

UNIT I: THE PROCESS OF FEDERAL PUBLIC DEBT STRATEGIC PLANNING

Federal Public Debt - FPD strategic planning in Brazil involves various aspects that can be grouped into three stages:

- Definition of the desired long-term structure (benchmark structure);
- Medium-term planning (transition strategy); and
- Elaboration, publication and implementation of the short-term strategy (Annual Borrowing Plan - ABP, first published in 2001).

The objective of this unit is to describe the FPD planning process, highlighting Brazilian experience in debt risk evaluation¹.

This unit is organized into six sections aimed at clarifying the different elements of the planning process:

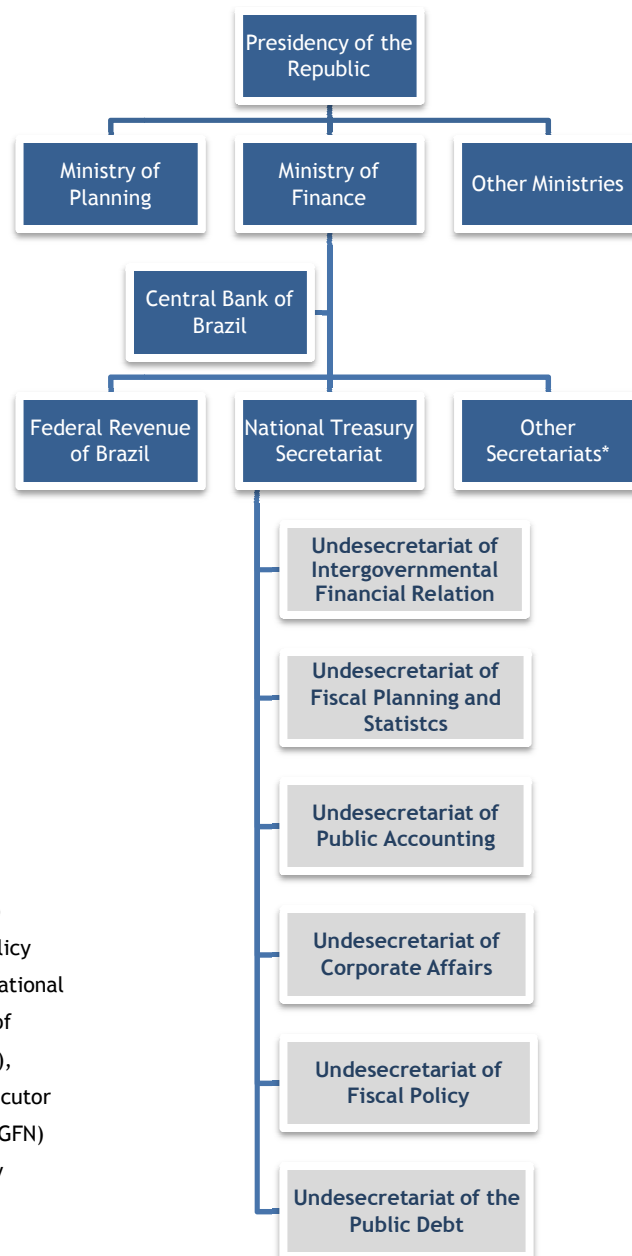
- Section 1 describes the institutional structure of the Public Debt Undersecretariat (SUDIP), charged with FPD management. Here, one should highlight the Debt Management Committee;
- Section 2 presents a broad explanation of the FPD strategic planning process;
- Section 3 breaks down the process of discussing and approving short-term FPD planning, set out in concrete form in the Annual Borrowing Plan;
- Section 4 presents a brief explanation of how the benchmark model aids in defining quantitative guidelines for the FPD structure over the long-term;
- Section 5 contains a discussion on how the strategy of transitioning from the current FPD composition to its benchmark is elaborated, with particular emphasis on the importance of the macroeconomic scenarios and the degree of debt market development to determining the speed of FPD convergence to the long-term structure;
- Finally, the final section details the historical evolution of the Brazilian strategic planning model, the risk indicators utilized for public debt management in the initial stages of this process and the more pertinent metrics currently used by debt managers.

¹Based on SILVA, CARVALHO & MEDEIROS (2009) and also on the various Annual Borrowing Plans (ABP), released since 2001 by the National Treasury Secretariat .

1. Institutional Structure of the Public Debt Undersecretariat

The National Treasury Secretariat was created in 1986 with the objective of improving public finance management in Brazil. The National Treasury is a component of the institutional structure of the Ministry of Finance and is currently composed of six distinct undersecretariats (see figure 1 below). The first stage of this process occurred in 1988, when the functions of federal securities debt planning, supervision, regulation and control were transferred to the National Treasury. Previously, these functions had been scattered about various federal government organs and the Central Bank (BACEN).

Figure 1. Administrative Structure of the Federal

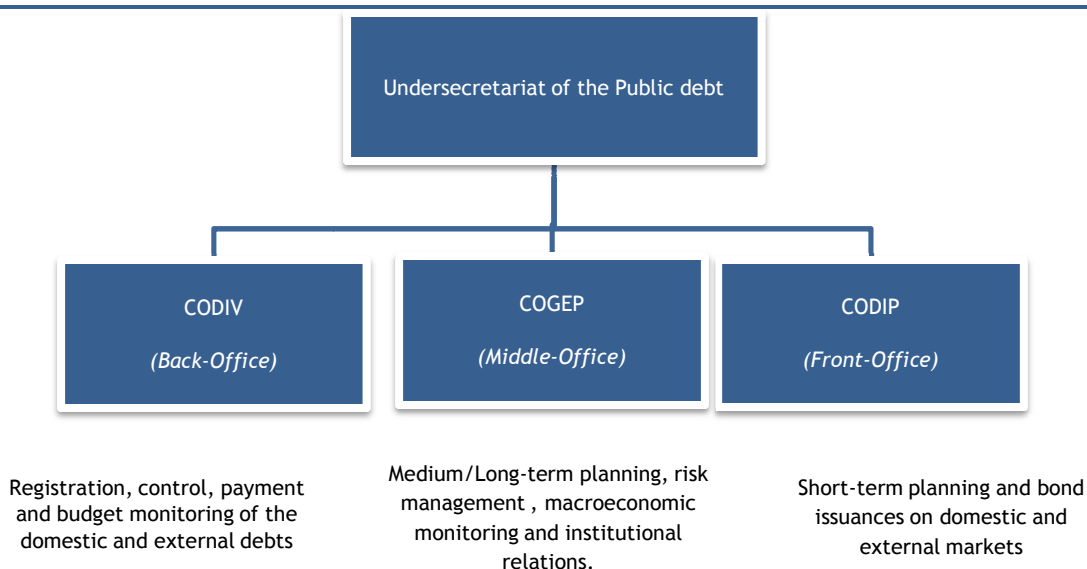


* Executive Secretariat (SE)
 Secretariat of Economic Policy (SPE), Secretariat of International Affairs (SAIN), Secretariat of Economic Monitoring (SEAE), Office of the General Prosecutor of the National Treasury (PGFN) and the College of Treasury Management (ESAF)

The practice of concentrating public debt management functions in a single government entity has become widely accepted internationally, since this institutional arrangement tends to result in more efficient and coordinated management². In line with international experience, the National Treasury is currently responsible for management of the entire Federal Public Debt (domestic and external debts, securities debt and contractual debt), a practice that has resulted in enhanced synergy for short and medium-term planning, operations in a diversity of markets, transparency and communication with different investor groups and risk classification agencies.

In this regard, in 1999 the National Treasury implemented a new management model based on the Debt Management Office - DMO philosophy. The Figure with the new National Treasury organizational structure is shown below. In this framework, the three SUDIP general coordination staffs participate in various segments of the public debt planning, issuance, registration, control and payment process: (i) Back-office (CODIV - General Coordination of Public Debt Control) is in charge of registration, control, payments and budget monitoring of the domestic and external debts; (ii) Middle-Office (COGEP - General Coordination of Public Debt Strategic Planning), responsible for medium/long-term planning, risk management, macroeconomic monitoring and institutional relations; and (iii) Front-Office (CODIP - General Coordination of Public Debt Operations), which is responsible for short-term planning and bond issuances on domestic and external markets.

Figure 2. Structure of the Public Debt Undersecretariat



Source: National Treasury

Within this institutional structure, FPD strategic management demands close coordination of proposed measures and monitoring of results during execution. In 2002, the Public Debt Management Committee

² In those countries in which public debt management responsibilities are distributed among various institutions, one can observe inconsistencies in processes and strategies, as well as duplication of functions.

was created and is composed of representatives of the three coordination staffs of the Undersecretariat of the Public Debt, together with the Undersecretary who presides over the Committee.

The Committee meets annually in order to analyze and approve the results of the optimal FPD composition model and to evaluate possible medium-term strategies for the debt. These discussions are the jumping off point for elaboration of the Annual Borrowing Plan, which is later discussed and agreed upon within the Committee before being sent to the National Treasury Secretary for final approval. The Annual Borrowing Plan is revised every four months in such a way as to evaluate whether changes in economic conditions may require significant alterations in initial planning.

The Committee meets in the final week of each month in order to define the short-term strategy to be adopted in order to achieve the targets set out in the Annual Borrowing Plan and to elaborate the official schedule of auctions in the coming month. These meetings are an opportunity for managers and analysts of the National Treasury Undersecretariat of the Public Debt to share their points of view and information regarding the current situation, markets and the future outlook for FPD financing.

Finally, one should stress that representatives of SUDIP's three coordination staffs, together with the National Treasury Secretary and Undersecretary, participate in the strategic planning process (including both short and long-term planning).

2. FPD Strategic Planning

The starting point for strategic planning is a clear definition of the objective of debt management. This objective may vary from one country to another. However, in general, it reflects an effort to attain adequate balancing between debt portfolio costs and risks and concerns regarding development of the government bond market.

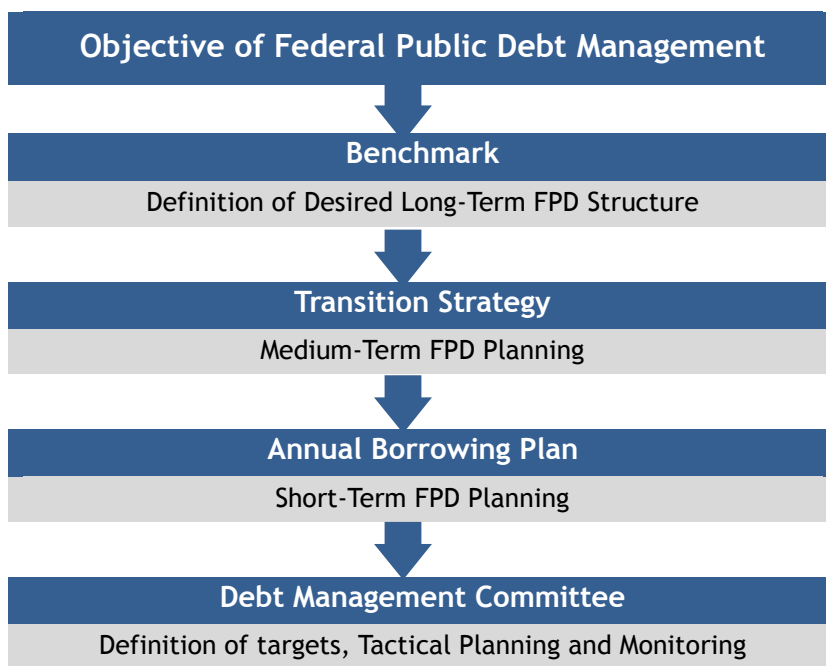
Objective of the FPD Management

The objective defined for Federal Public Debt management is that of efficiently meeting federal government borrowing requirements at the lowest possible long-term financing cost, while ensuring prudent risk levels. Additionally, the aim is to the smooth operation of the Brazilian government securities market.

The objective described above is the starting point and major reference for the entire process of Brazilian public debt planning and management, as shown in Figure 1. This process will be discussed in detail in the following sections.

In summary, the process begins with the elaboration of analytical studies to be used as the foundation for discussion of the public debt benchmark choice. The next step is the design of a transition strategy that allows for more complete mapping of risks, opportunities and restrictions that may appear over the medium-term during the gradual shift toward the desired long-term debt portfolio. These elements are of critical importance to defining and developing the short-term strategy presented in the ABP, in terms of the tactical decisions taken by the Public Debt Management Committee.

Figure 3. Process of FPD Strategic Planning



Source: National Treasury

3. Annual Planning

Since 2001, the National Treasury has published an Annual Borrowing Plan (ABP) for the Federal Public Debt³. In the last decade, the ABP has become an instrument for strengthening the transparency and predictability of public debt management, while considerably improving National Treasury performance on

³ Aside from the ABP, the National Treasury has also published the Annual Debt Report (ADR) since 2004. This Report presents the results achieved and the major events that marked public debt management in the previous year. Both the ABP and the ADR are available in Portuguese and English on the National Treasury website at: http://www.tesouro.gov.br/english/public_debt/index.asp.

the government bond market. The ABP is designed to serve the objective of Brazilian debt management and contains a series of guidelines that orient formulation of short-term strategy⁴.

Aside from the FPD objective, these guidelines give due consideration to the benchmark and the transition strategy. In general, they encompass lengthening of the average maturity, smoothing of the maturity profile, increased participation of fixed rate and inflation-linked bonds, broadening of the investor base and government bond market liquidity and development of the term structure of interest rate.

FPD Management Guidelines

- Increase the average maturity of the outstanding debt
- Smooth the maturity structure, with particular attention to the short-term debt
- Gradual replacement of floating rate bonds by fixed rate or inflation-linked instruments
- Improvement in the external Federal Public Debt (EFPD) profile through issuances of benchmark maturities, buybacks and structured operations
- Development of the yield curve on both domestic and external markets and growth in the liquidity of federal government securities on the secondary market
- Broadening of the investor base.

Various alternative macroeconomic scenarios are considered during the annual planning elaboration. These scenarios are constructed on the basis of a set of relevant macroeconomic variables (short-term interest rate, exchange rate and inflation, mainly) and the hypothesis of preserving the main pillars of the economic policy adopted as of 1999 (inflation targeting system, floating exchange rate and robust primary surpluses).

Based on the estimate of Federal Government borrowing requirements for the year, the ABP guidelines, the various macroeconomic scenarios and different bond issuance strategies, the National Treasury calculates the values expected for the major Federal Public Debt - FPD indicators: amount outstanding, composition broken down by indexing factor, average maturity and percentage maturing in 12 months. At that point, the ABP presents the indicative upper and lower limits expected for each one of these indicators at the end of the year, as shown in Table 1.

⁴Although the current framework of FPD management calls for definition of the benchmark and design of a medium-term plan, its initial stages focus exclusively on the design of the short-term strategies that were set out in the annual borrowing plans

Table 1. Federal Public Debt Targets in 2011

Indicators	2010	Limits for 2011	
		Minimum	Maximum
Stock of FPD (R\$ billion)			
	1,694.0	1,800.0	1,930.0
Profile (%)			
Fixed rate	36.6	36.0	40.0
Inflation-linked	26.6	26.0	29.0
Floating Rate	31.6	28.0	33.0
Exchange rate	5.1	4.0	6.0
Maturity Structure			
Average maturity (years)	3.5	3.5	3.7
% Maturing in 12 Months	23.9	21.0	25.0

Note: In the 2011 ABP, the National Treasury gathered under “Floating Rate” all bonds tied to interest rates subject to periodical resetting (e.g. Selic, TR and TJLP).

Source: National Treasury

Execution of the annual FPD planning demands rigid coordination between actions derived from planning and monitoring of results during the implementation stage. To avoid inconsistencies in ABP execution - and propose corrective measures, should that become necessary - the Debt Management Committee meets at the end of each month. During these meetings, questions related to the macroeconomic scenario are discussed, borrowing requirements and financial market conditions are evaluated, bond issuance strategy for the coming month is proposed and approved and its impacts in relation to the limits proposed in the ABP for the end of the year are assessed. The strategy includes such characteristics as the time to maturity and type of index (fixed-rate, floating rate, exchange variation or price index) of the financial instruments to be issued. This process also results in a definition of the public bond issuance schedule, specifying dates and types of auctions, coupled with the characteristics of the bonds to be issued.

4. Federal Public Debt Optimal Composition Model⁵

Definition of a financing strategy involves choices regarding the balancing of expected costs and risks that can be generated by a specific public debt structure. In this sense, based on social preferences between costs and risks, the debt manager must define the desired profile for long-term liabilities or, in other words, the benchmark, in such a way that financing of these liabilities can be done in the least burdensome manner possible without, however, resulting in increased risk exposure.

⁵ See Unit II of this document for a detailed description of the model.

Brazil is not alone in the pursuit of a long-term public debt benchmark portfolio. Various countries, including Portugal, Sweden, Ireland, Denmark and South Africa, have used similar theoretical frameworks. Parallel to this, international organizations such as the World Bank and International Monetary Fund recommend that sovereign debt managers adopt benchmark models as a risk management and strategic planning tool.

In recent years, the National Treasury has developed a model to aid in evaluation of the cost and risk that different debt structures may generate for FPD, focusing specifically on the choice of its benchmark. The analytical framework of the model, which will be discussed in Unit II, is founded upon a set of simulations that make it possible to evaluate the behavior of alternative FPD portfolios in light of varied scenarios for the evolution of the variables that define the financing costs of the debt.

Based on these simulations, cost and risk indicators are derived for each portfolio evaluated. The lowest cost portfolio for a specific risk level is considered efficient. As the final product of the model, the bringing together of all of the portfolios that satisfied this condition for the different risk levels is denominated the efficient frontier, which expresses the trade-off in terms of costs and risks with which the debt manager has to cope. In the stochastic frontier, each portfolio is different in terms of composition, average maturity and percentage maturing in 12 months. The final results are the subject of debate among debt managers, giving due consideration to the feasibility of attaining the possible benchmark portfolios.

Finally, in choosing the benchmark, the public debt manager presents the results of the efficient frontier to the fiscal policy manager, who may be the Minister of Finance, Treasury Secretary or some type of Executive Committee. As the representative of society, the fiscal policy manager will be charged with choosing an acceptable risk level and, consequently, the borrowing cost desired by the government. In this process of choosing the benchmark, it is important to highlight that questions related to sustainability of the debt must also be given consideration. In this way, optimal compositions that have the potential for making the debt unsustainable, as a result of the projected financing cost or assumption of excessive risk, must be eliminated.

For a diversity of reasons, convergence of the current public debt composition to its benchmark may vary over time. Such factors as an adverse macroeconomic environment or the absence of a developed local debt market - which could result in shortfalls in demand for some preferred debt instruments - may reduce the speed of the convergence process. Under such circumstances, more robust theoretical analysis, simulations of the dynamics of the debt in alternative scenarios and deepening of debates on the definition of long-term objectives may be as or even more important to debt management than concentrating efforts on the identification of possible optimal compositions.

The initial proposal of the Brazilian optimal composition model was published in the 2007 ABP. Simulations of this model indicated that efficient FPD management would be that which resulted in greater participation of fixed-rate bonds⁶ and inflation-linked bonds, in detriment to floating rate or exchange-

⁶ Among the advantages of fixed-rate bonds, mention should be made of the following: (i) they ensure greater predictability regarding debt costs; and (ii) they contribute to development of the country's fixed income market.

rate-indexed bonds⁷. Following the guidelines above, the recent evolution of the FPD profile has resulted in greater equilibrium between FPD costs and risks.

Annually, as shown in Table 2, discussions have moved forward to refining of the long-term FPD quantitative guidelines, including definition of indicative limits to be sought in the period. Although these limits provide guidance for defining strategies, it is important to emphasize that they also reflect possible constraints related to the Brazilian macroeconomic scenario and the development stage of local financial markets. The speed of convergence from the current FPD composition to that indicated in Table 3 will depend on surmounting some of these constraints.

Table 2. Indicative Intervals of the Desired FPD Composition over the Long-Term

	Lower limit	Upper limit
Fixed rate	40%	50%
Inflation-linked	30%	35%
Floating rate	10%	20%
Exchange rate	5%	10%

Source: National Treasury

5. Elaboration of Medium-Term Transition Strategy

Aside from informing society with regard to the short-term (one year) strategy and optimal long-term composition (benchmark) through publication of the ABP, strategic FPD planning annually defines a transition strategy from the current public debt composition to the long-term benchmark. The transition strategy seeks to respond to the following question: duly respecting initial conditions (the current debt profile) and short and medium-term restrictions (particularly, macroeconomic restrictions and development of local financial markets), what should be the convergence trajectory and speed toward the desired long-term composition?

Development of the transition strategy demands elaboration and discussion of qualitative and quantitative macroeconomic scenarios for the variables (mainly, the Selic rate, exchange rate, inflation and GDP) that impact FPD costs and risks. In each of the proposed scenarios, different strategies are evaluated in light of

⁷ As regards the debt tied to exchange rate (currently restricted to the external debt), simulations demonstrate that, though this debt tends to have lower average costs, its risk level is extremely high, particularly in stress scenarios. Despite this and in light of the protection provided by international reserves in the case of exchange rate fluctuations, taking some degree of exchange rate risk in the FPD can be considered interesting from the point of view of the Net Public Sector Debt (NPSD). At the same time, sovereign bonds are important to the development of the Brazilian yield curve on the international market, and serve as a reference for the private sector in Brazil.

the speed of convergence to the long-term benchmark. In practical terms and respecting the borrowing conditions set down for each scenario during the transition period, the speed of convergence toward the benchmark is the main difference among the alternative strategies.

The choice of transition strategies for the long-term also takes advantage of the trade-offs between public debt costs and risks. The results for the cost, risk, maturity profile and debt composition indicators are simulated for each strategy. For example, a public debt manager could choose to limit issuances essentially to fixed-rate debt, while another may attribute greater importance to issuance of inflation-linked bonds. Alternative choices such as these aid data managers in the decision-making process, since they show the consequences of their choices for the major debt indicators.

In conclusion, elaboration of the transition strategy involves integration of the processes of benchmark simulation and definition of the convergence strategy. While the benchmark model is based on the assumption that the economy is in a steady-state⁸, the transition strategy is defined on the basis of possible scenarios for the coming years. For this reason, discussions on macroeconomic scenarios and evolution of public debt markets are vital to determining how the economy will converge to its stationary state and, therefore, how public debt management must be implemented in order to attain the benchmark⁹.

6. Risk Evaluation: Brazilian Experience

Evaluation of risk exposure is an important element of the planning process and one of the foundations for defining FPD strategic guidelines¹⁰. Integration of risk management tools into FPD risk evaluation instruments must be viewed together with the economic evolution of the country, which has favored development of the public debt markets, thus expanding the array of financing alternatives. Economic stability and market improvements were conditions of essential importance to the evolution of public debt planning and analysis instruments.

⁸ In the public debt benchmark model, the steady state has two meanings. In the first place, it means that all of the economic variables are fluctuating around their long-term equilibrium values. In practical terms, the stationary state scenario encompasses the following characteristics: stability of the economic environment, reduced fiscal vulnerability, lower interest rates, controlled inflation and sustainable economic expansion. The second meaning found in the idea of a steady state is that each debt composition is associated to an issuance strategy that maintains constant the long-term FPD portfolio characteristics.

⁹ The alternatives for the transition strategy are simulated in a deterministic context. It is possible to design dynamic stochastic simulation systems with the aim of also optimizing the transition strategy. This approach is expected to be the next step in application of optimization models. However, since it is still incipient and highly complex, we have been unable to find any sovereign debt manager who has successfully used it.

¹⁰ More detailed information can be encountered in ALVES & SILVA (2009) and SILVA, CABRAL & BAGHDASSARIAN (2009).

The major risks involved in FPD management are refinancing and market risks, though due attention should also be given to strategic, operational and legal risks. A more detailed description of these types of risk is found in the following chart.

Major Risks Monitored in FPD Management

Refinancing Risk

- **Refinancing risk** is based on the possibility of having to cope with higher costs in order to obtain short-term financing or, in an extreme situation, of being unable to refinance the debt maturing over the short-term. This risk is related to the debt maturity profile, as well as to its short-term sensitivity to shocks in the major variables..

Market Risk

- **Market risk (or financial risk)** is derived from variations in the financing costs resulting from movements in the short-term interest rates, the yield curve, the exchange or inflation. In other words, this risk is related to fluctuations in the debt stock on the market.

Strategic Risk

- **Strategic risk** results from the possibility of a strategy not achieving its objectives. For the national Treasury, this risk is present, for example, in the possibility of not achieving the limits set down in the ABP for FPD composition by indexing factor, due to the choice of an inadequate strategy.

Operational Risk

- The Concept of **Operational Risk** is quite broad and encompasses the possibility of failures caused by persons, internal processes or systems or, furthermore, external events that generate losses for institutions. In the case of the National Treasury, this risk may be perceived by the external public, mainly through government bond auctions. For example, an interruption in electricity transmission could make it unfeasible to sell bonds at the programmed moment of the auction.

Legal Risk

- **Legal Risk** results from the possibility of not respecting the limits for debt indicators as expressed in legislation (annual volume of issuances, for example).

In Brazil, the development of the public debt optimal composition model was a natural consequence of a long process of improvement in the institutional framework it utilized to evaluate FPD costs and risks. Initially, the government's asset and liability management model was implemented. Following that, the risk management instruments used by the National Treasury were adopted in FPD management. At that point, studies were initiated on use of the optimal composition model for the public debt.

To facilitate understanding of this evolution over time, one can divide it into three different stages. In the first stage, the National Treasury adopted guidelines for FPD management using the Asset and Liability Management - ALM model as the basic reference. The objective of this model is to combine the characteristics of government assets and liabilities in such a way as to protect the net debt against market risks and thereby smooth out oscillations in the government asset balance. With this in mind, ALM considers the public debt management strategy and other macroeconomic policies. The 2002 ABP¹¹ was the first report to mention the ALM model.

The result of the implementation of the ALM model by the National Treasury was the elaboration of periodical monitoring reports on the assets and liabilities for which the Central Government was responsible. These reports made it possible to develop more effective financing strategies in terms of the balance between these assets and liabilities. The reports in question identified the mismatches between assets and liabilities in terms of indexing factors, average maturities, cash flows and the percentage of debt in the following 12 months, and included simulations of the future evolution of these mismatches.

The objective of the ALM model is to create a portfolio of liabilities with risk characteristics similar to those of the government's assets and, in this way, reduce the sensitivity of the public sector asset balance to shocks in economic and financial variables. Considering the particularities of the public sector, it is important to adequately map the assets to be included in the balance used for ALM purposes. The fact that the government does not seek to maximize profits and is able to charge taxes results in a situation in which the ALM structure differs from the public to the private sector.

Normally, one starts with an accounting balance, which is adapted to the "economic balance", which includes only those items that represent potential financial liabilities and those that will contribute to paying them. In other words, one should consider only assets/liabilities that interfere in sovereign risk. This rule may result in exclusion of assets that did not generate financial flows for debt management purposes and inclusion of contingent liabilities in the government balance. On the other hand, illiquid assets such as national parks, military equipment, government buildings are included in the accounting balance, but may be considered irrelevant to analysis in the framework of the government's ALM. However, should these items be incorporated into a privatization program, they would be included in the asset map.

Finally, one should stress that the major asset of a government is its capacity to collect taxes. In contrast to this, there are certain expenditures that are typically the responsibility of the public sector. From the ALM point of view, the debt manager must be capable of perceiving the characteristics of revenues or of

¹¹http://www.tesouro.gov.br/english/public_debt/downloads/paf2002eng.pdf.

future primary surpluses and, whenever possible, estimate them with the objective of "matching" the balance sheet. Over the long-term, the current value of the debt must be financed by the present value of the sum total of future primary surplus flows.

In the second stage of the process of improving the FPD risk management mechanisms, approaches were aggregated seeking to measure the impact of adverse shocks in debt indexing factors on FPD. This was the case of the stress test, which simulates the negative impact on the outstanding volume (or cost) of FPD as a result of strong and persistent pressure on the real interest rate or on the exchange rate. Another example was the initial use of stochastic indicators¹², such as Cash-flow-at-risk (Cfar)¹³ and Cost-at-risk (CaR)¹⁴. These indicators are obtained on the basis of simulations utilizing the Monte Carlo method for key variables (interest, exchange and inflation rates, in the Brazilian case), calibrated by historical data or deterministic parameters. As a result of these simulations, probability distributions of cash flow (CfaR) or outstanding debt (CaR) are obtained. This class of indicators made it possible to estimate losses expected in the debt as a result of negative events and were initially presented in the 2004 ABP¹⁵.

Table 3 below presents a brief description of the major indicators used to monitor FPD risks in Brazil.

¹² Risk indicators based on stochastic simulations that have the advantage of indicating a probability distribution of the value of payment flows or the value of outstanding debt. This type of risk measurement makes it possible to estimate losses for the public debt consequent upon negative events that may occur in the economy, aside from quantifying the probability of such events.

¹³ Cash-flow-at-risk indicates the maximum increase that may occur in FPD payments flows for a given period, in relation to the expected value of such payments, with a given probability (e.g. 95% confidence level).

¹⁴ In Brazil, Cost-at-risk is used to measure uncertainty in relation to the volume of debt at the end of a period. It indicates the maximum value that the debt can reach, for a given probability. Differently from the case of Denmark, in which the measurement is defined in terms of debt costs, the Brazilian CaR is determined on the basis of outstanding debt. However, the two approaches are equivalent, since, the greater the cost, the greater will be the outstanding debt for a given government primary result.

¹⁵ http://www.tesouro.gov.br/english/public_debt/downloads/PAF_2004_ingles.pdf.

Table 3. Major public debt risk indicators used in Brazil

Type of Risk	Indicator	Description	Comments
Refinancing risk	Percentage of FPD maturing in 12 months	Indicates the short-term concentration of debt maturities.	A complete description of the debt maturity profile can be drawn up on the basis of an analysis of the entire FPD maturity structure (that is, also evaluating the percentage of debt maturing over the medium and long-term)
	Average FPD maturity	Indicates the average period of time in which the debt should be paid or refinanced.	In Brazil, the present value of debt flows (principal and interest) is used as the weighting factor of the terms of each flow (concept of duration) in calculating the average FPD maturity.
	Cash-Flow-at-Risk (CfaR)	Indicates the maximum increase that may occur in FPD payment flows projected for a given period, considering a given confidence interval (e.g. 95% probability)	CfaR and CaR (see below) are risk indicators based on stochastic simulations, with the advantage of indicating a distribution of probabilities of the value of payment flows or of the value of the outstanding debt. This type of risk measurement makes it possible to estimate public debt losses consequent upon negative events that occur in the economy, as well as to quantify the probability of such events.
Market Risk	FPD Composition	Indicates the percentage of the outstanding debt by type of index	The types of index that categorize outstanding FPD in this indicator are defined according to classes of risk which, in turn, depend on debt indexing factors. In the case of FPD, there are 4 classes: Fixed Rate, Floating rate, Inflation-Linked (Price Indices), Exchange-rate
	Refixing Risk (or interest rate risk)	Indicates the share of FPD subject to cost increases caused by short-term interest rate fluctuations.	Corresponds to the debt exposed to interest rate fluctuations, caused by the fact that the debt must be refinanced (at new rates) or because earnings on the debt are generated by floating rate (e.g. Selic rate). Thus, the indicator is given by the sum total of percentages of FPD maturing over 12 months and the percentage with floating rate maturing after 12 months.
	FPD Sensitivity Analysis	Indicates the increase in the outstanding debt (cost) as a result of a 1% variation in a specified indexing factor (short-term interest rate or exchange rate).	This analysis seeks to respond to the following question: "What happens if a specific shock occurs?". Alternatively, this indicator may be calculated by assuming a variation equivalent to one standard deviation in the benchmark indexing factor.
	Stress Test	Measures the negative impact on outstanding FPD (or on its cost) due to strong and persistent pressure on real interest rate or real exchange rate.	This is equivalent to the sensitivity analysis. However, in this case, one applies a shock equivalent to 3 standard deviations of the real interest rate or real exchange devaluation accumulated over 12 months to outstanding FPD.
	Cost-at-Risk (CaR)	Indicates the maximum value that outstanding FPD may reach at the end of a specified period of time (e.g. 1 year) for a given confidence interval (e.g. 95% probability).	In Brazil, cost-at-risk is used to measure uncertainty with respect to the volume of debt at the end of the period. Despite being defined in terms of outstanding volume, instead of cost (interest), these two approaches are directly related, since, the greater the cost, the greater will be the debt stock for a given primary government result.

Source: National Treasury

Having defined risk management instruments, the final stage of institutional development resulted in efforts to elaborate a model that would further refine general FPD guidelines quantitatively. In other words, definition of an optimal long-term composition model for FPD was sought, with the purpose of minimizing impacts of public debt shocks on the fiscal result. The initial proposal of the model was published in the 2007 Annual Borrowing Plan¹⁶ and later in CABRAL et. alli. (2008). A more detailed description of the analytical framework used by the National Treasury to aid in defining the FPD benchmark will be discussed in Unit II of this document.

In conclusion, though utilization of sophisticated financial instruments in FPD management has transformed the National Treasury of Brazil into a reference for like institutions in the world, there is still room for improvement in the model. By way of example, one could include utilization of macrostructural models for generation of scenarios, in which macroeconomic and financial models are conjugated in the generation of stochastic scenarios, and use of different approaches to modeling of the yield curves¹⁷, inflation and exchange rates.

¹⁶ http://www.tesouro.gov.br/english/hp/downloads/annual_borrowing_plan2007.pdf.

¹⁷ Currently, a COX, INGERSOLL & ROSS (1985) - based model is utilized, known as CIR models, with just one factor (interest rate level) to explain the forward interest rate structure (ETTJ). In the future, one expects to work with models that include the dynamics of more yield curve factors (for example, level and inclination), whether they be derived from the CIR family or based on other specifications such as those derived from NELSON & SIEGEL (1987).

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