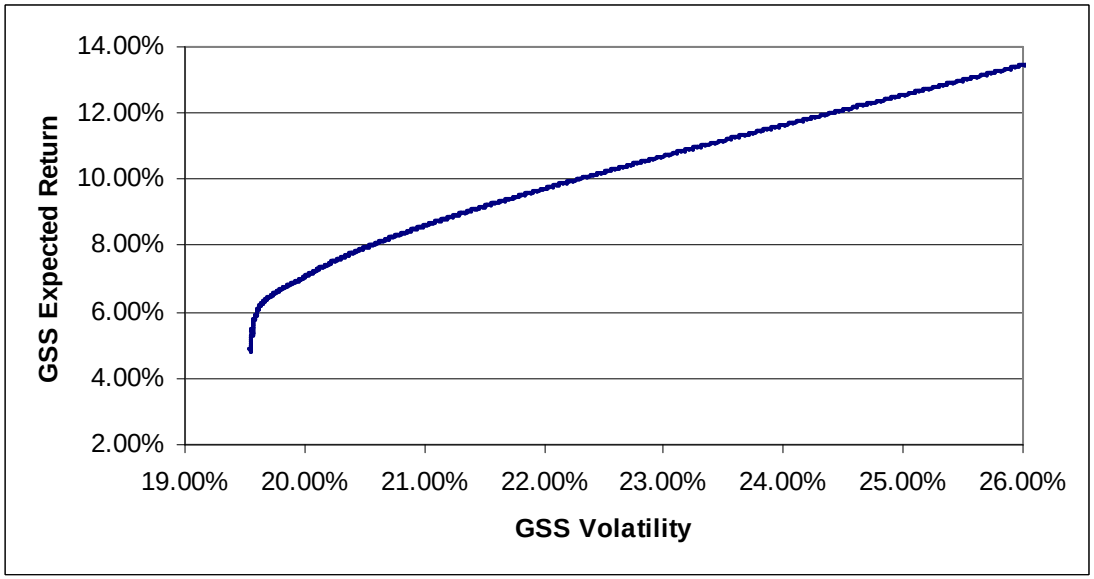
$$r_{GSS} = \sum_{i=1}^{n} w_i r_i + r_{FS} + r_{FD} - r_{DD}$$

$$\sum_{i=1}^{n} w_i = 1$$

$$w_i \geq 0$$

Sovereign Wealth Management in Chile

- Efficient Frontier: Chile Global Sovereign Surplus, Expected Return and Volatility Tradeoff, 2008



Estimation on Aug 2000 – Dec 2010

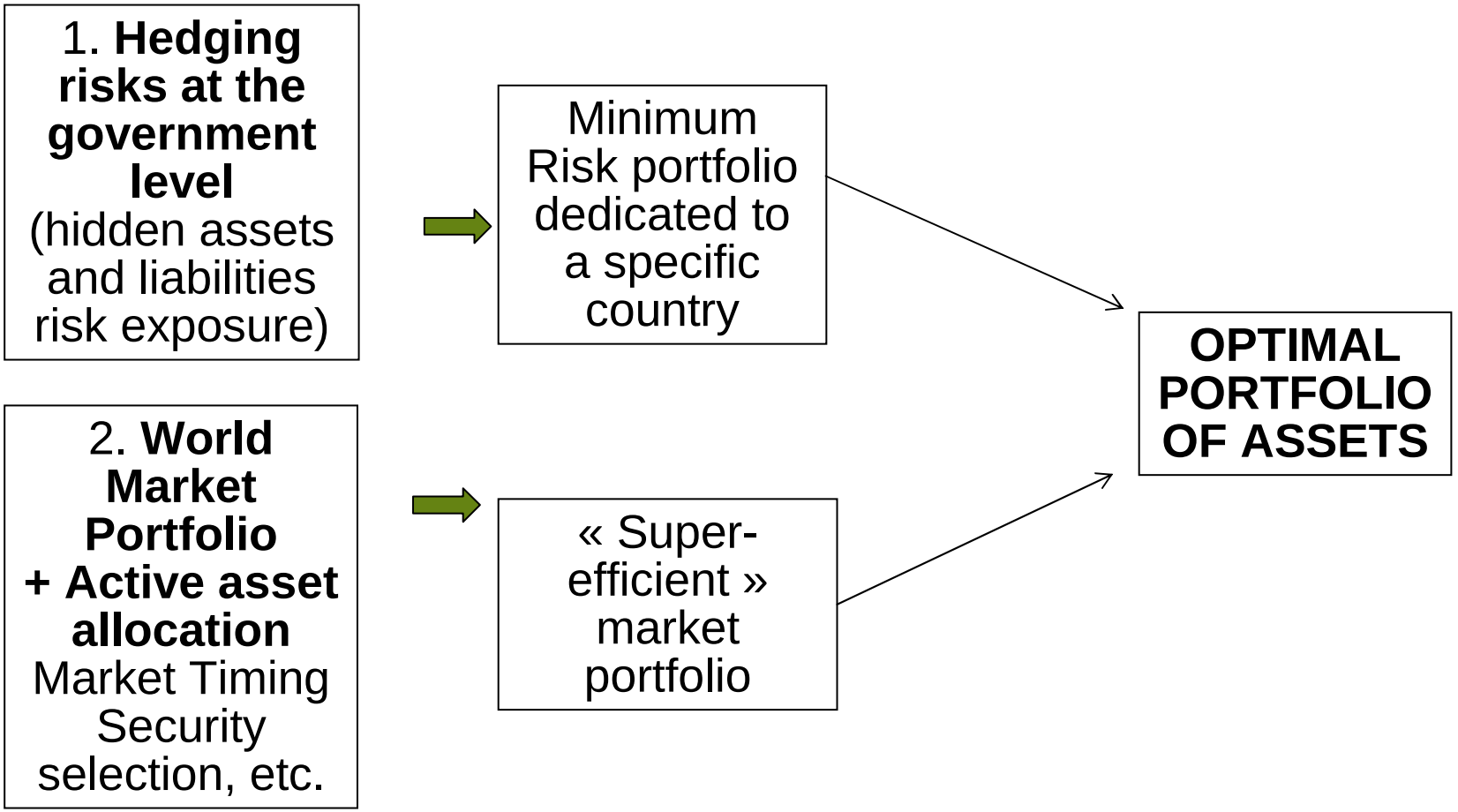
Sovereign Wealth Management in Chile

- Optimal Portfolios

	Min Vol	Portfolio return=6%	Portfolio return=6.96%
Ann. Mean	4.83%	6.00%	6.96%
Median	0.51%	0.62%	0.44%
Maximum	12.14%	12.45%	12.74%
Minimum	-11.48%	-11.43%	-11.01%
Volatility	13.24%	13.31%	13.79%
Skewness	0.00	0.00	0.00
Kurtosis	3.92	3.98	3.83
		Weights	
USD	0%	0%	0%
EUR	27%	25%	0%
JPY	0%	0%	0%
Emg Eqty	24%	48%	100%
Dvp Eqty	38%	1%	0%
Emg Bond	11%	26%	0%
Dvp Bond	0%	0%	0%
World IL Bond	0%	0%	0%

Estimation on Aug 2000 – Dec 2010

Simplified Investment Process of a Sovereign



Conclusion

- The unit of analysis for SWF asset allocation should be the **national risk balance sheet** (Gray Merton Bodie 2007). Working with balance sheets rather than flow of funds.
- Efficient management of the SWF should be done in accordance with the Sovereign objectives in an **Asset and Liability Management** Framework
- The starting point for asset allocation should be the **minimum risk** strategy. This step is equivalent to asset-liability matching
- Practical application of this approach still presents a number of difficulties: lack of risk dimension for traditional macroeconomic data, intangible asssets, human capital difficult to evaluate