APRIL 2006

The World Bank

SCOPE AND FUNDAMENTAL CHALLENGES TO PUBLIC DEBT RISK MANAGEMENT - THE BRAZILIAN DMO PERSPECTIVE

Anderson Silva
World Bank

Rodrigo Cabral
Brazilian National Treasury

William Baghdassarian
Brazilian National Treasury

GLOBAL FINANCE CONFERENCE

Agenda

Motivation

- Implementation of modern risk management practices has ranked high in the agenda of public debt managers
- Focus on strengthening Middle-Office capability
- Public debt risk management: a key attribution in Debt Management Offices (DMOs)
- The Brazilian National Treasury engaged in 2001 in a program to build capacity and develop tools and systems for risk management
- Two years later, the Brazilian risk management framework was presented and validated in a seminar attended by experts from several countries and international organizations

Motivation

- A number of studies have been produced by the Brazilian DMO
- However, there is still a gap in the understanding of how these individual pieces of work can be put together to form the complete set of attributions of the public debt risk manager.
- This paper describes the scope of activities and the fundamental challenges faced by the public debt risk manager

Agenda

"Macro Functions" of a Public Debt Risk Manager - Debt Sustainability Exercises

- Enhanced and accurate debt dynamics and sustainability exercises
- Strengths: refined skills and privileged access to information regarding the debt refinancing strategy
- Conventional assessments based on deterministic forecasts
- Include stochastic analysis
- Include the refinancing strategy (an insider)
  - More important in countries with unstable debt profiles;
  - Countries that have large share of debt maturing in the short term;
  - These are exactly the countries that DSA are more relevant

"Macro Functions" of a Public Debt Risk Manager

Table 1: Deterministic vs. Stochastic Simulation Results (100% floating rate debt)

Period	average DL (determ.)	Average DL (stoch.)	Volat	Relat. Volat
0	51,70%	51,70%	0,00%	0,00%
1	49,94%	49,93%	4,25%	8,50%
2	48,19%	48,09%	6,10%	12,69%
3	46,04%	46,00%	7,68%	16,69%
4	43,87%	43,78%	8,86%	20,25%
5	41,53%	41,46%	9,90%	23,89%
6	39,17%	39,16%	11,03%	28,18%
7	36,91%	36,85%	12,21%	33,12%
8	34,35%	34,26%	13,24%	38,65%
9	31,68%	31,65%	14,23%	44,97%
10	28,68%	28,39%	14,74%	51,91%

* DL = Debt/GDP

"Macro Functions" of a Public Debt Risk Manager

Table 2: Deterministic vs. Stochastic Simulation Results (with refinancing strategy)

Period	average DL (determ.)	Average DL (stoch.)	Volat	Relat. Volat
0	51,70%	51,70%	0,00%	0,00%
1	50,06%	50,11%	1,49%	2,98%
2	48,18%	48,22%	2,13%	4,42%
3	46,39%	46,43%	2,69%	5,80%
4	44,53%	44,58%	3,14%	7,03%
5	42,66%	42,70%	3,52%	8,23%
6	40,51%	40,55%	3,91%	9,64%
7	38,48%	38,52%	4,33%	11,23%
8	36,36%	36,40%	4,69%	12,89%
9	34,34%	34,37%	5,06%	14,73%
10	32,41%	32,44%	5,51%	16,99%

* DL = Debt/GDP

"Macro Functions" of a Public Debt Risk Manager

Graph 4: Distribution of Debt/GDP Ratios across Different Horizons Including o Refinancing Strategy towards Long-Term Fixed-Rate Debt

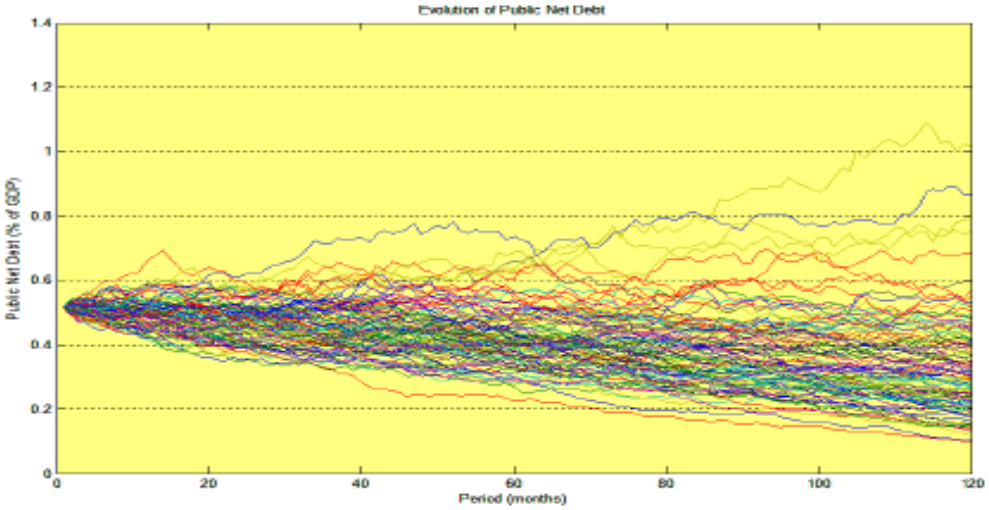


Table 4: Refinancing vs. no-refinancing strategy simulation (stochastic approach)

Period	Without Strategy	With Strategy	Difference
0	51,70%	51,70%	0,00%
1	49,93%	50,11%	-0,18%
2	48,09%	48,22%	-0,13%
3	46,00%	46,43%	-0,44%
4	43,78%	44,58%	-0,80%
5	41,46%	42,70%	-1,24%
6	39,16%	40,55%	-1,40%
7	36,85%	38,52%	-1,67%
8	34,26%	36,40%	-2,13%
9	31,65%	34,37%	-2,72%
10	28,39%	32,44%	-4,05%

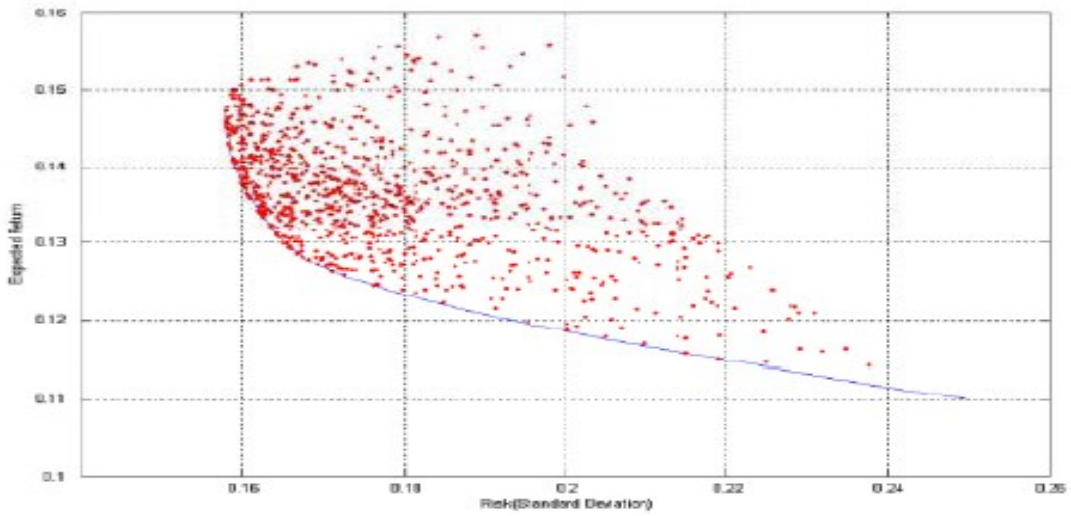
Agenda

A Long-Run Benchmark

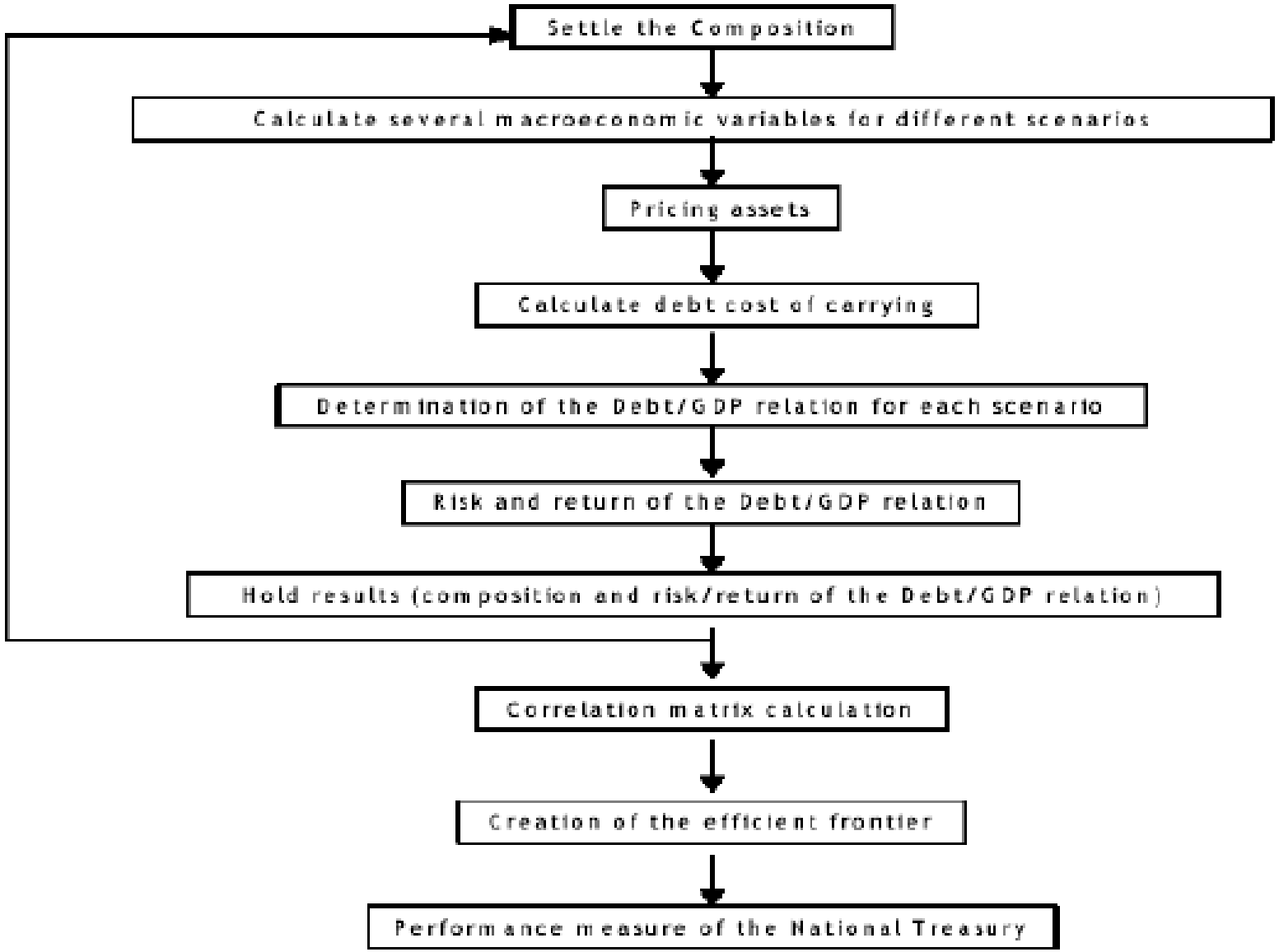
- A guideline to the short and medium term debt management strategies
- Active search for methodologies in many countries
- Usually, the benchmark is represented by some set of relevant debt indicators, such as composition, duration, debt profile etc.
- Some countries determine their benchmarks based on very simple analysis and ad-hoc assumptions
- Others develop risk indicators and investigate trade-offs in outputs
- Others use an even more analytical framework from which the "optimal" portfolio emerge endogenously

A Long-Run Benchmark - The Brazilian Approach

- An efficient frontier analysis in terms of the debt/GDP ratios
  - Steady-state compositions are simulated through a number of different periods
  - With some portfolios evaluated in terms of cost and risk, as well as the correlation matrix, it is possible to draw an efficient frontier
  - The debt manager chooses, based on its risk appetite, the single point representing the benchmark



A Long-Run Benchmark



A Long-Run Benchmark

Stochastic Processes:

Interest Rate Process: Cox-Ingersoll and Ross (CIR)

$$dJ_t = \alpha\,(J^* - J_t)dt + \sigma_1\sqrt{J_t}\,dz_t^1$$

Real FX rate Process: Chan, Karolyi, Longstaff and Sanders (CKLS)

$$dC_t = \beta\,(C^* - C_t)dt + \sigma_2 C_t dz_t^2$$

Domestic Inflation: Geometric Brownian Motion

$$dI_t = \mu I_t dt + \sigma_3 I_t dz_t^3$$

External Inflation: Deterministic Process

$$dI_t^e = \mu^e I_t^e dt$$

A Long-Run Benchmark

Macro Structural Model:

IS equation:

$$y = \beta r_{-1} + \delta e_{-1} + \lambda y_{-1} + \varepsilon$$

Phillips Curve:

$$\pi = \zeta \pi_{-1} + \alpha y_{-2} + \gamma (e_{-1} - e_{-2}) + \eta$$

Nominal FX rate:

$$e = \chi Embi + \nu$$

Country Risk:

$$Embi = \kappa Embi_{-1} + \varpi (Divida / PIB)_{-1} + \nu$$

Taylor Rule:

$$r = \rho r_{-1} + \psi (\pi_{-1} - \pi^*) + \phi y_{-1}$$

Debt Dynamic:

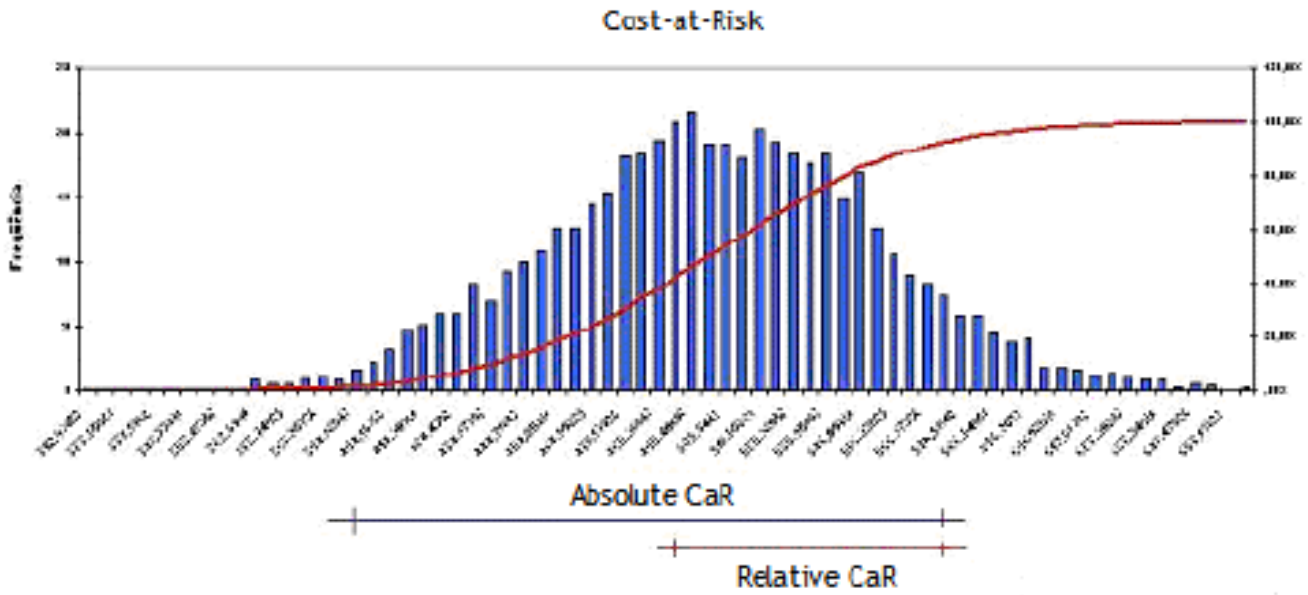
$$\frac{Dívida}{PIB} = \frac{(1+cc)}{(1+g)} \left(\frac{Dívida}{PIB} \right)_{-1} - \frac{\text{Pr}imário}{PIB}$$

Agenda

Public Debt Risk Indicators

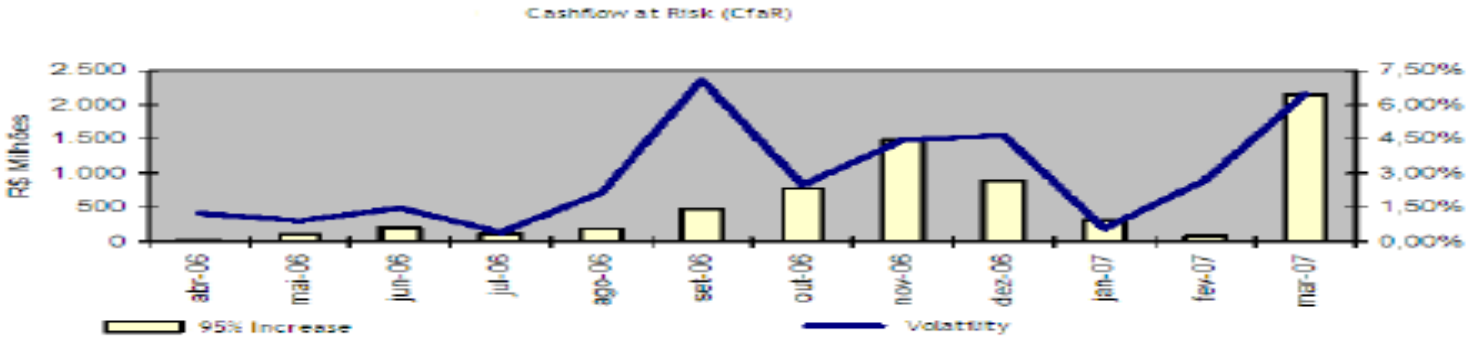
- Traditional vs. Stochastic
- MARKET RISK
  - uncertainty related to the expected costs owing to the volatility in the market indexes or currencies
  - duration, refixing-duration and convexity
  - the Cost-at-Risk (CaR) represents the maximum expected value that the debt stock can reach over a determined period, given a certain level of significance
  - stress tests

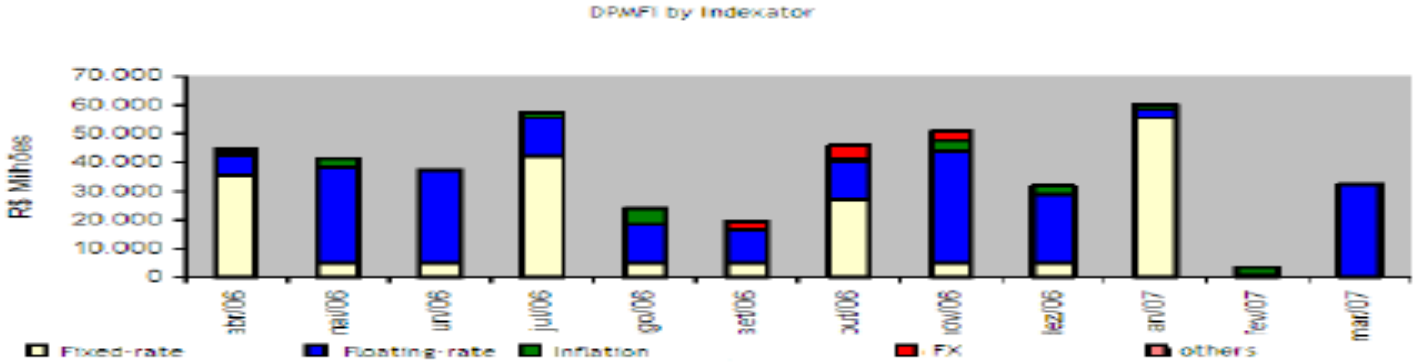
Graph 7: Cost-at-Risk (CaR)



Public Debt Risk Indicators

- REFINANCING RISK
  - defined as the risk of adverse changes in the stream of debt payments upon its refinancing
  - extreme cases: incapacity of a government to roll-over
  - average life, percentage of the debt maturing in the short term (usually in one year)
  - Cash-flow at Risk (CfaR): CfaR measures, with some level of significance, the maximum expected cash-flow (payments) at the specific dates or periods in the future

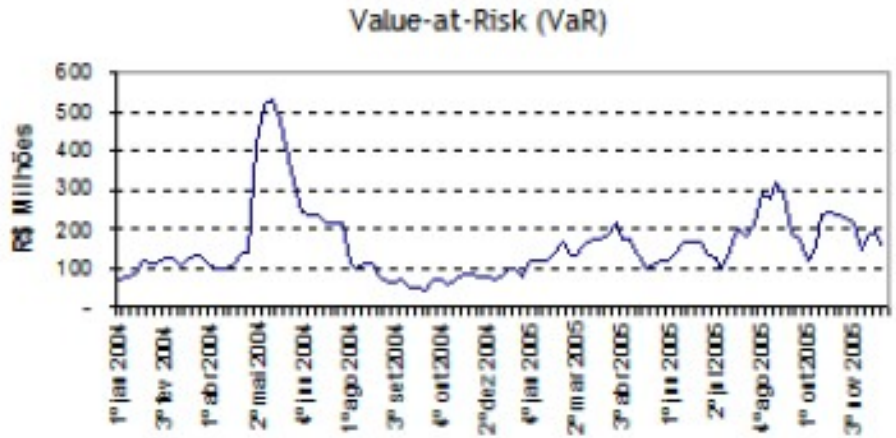


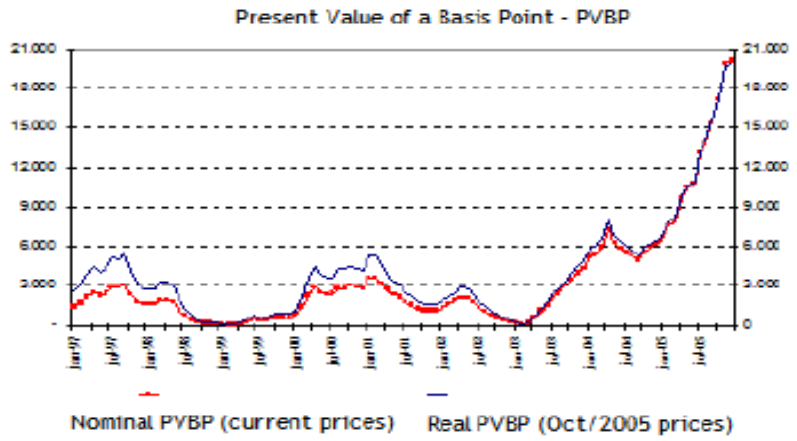


Public Debt Risk Indicators

- BUDGET RISK
  - the concept of Budget-at-Risk (BaR): risk that the debt service within a fiscal year (the official Budget period) surpasses the amount originally approved by Congress
  - focused in one year
  - exogenous reference value which is approved by the Congress => probability of exceeding that value.

- DEMAND SIDE RISK
  - risk of sudden shifts in the demand for government bonds
  - most common driver: interest rates
  - Investors due to stricter prudential regulations, internal investment policy, etc





Agenda

The Risk Manager and the Strategy Planning Design

- Process of design, implementation and monitoring:
  1. Definition of long-term objectives and guidelines;
  2. Development of Macroeconomic Scenarios;
  3. Preliminary discussions of scenarios and restrictions;
  4. (Transitional) Strategy design and preliminary risk assessment;
  5. Definition of targets: Expected results
  6. Analysis of opportunities and challenges in the following years[43];
  7. Tactical debt planning and execution (short-term) and
  8. Monitoring the implementation of the transitional strategy (Annual Borrowing Plan)

- **Role in Transitional Strategy design**
  - select and adequately employ the tools that were developed to measure the various types of risks across different potential strategies

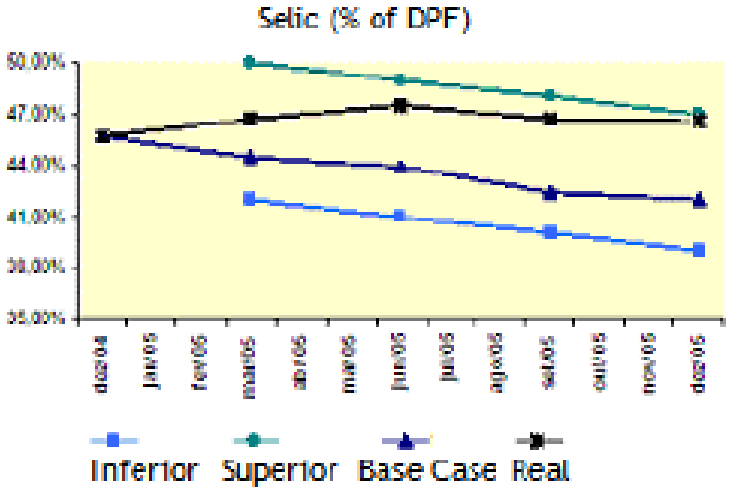
Results and Targets for the Federal Public Debt - DPF

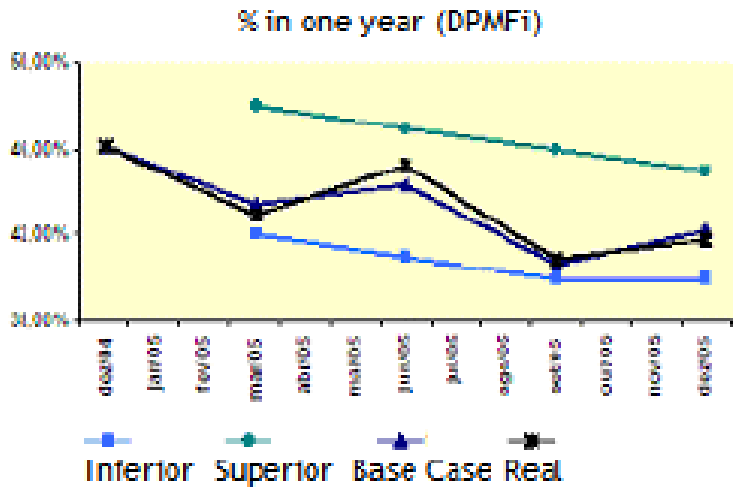
Indicators	Dec-04	PAF-2005	
		Minimum	Maximum
Stock of DPF held by the public (R$ billion)	1013.9	1160	1240
Average maturity of DPF (months)	35.3	36	41
% Maturing in 12 months	39.3	34	40
Share of DPF (%)			
Fixed rate	16.1	16	26
Floating rate	45.7	39	47
Exchange rate	24.2	12	16
Price Index	11.9	18	23
Others	2.1	1	3

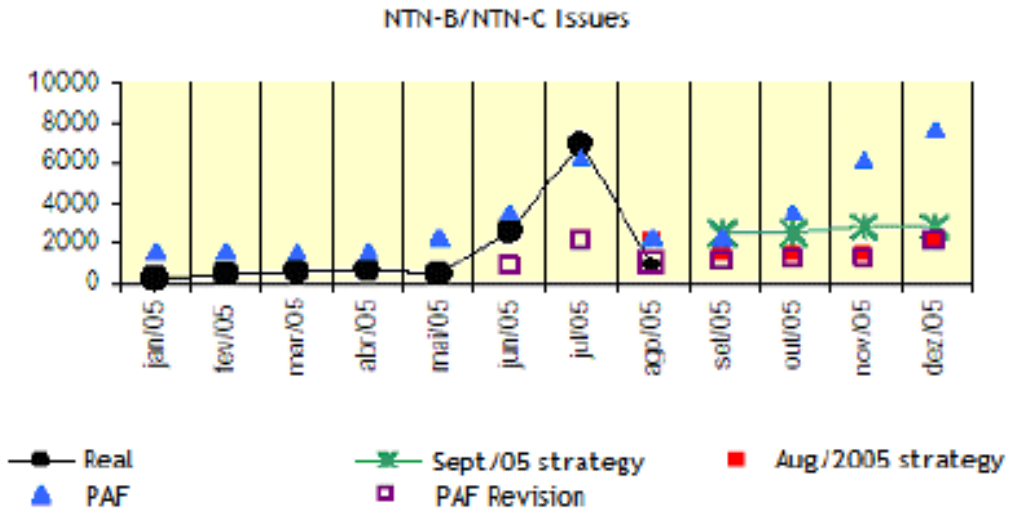
Source: National Treasury

The Risk Manager and the Strategy Planning Design

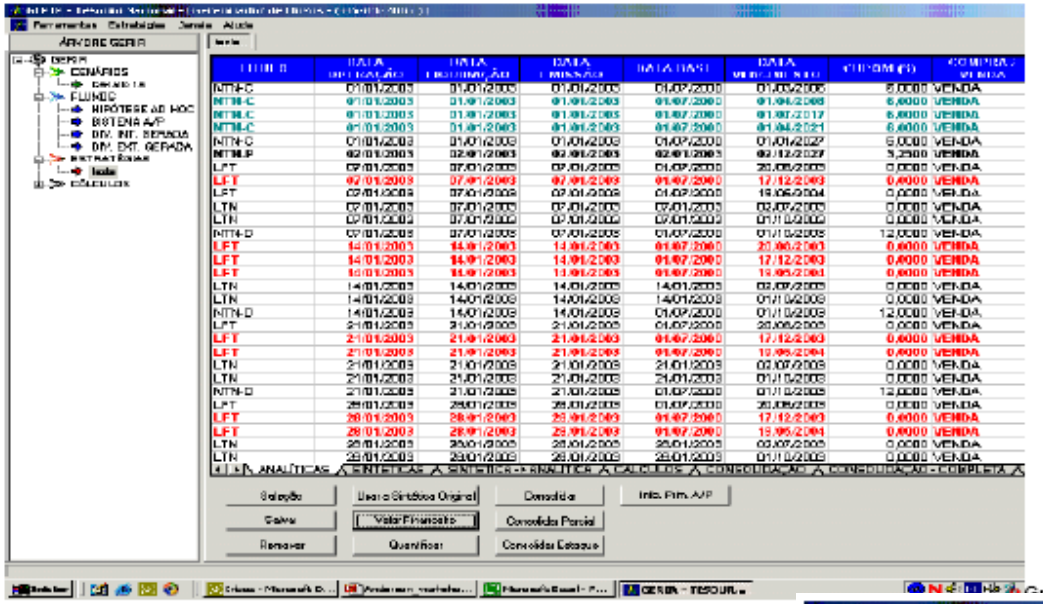
- **Role in monitoring the Transitional Strategy's implementation**
  - Preparation, assessment and debate of adequate "tracking-error" measures

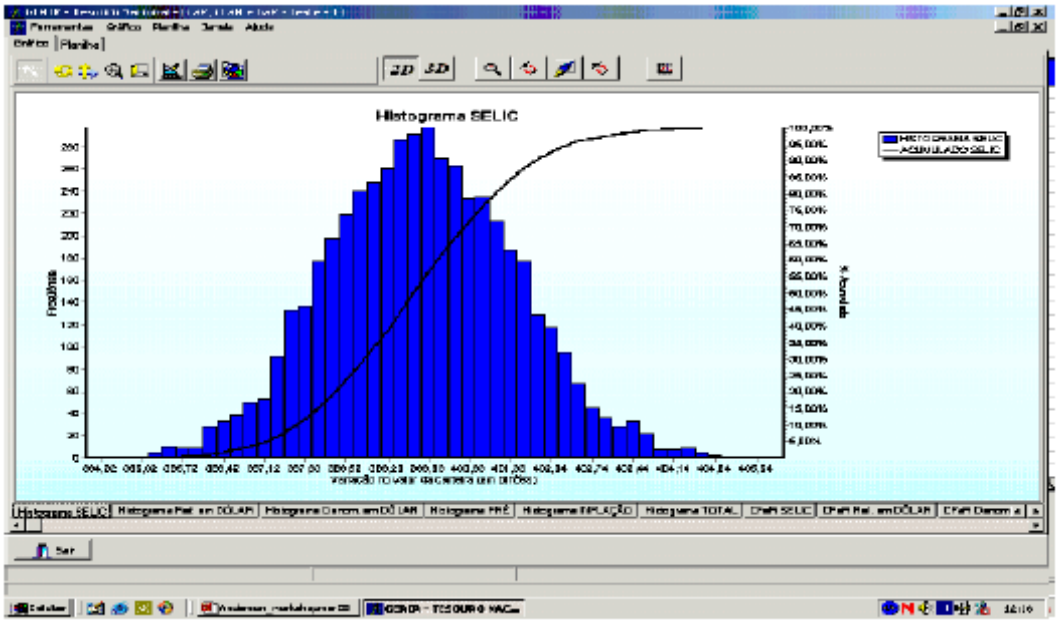






The GERIR System





The World Bank

Tesouro Nacional

Agenda

Concluding Remarks

- Aim: draw attention to the role of the public debt risk manager, providing a comprehensive view of her principal functions
- Ambitious task, subject to several gaps and criticisms
- In an environment that debt offices around the world have been paying significant efforts to modernize their risk management practices this can serve as a starting point to get a good grasp of the activities involved
- It also serves to enhance the awareness of Brazilian policy makers on how to best explore the skills and outputs that can be provided by public debt risk managers.