ESCUELA DE NEGOCIOS
Universidad Torcuato Di Tella

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Centro de Investigación en Finanzas

Documento de Trabajo 12/2002

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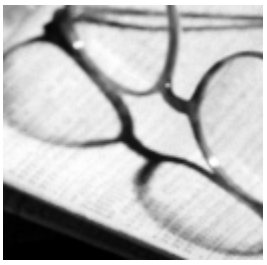
Federico Sturzenegger
Universidad Torcuato Di Tella



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Toolkit for an Analysis of Debt Problems[1]

Federico Sturzenegger
Business School, Universidad Torcuato Di Tella

November 2002

[1] I want to thank Miguel Broda, Craig Burnside, Daniel Heyman, Brian Pinto, Alfonso Prat-Gay and seminar participants at BCRA, CARI and Universidad Di Tella for useful comments. I also want to thank Rodolfo Campos, Pablo Datria, Luciana Monteverde, Josefina Rouillet, Iliana Reggio and, particularly, Luciana Esquerro for valuable research assistance. The usual caveat applies. This paper has been prepared for the World Bank.

The decision to default is usually reached after a painful process in which the country (or the country's authorities) agonize over the decision. Fears of being ostracized from the international financial community, of being subject to trade sanctions, or to be repudiated economically and politically contribute to the perception of the costliness of default. Historical experience reinforces this view in light of the protracted negotiations that followed each default episode, at least prior to the 1990s.

Case studies of recent default experiences show an impressive common pattern.[2] In most cases, an extremely fragile political system, using a fixed exchange rate to gain credibility and stability, runs unsustainable fiscal policies. Eventually the exchange rate regime instability becomes banking sector uncertainty due to two factors. First, the fear of devaluation combined with balance sheet risk puts at risk the solvency of the balance sheets of the banks. Second, fears of default affect directly the asset side of banks balance sheets.[3] Eventually, the capital outflows resulting from the fears of a banking collapse trigger the collapse of the currency, forcing a bailout of the financial sector, which makes the government bankrupt. The output collapse as a result of the financial sector crisis also contributes to the payment difficulties. In some cases this vicious circle is fed by negative sentiment and negative market expectations that make the adjustment even more difficult and costly. Thus, while the specifics may differ in each case defaults are, in general, the result of a combination of serious mismanagement of local policies, fiscal imbalances, overvalued exchange rates and financial crises.

In some cases the process leading to default may be self justifying. If market participants become skeptical about a country paying its debt (due to sustainability fears or just the perception that the country is unwilling to pay), this will immediately trigger a liquidity crunch. In the extreme, the country is unable to roll over the debt and is forced into default.

The idea of this chapter is to provide a number of tools that may allow an independent observer to assess the likelihood of default, to provide the clues for an evaluation of likely restructuring scenarios and to be able to estimate possible financial and real implications of such an event. We divide our *Toolkit* into seven exercises. In all cases our idea is to provide the needed elements so that the researcher applies directly the *Toolkit* to the country of analysis. Our exercises involve:

1. Establishing a set of warning signals.
2. Discussing static solvency analysis.
3. Estimating the probability of default of sovereign bonds.
4. Understanding the basics of debt sustainability analysis.
5. Estimating possible debt restructuring scenarios.
6. Assessing the financial costs of default.
7. Evaluating the output effects of default.

[2] See Sturzenegger (2002).

[3] Powell and Sturzenegger (2002) have shown that balance sheet effects transform currency risk into country risk in dollarized economies, thus providing evidence on the relevance of the balance sheet effect.

We discuss each of these in turn.

Tool # 1. Establishing a Set of Warning Signals

Objective: To identify macroeconomic indicators that may signal the risk of debt problems.

How to define the macroeconomic scenario that triggers a debt problem is one of the most important tasks of an analyst trying to anticipate possible restructuring events. As we mentioned above there is a striking common pattern in debt problems during the 90s: a weak fiscal situation combined with current account problems lead to fears of devaluation and default, triggering a bank run which plunges the economy into recession aggravating the fiscal scenario. Eventually, the collapse of the economy and the need for fiscal resources to keep the financial sector afloat lead to the default decision.[4] Thus an effective early warning system will probably have to start by looking carefully at the external situation of the country (also assessing its vulnerability to external shocks), at the fiscal situation and at the soundness of the banking sector.

While there are relatively standard techniques to study current account sustainability, fiscal soundness, or banking sector problems in isolation, we will focus here on how to bring together information from these and other dimensions for a systematic assessment of debt problems.[5]

Consider a sovereign bond that matures in one period. No arbitrage opportunities between assets imply that, in a risk neutral world, the default inclusive rate of return on the sovereign bond should equal to the rate of return from risk free asset, i.e.

$$(1+i)\times(1-IPD)+R\times IPD=(1+r), \qquad (1)$$

where *IPD* refers to the implicit probability of default, *i* denotes the yield on the sovereign bonds, *r* is the yield on US treasury bills with identical maturity date and size as that of the sovereign bond, and *R* indicates historical recovery values of bonds in the event of default.

This equation indicates that the return (*i*) if there is no default (which happens with probability *1-IPD*) plus the recovery value (*R*) in the event of default (which happens with probability *IPD*), have to equal in expected value the risk free rate *r*.

Equation (1) can be simplified to yield:

$$IPD=\left[\frac{S(1+r)}{S(1+r)+(1+r-R)}\right], \qquad (2)$$

[4] There is an ample literature that relates banking crises with currency crises. See Kaminsky and Reinhart (1999) and Glick and Hutchison (1999).

[5] On current account sustainability see Deutsche Bank (2000) and Edwards (2001). On banking soundness see Caprio, Honohan and Vittas (2002). We develop an analysis of fiscal solvency in Tool #4.

Where the spread is defined as $S = \left[\frac{1+i}{1+r}\right] - 1 = \frac{i-r}{1+r}$. (3)

Note that the spreads as defined here are the geometric spreads, i.e. the ratio of the rates of return on two assets. This definition of S is preferred to the usual approximation $i - r$, so that our probability of default is appropriately bounded between 0 and 1.[6]

In short, equation (2) indicates that the higher the spread, *given an expected recovery value,* the higher the probability of default. Thus, under the assumption of relatively stable or exogenous recovery values, the determinants of spreads are good indicators of the probability of default, and, therefore, of impending payment problems.

Rather than building a model for spreads from zero we use, as benchmark, a market based model of spreads. In particular we use Goldman Sachs' Equilibrium Sovereign Spread model (GS-ESS), presented in Ades *et al* (2000). The model estimates the sovereign spread a country should have, on the basis of some selected fundamentals. The model considers fundamentals related to the country's solvency position, liquidity in the markets and debt-service track record. Additionally to using the model to compute the spread that can be justified by the country's fundamentals, the analyst can use it to analyze how spreads would react to changes in each fundamental. The higher the equilibrium spread the weaker the fundamentals of the country. Tool # 3 teaches us how to transform that theoretical spread into a default probability.

In order to estimate the model Ades *et al* (2000) run a regression using data for 15 emerging market economies from 1996 onwards. The sample includes countries from Latin America, Asia, Emerging Europe, the Middle East and Africa. For each country, they selected one benchmark bond, typically between 10 and 20 years maturity. The sample is restricted to those countries that issue long-term bonds. The model explains the stripped static spread of that bond as a function of:

Solvency variables:

- *Variable # 1.* **Long-run Real GDP Growth** (GROWTH): refers to monthly estimates of real GDP year-on-year growth, interpolated from quarterly (where available) or annual figures. However, rather than using the actual growth figures they use the permanent or trend growth to smooth the short run volatility this variable usually exhibits in developing countries. The purpose of introducing this variable is clear: The higher the growth rate the lesser the potential debt problem as the economy will become richer and the relative debt burden smaller.
- *Variable # 2.* **Total External Debt as a Ratio of GDP** (TXDY). This variable measures directly the debt burden. By considering the external debt, it is closely related to the "external transfer" issue by which higher external debt implies more strain on the current account and therefore a higher probability of debt problems.

[6] The approximation *i-r* may lead to substantial mispricing if *r* is large.

External debt in this specification is measured as foreign currency denominated debt.[7]

- *Variable # 3.* **Nominal Budget Balance as a Ratio of GDP** (NBB). Obviously, the weaker public finances, the more likely debt problems. If the government runs an overall deficit it means that the primary surplus is unable to pay for interest, and therefore that the country is issuing yet more debt. On the other hand, a surplus indicates that the government is purchasing back debt and shows the political feasibility of reducing the debt numbers thus substantially improving the chances of not having debt problems.
- *Variable # 4.* **Ratio of Exports of Goods and Non-Factor Services to GDP** (XGD). This variable indicates how likely the country is to obtain the foreign resources to finance its external debt. A higher ratio of exports and non-factor services to GDP diminishes the risks associated to debt.
- *Variable # 5.* **Real Exchange Rate Misalignment** (MISAL). It is a measure of the country's currency overvaluation (in percentage points). The more overvalued the currency the more likely current account problems, the lack of foreign resources to service the debt, or of a currency collapse that increases the debt burden precipitating the default. This variable is relatively difficult to measure, and a discussion of overvaluation is well beyond the scope of this exercise. In what follows the analyst can provide his own measure or just work with the model assuming this variable equals zero.

Liquidity variables

- *Variable # 6.* **Global Liquidity** (LIBOR). The analyst can use as proxy for global liquidity conditions the GDP-weighted average nominal interest rate in G-7 economies (this is what Goldman Sachs uses) or any international interest rate such as LIBOR. An increase in interest rates in developed economies implies that capital flows may be more likely to remain in or flow back to developed economies thus increasing the rollover risk in emerging economies.
- *Variable # 7.* **Total External Amortizations as a Ratio of Gross International Reserves** (TAMRES). This variable indicates the amount of debt maturing within one year, measured as a fraction of international reserves. It indicates the fraction of financing needs (over the upcoming year) that can be managed with the international reserves already in the hands of the government. The larger this number, the less exposed is that government to being forced into default due to lack of refinancing.

A track record variable:

- *Variable # 8.* **Default History** (DEFAULT): this variable takes the value of 1 if the bond in question corresponds to restructured debt and 0 otherwise. The idea is

[7] Interestingly Ades *et al* (2000) find that domestic debt is not a relevant variable to anticipate debt problems. Underlying this view, is the idea that domestic currency denominated debt can always be financed through money printing.

that if the government has a past history with defaults it is likely to default again. Markets tend to price this into the spreads.[8]

Table 1 replicates the results in Ades *et al* (2000), which indicate the impact on country spreads of a 1% increase in the explanatory variables. All the coefficients have the right sign and are highly significant in the econometric specification, thus providing a useful set of variables that can be used to identify if country fundamentals are deteriorating or not. The coefficients also provide an estimate of the impact of each fundamental on country risk.

Table 1

Variable	**Impact on Spreads from 1% increase** (in basis points)
Long-Run Real GDP Growth	-7
Total Amortizations / Reserves Ratio	2
Total External debt / GDP Ratio	7
Nominal Budget Balance	-34
Total NFGS Exports / GDP Ratio	-3
FX Real Misalignment	2
Long-Run LIBOR	45
Debt Restructure Dummy	165 (if restructured)

Source: Ades et al (2000)

How can our analyst use this model?

The model can be used in two ways. One such use is a simple partial-effect calculation by which the analyst can look at the changes in one specific variable to estimate the impact on equilibrium sovereign spreads. Whenever the effect is positive we say that fundamentals have deteriorated. If the effect is negative it means that the fundamentals have improved and debt problems are less likely. These simple partial effects can be read directly from Table 1.

Alternatively, the analyst can find data for each of these variables and then plug them in the following equation replacing each variable by its value for the country under study.

$$\hat{S} = -439.3 - 6.9 * GROWTH + 1.6 * TAMRES + 7.5 * TXDY - 34.2 * NBB - 2.6 * XGD$$
$$+ 2.1 * MISAL + 45.3 * LIBOR + 165.0 * DEFAULT$$

[8] Ades *et al* (2000) include both a default variable and a dummy for instruments arising from default restructurings, finding only the second dummy to come in significantly. This result, however, can be due to a special characteristic of Brady bonds: the fact that they mixed sovereign and US risk, thus making them relatively unattractive as a way of purchasing pure emerging market risk.

The result will deliver the equilibrium or theoretical spread which can be used in combination with Tool # 3, to assess the theoretical probability of default.

When carrying on this exercise it is essential that the data have the same units discussed in the variable description, as these were used to estimate the above model. In most cases the units of account do not pose a problem. However as the model has been estimated by interpolating quarterly or annual data to monthly figures, it is important that seasonality components (filtered out in the above procedure) be equally cleaned in the numbers used. In other words in estimating equilibrium sovereign spreads it is important to "remove" short run volatility from some explanatory variables such as GDP growth. An econometric procedure known as the Hodrick-Prescott (HP) filter should be used to effectively extract the permanent or trend component from the relevant variables. Standard deseasonalization can also be implemented.

Except for the misalignment variable that can be excluded if no data is available (setting its value equal to zero) all other variables must carry a number for the exercise to make sense.

An application to Brazil 2002

Let`s ilustrate the use of this tool by applying it to Brazil by comparing the situation in Brazil in August 2001 with that in August 2002.

First, we have to find data on the variables that are used to estimate the spreads. Most of the data is taken from IBGE (Brazilian Institute of Geography and Statistics). For Long-run Real GDP Growth (GROWTH), we used a quarterly GDP index (1990=100) on observed data at market prices, applied a Hodrick-Prescott filter to it and then calculated the long-run interannual growth rate from the filtered series for the second quarter of each year. We then calculated Total External Debt as a Ratio of GDP (TXDY) and the Ratio of Exports of Goods and Non-Factor Services to GDP (XGD) also using data from IBGE. We use Total External Debt stock for June 2001 and June 2002 as a percentage of annualized GDP as of June 2001 and June 2002. For the XGD variable we used the exports accumulated in the previous 12 months to August 2001 and August 2002 as a percentage of annualized GDP as of August 2001 and August 2002. For the Nominal Budget Balance as a Ratio of GDP (NBB) we used annual figures taken from Merrill Lynch (2002). We assume that Real Exchange Rate Misalignment (MISAL) is 0. For Global Liquidity (LIBOR) we use the 1 year LIBO rate. For Total External Amortizations as a Ratio of Gross International Reserves (TAMRES) we use data from the joint BIS-IMF-OECD-World Bank statistics on external debt (lines G+I, which include liabilities to banks due within a year and non-bank trade credits due within a year) as a percentage of total international reserves of the country. The Default History (DEFAULT) dummy takes the value 1 for Brazil because the country defaulted in the 80s.

Table 2

	Intercept	Long Run Real GDP Growth Rate **(GROWTH)**	Total External Debt as a Ratio of GDP **(TXDY)**	Nominal Budget Balance as a Ratio of GDP **(NBB)**	Ratio of Exports of Goods an Non-Factor Services to GDP **(XGD)**	Real Exchange Rate Misalignment **(MISAL)**	Global Liquidity **(LIBOR)**	Total External Amortizations as a Ratio of Gross International Reserves **(TAMRES)**	Default History **(DEFAULT)**	**Estimated spread**	**Actual spread**
Coeff.	**-439.3**	**-6.9**	**7.5**	**-34.2**	**-2.6**	**2.1**	**45.3**	**1.6**	**165.0**		
Aug-01		1.8	37.5	-5.2	10.8	0.0	3.6	95.6	1	**461**	**563**
Aug-02		1.7	44.2	-9.5	11.3	0.0	1.9	83.6	1	**563**	**1.905**
Change in spread		0.6	50.8	147.1	-1.3	0.0	-75.7	-19.4	0	**102**	**1.342**

The table indicates in the last row, by how much each variable contributes to the increase in country spreads. The main contributors to the deterioration of fundamentals are the deterioration of the budget situation and the increase in the debt ratio. Most other variables contributed to a decrease in spreads.

The last column, however indicates the limits of the model. While the direction of the change is properly captured by the identified variables, the increase in country spreads indicates that the risk associated to Brazilian debt holdings skyrocketed between August 2001 and August 2002. Among the considerations to be included in this analysis and *that are not captured* by the specification, were the regional crises (for example the Argentine default of December 2001), the upcoming Presidential elections where left wing candidate Lula was favored to win, among other factors. The analyst, thus, must complement the analysis suggested here, which at best can provide an indication of what is happening with fundamentals, with a much broader view of the political and economic scenario.

Tool # 2. Static Solvency Analysis

Objective: Provide of the bat indicators of debt problems.

Some indicators are usually used to provide a first and direct glance at a country's possible debt problems. These indicators are known as debt ratios and try to give an assessment of the burden imposed by the country's debt.

The two most important debt ratios are: (i) the debt to GDP (Debt/GDP) ratio that measures the size of the stock of debt relative to the economy and (ii) the interest payment due each year, also as a percentage of GDP (I/GDP). The Debt/GDP ratio measures how big the debt is and is the most general proxy for debt problems. The I/GDP ratio looks at the burden imposed on the country that specific year in terms of interest payments. These variables, however, are just indicative of debt problems. A country with a relatively small debt but facing large interest payments in the near future may default on its debt in spite of it being able to repay its obligations had the maturity of the debt been different. Conversely, countries with high debt to GDP ratios may have low interest burdens (its debt being mostly on concessional terms) and therefore not have a debt problem.[9]

The measurement of debt can be refined in several ways. Usually many analysts distinguish between external debt (that owed to non-residents) and domestic debt owed to residents. External debt ratios give a better assessment of the external resources the economy will have to generate in order to service its debt. Most of the time, external debt is measured by looking at dollar (or foreign currency) denominated debt, while domestic debt is measured by local currency denominated debt. Nowadays, this distinction does not make much sense anymore.[10] Many countries are not willing or cannot issue locally denominated debt; in those countries locals purchase and trade actively in foreign denominated debt and.

In many countries local residents hold considerable foreign assets. An important question is whether relevant debt stocks should be gross debt or net of foreign assets. Following Hausmann and Velasco (2002) we suggest disregarding foreign assets, as these assets result equally or even less available in times of crises. Thus, when liquidity or solvency problems arise, seldom can these resources be counted upon to provide a counterweight to the burden of debt. An exception may be the assets of local firms abroad or those held by the foreign headquarters of local firms, as in both cases the firm may be willing to commit those resources in order to avoid harming the credit rating of the global corporation.

An alternative distinction is between public and private debt. Total debt includes debt owed by the government (public debt) and by the private sector (private sector debt).[11] The

[9] When referring to public sector debt, debt numbers include "explicit" debt, i.e. that which is registered in the books of the public sector. However, many governments have hidden liabilities arising from social security dynamics or unfulfilled obligations. Most debt analyses omit these items. However a careful assessment should not avoid looking into the potential obligations of the government in search of "skeletons".

[10] Similarly, while less common, non-residents also hold locally denominated debt.

[11] Public sector debt may be classified by level of government, and so on.

interest to GDP ratio corresponding to public debt also determines the primary surplus the government has to attain in order to keep the total level of debt constant. While private debt should not be included in an assessment of sovereign defaults, many analysts include private debt burdens as part of the overall debt problem *of the government.* The reasoning behind this relies on the fact that a debt default may have consequences that go well beyond the interruption of debt payments and are usually associated to devaluations, capital controls and other disruptions in the normal operation of the economy. When this happens, many governments nationalize or take up part of the debt burden of the private sector. Anticipation of this requires adding the private sector debt burden in the assessment of debt problems.

The interest to debt ratio (I/Debt) measures the average cost of the debt. This number is obviously affected by the maturity and coupon structure of the debt, but provides a first approximation to the yearly cost of the debt. It should be distinguished from the marginal cost of debt, which is the cost of new indebtedness. As an economy approaches a debt default situation the marginal cost of debt skyrockets while average costs remain relatively stable.[12]

In order to measure potential liquidity problems it is common to use the financing requirement ratio. Financing requirements are usually measured in dollar terms rather than as a percentage of GDP. Financing requirements measure how much money the government, private sector or both will have to obtain in the market during a given period of time. Computing financing requirements implies knowing the amortization structure of the debt. A T-bill with a three month maturity of 3 billion will enter in the financing requirement numbers for the following year as 12 billion as it will have to be rolled over four times during that period. Financing requirements are a good indicator of potential liquidity problems. As long as the market rolls over automatically existing debt, amortizations are usually not considered an important part of the debt problem. However, once roll-over is under question, knowing how many resources the market will have to provide becomes essential.

In order to figure out the burden of the interest payments on the budget we use the ratio of interest to total revenue or taxes. If this ratio is very high it indicates that a large fraction of government's income is being used for servicing the debt. Such a situation is worrisome, at least in terms of assuring creditors that the country will be able to maintain the political support for servicing the debt.

There are many other debt indicators such as Debt/Exports, Interests/Exports, Amortizations/Reserves, among others. The analyst will have to identify which are the relevant indicators in his case of study. The Debt/Exports ratio, for example, is particularly relevant for a country that is relatively isolated from world capital markets and whose only source of foreign exchange are trade related activities. For countries better integrated the ratio becomes less significant. And so on…

[12] Mussa (2002) for example, in his description of the Argentine crisis confuses the two terms, thus making a negative assessment of the debt situation that was not warranted by the facts.

Table 3 illustrates the usefulness and the drawbacks of debt ratios for some arbitrarily selected emerging economies. The table includes two groups. The first includes the countries that defaulted on their debt during the 90s.[13] The second is a group of non defaulters.

Among the first group, Pakistan shows the largest debt burdens both in terms of debt to GDP ratios as well as in terms of the size of resources absorbed by interest payments. Ecuador shows a slightly smaller debt to GDP ratio, but its low average cost (as a result of recent debt restructurings and concessional lending), reduces substantially the size of interest payments. Yet, as a percentage of tax revenues the cost remains sizable. The other countries, with differences, show a much more manageable picture, both in terms of debt ratios, required primary surpluses and share of taxes used for interest payments.

Table 3

	Defaulters					Non-defaulters			
Year end before the crisis	Argentina (2000)	Ecuador (1998)	Pakistan (1998)	Russia (1997)	Ukraine (1999)	Colombia	Mexico	Venezuela	Poland
Interest/GDP	3.4	3.2	7.1	4.8	2.4	5.0	2.6	3.3	2.9
Interest/Taxes	26.1	44.9	52.2	48.4	7.4	25.3	25.7	18.7	11.0
Interest/Public Debt	7.5	4.0	7.5	9.0	3.8	9.8	9.4	9.3	7.4
Public Debt/GDP	44.9	80.0	94.3	52.5	62.8	50.8	27.7	35.3	39.1

Source: IMF, GS estimates

While these indicators allow us to identify most obviously problematic cases, it is clear from the table that it is difficult to assess a problem country from static indicators alone. For example, Table 4 shows no major difference in terms of debt burdens between the group of non-defaulting countries and the defaulters Argentina, Ukraine and Russia.

Table 4

	Argentina, Ukraine and Russia	Colombia, Venezuela, México and Poland	Developing Countries (2000)
Interest/GDP	3.5	3.5	2.0
Interest/Taxes	27.3	20.2	N/A
Interest/Public Debt	6.8	9.0	5.0
Public Debt/GDP	53.4	38.2	22.6

Source: IMF, GS estimates, Global Development Finance (WB).

Why do static debt indicators work so poorly? Debt problems, by definition have to do with an intertemporal problem. Debt burdens may be considered a problem or not depending on whether the analyst thinks that in the future the country will be able to honor its obligations or not. Thus, it is less important where the country stands today, relative to where analysts and market participants think the country will be in the future. How to take into account the

[13] To make the comparison meaningful for these countries we include the numbers prior to default.

future is the objective of Tool # 4. However, in spite of its limitations, the analysis of debt ratios remains one of the most important methods of analysis of debt problems.

Tool # 3. Estimating the Probability of Default with a Fixed Recovery Value

Objective: Estimate the probability of default implicit in sovereign bond prices.

In this tool we provide a simple way to estimate the implicit probability of default (IPD) of sovereign bonds using the yield on sovereign bonds (*i*), the yield on US treasury bills with identical maturity date and size as that of the sovereign bond (*r*) and an estimate for the recovery values of bonds (*R*).

Imagine a bond that matures in one period.[14] As we saw in Tool # 1 the no arbitrage condition implies that

$$(1+i)\times(1-IPD)+R\times IPD=(1+r). \qquad (4)$$

which can be simplified to yield:

$$IPD=\left[\frac{S(1+r)}{S(1+r)+(1+r-R)}\right], \qquad (5)$$

where the spread is defined as $S=\left[\frac{1+i}{1+r}\right]-1=\frac{i-r}{1+r}$.

Equation (5) can be readily used to estimate the probability of default as long as an estimate of *R* is available.

While the above assumes that the bond has a maturity of one period the above computation extends to the case of a bond with longer maturities as long as the probability of default is distributed uniformly over the life of the bond.[15]

To see this assume a multiperiod bond with a constant probability of default that we will model as a Poisson process with parameter λ. The probability of no default from time zero until time t is then $e^{-\lambda t}$. The annualized probability of default is $(1-e^{-\lambda})$ which is approximately λ when λ is not too large.

Under the assumption of recovery value *R* for one dollar of principal, the market price of a bond paying annual coupon *C* should be

[14] The formula provides the probability of default corresponding to the time frame specified in the interest rate return.
[15] This presentation follows closely the exercise done in JP Morgan (2000).

$$P = \sum_{i=1}^{n} C \frac{1}{(1+r)^i} e^{-il} + \frac{1}{(1+r)^n} e^{-nl} + R \sum_{i=1}^{n} \frac{1}{(1+r)^i} \left[e^{-(i-1)l} - e^{il} \right]$$

$$= \sum_{i=1}^{n} C \frac{1}{(1+r)^i} \frac{1}{(1+\Lambda)^i} + \frac{1}{(1+r)^n} \frac{1}{(1+\Lambda)^n} + R \sum_{i=1}^{n} \frac{1}{(1+r)^i} \frac{\Lambda}{(1+\Lambda)^i}$$

where $\Lambda = e^{l} - 1$.

So $\frac{1}{(1+\Lambda)^i}$ is the probability of no default and $\frac{\Lambda}{(1+\Lambda)^i}$ is the probability of default from period 0 to period *i*.

Consider a par floater paying an annual coupon of $1 + i = r + S + rS$.[16] Then the price of the par floater is

$$1 = \sum_{i=1}^{n} (r + S + rS) \frac{1}{(1+r)^i} \frac{1}{(1+\Lambda)^i} + \frac{1}{(1+r)^n} \frac{1}{(1+\Lambda)^n} + R \sum_{i=1}^{n} \frac{1}{(1+r)^i} \frac{\Lambda}{(1+\Lambda)^i}$$

$$1 = \underbrace{\sum_{i=1}^{n} (r + \Lambda + r\Lambda) \frac{1}{(1+r)^i} \frac{1}{(1+\Lambda)^i} + \frac{1}{(1+r)^n} \frac{1}{(1+\Lambda)^n}}_{\mathbf{=1}} + (S + rS - \Lambda + R\Lambda - r\Lambda) \sum_{i=1}^{n} \frac{1}{(1+r)^i} \frac{1}{(1+\Lambda)^i}$$

Upon cancellation of 1 on both sides, we obtain the coupon spread:

$$S(1+r) = \Lambda(1 - R + r)$$

$$\Lambda = \frac{S(1+r)}{(1-R+r)}$$

that gives, once again, an implicit probability of default

$$\text{IPD} = \frac{\Lambda}{1+\Lambda} = \left[\frac{S(1+r)}{S(1+r) + (1+r-R)} \right]. \qquad (6)$$

As can be readily seen from the equation an essential piece in the estimation is the recovery value *R*. Tool # 4 provides some insights as to how to compute the recovery values.

[16] Remember we defined S= $\left[\frac{1+i}{1+r} \right] - 1$, so $1 + i = (1+S)(1+r)$ and $i = r + S + rS$.

Using the table

The computation of equation (6) is presented in Table 5 (see also Tables 5.1 to 5.11 in the appendix for different interest rate assumptions) for different assumptions regarding recovery values and spreads, given a risk free interest rate. The analyst can use this table to assess quickly the probability of default in his/her country of analysis. For example, for a recovery value of 50% and a spread of 350bps., the table indicates the market is assigning a 6.2% probability of default over the upcoming year.[17]

Table 5

Implicit probability of default

	i	7%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.4%	1.9%	3.1%
	100	1.1%	1.2%	1.4%	1.6%	1.8%	2.2%	2.8%	3.8%	5.9%
	150	1.6%	1.8%	2.0%	2.3%	2.7%	3.3%	4.2%	5.6%	8.6%
	200	2.2%	2.4%	2.7%	3.1%	3.6%	4.4%	5.5%	7.3%	11.2%
	250	2.7%	3.0%	3.4%	3.8%	4.5%	5.4%	6.7%	9.0%	13.6%
	300	3.2%	3.6%	4.0%	4.6%	5.3%	6.4%	8.0%	10.6%	15.9%
	350	3.7%	4.1%	4.6%	5.3%	6.2%	7.4%	9.2%	12.2%	18.1%
	400	4.2%	4.7%	5.3%	6.0%	7.0%	8.3%	10.4%	13.7%	20.1%
	450	4.7%	5.2%	5.9%	6.7%	7.8%	9.3%	11.5%	15.1%	22.1%
	500	5.2%	5.8%	6.5%	7.4%	8.6%	10.2%	12.6%	16.5%	23.9%
	550	5.7%	6.3%	7.1%	8.1%	9.4%	11.1%	13.7%	17.9%	25.7%
	600	6.2%	6.9%	7.7%	8.7%	10.1%	12.0%	14.8%	19.2%	27.4%
	650	6.7%	7.4%	8.3%	9.4%	10.9%	12.9%	15.8%	20.5%	29.0%
	700	7.2%	7.9%	8.9%	10.1%	11.6%	13.7%	16.8%	21.7%	30.6%
	750	7.6%	8.4%	9.4%	10.7%	12.3%	14.6%	17.8%	22.9%	32.1%
	800	8.1%	9.0%	10.0%	11.3%	13.1%	15.4%	18.8%	24.1%	33.5%
	850	8.6%	9.5%	10.6%	12.0%	13.8%	16.2%	19.7%	25.2%	34.9%
	900	9.0%	10.0%	11.1%	12.6%	14.5%	17.0%	20.7%	26.3%	36.2%
	950	9.5%	10.5%	11.7%	13.2%	15.1%	17.8%	21.6%	27.4%	37.4%
	1000	9.9%	11.0%	12.2%	13.8%	15.8%	18.5%	22.4%	28.4%	38.6%
	1050	10.4%	11.4%	12.7%	14.4%	16.5%	19.3%	23.3%	29.4%	39.8%
	1100	10.8%	11.9%	13.3%	14.9%	17.1%	20.0%	24.1%	30.4%	40.9%
	1150	11.3%	12.4%	13.8%	15.5%	17.8%	20.7%	25.0%	31.3%	42.0%
	1200	11.7%	12.9%	14.3%	16.1%	18.4%	21.5%	25.8%	32.2%	43.0%
	1250	12.1%	13.3%	14.8%	16.6%	19.0%	22.2%	26.6%	33.1%	44.0%
	1300	12.5%	13.8%	15.3%	17.2%	19.6%	22.8%	27.3%	34.0%	45.0%
	1350	13.0%	14.2%	15.8%	17.7%	20.2%	23.5%	28.1%	34.9%	45.9%
	1400	13.4%	14.7%	16.3%	18.3%	20.8%	24.2%	28.8%	35.7%	46.8%
	1450	13.8%	15.1%	16.8%	18.8%	21.4%	24.8%	29.5%	36.5%	47.7%
	1500	14.2%	15.6%	17.2%	19.3%	22.0%	25.5%	30.3%	37.3%	48.6%
	1550	14.6%	16.0%	17.7%	19.8%	22.5%	26.1%	31.0%	38.1%	49.4%
	1600	15.0%	16.4%	18.2%	20.4%	23.1%	26.7%	31.6%	38.8%	50.2%
	1650	15.4%	16.9%	18.7%	20.9%	23.6%	27.3%	32.3%	39.5%	50.9%
	1700	15.8%	17.3%	19.1%	21.4%	24.2%	27.9%	33.0%	40.3%	51.7%
	1750	16.2%	17.7%	19.6%	21.8%	24.7%	28.5%	33.6%	41.0%	52.4%
	1800	16.6%	18.1%	20.0%	22.3%	25.3%	29.1%	34.2%	41.6%	53.1%
	1850	16.9%	18.5%	20.5%	22.8%	25.8%	29.6%	34.9%	42.3%	53.8%
	1900	17.3%	18.9%	20.9%	23.3%	26.3%	30.2%	35.5%	43.0%	54.5%
	1950	17.7%	19.3%	21.3%	23.7%	26.8%	30.7%	36.1%	43.6%	55.1%
	2000	18.1%	19.7%	21.7%	24.2%	27.3%	31.3%	36.6%	44.2%	55.7%
	2500	21.6%	23.5%	25.8%	28.5%	31.9%	36.3%	42.0%	49.8%	61.1%
	3000	24.9%	27.0%	29.4%	32.4%	36.0%	40.6%	46.5%	54.3%	65.4%
	3500	27.9%	30.1%	32.7%	35.9%	39.7%	44.3%	50.3%	58.1%	68.8%
	4000	30.6%	33.0%	35.7%	39.0%	42.9%	47.7%	53.6%	61.3%	71.6%
	4500	33.2%	35.6%	38.5%	41.8%	45.8%	50.6%	56.5%	64.1%	73.9%
	5000	35.5%	38.1%	41.0%	44.4%	48.4%	53.2%	59.1%	66.5%	75.9%
	5500	37.8%	40.3%	43.3%	46.8%	50.8%	55.6%	61.4%	68.5%	77.6%
	6000	39.8%	42.5%	45.5%	48.9%	53.0%	57.7%	63.4%	70.4%	79.1%

[17] The probability of default is estimated for the time period corresponding to the interest rates considered.

The probabilities of default increase as we move to the right in the table. Higher recovery values imply that a given spread can only be rationalized if there is a higher probability of default. Likewise, the higher the spreads, the higher the probability of default.

Using credit default swaps to estimate default probabilities[18]

Default probabilities can also be calculated from information implied in credit default swap spreads. To evaluate the risk premium (credit spread) of an instrument we have to compute the difference between the present value of the risky asset versus the risk-free investment of $1 for one period.

In the event of default, the buyer would deliver a bond and would get paid $100. In the event of no default, the buyer would get paid nothing. Thus, the net value of the default payment is the difference between the cheapest bond that the investor can buy in the market and the $100 payment.

Call *R* the bond price within 30 days of a default. The swap value in the event of default is 100 – *R* (assume par = 100). Let P_d be the probability of default. For the swap contract to have zero initial value (fairly priced), the expected gain from default must be equal to the premium paid.

Expected gain from default = PV.[P_d (100-R)]=PV.[Premium] (7)

Or, P_d = (Premium)/(100-R) (8)

for instant default protection. Let's look at an example. Since the credit default swaps are quoted on an annual basis, a spread of 3000 bps would cost $15 in 6 months. Assume the bond price in the aftermath of default is $20 per $100. The probability of default over the six-month time frame would be:

P_d = (Premium) /(100-R) = (15)/(100-20) ≈ 18.75%.

Table 6 shows the sensitivity to the price of the cheapest asset within 30 days of default using the Brazil CDS spreads mid-June.

Table 6. Sensitivity of Recovery Value

Recovery Values	Probability of Default
0.15	28.3%
0.20	30.0%
0.25	31.5%
0.30	33.3%

Source: Bloomberg

[18] This section follows closely Merril Lynch (2002).

While the CDS market may be useful to provide an alternative estimation of the default probability, one should be aware that, on occasions, the market becomes extremely thin. Once trading stops CDS may provide a distorted view of default probabilities.

Tool # 4. Debt Sustainability

Objective: To assess if the government will be able to honor its debt obligations and to assess potential restructuring scenarios.

Debt sustainability has become one of the most used and abused concepts in the recent discussion regarding international financial architecture. The truth of the matter is that nobody knows what it really means. Because debt sustainability has to do with the possibility of paying debts over the infinite future, it is obvious that reaching an agreement as to when this is possible and when it is not is a daunting task. This difficulty is compounded by the fact that governments will claim that they can make the payments, and that they can generate the needed primary surpluses even when history or common sense tends to suggest that such primary surpluses are not attainable. The issue is further complicated by the fact that what is attainable or not depends squarely on growth forecasts, and here governments, IFIs and the markets are certainly not bound to agree.

Thus, we accept this truth openly: debt sustainability is an ill-defined concept. In what follows we provide, nevertheless, the most standard approximation to the issue of debt sustainability. To do so we start from the intertemporal budget constraint of the government. We show that if the debt is to be paid, current debt levels have to equal the present discounted value of future fiscal primary surpluses. With this fact, we implement two exercises. One is to find out, under the assumption that the economy is in steady state, what this primary surplus should be. Second, we allow for a transition phase. In this case we ask, given a possible long term primary surplus, what the maximum level of deficit allowed in the short run is. We also discuss the implications of exchange rate depreciations on sustainability.

These exercises, of course, assume an extremely rigid setup that many would argue goes well beyond what is reasonable. However, unsatisfactory as it may seem, it is the best tool we have to discuss the issue of debt sustainability.

The arithmetic

The basic equation describing the dynamics of debt accumulation is

$$D_{t+1} - D_t = i_{t+1}D_t - PS_{t+1}, \qquad (9)$$

where PS_{t+1} is primary surplus of period $t+1$,
D_{t+1} is total end-of-period $t+1$ public debt stock (both domestic and external)
D_t is total beginning-of-period $t+1$ public debt stock (both domestic and external)
and i_{t+1} is period $t+1$interest rate.

If we write everything as a % of *GDP* we have:

$$\frac{D_{t+1}}{GDP_{t+1}} = (1+i)\frac{D_t}{GDP_t}\frac{GDP_1}{GDP_{t+1}} - \frac{PS_{t+1}}{GDP_{t+1}}. \qquad (10)$$

Thus, we obtain:

$$d_{t+1} = \frac{(1+i_{t+1})}{(1+g_{t+1})}d_t - ps_{t+1}, \qquad (11)$$

where g_{t+1} is the *GDP* growth rate from period *t* to period *t+1*.

This is a standard difference equation. Solving it forward and imposing the transversality condition that debt stock as a percentage of GDP in present value converges to zero we find the solution to be:

$$d_t = \left[\sum_{v=t}^{\infty} R_{s,v}\, ps_v\right], \qquad (12)$$

$$\text{where } R_{s,v} = \prod_{s=t}^{v}\frac{1+g_s}{1+i_s}, \qquad (13)$$

i.e. the debt stock has to equal the present value of future primary surpluses.

If we assume that the interest rate, the GDP growth rate and the primary surplus ratio are constant, then:

$$d_t = p\left[\sum_{v=t}^{\infty}\left(\frac{1+g}{1+i}\right)^{v-t-1}\right]. \qquad (14)$$

If we solve the above equation assuming that the primary surplus is always equal to $\overline{ps}$ to yield:

$$\text{Target } \overline{ps} = d_t\left[\frac{i-g}{1+g}\right], \qquad (15)$$

if $0 < \frac{1+g}{1+i} < 1$ which can also be derived directly from (11).

Our first pass at debt sustainability

Our first exercise uses equation (15) and asks what primary surplus the government needs in order to make the debt sustainable. The results are presented in Table 7. The table

assumes an annual interest rate of 7% but different GDP growth rates and initial debt stocks. The table should be read in the following way: Given the expected rate of growth and the debt to GDP ratio, the table indicates the permanent primary surplus needed for that debt to be sustainable. For example Argentina today has a debt to GDP ratio of 130%. If expected growth rate is 2%, it needs to obtain a 6.4% primary surplus to honor its debt. If expected growth rate is 5% the number falls to 2.5%. Obviously the higher the growth rate the smaller the required primary surplus, because the debt to GDP ratio becomes increasingly stable the faster GDP is growing.

Table 7

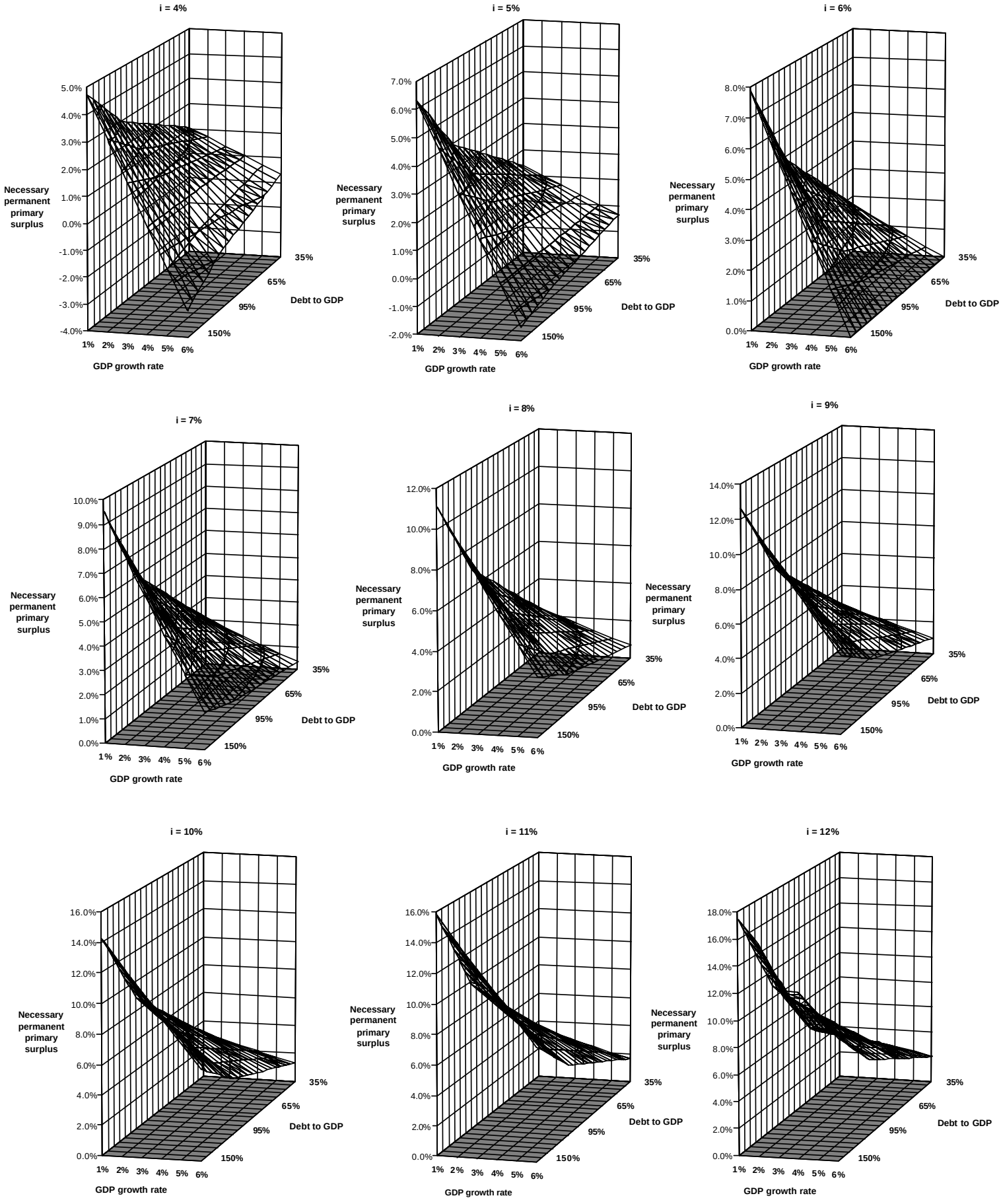
Necessary Permanent Primary Surplus

	i	**7.0%**					
		GDP growth rate					
		1.0%	**2.0%**	**3.0%**	**4.0%**	**5.0%**	**6.0%**
Public debt to GDP	**35%**	2.1%	1.7%	1.4%	1.0%	0.7%	0.3%
	40%	2.4%	2.0%	1.6%	1.2%	0.8%	0.4%
	45%	2.7%	2.2%	1.7%	1.3%	0.9%	0.4%
	50%	3.0%	2.5%	1.9%	1.4%	1.0%	0.5%
	55%	3.3%	2.7%	2.1%	1.6%	1.0%	0.5%
	60%	3.6%	2.9%	2.3%	1.7%	1.1%	0.6%
	65%	3.9%	3.2%	2.5%	1.9%	1.2%	0.6%
	70%	4.2%	3.4%	2.7%	2.0%	1.3%	0.7%
	75%	4.5%	3.7%	2.9%	2.2%	1.4%	0.7%
	80%	4.8%	3.9%	3.1%	2.3%	1.5%	0.8%
	85%	5.0%	4.2%	3.3%	2.5%	1.6%	0.8%
	90%	5.3%	4.4%	3.5%	2.6%	1.7%	0.8%
	95%	5.6%	4.7%	3.7%	2.7%	1.8%	0.9%
	100%	5.9%	4.9%	3.9%	2.9%	1.9%	0.9%
	110%	6.5%	5.4%	4.3%	3.2%	2.1%	1.0%
	120%	7.1%	5.9%	4.7%	3.5%	2.3%	1.1%
	130%	7.7%	6.4%	5.0%	3.8%	2.5%	1.2%
	140%	8.3%	6.9%	5.4%	4.0%	2.7%	1.3%
	150%	8.9%	7.4%	5.8%	4.3%	2.9%	1.4%
	160%	9.5%	7.8%	6.2%	4.6%	3.0%	1.5%

What primary surplus may be considered feasible or not feasible is debatable. In general, what is feasible usually is determined by a historical comparison that, to some extent, factors in political and economic constraints. For example, Argentina has had trouble delivering primary surpluses above 1% of GDP, given this, a primary surplus of 6.4% would be dubbed unsustainable.

Of course, the above exercise is strongly influenced by the cost of debt. Reducing the interest rate on the debt improves sustainability. However several comments are necessary. The interest rate that has to be used for this exercise is the average interest rate, and therefore quite isolated from sharp spikes in the marginal rates caused by liquidity crises. Tables 7.1 to 7.9 (in the appendix) and Figure 1 show how these results change once we move the rates from 4% to 12%.

Figure 1


i = 4%
i = 5%
i = 6%
i = 7%
i = 8%
i = 9%
i = 10%
i = 11%
i = 12%
Necessary permanent primary surplus
Debt to GDP
35%
65%
95%
150%
GDP growth rate
1%
2%
3%
4%
5%
6%

Does a devaluation affect debt ratios?[19]

Key to the analysis of debt sustainability is the denomination of debt in terms of tradables and non-tradables of the initial debt to GDP ratio (*d*). This ratio can be expressed as:

$$d = \frac{B + eB^*}{Y + eY^*} \qquad (16)$$

where *e* is the real exchange rate (defined as the price of tradables relative to non-tradables), *B* is debt payable in terms of non-tradables, *B** is debt payable in terms of tradables, *Y* is output of non-tradables, and *Y** is output of tradables.

Mismatches between debt and output composition can lead to substantial differences in valuation of the debt/GDP ratio following a real exchange rate depreciation. For example, consider the case in which all debt is foreign denominated $d = eB^*/Y$. This is the worst scenario in which a real exchange rate depreciation hits fully on sustainability. Another case that is particularly relevant is that in which *(B/eB*)/(Y/eY*)* = 1, i. e., when the composition of debt and output is perfectly matched. When this condition holds, a depreciation has no effect on debt ratios. Table 8, taken from Calvo et. Al (2002) shows how countries ranked in terms of mismatch at the time of the Russian crisis. A value of 1 indicates a perfect match, and value of zero would indicate the highest degree of mismatch. Clearly, the highest mismatch holds for Argentina. On the other side of the spectrum lies Chile, the best matched economy, with a value of 0.45.

Table 8. Public Sector Debt Mismatch Measure (Table 6 in Calvo et al, 2002)

	Argentina	Ecuador	Colombia	Brazil	Chile
*B/eB**	0.08	0.02	0.59	1.76	1.30
*Y/eY**	8.63	2.94	6.36	12.34	2.85
(B/eB)/(Y/eY*)*	0.01	0.01	0.09	0.14	0.45

Source: Calvo *et al*,2002, estimates. Note: Values are given for 1998.

Consider now the effects of a depreciation of the real exchange rate of 50 percent. Argentina and Ecuador, are the hardest hit. Just because of the relative price adjustment (holding the assumption that interest rates on public debt and GDP growth remain unchanged), Argentina's debt/GDP ratio jumps from 36.5 percent of GDP to 50.8. Quite a different scenario plays out for Chile, where the debt revaluation effect is minimal: public sector debt as a share of GDP increases from 17.3 percent to 18.7 percent. The increase in the required primary surplus is shown in Table 9, also taken from Calvo et al (2002).

[19] This section follows closely Calvo, Izquierdo and Talvi (2002).

Table 9. Fiscal Sustainability Under a 50% RER Depreciation

	ARG	BRA	CHL	COL	ECU
Real Interest Rate	7.1	5.8	5.9	7.3	6.3
Real GDP Growth	3.8	2.0	7.5	3.6	2.6
Observed Public Debt (% of GDP)	36.5	51.0	17.3	28.4	81.0
i. Req. Primary Surplus (% of GDP)	1.2	1.9	n.a.	1.0	2.9
With 50% depreciation					
Imputed Public Debt (% of GDP)	50.8	58.1	18.7	34.9	107.2
ii. Req. Primary Surplus	1.6	2.2	n.a.	1.2	3.9
NPV of ***ii – i*** (% of GDP)	14.3	7.1	n.a.	6.5	26.3

Source: Calvo *et al*, 2002, estimates. Note: Values are given for 1998. n.a.: Not applicable given that the real interest rate is smaller than the grwth of GDP, so sustainability is not a concern.

Sustainability in five real cases

As a real world example of the previous simulation consider the required primary surplus for five countries that defaulted during the 90s. The required primary surplus is computed under the assumption of an annual interest rate of 10% and a GDP growth 4% per year and compared with actual primary surpluses in the aftermath of default.

Noticeably, in spite of the devaluation that came with defaults increasing the burden on sustainability, with the exception of Pakistan, for which debt burdens were and remain unsustainable, all other countries have attained sustainability in the post default period. For all countries, fiscal adjustment accommodated the larger pressure.[20]

Table 10. Debt sustainability before and after default (all data as % of GDP)

	Country indicators before and after default									
	Argentina		Ecuador		Pakistan		Russia		Ukraine	
	Before (2000)	After (2002)	Before (1998)	After (2000)	Before (1998)	After (2000)	Before (1997)	After (2000)	Before (1999)	After (2000)
Government Debt	44.9	130.0	80.0	106.8	94.3	98.0	52.5	64.3	62.8	44.1
Primary Balance (Actual data)	0.4	?	2.9	7.6	-0.3	1.2	-2.0	5.0	0.9	2.5
Required Primary Balance for sustainability	**2.6**	**7.5**	**4.6**	**6.2**	**5.4**	**5.7**	**3.0**	**3.7**	**3.6**	**2.5**

Source: IMF and author's computations.

The striking adjustments in the primary surplus indicate another factor that has to be taken into account when considering the effect of a devaluation on debt sustainability: the strong increase in primary surpluses that follows a devaluation. The reason for this increase arises on the one hand from the fact that the revenue base of the government is at

[20] In the short run may very well represent an overshooting of its long run level

least partially dollarized. In fact the prices of the production of tradables (not exports) increase following the devaluation. On the other hand the main liability of government spending are wages and pensions that are quoted in domestic currency. Thus, as long as wages and pensions lag behind prices and the exchange rate, there is an automatic improvement in the primary surplus attained by the government. Thus what is relevant for determining if fiscal sustainability is compromised or not by a devaluation is to compare the effect of the devaluation on debt ratios on the one hand with the effect of devaluation on primary surpluses on the other. The elasticity of the primary surplus relative to devaluation will be higher, the higher the wage bill in government spending. The degree of pass through of the economy (which measures how much local wages will change upon a devaluation of the currency) is critical for evaluating the scope for a fiscal improving nominal devaluation. The recent experience of crisis countries, particularly in Latin America, as well as the result in Table 10, suggest that there is significant scope for this effect to be very significant.

Using the framework to estimate transitional feasible deficits.

If we assume in equation (11) that we arrive at the steady state primary surplus only after one period, then we can compute the primary surplus that can/should be obtained in the short run as:

$$ps_t = d_t \frac{(1+i)}{(1+g)} - \overline{ps}\frac{(1+g)}{(i-g)}. \qquad (17)$$

[21]Assuming different steady state primary surpluses, we can calculate what primary surpluses a country has to run today to make its debt sustainable. The results are presented in Table 11.

Table 11. Tolerable Temporary Primary Surplus

	i	1%						2%						3%						4%					
	Permanent PS	1%						2%						3%						4%					
	GDP Growth Rate	1%	2%	3%	4%	5%	6%	1%	2%	3%	4%	5%	6%	1%	2%	3%	4%	5%	6%	1%	2%	3%	4%	5%	6%
	35%	20%	16%	11%	1%	-17%	-71%	3%	-4%	-15%	-33%	-69%	-177%	-13%	-24%	-41%	-68%	-122%	-283%	-30%	-45%	-67%	-103%	-174%	-389%
	40%	26%	22%	16%	6%	-12%	-66%	9%	1%	-10%	-28%	-64%	-172%	-8%	-19%	-36%	-63%	-117%	-278%	-25%	-40%	-61%	-98%	-169%	-384%
	45%	31%	27%	21%	12%	-7%	-61%	14%	6%	-5%	-23%	-59%	-167%	-3%	-14%	-31%	-58%	-112%	-273%	-20%	-34%	-56%	-92%	-164%	-379%
P	50%	36%	32%	26%	17%	-2%	-56%	19%	12%	0%	-18%	-54%	-162%	2%	-9%	-25%	-53%	-107%	-268%	-14%	-29%	-51%	-87%	-159%	-374%
u	55%	41%	37%	31%	22%	4%	-50%	25%	17%	6%	-13%	-49%	-156%	8%	-4%	-20%	-47%	-101%	-262%	-9%	-24%	-46%	-82%	-154%	-368%
b	60%	47%	43%	37%	27%	9%	-45%	30%	22%	11%	-8%	-44%	-151%	13%	2%	-15%	-42%	-96%	-257%	-4%	-19%	-41%	-77%	-149%	-363%
l	65%	52%	48%	42%	32%	14%	-40%	35%	27%	16%	-2%	-39%	-146%	18%	7%	-10%	-37%	-91%	-252%	2%	-13%	-35%	-72%	-144%	-358%
i	70%	57%	53%	47%	37%	19%	-35%	40%	33%	21%	3%	-34%	-141%	24%	12%	-5%	-32%	-86%	-247%	7%	-8%	-30%	-67%	-139%	-353%
c	75%	63%	58%	52%	42%	24%	-30%	46%	38%	26%	8%	-29%	-136%	29%	17%	1%	-27%	-81%	-242%	12%	-3%	-25%	-62%	-134%	-348%
	80%	68%	64%	57%	48%	29%	-25%	51%	43%	32%	13%	-23%	-131%	34%	23%	6%	-22%	-76%	-237%	17%	2%	-20%	-56%	-128%	-343%
D	85%	73%	69%	63%	53%	34%	-20%	56%	48%	37%	18%	-18%	-126%	40%	28%	11%	-17%	-71%	-232%	23%	8%	-15%	-51%	-123%	-338%
e	90%	79%	74%	68%	58%	39%	-15%	62%	54%	42%	23%	-13%	-121%	45%	33%	16%	-11%	-66%	-227%	28%	13%	-10%	-46%	-118%	-333%
b	95%	84%	79%	73%	63%	44%	-10%	67%	59%	47%	28%	-8%	-116%	50%	38%	21%	-6%	-61%	-222%	33%	18%	-4%	-41%	-113%	-328%
t	100%	89%	85%	78%	68%	49%	-5%	72%	64%	52%	34%	-3%	-111%	55%	44%	27%	-1%	-56%	-217%	39%	23%	1%	-36%	-108%	-323%
	105%	94%	90%	83%	73%	55%	0%	78%	69%	58%	39%	2%	-106%	61%	49%	32%	4%	-51%	-212%	44%	29%	6%	-31%	-103%	-318%
t	110%	100%	95%	89%	79%	60%	5%	83%	75%	63%	44%	7%	-101%	66%	54%	37%	9%	-45%	-207%	49%	34%	11%	-25%	-98%	-313%
o	115%	106%	100%	94%	84%	65%	10%	88%	80%	68%	49%	12%	-96%	71%	59%	42%	14%	-40%	-202%	54%	39%	16%	-20%	-93%	-308%
	120%	110%	105%	99%	89%	70%	15%	93%	86%	73%	54%	17%	-91%	77%	65%	47%	19%	-36%	-197%	60%	44%	22%	-15%	-88%	-303%
G	125%	116%	111%	104%	94%	75%	20%	99%	90%	78%	59%	22%	-86%	82%	70%	53%	25%	-30%	-192%	65%	50%	27%	-10%	-83%	-298%
D	130%	121%	116%	109%	99%	80%	25%	104%	96%	84%	64%	27%	-81%	87%	75%	58%	30%	-25%	-187%	70%	55%	32%	-5%	-78%	-293%
P	135%	126%	121%	114%	104%	85%	30%	109%	101%	89%	70%	33%	-76%	93%	80%	63%	35%	-20%	-182%	76%	60%	37%	0%	-72%	-288%
	140%	131%	126%	120%	109%	90%	35%	115%	106%	94%	75%	38%	-71%	98%	86%	68%	40%	-15%	-177%	81%	65%	42%	5%	-67%	-283%
	145%	137%	132%	125%	115%	95%	40%	120%	111%	99%	80%	43%	-66%	103%	91%	73%	46%	-10%	-172%	86%	71%	48%	11%	-62%	-278%
	150%	142%	137%	130%	120%	100%	45%	125%	117%	104%	86%	48%	-61%	108%	96%	79%	50%	-5%	-167%	92%	76%	53%	16%	-57%	-273%
	155%	147%	142%	135%	125%	105%	50%	131%	122%	110%	90%	53%	-56%	114%	101%	84%	55%	0%	-162%	97%	81%	58%	21%	-52%	-268%
	160%	153%	147%	140%	130%	111%	56%	136%	127%	115%	96%	58%	-50%	119%	107%	89%	61%	6%	-156%	102%	86%	63%	26%	-47%	-262%

[21] The result can be extended to any period of undefined length by adjusting the interest rates to the new time set accordingly.

A negative value implies that the debt is sustainable and therefore that the government can actually run a deficit in the short run. The analyst should use this table in the following manner. He/she should decide what is a feasible "long run" primary surplus for the country. Once this is decided or agreed, an assumption on the growth rate should be made. Looking up the country, by choosing the row corresponding to the debt to GDP ratio of the country, the table will deliver the primary surplus/deficit that is compatible in the short run with debt sustainability. This value should be compared to actual primary surplus or deficit numbers.

Tool # 5. Estimating the haircut after default

Objective: to have a way of estimating potential haircut levels in a restructuring scenario.

Table 12

Jarrow et al (1997) Average 1974-1991	Senior secured	67.13
	Senior unsecured	46.53
	Senior subordinated	32.10
	Subordinated	26.44
	Junior subordinated	17.95
	Weighted average	39.22
Merrick (1999)	**Russian Eurobond**	13.0
	Pre-GKO Default Subsample: 07/23/1998 – 08/14/1998	27.3
	Post-GKO Default Subsample: 08/17/1998 – 12/14/1998	10.3
	Argentina	49.6
	Pre-GKO Default Subsample: 07/23/1998 – 08/14/1998	51.2
	Post-GKO Default Subsample: 08/17/1998 – 12/14/1998	49.3
Sosa Navarro (2002)	Argentina: 12/10/01 - 12/20/01	21.7
	Argentina Post-Default: 12/21/01	20.8

An important practical question when trying to estimate default probabilities relates to what recovery value to use. One possibility is to use data from the US corporate bond market, where there is enough evidence on the recovery values obtained from past defaults. Table 12 shows the historical recovery rates included in Jarrow *et al* (1997), taken from Moody's Special Report (1992). As can be seen, recovery rates increase with the seniority of the debt. The average recovery rate is 39% for all US corporates.

Merrick (1999) using the additional information provided by looking at several bonds with cross default clauses (and thus the same default probability) provides an independent estimator for the default probability and recovery values. He finds that for the Russian default, recovery values were substantially lower than those of US corporates, while Argentina's recovery values during the 1998 Russian crisis remained high and similar to a senior unsecured US corporate. Sosa Navarro (2002), using a similar framework, reestimates recovery values for Argentina's default, by then recovery values had fallen considerably.

Table 7 of Tool # 4 can also be used to provide some idea as to what sort of restructuring may be necessary to make the debt sustainable. To illustrate the workings of the exercise consider the case of Argentina. Assuming a debt to GDP ratio of 130%, a growth rate of 2% and an average interest rate of 7%, the table indicates that the country needs a primary surplus of 6.4% to pay its debt. Consider now that we believe that the maximum primary surplus attainable is 2% of GDP, an assumption made by the analyst based on an informed guess which takes into account the political willingness and feasibility of delivering such a result. In order to figure out the degree of necessary restructuring we have to move up the column to find the debt to GDP ratio for which a 2% primary surplus is enough to ensure sustainability. Interpolating the figures in the table we find the number to be about 40%, in other words, under those assumptions, only a debt of 40% of GDP is sustainable. Given that the debt currently stands at 130% of GDP, the debt has to be reduced to 30.8% (40/130) of its original level delivering a haircut of about 69.2%.

More generally, in the set of Tables 7.1 to 7.9 the exercise is always the same. Assuming a certain growth rate and expected cost of capital in the post default scenario we look at "feasible" or "targeted" primary surpluses. Once this is determined we read of the graph or the table the corresponding level of the debt to GDP ratio. The comparison between this level and the current debt to GDP ratio provides the amount of required haircut.[22]

[22] In the aftermath of a default the current debt to GDP ratio may be influenced by an overshooting of the exchange rate. In that case the computations should more safely be done with an equilibrium level for the real exchange rate.

Tool # 6. Estimating the Financial Impact of Default

Objective: to have an assessment of the financial costs or benefits of the default decision.

Default entails two potential effects: on financial costs and potentially worse growth performance. This and the next tool provide the instruments to measure these two effects.

The default decision will most likely change the future costs of indebtedness. However, there are two squarely different views on this issue. On the one hand, there are those that argue that defaulting reduces financing costs because by bringing the country closer to sustainability and reducing the debt ratios, it allows the country to entice future creditors to offer financing at a lower cost. On the other hand, others argue that the reputational costs of the decision to default increases the financial cost looking forward, thus making future debt issues more costly, as new investors fear the recurrence of the event. In addition to all this, the haircut reduces financing costs directly from the lower level of debt.

The empirical model discussed in the Tool # 1 helps us bring some structure to discussing this problem for the marginal cost of debt[23]. In that model, spreads were associated to debt levels as well as to previous default experiences. According to that model each percentage point reduction in the debt to GDP level implied a reduction of 7 basis points in spreads. On the other hand, the same model estimated the reputational cost to be equal to 165 basis points as identified by the restructuring dummy in the model. As a restructuring reduces the total amount of debt, the net effect is ambiguous.

In short, the financial impact of a restructuring, can be computed as

$$\text{Change in debt payments (\% of GDP)} = -\sum_{t=0}^{\infty}\left(\frac{1}{1+r^*}\right)^t\left(r_t^{before}d_t^{before} - r_t^{after}d_t^{after}\right). \quad (18)$$

The interpretation of the formula is very simple. It just compares the stream of payments before and after default. Using rather strictly the model in Tool # 1, we can compare the *before* and *after* restructuring cost of interest by the using the formula:

$r_{after} = r_{before}$ + 165 bps – 7 x (percentage debt reduction in percentage of GDP). (19)

Table 13 shows our estimates for (18) using (19). The table is computed for several restructuring scenarios and several maturity assumptions for the debt. If 50% of the debt has to be refinanced each year, debt structure is shorter and the change in costs kicks in quickly, In the case that only 12.5 has to be refinanced each year the costs change more slowly.

[23] As mentioned above, the average cost of debt moves slowly.

The numbers in Table 13 combine three effects. First, it is assumed that a debt restructuring implies a higher cost for more debt (in our case of 165 bps.) due to reputational effects. This higher rate applies to new issues and therefore will be more significant for shorter maturity debt. Second, this number may be compensated by a reduction of spreads due to the decline in debt ratios. As each percentage point reduction in debt to GDP levels leads to 7 basis points of spread declines we need a debt reduction of over 23% to compensate the reputational effect of the default on interest cost. Thus, small restructurings increase the financial cost, while large restructurings reduce the financial effort required to pay the debt. The third channel is the reduction in debt levels itself, which reduces the debt cost directly. All values are computed as PDV at the arbitrary rate of 10% and expressed as percentages of GDP.

The exercise is certainly mechanical but helps to illustrate the three mechanics by which debt payments can be reduced.

Table 13

		Debt reduction														
		0%			10%			20%			30%			40%		
		Debt roll-over			Debt roll-over			Debt roll-over			Debt roll-over			Debt roll-over		
		50%	25%	12.5%	50%	25%	12.5%	50%	25%	12.5%	50%	25%	12.5%	50%	25%	12.5%
Debt as a % of GDP	10%	1.8%	1.6%	1.4%	-0.1%	-0.2%	-0.3%	-1.8%	-1.8%	-1.8%	-3.3%	-3.3%	-3.3%	-4.7%	-4.7%	-4.6%
	15%	2.6%	2.4%	2.1%	-0.1%	-0.2%	-0.4%	-2.7%	-2.7%	-2.7%	-5.0%	-5.0%	-4.9%	-7.1%	-7.0%	-6.9%
	20%	3.5%	3.2%	2.8%	-0.2%	-0.3%	-0.6%	-3.6%	-3.6%	-3.7%	-6.7%	-6.6%	-6.5%	-9.5%	-9.4%	-9.2%
	25%	4.4%	4.0%	3.5%	-0.2%	-0.4%	-0.7%	-4.5%	-4.5%	-4.6%	-8.3%	-8.3%	-8.2%	-11.8%	-11.7%	-11.4%
	30%	5.3%	4.9%	4.1%	-0.3%	-0.5%	-0.9%	-5.4%	-5.4%	-5.5%	-10.0%	-9.9%	-9.8%	-14.2%	-14.0%	-13.7%
	35%	6.2%	5.7%	4.8%	-0.3%	-0.6%	-1.0%	-6.3%	-6.3%	-6.4%	-11.7%	-11.6%	-11.4%	-16.6%	-16.4%	-16.0%
	40%	7.0%	6.5%	5.5%	-0.4%	-0.6%	-1.1%	-7.1%	-7.2%	-7.3%	-13.3%	-13.2%	-13.1%	-18.9%	-18.7%	-18.3%
	45%	7.9%	7.3%	6.2%	-0.4%	-0.7%	-1.3%	-8.0%	-8.1%	-8.2%	-15.0%	-14.9%	-14.7%	-21.3%	-21.0%	-20.6%
	50%	8.8%	8.1%	6.9%	-0.4%	-0.8%	-1.4%	-8.9%	-9.0%	-9.2%	-16.7%	-16.5%	-16.3%	-23.7%	-23.4%	-22.9%
	55%	9.7%	8.9%	7.6%	-0.5%	-0.9%	-1.6%	-9.8%	-9.9%	-10.1%	-18.3%	-18.2%	-18.0%	-26.0%	-25.7%	-25.2%
	60%	10.5%	9.7%	8.3%	-0.5%	-1.0%	-1.7%	-10.7%	-10.8%	-11.0%	-20.0%	-19.9%	-19.6%	-28.4%	-28.1%	-27.5%
	65%	11.4%	10.5%	9.0%	-0.6%	-1.0%	-1.8%	-11.6%	-11.7%	-11.9%	-21.7%	-21.5%	-21.2%	-30.8%	-30.4%	-29.8%
	70%	12.3%	11.3%	9.7%	-0.6%	-1.1%	-2.0%	-12.5%	-12.6%	-12.8%	-23.3%	-23.2%	-22.8%	-33.1%	-32.7%	-32.0%
	75%	13.2%	12.1%	10.4%	-0.7%	-1.2%	-2.1%	-13.4%	-13.5%	-13.7%	-25.0%	-24.8%	-24.5%	-35.5%	-35.1%	-34.3%
	80%	14.1%	12.9%	11.1%	-0.7%	-1.3%	-2.3%	-14.3%	-14.4%	-14.7%	-26.7%	-26.5%	-26.1%	-37.9%	-37.4%	-36.6%
	85%	14.9%	13.8%	11.8%	-0.8%	-1.4%	-2.4%	-15.2%	-15.3%	-15.6%	-28.4%	-28.1%	-27.7%	-40.2%	-39.8%	-38.9%
	90%	15.8%	14.6%	12.4%	-0.8%	-1.5%	-2.6%	-16.1%	-16.2%	-16.5%	-30.0%	-29.8%	-29.4%	-42.6%	-42.1%	-41.2%
	95%	16.7%	15.4%	13.1%	-0.8%	-1.5%	-2.7%	-17.0%	-17.1%	-17.4%	-31.7%	-31.4%	-31.0%	-45.0%	-44.4%	-43.5%
	100%	17.6%	16.2%	13.8%	-0.9%	-1.6%	-2.8%	-17.9%	-18.0%	-18.3%	-33.4%	-33.1%	-32.6%	-47.4%	-46.8%	-45.8%
	110%	19.3%	17.8%	15.2%	-1.0%	-1.8%	-3.1%	-19.7%	-19.8%	-20.2%	-36.7%	-36.4%	-35.9%	-52.1%	-51.4%	-50.4%
	120%	21.1%	19.4%	16.6%	-1.1%	-1.9%	-3.4%	-21.4%	-21.6%	-22.0%	-40.0%	-39.7%	-39.2%	-56.8%	-56.1%	-54.9%
	130%	22.8%	21.0%	18.0%	-1.2%	-2.1%	-3.7%	-23.2%	-23.4%	-23.8%	-43.4%	-43.0%	-42.4%	-61.6%	-60.8%	-59.5%
	140%	24.6%	22.7%	19.4%	-1.2%	-2.3%	-4.0%	-25.0%	-25.3%	-25.7%	-46.7%	-46.3%	-45.7%	-66.3%	-65.5%	-64.1%
	150%	26.4%	24.3%	20.7%	-1.3%	-2.4%	-4.3%	-26.8%	-27.1%	-27.5%	-50.0%	-49.6%	-49.0%	-71.0%	-70.2%	-68.7%

Tool # 7. Assessing the Output Effects.

Objective: To estimate the real economy implications of defaults.

Measuring the output implications of default decisions is difficult. Default decisions usually do not come isolated from a general mismanagement of the economy. Thus to assess the contributing role of defaults one should be able to identify the differential impact of those other factors relative to that of the default decision itself. That is a daunting task. One possibility to approximate an answer to this question is to consider a standard cross-country growth regression format. However, to the usual growth literature specification we add the default decision.

Comprehensive data since 1974 can be gathered for close to 100 countries. We condition growth performance by population (POP), the ratio of investment to GDP (INVGDP), the rate of growth of population (POPWDI), the initial level of GDP (GDPPC74), the growth of government consumption (GOV1), the initial level of education (SECB), an indicator of civil unrest (CIVIL), the change in terms of trade (DTIWDI), a measure of openness (OPENNESS) and yearly dummies.[24] To that specification we add DEF, a dummy variable that takes the value 1 if the country ever defaulted and 0 otherwise or DEFPLUS, a variable that counts the number of times a country defaulted. DEFPLUS takes the value 1 if the country defaulted in the 80s *or* in the 90s, 2 if the country defaulted in the 80s *and* in the 90s and 0 if the country never defaulted.

[24] See Barro and Sala-i-Martin (1995) for a description of why these are the variables to include. See footnoe 25 for data sources.

Table 14. Cross-section Growth Regressions (Average 1974-1999)

	(I) Baseline/def	(II) Baseline/defplus	(I) Inflation and Banking crisis/def	(II) Inflation and Banking crisis/defplus
POPAV	0.003*	0.003*	0.003*	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)
INVGDPAV	7.110*	7.139*	6.378	6.395
	(4.194)	(4.193)	(4.303)	(4.302)
POPWDIAV	-0.166	-0.156	-0.133	-0.119
	(0.154)	(0.157)	(0.216)	(0.220)
GDPPC74AV	-0.485***	-0.489***	-0.439***	-0.443***
	(0.095)	(0.095)	(0.112)	(0.111)
GOV1AV	-1.283	-1.322	3.302**	3.280**
	(1.168)	(1.156)	(1.558)	(1.550)
SECBAV	0.898	0.920	1.001	1.025
	(1.028)	(1.028)	(1.006)	(1.006)
CIVILAV	-0.538***	-0.547***	-0.484***	-0.493***
	(0.180)	(0.182)	(0.175)	(0.176)
DTIWDIAV	1.630***	1.636***	1.354***	1.352***
	(0.396)	(0.394)	(0.390)	(0.390)
OPENNESSAV	1.141*	1.117*	1.186*	1.167
	(0.630)	(0.633)	(0.710)	(0.715)
INFAV			-2.324	-2.320
			(1.435)	(1.425)
VOLINFAV			-0.002***	-0.002***
			(0.001)	(0.001)
BANK2AV			-0.479	-0.447
			(1.008)	(1.013)
DEF	-0.645*		-0.664*	
	(0.358)		(0.337)	
DEFPLUS		-0.604*		-0.635**
		(0.322)		(0.303)
Observations	99	99	98	98
R-squared	0.62	0.62	0.66	0.67

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The results are fully consistent with traditional growth theory and indicate, in Table 14, a very significant impact of defaults on growth. Specifically the results indicate that countries that defaulted grow about 0.6% less than those that do not. In order to disentangle the independent role of macroeconomic instability and of the default decision we introduce average inflation (INFAV), its volatility (VOLINFAV) and a banking crisis "average" (BANK2AV) as independent variables in the previous specification all of which may be correlated with the default decision. Yet, the result remains virtually unchanged. For the period 74 to 99 this implies that defaulters lag no defaulters by about 14%. If this number were true, this would represent a significant cost.

This estimation has two main drawbacks. First, the question may arise as to what extent the default coefficient is capturing the effect of other omitted variables, which are correlated to the default decision. If default comes together with a weak political system, other type of conflicts, weak institutions, etc. the default dummy may be capturing the effect of these other factors. Second, the question may arise as to whether the true effect of default may not be captured by other variables (for example the investment variable). While multicollinearity is usually not a problem in the interpretation of regression coefficients, we need to ensure that the investment variable is not endogenous to growth performance, which in turn depends on the default variable.

We address these two concerns in turn. First we run a similar specification to that above but using annual data with fixed effects. The fixed effect should factor out all the country's idiosyncrasies. As the default dummy is swamped in the fixed effect our default variable is a dummy pivoting around the default experience of the early 80s. DEFPLUS1 is a variable that takes the value of 1 in the year of default and the following year. DEFPLUS5 incorporates the following 5 years.

Table 15. Fixed effect Growth Regressions (1974-1999) [25]

FIXED EFFECTS	(I) Baseline w / def80plus1	(II) Baseline w / def80plus5	(III) Inflation and Banking w / def80plus1	(IV) Inflation and Banking w / def80plus5	(V) Baseline w / def90
POP	0.002	0.002	0.003	0.003	0.004
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
INVGDP	12.475***	11.993***	10.583***	10.101***	10.243***
	(2.080)	(2.090)	(2.117)	(2.124)	(2.122)
POPWDI	0.803***	0.801***	-0.116	-0.121	-0.132
	(0.123)	(0.123)	(0.182)	(0.182)	(0.182)
GOV1	-1.082***	-1.016***	1.309***	1.349***	1.393***
	(0.314)	(0.315)	(0.434)	(0.435)	(0.434)
CIVIL	-0.089	-0.094	0.068	0.065	0.046
	(0.123)	(0.124)	(0.126)	(0.127)	(0.126)
DTIWDI	0.662***	0.667***	0.600***	0.604***	0.607***
	(0.055)	(0.055)	(0.054)	(0.054)	(0.054)
OPENNESS	2.017	2.215	2.498	2.737*	3.045*
	(1.637)	(1.646)	(1.611)	(1.617)	(1.610)
DEF80PLUS1	-2.105***		-1.852***		
	(0.532)		(0.526)		
DEF80PLUS5		-0.833**		-0.635*	
		(0.389)		(0.383)	
DEF90					-3.370
					(3.063)
INF			-2.721***	-2.706***	-2.782***
			(0.489)	(0.492)	(0.490)
VOLINF			-0.000	-0.000	-0.000
			(0.000)	(0.000)	(0.000)
BANK2			-1.561***	-1.599***	-1.601***
			(0.294)	(0.294)	(0.295)
CONSTANT	-3.650***	-3.624***	-1.811**	-1.805**	-1.927**
	(0.819)	(0.826)	(0.854)	(0.858)	(0.856)
Observations	2240	2240	2087	2087	2087
Number of code	99	99	98	98	98
R-squared	0.12	0.12	0.12	0.12	0.12

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The dummy also takes a value of one for the year of the default and the year before. These events may not be subject to much endogeneity problems as debt defaults in the 80s were to a great extent the result of exogenous liquidity shocks propagating after the Mexican default. As can be seen in Table 15 these dummies have significant negative coefficients indicating that the default in the 80s had significant and long lasting growth costs (thus the reference to this period as the lost decade).

[25] DGDPPC is the rate of growth of Real per Capita GDP (Source: World Economic Outlook (WEO)); INVGDP is the investment to GDP Ratio (Source: IMF's International Financial Statistics); POPWDI is the population growth (annual %) (SP.POP.GROW) (Source: World Development Indicators (WDI)); GDPPC74 is the initial per capita GDP (average over 1970-1973) (Source: WEO); GOV1 is the growth of government consumption (lagged one period) (Source: IMF); SECB is the total gross enrollment ratio for secondary education (Source: Barro (1991)); CIVIL is the index of civil liberties (index measured on a 1 to 7 scale; 1=highest degree of freedom) (Source: Freedom in the World - Annual survey of freedom country ratings); DTIWDI is the Change in terms of trade - exports as a capacity to import (constant LCU) (NY.EXP.CAPM.KN) (Source: WDI); OPENNESS is the ratio of (export + import)/2 to GDP (Source: IMF). Table 14 uses the corresponding variables averaged over the dates for which country data is available.

While Table 15 appears to indicate a negative impact of the default decision, it is true that following the default macroeconomic instability increases dramatically. This macroeconomic instability usually is the result of the default decision, the lack of alternative financing or both. However, in order to disentangle the independent role of macroeconomic instability and of the default decision we introduce the inflation (INF) and its volatility (VOLINF) and a banking crisis dummy (BANK2) as independent variables in the previous specification. As before, once this is done in Table 15 the results remain robust indicating that default decisions do have an independent negative effect.

In the short run all these variables have a negative effect on output performance. However the default variable remains significant. The analysis warrants the conclusion that defaults that trigger banking crises and macroeconomic instability lead to far worse outcomes than those that do not.

Column (v) introduces a dummy for the default in the 90s (DEF90). The results show no significant effect. One could be tempted to infer that this implies that these defaults had no growth implications. However, this would be rushing to an unwarranted conclusion. Due to lack of information on other variables the 90s default dummy includes very few observations and, given how recent the events are, cannot span fully the effects of the default decision. Unfortunately, no improvement can be made at this stage in terms of econometric evaluation; thus, we need a more informal, look at the data.

Finally, to address the concern regarding the endogeneity of some of the variables correlated to the default decision, such as investment, we present in Table 16 the same results but instrumenting the investment variable with its own value lagged (lagged one period and twice). While the investment variable becomes insignificant the results regarding the default variables remain almost unchanged.

Table 16. Fixed effect Growth Regressions w/investment instrumented (1974-1999)

FIXED EFFECTS	(I) Baseline w / def80plus1	(II) Baseline w / def80plus5	(III) Inflation and Banking w / def80plus1	(IV) Inflation and Banking w / def80plus5	(V) Baseline w / def90
POP	0.004	0.005	0.006	0.006	0.007
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
INVGDP	-2.558	-3.352	-4.086	-4.889	-4.675
	(3.049)	(3.068)	(3.001)	(3.017)	(3.011)
POPWDI	0.925***	0.924***	0.031	0.028	0.013
	(0.128)	(0.128)	(0.193)	(0.193)	(0.193)
GOV1	-0.729**	-0.655*	1.789***	1.819***	1.861***
	(0.337)	(0.337)	(0.458)	(0.460)	(0.459)
CIVIL	-0.059	-0.061	0.125	0.125	0.105
	(0.132)	(0.133)	(0.135)	(0.136)	(0.135)
DTIWDI	0.661***	0.662***	0.602***	0.603***	0.608***
	(0.061)	(0.062)	(0.060)	(0.061)	(0.060)
OPENNESS	5.655***	5.879***	5.389***	5.686***	5.965***
	(1.848)	(1.852)	(1.800)	(1.803)	(1.798)
DEF80PLUS1	-1.743***		-1.523***		
	(0.554)		(0.547)		
DEF80PLUS5		-0.826**		-0.606	
		(0.413)		(0.406)	
DEF90					-3.867
					(3.116)
INF			-2.655***	-2.632***	-2.722***
			(0.527)	(0.532)	(0.528)
VOLINF			-0.001**	-0.001**	-0.001**
			(0.000)	(0.000)	(0.000)
BANK2			-1.774***	-1.802***	-1.795***
			(0.305)	(0.305)	(0.306)
Constant	-2.106**	-2.022**	-0.211	-0.154	-0.278
	(0.911)	(0.920)	(0.951)	(0.957)	(0.953)
Observations	2064	2064	1932	1932	1932
Number of code	99	99	98	98	98

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

For the analyst the results just provide a sketch as to how to estimate the output effects. The length and deepness of the fall in output will depend, to a great extent, on the assessment of whether a financial crisis will ensue or not. The experience of the 80s tends to suggest an accumulated 4% drop in output over the immediately following four years.

V. Conclusions: Lessons from Recent Defaults

This chapter has discussed several tools that allow us to understand some of the changes that occur, during, prior or after a default decision. However, the analysis cannot be this mechanical.

While recent experiences have exhibited a fairly common pattern the lessons should be enriched by the analyst judgment. For example, unsustainable fixed exchange rate regimes, combined with weak fiscal problems have been important determinants of recent experiences and their correction an important factor in the turnaround. However, this should not be interpreted as implying that a country with a floating rate would be able to avoid a default if its fiscal policies are inconsistent.[26] Yet a country with fixed rates may be more vulnerable, both due to balance sheet effects and increased fragility of the financial sector. As of late, one should add the fact that the Fund and other multilaterals have been totally unwilling to support fixed exchange rate regimes. All these factors feed into the instability of the situation, acting as a catalyst for the crisis. In any case, it is the combination of fiscal unsustainability and exposed financial sectors what combines to increase the probability of a crisis.

Needless to say, the best alternative to avoid the mess associated to defaults is for sensible macroeconomic policies: reasonable budgets, relatively low money printing and inflation, and the pursuing of a sensible growth agenda by pursuing deregulation, openness, reasonable tax systems and strong defense of property rights. However, for countries which are relatively exposed to default risk, and which do not have the internal consensus to steer course into safer waters, some second best solutions may be tried.

A weak point in the link is the banking sector. Having strong prudential regulation is a good initial step but, as proven by the Argentine experience, it is not enough to insure stability. The problem with the financial sector is that, either because of internal moral hazard (banks expect to be bailed out) or because they are forced to, the domestic financial sector ends with substantial long positions in the defaulting countries´ debt instruments. Once the government defaults on these instruments, the financial sector is bankrupt. The anticipation of this event triggers a financial crisis prior to the default. Compounded with the balance sheet effects of the devaluation the impact is extremely negative.

One solution to this problem is to limit bank's bond holdings. While in most countries government debt is considered among the safest and liquid of assets,[27] this is not the case for near default economies. In those cases it may be a sensible decision to limit bank exposure to default risk as default becomes more imminent. The implementation of this, however, is not trivial if it forces banks to sell its bond holdings in the running up to a default crisis. A clean solution would be to prohibit banks from holding government debt.

[26] Neither does this imply that a country with a floating rate cannot suffer a liquidity crunch or a run on its bond market.

[27] In fact, new Basle rules have started to take this into account, see Castro (2002).

Of course banks could sell government debt to their clients, but they could not hold it themselves. Thus, default risk would be taken fully by the households or private investors. This is certainly a massive change in banking regulation proposals, and could be restricted to countries without investment grade on their debt holdings.

More involved are the proposals to reduce the balance sheet problem of the financial sector. Countries with the original sin à la Hausmann will likely develop a financial sector that is strongly dollarized and governments will also be forced to issue debt in foreign currency, both to gain credibility and reduce costs. Both factors contribute, to increasing the costs of a devaluation. One alternative is to move towards dollarization as in Ecuador.[28] However, if fiscal accounts remain unbalanced, dollarization risks the monetary anarchy currently in Argentina.[29] In such a context dollarization may be of limited use. Alternatively financial restrictions as in Brazil that do not allow for a dollarized financial sector or as in Chile where an indexed financial unit of account is used may become more prevalent in years to come. While these measures may induce some capital flight if savers insist in holding dollar denominated assets, they may render a more stable financial sector than what is obtained by imposing capital controls at the moment in which the crisis emerges, a pervasive phenomenon in the experiences described in this paper.

The analyst interested in anticipating and evaluating debt problems will have to assess all these second best solutions as a way of assessing the risks of default. And then that is just a starter, the real difficulties lie when we have to factor in political considerations.

[28] See Levy-Yeyati and Sturzenegger (2002) for a comprehensive discussion of dollarization.

[29] Once debt financing was not available any longer, provinces in Argentina started printing their own currency. As of early 2002 there were about 14 currencies circulating in the country.

Appendix

Table 5.1

Implicit probability of default

Spread - in Basis Points	i	0%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	50	0.6%	0.6%	0.7%	0.8%	1.0%	1.2%	1.6%	2.4%	4.8%
	100	1.1%	1.2%	1.4%	1.6%	2.0%	2.4%	3.2%	4.8%	9.1%
	150	1.6%	1.8%	2.1%	2.4%	2.9%	3.6%	4.8%	7.0%	13.0%
	200	2.2%	2.4%	2.8%	3.2%	3.8%	4.8%	6.3%	9.1%	16.7%
	250	2.7%	3.0%	3.4%	4.0%	4.8%	5.9%	7.7%	11.1%	20.0%
	300	3.2%	3.6%	4.1%	4.8%	5.7%	7.0%	9.1%	13.0%	23.1%
	350	3.7%	4.2%	4.8%	5.5%	6.5%	8.0%	10.4%	14.9%	25.9%
	400	4.3%	4.8%	5.4%	6.3%	7.4%	9.1%	11.8%	16.7%	28.6%
	450	4.8%	5.3%	6.0%	7.0%	8.3%	10.1%	13.0%	18.4%	31.0%
	500	5.3%	5.9%	6.7%	7.7%	9.1%	11.1%	14.3%	20.0%	33.3%
	550	5.8%	6.4%	7.3%	8.4%	9.9%	12.1%	15.5%	21.6%	35.5%
	600	6.3%	7.0%	7.9%	9.1%	10.7%	13.0%	16.7%	23.1%	37.5%
	650	6.7%	7.5%	8.5%	9.8%	11.5%	14.0%	17.8%	24.5%	39.4%
	700	7.2%	8.0%	9.1%	10.4%	12.3%	14.9%	18.9%	25.9%	41.2%
	750	7.7%	8.6%	9.7%	11.1%	13.0%	15.8%	20.0%	27.3%	42.9%
	800	8.2%	9.1%	10.3%	11.8%	13.8%	16.7%	21.1%	28.6%	44.4%
	850	8.6%	9.6%	10.8%	12.4%	14.5%	17.5%	22.1%	29.8%	45.9%
	900	9.1%	10.1%	11.4%	13.0%	15.3%	18.4%	23.1%	31.0%	47.4%
	950	9.5%	10.6%	11.9%	13.7%	16.0%	19.2%	24.1%	32.2%	48.7%
	1000	10.0%	11.1%	12.5%	14.3%	16.7%	20.0%	25.0%	33.3%	50.0%
	1050	10.4%	11.6%	13.0%	14.9%	17.4%	20.8%	25.9%	34.4%	51.2%
	1100	10.9%	12.1%	13.6%	15.5%	18.0%	21.6%	26.8%	35.5%	52.4%
	1150	11.3%	12.6%	14.1%	16.1%	18.7%	22.3%	27.7%	36.5%	53.5%
	1200	11.8%	13.0%	14.6%	16.7%	19.4%	23.1%	28.6%	37.5%	54.5%
	1250	12.2%	13.5%	15.2%	17.2%	20.0%	23.8%	29.4%	38.5%	55.6%
	1300	12.6%	14.0%	15.7%	17.8%	20.6%	24.5%	30.2%	39.4%	56.5%
	1350	13.0%	14.4%	16.2%	18.4%	21.3%	25.2%	31.0%	40.3%	57.4%
	1400	13.5%	14.9%	16.7%	18.9%	21.9%	25.9%	31.8%	41.2%	58.3%
	1450	13.9%	15.3%	17.2%	19.5%	22.5%	26.6%	32.6%	42.0%	59.2%
	1500	14.3%	15.8%	17.6%	20.0%	23.1%	27.3%	33.3%	42.9%	60.0%
	1550	14.7%	16.2%	18.1%	20.5%	23.7%	27.9%	34.1%	43.7%	60.8%
	1600	15.1%	16.7%	18.6%	21.1%	24.2%	28.6%	34.8%	44.4%	61.5%
	1650	15.5%	17.1%	19.1%	21.6%	24.8%	29.2%	35.5%	45.2%	62.3%
	1700	15.9%	17.5%	19.5%	22.1%	25.4%	29.8%	36.2%	45.9%	63.0%
	1750	16.3%	17.9%	20.0%	22.6%	25.9%	30.4%	36.8%	46.7%	63.6%
	1800	16.7%	18.4%	20.5%	23.1%	26.5%	31.0%	37.5%	47.4%	64.3%
	1850	17.1%	18.8%	20.9%	23.6%	27.0%	31.6%	38.1%	48.1%	64.9%
	1900	17.4%	19.2%	21.3%	24.1%	27.5%	32.2%	38.8%	48.7%	65.5%
	1950	17.8%	19.6%	21.8%	24.5%	28.1%	32.8%	39.4%	49.4%	66.1%
	2000	18.2%	20.0%	22.2%	25.0%	28.6%	33.3%	40.0%	50.0%	66.7%
	2500	21.7%	23.8%	26.3%	29.4%	33.3%	38.5%	45.5%	55.6%	71.4%
	3000	25.0%	27.3%	30.0%	33.3%	37.5%	42.9%	50.0%	60.0%	75.0%
	3500	28.0%	30.4%	33.3%	36.8%	41.2%	46.7%	53.8%	63.6%	77.8%
	4000	30.8%	33.3%	36.4%	40.0%	44.4%	50.0%	57.1%	66.7%	80.0%
	4500	33.3%	36.0%	39.1%	42.9%	47.4%	52.9%	60.0%	69.2%	81.8%
	5000	35.7%	38.5%	41.7%	45.5%	50.0%	55.6%	62.5%	71.4%	83.3%
	5500	37.9%	40.7%	44.0%	47.8%	52.4%	57.9%	64.7%	73.3%	84.6%
	6000	40.0%	42.9%	46.2%	50.0%	54.5%	60.0%	66.7%	75.0%	85.7%

Table 5.2

Implicit probability of default

	i	1%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.6%	0.6%	0.7%	0.8%	1.0%	1.2%	1.6%	2.3%	4.4%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.4%	3.2%	4.6%	8.4%
	150	1.6%	1.8%	2.1%	2.4%	2.9%	3.6%	4.7%	6.7%	12.1%
	200	2.2%	2.4%	2.8%	3.2%	3.8%	4.7%	6.1%	8.8%	15.5%
	250	2.7%	3.0%	3.4%	4.0%	4.7%	5.8%	7.5%	10.7%	18.7%
	300	3.2%	3.6%	4.1%	4.7%	5.6%	6.9%	8.9%	12.6%	21.6%
	350	3.7%	4.2%	4.7%	5.5%	6.5%	7.9%	10.2%	14.4%	24.3%
	400	4.3%	4.8%	5.4%	6.2%	7.3%	9.0%	11.5%	16.1%	26.9%
	450	4.8%	5.3%	6.0%	6.9%	8.2%	10.0%	12.8%	17.8%	29.2%
	500	5.3%	5.9%	6.6%	7.6%	9.0%	11.0%	14.0%	19.4%	31.5%
	550	5.8%	6.4%	7.3%	8.3%	9.8%	11.9%	15.2%	20.9%	33.6%
	600	6.2%	7.0%	7.9%	9.0%	10.6%	12.9%	16.4%	22.4%	35.5%
	650	6.7%	7.5%	8.5%	9.7%	11.4%	13.8%	17.5%	23.8%	37.4%
	700	7.2%	8.0%	9.1%	10.4%	12.2%	14.7%	18.6%	25.2%	39.1%
	750	7.7%	8.6%	9.6%	11.0%	12.9%	15.6%	19.6%	26.5%	40.8%
	800	8.2%	9.1%	10.2%	11.7%	13.7%	16.5%	20.7%	27.8%	42.3%
	850	8.6%	9.6%	10.8%	12.3%	14.4%	17.3%	21.7%	29.0%	43.8%
	900	9.1%	10.1%	11.3%	13.0%	15.1%	18.1%	22.7%	30.2%	45.2%
	950	9.5%	10.6%	11.9%	13.6%	15.8%	19.0%	23.6%	31.4%	46.6%
	1000	10.0%	11.1%	12.5%	14.2%	16.5%	19.8%	24.6%	32.5%	47.9%
	1050	10.4%	11.6%	13.0%	14.8%	17.2%	20.6%	25.5%	33.6%	49.1%
	1100	10.9%	12.1%	13.5%	15.4%	17.9%	21.3%	26.4%	34.6%	50.2%
	1150	11.3%	12.5%	14.1%	16.0%	18.5%	22.1%	27.3%	35.6%	51.4%
	1200	11.8%	13.0%	14.6%	16.6%	19.2%	22.8%	28.1%	36.6%	52.4%
	1250	12.2%	13.5%	15.1%	17.1%	19.8%	23.5%	28.9%	37.5%	53.4%
	1300	12.6%	13.9%	15.6%	17.7%	20.5%	24.3%	29.8%	38.5%	54.4%
	1350	13.0%	14.4%	16.1%	18.3%	21.1%	25.0%	30.5%	39.4%	55.3%
	1400	13.4%	14.9%	16.6%	18.8%	21.7%	25.6%	31.3%	40.2%	56.2%
	1450	13.9%	15.3%	17.1%	19.4%	22.3%	26.3%	32.1%	41.1%	57.1%
	1500	14.3%	15.8%	17.6%	19.9%	22.9%	27.0%	32.8%	41.9%	57.9%
	1550	14.7%	16.2%	18.1%	20.4%	23.5%	27.6%	33.6%	42.7%	58.7%
	1600	15.1%	16.6%	18.5%	20.9%	24.1%	28.3%	34.3%	43.5%	59.5%
	1650	15.5%	17.1%	19.0%	21.5%	24.6%	28.9%	35.0%	44.2%	60.2%
	1700	15.9%	17.5%	19.5%	22.0%	25.2%	29.5%	35.6%	45.0%	61.0%
	1750	16.3%	17.9%	19.9%	22.5%	25.7%	30.1%	36.3%	45.7%	61.6%
	1800	16.7%	18.3%	20.4%	23.0%	26.3%	30.7%	37.0%	46.4%	62.3%
	1850	17.0%	18.7%	20.8%	23.4%	26.8%	31.3%	37.6%	47.1%	62.9%
	1900	17.4%	19.2%	21.3%	23.9%	27.3%	31.9%	38.2%	47.7%	63.6%
	1950	17.8%	19.6%	21.7%	24.4%	27.9%	32.4%	38.8%	48.4%	64.2%
	2000	18.2%	20.0%	22.1%	24.9%	28.4%	33.0%	39.5%	49.0%	64.7%
	2500	21.7%	23.8%	26.2%	29.3%	33.1%	38.1%	44.9%	54.6%	69.7%
	3000	25.0%	27.2%	29.9%	33.2%	37.3%	42.5%	49.4%	59.1%	73.4%
	3500	28.0%	30.4%	33.2%	36.7%	40.9%	46.3%	53.3%	62.7%	76.3%
	4000	30.7%	33.3%	36.3%	39.8%	44.2%	49.6%	56.6%	65.8%	78.6%
	4500	33.3%	35.9%	39.0%	42.7%	47.1%	52.6%	59.5%	68.4%	80.5%
	5000	35.7%	38.4%	41.6%	45.3%	49.8%	55.2%	62.0%	70.6%	82.1%
	5500	37.9%	40.7%	43.9%	47.7%	52.1%	57.5%	64.2%	72.6%	83.5%
	6000	40.0%	42.8%	46.0%	49.8%	54.3%	59.6%	66.2%	74.3%	84.6%

Table 5.3

Implicit probability of default

	i	2%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.6%	0.6%	0.7%	0.8%	1.0%	1.2%	1.6%	2.3%	4.1%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.4%	3.1%	4.4%	7.8%
	150	1.6%	1.8%	2.1%	2.4%	2.9%	3.5%	4.6%	6.5%	11.3%
	200	2.2%	2.4%	2.8%	3.2%	3.8%	4.6%	6.0%	8.5%	14.5%
	250	2.7%	3.0%	3.4%	4.0%	4.7%	5.7%	7.4%	10.4%	17.5%
	300	3.2%	3.6%	4.1%	4.7%	5.6%	6.8%	8.7%	12.2%	20.3%
	350	3.7%	4.2%	4.7%	5.4%	6.4%	7.8%	10.0%	14.0%	22.9%
	400	4.2%	4.7%	5.4%	6.2%	7.3%	8.9%	11.3%	15.6%	25.4%
	450	4.8%	5.3%	6.0%	6.9%	8.1%	9.9%	12.5%	17.3%	27.7%
	500	5.3%	5.9%	6.6%	7.6%	8.9%	10.8%	13.7%	18.8%	29.8%
	550	5.7%	6.4%	7.2%	8.3%	9.7%	11.8%	14.9%	20.3%	31.9%
	600	6.2%	6.9%	7.8%	9.0%	10.5%	12.7%	16.1%	21.8%	33.8%
	650	6.7%	7.5%	8.4%	9.7%	11.3%	13.6%	17.2%	23.2%	35.6%
	700	7.2%	8.0%	9.0%	10.3%	12.1%	14.5%	18.2%	24.5%	37.3%
	750	7.7%	8.5%	9.6%	11.0%	12.8%	15.4%	19.3%	25.8%	38.9%
	800	8.1%	9.1%	10.2%	11.6%	13.6%	16.3%	20.3%	27.1%	40.5%
	850	8.6%	9.6%	10.7%	12.3%	14.3%	17.1%	21.3%	28.3%	41.9%
	900	9.1%	10.1%	11.3%	12.9%	15.0%	17.9%	22.3%	29.4%	43.3%
	950	9.5%	10.6%	11.9%	13.5%	15.7%	18.7%	23.2%	30.6%	44.7%
	1000	10.0%	11.1%	12.4%	14.1%	16.4%	19.5%	24.2%	31.7%	45.9%
	1050	10.4%	11.6%	12.9%	14.7%	17.1%	20.3%	25.1%	32.7%	47.2%
	1100	10.9%	12.0%	13.5%	15.3%	17.7%	21.1%	26.0%	33.8%	48.3%
	1150	11.3%	12.5%	14.0%	15.9%	18.4%	21.8%	26.8%	34.8%	49.4%
	1200	11.7%	13.0%	14.5%	16.5%	19.1%	22.6%	27.7%	35.7%	50.5%
	1250	12.2%	13.5%	15.0%	17.1%	19.7%	23.3%	28.5%	36.7%	51.5%
	1300	12.6%	13.9%	15.6%	17.6%	20.3%	24.0%	29.3%	37.6%	52.5%
	1350	13.0%	14.4%	16.1%	18.2%	20.9%	24.7%	30.1%	38.5%	53.4%
	1400	13.4%	14.8%	16.6%	18.7%	21.5%	25.4%	30.9%	39.4%	54.3%
	1450	13.8%	15.3%	17.0%	19.3%	22.1%	26.0%	31.6%	40.2%	55.2%
	1500	14.3%	15.7%	17.5%	19.8%	22.7%	26.7%	32.3%	41.0%	56.0%
	1550	14.7%	16.2%	18.0%	20.3%	23.3%	27.3%	33.1%	41.8%	56.9%
	1600	15.1%	16.6%	18.5%	20.8%	23.9%	28.0%	33.8%	42.6%	57.6%
	1650	15.5%	17.0%	18.9%	21.3%	24.5%	28.6%	34.5%	43.3%	58.4%
	1700	15.9%	17.5%	19.4%	21.9%	25.0%	29.2%	35.1%	44.1%	59.1%
	1750	16.2%	17.9%	19.9%	22.4%	25.6%	29.8%	35.8%	44.8%	59.8%
	1800	16.6%	18.3%	20.3%	22.8%	26.1%	30.4%	36.5%	45.5%	60.5%
	1850	17.0%	18.7%	20.8%	23.3%	26.6%	31.0%	37.1%	46.2%	61.1%
	1900	17.4%	19.1%	21.2%	23.8%	27.2%	31.6%	37.7%	46.8%	61.8%
	1950	17.8%	19.5%	21.6%	24.3%	27.7%	32.1%	38.3%	47.5%	62.4%
	2000	18.1%	19.9%	22.1%	24.8%	28.2%	32.7%	38.9%	48.1%	63.0%
	2500	21.7%	23.7%	26.2%	29.1%	32.9%	37.8%	44.3%	53.7%	68.0%
	3000	25.0%	27.2%	29.8%	33.0%	37.0%	42.1%	48.9%	58.2%	71.8%
	3500	28.0%	30.3%	33.1%	36.5%	40.7%	45.9%	52.7%	61.9%	74.8%
	4000	30.7%	33.2%	36.2%	39.7%	44.0%	49.3%	56.0%	65.0%	77.3%
	4500	33.3%	35.9%	38.9%	42.5%	46.9%	52.2%	58.9%	67.6%	79.3%
	5000	35.7%	38.3%	41.5%	45.1%	49.5%	54.8%	61.4%	69.9%	81.0%
	5500	37.9%	40.6%	43.8%	47.5%	51.9%	57.2%	63.7%	71.8%	82.4%
	6000	39.9%	42.7%	45.9%	49.7%	54.1%	59.3%	65.7%	73.6%	83.6%

Table 5.4

Implicit probability of default

Spread - in Basis Points	i	3%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
	50	0.6%	0.6%	0.7%	0.8%	1.0%	1.2%	1.5%	2.2%	3.8%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.3%	3.0%	4.3%	7.3%
	150	1.6%	1.8%	2.1%	2.4%	2.8%	3.5%	4.5%	6.3%	10.6%
	200	2.2%	2.4%	2.7%	3.2%	3.7%	4.6%	5.9%	8.2%	13.7%
	250	2.7%	3.0%	3.4%	3.9%	4.6%	5.7%	7.2%	10.1%	16.5%
	300	3.2%	3.6%	4.1%	4.7%	5.5%	6.7%	8.6%	11.8%	19.2%
	350	3.7%	4.2%	4.7%	5.4%	6.4%	7.7%	9.8%	13.6%	21.7%
	400	4.2%	4.7%	5.3%	6.1%	7.2%	8.7%	11.1%	15.2%	24.1%
	450	4.7%	5.3%	6.0%	6.9%	8.0%	9.7%	12.3%	16.8%	26.3%
	500	5.2%	5.8%	6.6%	7.6%	8.9%	10.7%	13.5%	18.3%	28.4%
	550	5.7%	6.4%	7.2%	8.3%	9.7%	11.6%	14.7%	19.8%	30.4%
	600	6.2%	6.9%	7.8%	8.9%	10.4%	12.6%	15.8%	21.2%	32.2%
	650	6.7%	7.5%	8.4%	9.6%	11.2%	13.5%	16.9%	22.5%	34.0%
	700	7.2%	8.0%	9.0%	10.3%	12.0%	14.4%	17.9%	23.9%	35.7%
	750	7.7%	8.5%	9.6%	10.9%	12.7%	15.2%	19.0%	25.1%	37.3%
	800	8.1%	9.0%	10.1%	11.6%	13.5%	16.1%	20.0%	26.4%	38.8%
	850	8.6%	9.5%	10.7%	12.2%	14.2%	16.9%	21.0%	27.6%	40.2%
	900	9.1%	10.0%	11.3%	12.8%	14.9%	17.7%	21.9%	28.7%	41.6%
	950	9.5%	10.5%	11.8%	13.4%	15.6%	18.5%	22.9%	29.8%	42.9%
	1000	10.0%	11.0%	12.4%	14.1%	16.3%	19.3%	23.8%	30.9%	44.2%
	1050	10.4%	11.5%	12.9%	14.7%	16.9%	20.1%	24.7%	32.0%	45.4%
	1100	10.9%	12.0%	13.4%	15.2%	17.6%	20.9%	25.6%	33.0%	46.6%
	1150	11.3%	12.5%	14.0%	15.8%	18.3%	21.6%	26.4%	34.0%	47.7%
	1200	11.7%	13.0%	14.5%	16.4%	18.9%	22.3%	27.2%	35.0%	48.7%
	1250	12.2%	13.4%	15.0%	17.0%	19.5%	23.0%	28.1%	35.9%	49.8%
	1300	12.6%	13.9%	15.5%	17.5%	20.2%	23.7%	28.9%	36.8%	50.7%
	1350	13.0%	14.3%	16.0%	18.1%	20.8%	24.4%	29.6%	37.7%	51.7%
	1400	13.4%	14.8%	16.5%	18.6%	21.4%	25.1%	30.4%	38.5%	52.6%
	1450	13.8%	15.2%	17.0%	19.2%	22.0%	25.8%	31.2%	39.4%	53.5%
	1500	14.2%	15.7%	17.5%	19.7%	22.6%	26.4%	31.9%	40.2%	54.3%
	1550	14.7%	16.1%	17.9%	20.2%	23.1%	27.1%	32.6%	41.0%	55.1%
	1600	15.1%	16.6%	18.4%	20.7%	23.7%	27.7%	33.3%	41.7%	55.9%
	1650	15.5%	17.0%	18.9%	21.2%	24.3%	28.3%	34.0%	42.5%	56.7%
	1700	15.8%	17.4%	19.3%	21.7%	24.8%	28.9%	34.7%	43.2%	57.4%
	1750	16.2%	17.8%	19.8%	22.2%	25.4%	29.5%	35.3%	43.9%	58.1%
	1800	16.6%	18.3%	20.3%	22.7%	25.9%	30.1%	36.0%	44.6%	58.8%
	1850	17.0%	18.7%	20.7%	23.2%	26.4%	30.7%	36.6%	45.3%	59.4%
	1900	17.4%	19.1%	21.1%	23.7%	27.0%	31.3%	37.2%	46.0%	60.1%
	1950	17.8%	19.5%	21.6%	24.2%	27.5%	31.8%	37.8%	46.6%	60.7%
	2000	18.1%	19.9%	22.0%	24.6%	28.0%	32.4%	38.4%	47.2%	61.3%
	2500	21.7%	23.7%	26.1%	29.0%	32.7%	37.5%	43.8%	52.8%	66.5%
	3000	24.9%	27.1%	29.7%	32.9%	36.8%	41.8%	48.4%	57.3%	70.4%
	3500	27.9%	30.3%	33.1%	36.4%	40.5%	45.6%	52.2%	61.0%	73.5%
	4000	30.7%	33.2%	36.1%	39.5%	43.7%	48.9%	55.5%	64.2%	76.0%
	4500	33.3%	35.8%	38.8%	42.4%	46.7%	51.9%	58.4%	66.8%	78.1%
	5000	35.6%	38.3%	41.4%	45.0%	49.3%	54.5%	60.9%	69.1%	79.8%
	5500	37.9%	40.6%	43.7%	47.3%	51.7%	56.8%	63.2%	71.1%	81.3%
	6000	39.9%	42.7%	45.8%	49.5%	53.8%	59.0%	65.2%	72.9%	82.6%

Table 5.5

Implicit probability of default

	i	4%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.6%	0.6%	0.7%	0.8%	1.0%	1.2%	1.5%	2.1%	3.6%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.3%	3.0%	4.2%	6.9%
	150	1.6%	1.8%	2.1%	2.4%	2.8%	3.4%	4.4%	6.1%	10.0%
	200	2.2%	2.4%	2.7%	3.1%	3.7%	4.5%	5.8%	8.0%	12.9%
	250	2.7%	3.0%	3.4%	3.9%	4.6%	5.6%	7.1%	9.8%	15.7%
	300	3.2%	3.6%	4.0%	4.6%	5.5%	6.6%	8.4%	11.5%	18.2%
	350	3.7%	4.2%	4.7%	5.4%	6.3%	7.6%	9.7%	13.2%	20.6%
	400	4.2%	4.7%	5.3%	6.1%	7.2%	8.6%	10.9%	14.8%	22.9%
	450	4.7%	5.3%	5.9%	6.8%	8.0%	9.6%	12.1%	16.3%	25.1%
	500	5.2%	5.8%	6.6%	7.5%	8.8%	10.6%	13.3%	17.8%	27.1%
	550	5.7%	6.4%	7.2%	8.2%	9.6%	11.5%	14.4%	19.2%	29.0%
	600	6.2%	6.9%	7.8%	8.9%	10.4%	12.4%	15.5%	20.6%	30.8%
	650	6.7%	7.4%	8.4%	9.6%	11.1%	13.3%	16.6%	22.0%	32.6%
	700	7.2%	8.0%	9.0%	10.2%	11.9%	14.2%	17.6%	23.3%	34.2%
	750	7.7%	8.5%	9.5%	10.9%	12.6%	15.1%	18.7%	24.5%	35.8%
	800	8.1%	9.0%	10.1%	11.5%	13.4%	15.9%	19.7%	25.7%	37.3%
	850	8.6%	9.5%	10.7%	12.1%	14.1%	16.7%	20.6%	26.9%	38.7%
	900	9.1%	10.0%	11.2%	12.8%	14.8%	17.5%	21.6%	28.1%	40.1%
	950	9.5%	10.5%	11.8%	13.4%	15.5%	18.3%	22.5%	29.2%	41.4%
	1000	10.0%	11.0%	12.3%	14.0%	16.1%	19.1%	23.4%	30.2%	42.6%
	1050	10.4%	11.5%	12.9%	14.6%	16.8%	19.9%	24.3%	31.3%	43.8%
	1100	10.8%	12.0%	13.4%	15.2%	17.5%	20.6%	25.2%	32.3%	45.0%
	1150	11.3%	12.5%	13.9%	15.7%	18.1%	21.4%	26.0%	33.3%	46.1%
	1200	11.7%	12.9%	14.4%	16.3%	18.8%	22.1%	26.9%	34.2%	47.1%
	1250	12.1%	13.4%	14.9%	16.9%	19.4%	22.8%	27.7%	35.1%	48.1%
	1300	12.6%	13.9%	15.4%	17.4%	20.0%	23.5%	28.5%	36.0%	49.1%
	1350	13.0%	14.3%	15.9%	18.0%	20.6%	24.2%	29.2%	36.9%	50.1%
	1400	13.4%	14.8%	16.4%	18.5%	21.2%	24.9%	30.0%	37.8%	51.0%
	1450	13.8%	15.2%	16.9%	19.1%	21.8%	25.5%	30.7%	38.6%	51.9%
	1500	14.2%	15.7%	17.4%	19.6%	22.4%	26.2%	31.5%	39.4%	52.7%
	1550	14.6%	16.1%	17.9%	20.1%	23.0%	26.8%	32.2%	40.2%	53.5%
	1600	15.0%	16.5%	18.4%	20.6%	23.6%	27.4%	32.9%	40.9%	54.3%
	1650	15.4%	17.0%	18.8%	21.1%	24.1%	28.1%	33.5%	41.7%	55.1%
	1700	15.8%	17.4%	19.3%	21.6%	24.7%	28.7%	34.2%	42.4%	55.8%
	1750	16.2%	17.8%	19.7%	22.1%	25.2%	29.3%	34.9%	43.1%	56.5%
	1800	16.6%	18.2%	20.2%	22.6%	25.7%	29.8%	35.5%	43.8%	57.2%
	1850	17.0%	18.6%	20.6%	23.1%	26.3%	30.4%	36.1%	44.5%	57.9%
	1900	17.4%	19.0%	21.1%	23.6%	26.8%	31.0%	36.8%	45.2%	58.5%
	1950	17.7%	19.4%	21.5%	24.1%	27.3%	31.5%	37.4%	45.8%	59.2%
	2000	18.1%	19.8%	21.9%	24.5%	27.8%	32.1%	38.0%	46.4%	59.8%
	2500	21.7%	23.6%	26.0%	28.9%	32.5%	37.1%	43.3%	52.0%	65.0%
	3000	24.9%	27.1%	29.7%	32.8%	36.6%	41.5%	47.9%	56.5%	69.0%
	3500	27.9%	30.2%	33.0%	36.3%	40.3%	45.3%	51.7%	60.3%	72.2%
	4000	30.7%	33.1%	36.0%	39.4%	43.5%	48.6%	55.0%	63.4%	74.8%
	4500	33.2%	35.8%	38.7%	42.2%	46.4%	51.5%	57.9%	66.1%	77.0%
	5000	35.6%	38.2%	41.3%	44.8%	49.1%	54.2%	60.5%	68.4%	78.8%
	5500	37.8%	40.5%	43.6%	47.2%	51.4%	56.5%	62.7%	70.4%	80.3%
	6000	39.9%	42.6%	45.7%	49.4%	53.6%	58.6%	64.7%	72.2%	81.7%

Table 5.6

Implicit probability of default

	i	5%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.2%	1.5%	2.1%	3.4%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.3%	2.9%	4.0%	6.5%
	150	1.6%	1.8%	2.1%	2.4%	2.8%	3.4%	4.3%	5.9%	9.5%
	200	2.2%	2.4%	2.7%	3.1%	3.7%	4.5%	5.7%	7.7%	12.3%
	250	2.7%	3.0%	3.4%	3.9%	4.6%	5.5%	7.0%	9.5%	14.9%
	300	3.2%	3.6%	4.0%	4.6%	5.4%	6.5%	8.3%	11.2%	17.4%
	350	3.7%	4.1%	4.7%	5.4%	6.3%	7.6%	9.5%	12.8%	19.7%
	400	4.2%	4.7%	5.3%	6.1%	7.1%	8.5%	10.7%	14.4%	21.9%
	450	4.7%	5.3%	5.9%	6.8%	7.9%	9.5%	11.9%	15.9%	24.0%
	500	5.2%	5.8%	6.5%	7.5%	8.7%	10.4%	13.0%	17.4%	25.9%
	550	5.7%	6.4%	7.1%	8.2%	9.5%	11.4%	14.2%	18.8%	27.8%
	600	6.2%	6.9%	7.7%	8.8%	10.3%	12.3%	15.3%	20.1%	29.6%
	650	6.7%	7.4%	8.3%	9.5%	11.0%	13.2%	16.3%	21.4%	31.3%
	700	7.2%	8.0%	8.9%	10.2%	11.8%	14.0%	17.4%	22.7%	32.9%
	750	7.7%	8.5%	9.5%	10.8%	12.5%	14.9%	18.4%	24.0%	34.4%
	800	8.1%	9.0%	10.1%	11.4%	13.2%	15.7%	19.4%	25.1%	35.9%
	850	8.6%	9.5%	10.6%	12.1%	14.0%	16.6%	20.3%	26.3%	37.3%
	900	9.0%	10.0%	11.2%	12.7%	14.7%	17.4%	21.3%	27.4%	38.7%
	950	9.5%	10.5%	11.7%	13.3%	15.4%	18.1%	22.2%	28.5%	39.9%
	1000	10.0%	11.0%	12.3%	13.9%	16.0%	18.9%	23.1%	29.6%	41.2%
	1050	10.4%	11.5%	12.8%	14.5%	16.7%	19.7%	24.0%	30.6%	42.4%
	1100	10.8%	12.0%	13.3%	15.1%	17.4%	20.4%	24.8%	31.6%	43.5%
	1150	11.3%	12.4%	13.9%	15.7%	18.0%	21.2%	25.7%	32.6%	44.6%
	1200	11.7%	12.9%	14.4%	16.2%	18.6%	21.9%	26.5%	33.5%	45.7%
	1250	12.1%	13.4%	14.9%	16.8%	19.3%	22.6%	27.3%	34.4%	46.7%
	1300	12.6%	13.8%	15.4%	17.4%	19.9%	23.3%	28.1%	35.3%	47.6%
	1350	13.0%	14.3%	15.9%	17.9%	20.5%	24.0%	28.8%	36.2%	48.6%
	1400	13.4%	14.7%	16.4%	18.4%	21.1%	24.6%	29.6%	37.0%	49.5%
	1450	13.8%	15.2%	16.9%	19.0%	21.7%	25.3%	30.3%	37.8%	50.4%
	1500	14.2%	15.6%	17.4%	19.5%	22.3%	25.9%	31.0%	38.7%	51.2%
	1550	14.6%	16.1%	17.8%	20.0%	22.8%	26.6%	31.7%	39.4%	52.0%
	1600	15.0%	16.5%	18.3%	20.5%	23.4%	27.2%	32.4%	40.2%	52.8%
	1650	15.4%	16.9%	18.8%	21.0%	24.0%	27.8%	33.1%	40.9%	53.6%
	1700	15.8%	17.4%	19.2%	21.5%	24.5%	28.4%	33.8%	41.7%	54.3%
	1750	16.2%	17.8%	19.7%	22.0%	25.0%	29.0%	34.4%	42.4%	55.1%
	1800	16.6%	18.2%	20.1%	22.5%	25.6%	29.6%	35.1%	43.1%	55.8%
	1850	17.0%	18.6%	20.6%	23.0%	26.1%	30.2%	35.7%	43.7%	56.4%
	1900	17.4%	19.0%	21.0%	23.5%	26.6%	30.7%	36.3%	44.4%	57.1%
	1950	17.7%	19.4%	21.4%	24.0%	27.1%	31.3%	36.9%	45.0%	57.7%
	2000	18.1%	19.8%	21.9%	24.4%	27.6%	31.8%	37.5%	45.7%	58.3%
	2500	21.6%	23.6%	25.9%	28.8%	32.3%	36.8%	42.9%	51.2%	63.6%
	3000	24.9%	27.0%	29.6%	32.6%	36.4%	41.2%	47.4%	55.8%	67.7%
	3500	27.9%	30.2%	32.9%	36.1%	40.1%	45.0%	51.2%	59.5%	71.0%
	4000	30.7%	33.1%	35.9%	39.3%	43.3%	48.3%	54.5%	62.7%	73.7%
	4500	33.2%	35.7%	38.7%	42.1%	46.2%	51.2%	57.4%	65.4%	75.9%
	5000	35.6%	38.2%	41.2%	44.7%	48.8%	53.8%	60.0%	67.7%	77.8%
	5500	37.8%	40.5%	43.5%	47.0%	51.2%	56.2%	62.3%	69.8%	79.4%
	6000	39.9%	42.6%	45.7%	49.2%	53.4%	58.3%	64.3%	71.6%	80.8%

Table 5.7

Implicit probability of default

	i	6%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.5%	2.0%	3.2%
	100	1.1%	1.2%	1.4%	1.6%	1.9%	2.3%	2.9%	3.9%	6.2%
	150	1.6%	1.8%	2.0%	2.4%	2.8%	3.3%	4.2%	5.8%	9.0%
	200	2.2%	2.4%	2.7%	3.1%	3.6%	4.4%	5.6%	7.5%	11.7%
	250	2.7%	3.0%	3.4%	3.9%	4.5%	5.4%	6.9%	9.2%	14.2%
	300	3.2%	3.6%	4.0%	4.6%	5.4%	6.5%	8.1%	10.9%	16.6%
	350	3.7%	4.1%	4.7%	5.3%	6.2%	7.5%	9.3%	12.5%	18.8%
	400	4.2%	4.7%	5.3%	6.0%	7.0%	8.4%	10.5%	14.0%	20.9%
	450	4.7%	5.3%	5.9%	6.7%	7.8%	9.4%	11.7%	15.5%	23.0%
	500	5.2%	5.8%	6.5%	7.4%	8.6%	10.3%	12.8%	16.9%	24.9%
	550	5.7%	6.3%	7.1%	8.1%	9.4%	11.2%	13.9%	18.3%	26.7%
	600	6.2%	6.9%	7.7%	8.8%	10.2%	12.1%	15.0%	19.7%	28.4%
	650	6.7%	7.4%	8.3%	9.5%	11.0%	13.0%	16.1%	20.9%	30.1%
	700	7.2%	7.9%	8.9%	10.1%	11.7%	13.9%	17.1%	22.2%	31.7%
	750	7.6%	8.5%	9.5%	10.8%	12.4%	14.7%	18.1%	23.4%	33.2%
	800	8.1%	9.0%	10.0%	11.4%	13.2%	15.6%	19.1%	24.6%	34.6%
	850	8.6%	9.5%	10.6%	12.0%	13.9%	16.4%	20.0%	25.7%	36.0%
	900	9.0%	10.0%	11.2%	12.6%	14.6%	17.2%	20.9%	26.8%	37.4%
	950	9.5%	10.5%	11.7%	13.2%	15.2%	18.0%	21.9%	27.9%	38.6%
	1000	9.9%	11.0%	12.2%	13.8%	15.9%	18.7%	22.7%	29.0%	39.8%
	1050	10.4%	11.5%	12.8%	14.4%	16.6%	19.5%	23.6%	30.0%	41.0%
	1100	10.8%	11.9%	13.3%	15.0%	17.2%	20.2%	24.5%	31.0%	42.2%
	1150	11.3%	12.4%	13.8%	15.6%	17.9%	20.9%	25.3%	31.9%	43.2%
	1200	11.7%	12.9%	14.3%	16.2%	18.5%	21.7%	26.1%	32.9%	44.3%
	1250	12.1%	13.4%	14.8%	16.7%	19.1%	22.4%	26.9%	33.8%	45.3%
	1300	12.6%	13.8%	15.3%	17.3%	19.7%	23.1%	27.7%	34.6%	46.3%
	1350	13.0%	14.3%	15.8%	17.8%	20.4%	23.7%	28.4%	35.5%	47.2%
	1400	13.4%	14.7%	16.3%	18.4%	20.9%	24.4%	29.2%	36.3%	48.1%
	1450	13.8%	15.2%	16.8%	18.9%	21.5%	25.0%	29.9%	37.2%	49.0%
	1500	14.2%	15.6%	17.3%	19.4%	22.1%	25.7%	30.6%	37.9%	49.8%
	1550	14.6%	16.0%	17.8%	19.9%	22.7%	26.3%	31.3%	38.7%	50.7%
	1600	15.0%	16.5%	18.2%	20.4%	23.2%	26.9%	32.0%	39.5%	51.5%
	1650	15.4%	16.9%	18.7%	20.9%	23.8%	27.5%	32.7%	40.2%	52.2%
	1700	15.8%	17.3%	19.2%	21.4%	24.3%	28.1%	33.4%	40.9%	53.0%
	1750	16.2%	17.7%	19.6%	21.9%	24.9%	28.7%	34.0%	41.6%	53.7%
	1800	16.6%	18.2%	20.1%	22.4%	25.4%	29.3%	34.6%	42.3%	54.4%
	1850	17.0%	18.6%	20.5%	22.9%	25.9%	29.9%	35.3%	43.0%	55.1%
	1900	17.3%	19.0%	20.9%	23.4%	26.5%	30.5%	35.9%	43.6%	55.7%
	1950	17.7%	19.4%	21.4%	23.8%	27.0%	31.0%	36.5%	44.3%	56.4%
	2000	18.1%	19.8%	21.8%	24.3%	27.5%	31.5%	37.1%	44.9%	57.0%
	2500	21.6%	23.6%	25.9%	28.6%	32.1%	36.6%	42.4%	50.5%	62.4%
	3000	24.9%	27.0%	29.5%	32.5%	36.2%	40.9%	46.9%	55.0%	66.5%
	3500	27.9%	30.1%	32.8%	36.0%	39.8%	44.6%	50.8%	58.8%	69.9%
	4000	30.6%	33.0%	35.8%	39.1%	43.1%	48.0%	54.1%	62.0%	72.6%
	4500	33.2%	35.7%	38.6%	42.0%	46.0%	50.9%	57.0%	64.7%	74.9%
	5000	35.6%	38.1%	41.1%	44.5%	48.6%	53.5%	59.6%	67.1%	76.8%
	5500	37.8%	40.4%	43.4%	46.9%	51.0%	55.9%	61.8%	69.2%	78.5%
	6000	39.8%	42.5%	45.6%	49.1%	53.2%	58.0%	63.9%	71.0%	79.9%

Table 5.8

Implicit probability of default

	i	7%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.4%	1.9%	3.1%
	100	1.1%	1.2%	1.4%	1.6%	1.8%	2.2%	2.8%	3.8%	5.9%
	150	1.6%	1.8%	2.0%	2.3%	2.7%	3.3%	4.2%	5.6%	8.6%
	200	2.2%	2.4%	2.7%	3.1%	3.6%	4.4%	5.5%	7.3%	11.2%
	250	2.7%	3.0%	3.4%	3.8%	4.5%	5.4%	6.7%	9.0%	13.6%
	300	3.2%	3.6%	4.0%	4.6%	5.3%	6.4%	8.0%	10.6%	15.9%
	350	3.7%	4.1%	4.6%	5.3%	6.2%	7.4%	9.2%	12.2%	18.1%
	400	4.2%	4.7%	5.3%	6.0%	7.0%	8.3%	10.4%	13.7%	20.1%
	450	4.7%	5.2%	5.9%	6.7%	7.8%	9.3%	11.5%	15.1%	22.1%
	500	5.2%	5.8%	6.5%	7.4%	8.6%	10.2%	12.6%	16.5%	23.9%
	550	5.7%	6.3%	7.1%	8.1%	9.4%	11.1%	13.7%	17.9%	25.7%
	600	6.2%	6.9%	7.7%	8.7%	10.1%	12.0%	14.8%	19.2%	27.4%
	650	6.7%	7.4%	8.3%	9.4%	10.9%	12.9%	15.8%	20.5%	29.0%
	700	7.2%	7.9%	8.9%	10.1%	11.6%	13.7%	16.8%	21.7%	30.6%
	750	7.6%	8.4%	9.4%	10.7%	12.3%	14.6%	17.8%	22.9%	32.1%
	800	8.1%	9.0%	10.0%	11.3%	13.1%	15.4%	18.8%	24.1%	33.5%
	850	8.6%	9.5%	10.6%	12.0%	13.8%	16.2%	19.7%	25.2%	34.9%
	900	9.0%	10.0%	11.1%	12.6%	14.5%	17.0%	20.7%	26.3%	36.2%
	950	9.5%	10.5%	11.7%	13.2%	15.1%	17.8%	21.6%	27.4%	37.4%
	1000	9.9%	11.0%	12.2%	13.8%	15.8%	18.5%	22.4%	28.4%	38.6%
	1050	10.4%	11.4%	12.7%	14.4%	16.5%	19.3%	23.3%	29.4%	39.8%
	1100	10.8%	11.9%	13.3%	14.9%	17.1%	20.0%	24.1%	30.4%	40.9%
	1150	11.3%	12.4%	13.8%	15.5%	17.8%	20.7%	25.0%	31.3%	42.0%
	1200	11.7%	12.9%	14.3%	16.1%	18.4%	21.5%	25.8%	32.2%	43.0%
	1250	12.1%	13.3%	14.8%	16.6%	19.0%	22.2%	26.6%	33.1%	44.0%
	1300	12.5%	13.8%	15.3%	17.2%	19.6%	22.8%	27.3%	34.0%	45.0%
	1350	13.0%	14.2%	15.8%	17.7%	20.2%	23.5%	28.1%	34.9%	45.9%
	1400	13.4%	14.7%	16.3%	18.3%	20.8%	24.2%	28.8%	35.7%	46.8%
	1450	13.8%	15.1%	16.8%	18.8%	21.4%	24.8%	29.5%	36.5%	47.7%
	1500	14.2%	15.6%	17.2%	19.3%	22.0%	25.5%	30.3%	37.3%	48.6%
	1550	14.6%	16.0%	17.7%	19.8%	22.5%	26.1%	31.0%	38.1%	49.4%
	1600	15.0%	16.4%	18.2%	20.4%	23.1%	26.7%	31.6%	38.8%	50.2%
	1650	15.4%	16.9%	18.7%	20.9%	23.6%	27.3%	32.3%	39.5%	50.9%
	1700	15.8%	17.3%	19.1%	21.4%	24.2%	27.9%	33.0%	40.3%	51.7%
	1750	16.2%	17.7%	19.6%	21.8%	24.7%	28.5%	33.6%	41.0%	52.4%
	1800	16.6%	18.1%	20.0%	22.3%	25.3%	29.1%	34.2%	41.6%	53.1%
	1850	16.9%	18.5%	20.5%	22.8%	25.8%	29.6%	34.9%	42.3%	53.8%
	1900	17.3%	18.9%	20.9%	23.3%	26.3%	30.2%	35.5%	43.0%	54.5%
	1950	17.7%	19.3%	21.3%	23.7%	26.8%	30.7%	36.1%	43.6%	55.1%
	2000	18.1%	19.7%	21.7%	24.2%	27.3%	31.3%	36.6%	44.2%	55.7%
	2500	21.6%	23.5%	25.8%	28.5%	31.9%	36.3%	42.0%	49.8%	61.1%
	3000	24.9%	27.0%	29.4%	32.4%	36.0%	40.6%	46.5%	54.3%	65.4%
	3500	27.9%	30.1%	32.7%	35.9%	39.7%	44.3%	50.3%	58.1%	68.8%
	4000	30.6%	33.0%	35.7%	39.0%	42.9%	47.7%	53.6%	61.3%	71.6%
	4500	33.2%	35.6%	38.5%	41.8%	45.8%	50.6%	56.5%	64.1%	73.9%
	5000	35.5%	38.1%	41.0%	44.4%	48.4%	53.2%	59.1%	66.5%	75.9%
	5500	37.8%	40.3%	43.3%	46.8%	50.8%	55.6%	61.4%	68.5%	77.6%
	6000	39.8%	42.5%	45.5%	48.9%	53.0%	57.7%	63.4%	70.4%	79.1%

Table 5.9

Implicit probability of default

	i	8%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.4%	1.9%	2.9%
	100	1.1%	1.2%	1.4%	1.6%	1.8%	2.2%	2.8%	3.7%	5.7%
	150	1.6%	1.8%	2.0%	2.3%	2.7%	3.3%	4.1%	5.5%	8.3%
	200	2.2%	2.4%	2.7%	3.1%	3.6%	4.3%	5.4%	7.2%	10.7%
	250	2.7%	3.0%	3.3%	3.8%	4.4%	5.3%	6.6%	8.8%	13.0%
	300	3.2%	3.6%	4.0%	4.5%	5.3%	6.3%	7.9%	10.4%	15.3%
	350	3.7%	4.1%	4.6%	5.3%	6.1%	7.3%	9.0%	11.9%	17.4%
	400	4.2%	4.7%	5.2%	6.0%	6.9%	8.3%	10.2%	13.4%	19.4%
	450	4.7%	5.2%	5.9%	6.7%	7.7%	9.2%	11.3%	14.8%	21.3%
	500	5.2%	5.8%	6.5%	7.4%	8.5%	10.1%	12.4%	16.2%	23.1%
	550	5.7%	6.3%	7.1%	8.0%	9.3%	11.0%	13.5%	17.5%	24.8%
	600	6.2%	6.9%	7.7%	8.7%	10.0%	11.9%	14.6%	18.8%	26.5%
	650	6.7%	7.4%	8.3%	9.4%	10.8%	12.8%	15.6%	20.0%	28.1%
	700	7.2%	7.9%	8.8%	10.0%	11.5%	13.6%	16.6%	21.3%	29.6%
	750	7.6%	8.4%	9.4%	10.6%	12.3%	14.4%	17.6%	22.4%	31.0%
	800	8.1%	8.9%	10.0%	11.3%	13.0%	15.3%	18.5%	23.6%	32.4%
	850	8.6%	9.4%	10.5%	11.9%	13.7%	16.1%	19.5%	24.7%	33.8%
	900	9.0%	9.9%	11.1%	12.5%	14.4%	16.8%	20.4%	25.8%	35.1%
	950	9.5%	10.4%	11.6%	13.1%	15.0%	17.6%	21.3%	26.8%	36.3%
	1000	9.9%	10.9%	12.2%	13.7%	15.7%	18.4%	22.1%	27.8%	37.5%
	1050	10.4%	11.4%	12.7%	14.3%	16.4%	19.1%	23.0%	28.8%	38.7%
	1100	10.8%	11.9%	13.2%	14.9%	17.0%	19.8%	23.8%	29.8%	39.8%
	1150	11.2%	12.4%	13.7%	15.4%	17.6%	20.6%	24.6%	30.7%	40.8%
	1200	11.7%	12.8%	14.2%	16.0%	18.3%	21.3%	25.4%	31.6%	41.9%
	1250	12.1%	13.3%	14.8%	16.6%	18.9%	22.0%	26.2%	32.5%	42.9%
	1300	12.5%	13.8%	15.3%	17.1%	19.5%	22.6%	27.0%	33.4%	43.8%
	1350	13.0%	14.2%	15.7%	17.7%	20.1%	23.3%	27.7%	34.2%	44.8%
	1400	13.4%	14.7%	16.2%	18.2%	20.7%	24.0%	28.5%	35.1%	45.7%
	1450	13.8%	15.1%	16.7%	18.7%	21.3%	24.6%	29.2%	35.9%	46.5%
	1500	14.2%	15.5%	17.2%	19.2%	21.8%	25.2%	29.9%	36.7%	47.4%
	1550	14.6%	16.0%	17.7%	19.8%	22.4%	25.9%	30.6%	37.4%	48.2%
	1600	15.0%	16.4%	18.1%	20.3%	23.0%	26.5%	31.3%	38.2%	49.0%
	1650	15.4%	16.8%	18.6%	20.8%	23.5%	27.1%	31.9%	38.9%	49.7%
	1700	15.8%	17.3%	19.1%	21.3%	24.0%	27.7%	32.6%	39.6%	50.5%
	1750	16.2%	17.7%	19.5%	21.7%	24.6%	28.3%	33.2%	40.3%	51.2%
	1800	16.6%	18.1%	20.0%	22.2%	25.1%	28.8%	33.8%	41.0%	51.9%
	1850	16.9%	18.5%	20.4%	22.7%	25.6%	29.4%	34.5%	41.6%	52.6%
	1900	17.3%	18.9%	20.8%	23.2%	26.1%	29.9%	35.1%	42.3%	53.3%
	1950	17.7%	19.3%	21.3%	23.6%	26.6%	30.5%	35.7%	42.9%	53.9%
	2000	18.1%	19.7%	21.7%	24.1%	27.1%	31.0%	36.2%	43.5%	54.5%
	2500	21.6%	23.5%	25.7%	28.4%	31.8%	36.0%	41.5%	49.1%	60.0%
	3000	24.8%	26.9%	29.3%	32.3%	35.8%	40.3%	46.0%	53.6%	64.3%
	3500	27.8%	30.0%	32.6%	35.7%	39.5%	44.1%	49.9%	57.4%	67.7%
	4000	30.6%	32.9%	35.6%	38.8%	42.7%	47.4%	53.2%	60.7%	70.6%
	4500	33.2%	35.6%	38.4%	41.7%	45.6%	50.3%	56.1%	63.4%	73.0%
	5000	35.5%	38.0%	40.9%	44.3%	48.2%	52.9%	58.7%	65.9%	75.0%
	5500	37.7%	40.3%	43.2%	46.6%	50.6%	55.3%	61.0%	68.0%	76.7%
	6000	39.8%	42.4%	45.4%	48.8%	52.8%	57.4%	63.0%	69.8%	78.3%

Table 5.10

Implicit probability of default

	i	9%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.4%	1.8%	2.8%
	100	1.1%	1.2%	1.4%	1.6%	1.8%	2.2%	2.7%	3.6%	5.4%
	150	1.6%	1.8%	2.0%	2.3%	2.7%	3.2%	4.0%	5.3%	7.9%
	200	2.2%	2.4%	2.7%	3.1%	3.6%	4.3%	5.3%	7.0%	10.3%
	250	2.7%	3.0%	3.3%	3.8%	4.4%	5.3%	6.5%	8.6%	12.5%
	300	3.2%	3.5%	4.0%	4.5%	5.3%	6.3%	7.7%	10.1%	14.7%
	350	3.7%	4.1%	4.6%	5.2%	6.1%	7.2%	8.9%	11.6%	16.7%
	400	4.2%	4.7%	5.2%	5.9%	6.9%	8.2%	10.1%	13.1%	18.7%
	450	4.7%	5.2%	5.8%	6.6%	7.7%	9.1%	11.2%	14.5%	20.5%
	500	5.2%	5.8%	6.5%	7.3%	8.5%	10.0%	12.3%	15.8%	22.3%
	550	5.7%	6.3%	7.1%	8.0%	9.2%	10.9%	13.3%	17.1%	24.0%
	600	6.2%	6.8%	7.6%	8.7%	10.0%	11.8%	14.4%	18.4%	25.6%
	650	6.7%	7.4%	8.2%	9.3%	10.7%	12.6%	15.4%	19.6%	27.2%
	700	7.2%	7.9%	8.8%	10.0%	11.5%	13.5%	16.4%	20.8%	28.7%
	750	7.6%	8.4%	9.4%	10.6%	12.2%	14.3%	17.3%	22.0%	30.1%
	800	8.1%	8.9%	9.9%	11.2%	12.9%	15.1%	18.3%	23.1%	31.5%
	850	8.6%	9.4%	10.5%	11.8%	13.6%	15.9%	19.2%	24.2%	32.8%
	900	9.0%	9.9%	11.0%	12.4%	14.3%	16.7%	20.1%	25.3%	34.1%
	950	9.5%	10.4%	11.6%	13.0%	14.9%	17.4%	21.0%	26.3%	35.3%
	1000	9.9%	10.9%	12.1%	13.6%	15.6%	18.2%	21.8%	27.3%	36.5%
	1050	10.4%	11.4%	12.7%	14.2%	16.2%	18.9%	22.7%	28.3%	37.6%
	1100	10.8%	11.9%	13.2%	14.8%	16.9%	19.7%	23.5%	29.3%	38.7%
	1150	11.2%	12.3%	13.7%	15.4%	17.5%	20.4%	24.3%	30.2%	39.7%
	1200	11.7%	12.8%	14.2%	15.9%	18.1%	21.1%	25.1%	31.1%	40.8%
	1250	12.1%	13.3%	14.7%	16.5%	18.8%	21.8%	25.9%	32.0%	41.8%
	1300	12.5%	13.7%	15.2%	17.0%	19.4%	22.4%	26.7%	32.8%	42.7%
	1350	12.9%	14.2%	15.7%	17.6%	20.0%	23.1%	27.4%	33.7%	43.6%
	1400	13.4%	14.6%	16.2%	18.1%	20.5%	23.7%	28.1%	34.5%	44.5%
	1450	13.8%	15.1%	16.7%	18.6%	21.1%	24.4%	28.8%	35.3%	45.4%
	1500	14.2%	15.5%	17.1%	19.2%	21.7%	25.0%	29.5%	36.1%	46.3%
	1550	14.6%	16.0%	17.6%	19.7%	22.3%	25.6%	30.2%	36.8%	47.1%
	1600	15.0%	16.4%	18.1%	20.2%	22.8%	26.2%	30.9%	37.6%	47.9%
	1650	15.4%	16.8%	18.5%	20.7%	23.4%	26.8%	31.6%	38.3%	48.6%
	1700	15.8%	17.2%	19.0%	21.2%	23.9%	27.4%	32.2%	39.0%	49.4%
	1750	16.2%	17.6%	19.4%	21.7%	24.4%	28.0%	32.8%	39.7%	50.1%
	1800	16.5%	18.1%	19.9%	22.1%	25.0%	28.6%	33.5%	40.4%	50.8%
	1850	16.9%	18.5%	20.3%	22.6%	25.5%	29.2%	34.1%	41.0%	51.5%
	1900	17.3%	18.9%	20.8%	23.1%	26.0%	29.7%	34.7%	41.7%	52.2%
	1950	17.7%	19.3%	21.2%	23.5%	26.5%	30.3%	35.3%	42.3%	52.8%
	2000	18.0%	19.7%	21.6%	24.0%	27.0%	30.8%	35.9%	42.9%	53.4%
	2500	21.6%	23.4%	25.6%	28.3%	31.6%	35.7%	41.1%	48.4%	58.9%
	3000	24.8%	26.9%	29.3%	32.2%	35.7%	40.0%	45.6%	53.0%	63.2%
	3500	27.8%	30.0%	32.6%	35.6%	39.3%	43.8%	49.4%	56.8%	66.8%
	4000	30.6%	32.9%	35.6%	38.7%	42.5%	47.1%	52.8%	60.1%	69.6%
	4500	33.1%	35.5%	38.3%	41.6%	45.4%	50.0%	55.7%	62.8%	72.1%
	5000	35.5%	38.0%	40.8%	44.1%	48.0%	52.7%	58.3%	65.3%	74.1%
	5500	37.7%	40.2%	43.1%	46.5%	50.4%	55.0%	60.6%	67.4%	75.9%
	6000	39.8%	42.4%	45.3%	48.7%	52.6%	57.2%	62.6%	69.3%	77.5%

Table 5.11

Implicit probability of default

	i	10%								
		Recovery Value (as a % of principal)								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Spread - in Basis Points	50	0.5%	0.6%	0.7%	0.8%	0.9%	1.1%	1.4%	1.8%	2.7%
	100	1.1%	1.2%	1.4%	1.5%	1.8%	2.2%	2.7%	3.5%	5.2%
	150	1.6%	1.8%	2.0%	2.3%	2.7%	3.2%	4.0%	5.2%	7.6%
	200	2.2%	2.4%	2.7%	3.0%	3.5%	4.2%	5.2%	6.8%	9.9%
	250	2.7%	3.0%	3.3%	3.8%	4.4%	5.2%	6.4%	8.4%	12.1%
	300	3.2%	3.5%	4.0%	4.5%	5.2%	6.2%	7.6%	9.9%	14.2%
	350	3.7%	4.1%	4.6%	5.2%	6.0%	7.1%	8.8%	11.4%	16.1%
	400	4.2%	4.7%	5.2%	5.9%	6.8%	8.1%	9.9%	12.8%	18.0%
	450	4.7%	5.2%	5.8%	6.6%	7.6%	9.0%	11.0%	14.2%	19.8%
	500	5.2%	5.8%	6.4%	7.3%	8.4%	9.9%	12.1%	15.5%	21.6%
	550	5.7%	6.3%	7.0%	8.0%	9.2%	10.8%	13.1%	16.8%	23.2%
	600	6.2%	6.8%	7.6%	8.6%	9.9%	11.7%	14.2%	18.0%	24.8%
	650	6.7%	7.4%	8.2%	9.3%	10.6%	12.5%	15.2%	19.2%	26.3%
	700	7.1%	7.9%	8.8%	9.9%	11.4%	13.3%	16.1%	20.4%	27.8%
	750	7.6%	8.4%	9.3%	10.5%	12.1%	14.2%	17.1%	21.6%	29.2%
	800	8.1%	8.9%	9.9%	11.2%	12.8%	15.0%	18.0%	22.7%	30.6%
	850	8.6%	9.4%	10.5%	11.8%	13.5%	15.8%	18.9%	23.8%	31.9%
	900	9.0%	9.9%	11.0%	12.4%	14.2%	16.5%	19.8%	24.8%	33.1%
	950	9.5%	10.4%	11.6%	13.0%	14.8%	17.3%	20.7%	25.8%	34.3%
	1000	9.9%	10.9%	12.1%	13.6%	15.5%	18.0%	21.6%	26.8%	35.5%
	1050	10.4%	11.4%	12.6%	14.2%	16.1%	18.8%	22.4%	27.8%	36.6%
	1100	10.8%	11.9%	13.1%	14.7%	16.8%	19.5%	23.2%	28.7%	37.7%
	1150	11.2%	12.3%	13.7%	15.3%	17.4%	20.2%	24.0%	29.7%	38.7%
	1200	11.7%	12.8%	14.2%	15.9%	18.0%	20.9%	24.8%	30.6%	39.8%
	1250	12.1%	13.3%	14.7%	16.4%	18.6%	21.6%	25.6%	31.4%	40.7%
	1300	12.5%	13.7%	15.2%	17.0%	19.2%	22.2%	26.3%	32.3%	41.7%
	1350	12.9%	14.2%	15.7%	17.5%	19.8%	22.9%	27.1%	33.1%	42.6%
	1400	13.3%	14.6%	16.1%	18.0%	20.4%	23.5%	27.8%	33.9%	43.5%
	1450	13.8%	15.1%	16.6%	18.6%	21.0%	24.2%	28.5%	34.7%	44.4%
	1500	14.2%	15.5%	17.1%	19.1%	21.6%	24.8%	29.2%	35.5%	45.2%
	1550	14.6%	15.9%	17.6%	19.6%	22.1%	25.4%	29.9%	36.2%	46.0%
	1600	15.0%	16.4%	18.0%	20.1%	22.7%	26.0%	30.6%	37.0%	46.8%
	1650	15.4%	16.8%	18.5%	20.6%	23.2%	26.6%	31.2%	37.7%	47.6%
	1700	15.8%	17.2%	18.9%	21.1%	23.8%	27.2%	31.9%	38.4%	48.3%
	1750	16.1%	17.6%	19.4%	21.6%	24.3%	27.8%	32.5%	39.1%	49.0%
	1800	16.5%	18.0%	19.8%	22.0%	24.8%	28.4%	33.1%	39.8%	49.7%
	1850	16.9%	18.4%	20.3%	22.5%	25.3%	28.9%	33.7%	40.4%	50.4%
	1900	17.3%	18.8%	20.7%	23.0%	25.8%	29.5%	34.3%	41.1%	51.1%
	1950	17.7%	19.2%	21.1%	23.5%	26.3%	30.0%	34.9%	41.7%	51.7%
	2000	18.0%	19.6%	21.6%	23.9%	26.8%	30.6%	35.5%	42.3%	52.4%
	2500	21.6%	23.4%	25.6%	28.2%	31.4%	35.5%	40.7%	47.8%	57.9%
	3000	24.8%	26.8%	29.2%	32.0%	35.5%	39.8%	45.2%	52.4%	62.3%
	3500	27.8%	30.0%	32.5%	35.5%	39.1%	43.5%	49.0%	56.2%	65.8%
	4000	30.6%	32.8%	35.5%	38.6%	42.3%	46.8%	52.4%	59.5%	68.8%
	4500	33.1%	35.5%	38.2%	41.4%	45.2%	49.7%	55.3%	62.3%	71.2%
	5000	35.5%	37.9%	40.7%	44.0%	47.8%	52.4%	57.9%	64.7%	73.3%
	5500	37.7%	40.2%	43.1%	46.4%	50.2%	54.8%	60.2%	66.9%	75.2%
	6000	39.8%	42.3%	45.2%	48.5%	52.4%	56.9%	62.3%	68.8%	76.7%

Table 7.1

Necessary Permanent Primary Surplus

	i	4.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	1.0%	0.7%	0.3%	0.0%	-0.3%	-0.7%
	40%	1.2%	0.8%	0.4%	0.0%	-0.4%	-0.8%
	45%	1.3%	0.9%	0.4%	0.0%	-0.4%	-0.8%
	50%	1.5%	1.0%	0.5%	0.0%	-0.5%	-0.9%
	55%	1.6%	1.1%	0.5%	0.0%	-0.5%	-1.0%
	60%	1.8%	1.2%	0.6%	0.0%	-0.6%	-1.1%
	65%	1.9%	1.3%	0.6%	0.0%	-0.6%	-1.2%
	70%	2.1%	1.4%	0.7%	0.0%	-0.7%	-1.3%
	75%	2.2%	1.5%	0.7%	0.0%	-0.7%	-1.4%
	80%	2.4%	1.6%	0.8%	0.0%	-0.8%	-1.5%
	85%	2.5%	1.7%	0.8%	0.0%	-0.8%	-1.6%
	90%	2.7%	1.8%	0.9%	0.0%	-0.9%	-1.7%
	95%	2.8%	1.9%	0.9%	0.0%	-0.9%	-1.8%
	100%	3.0%	2.0%	1.0%	0.0%	-1.0%	-1.9%
	110%	3.3%	2.2%	1.1%	0.0%	-1.0%	-2.1%
	120%	3.6%	2.4%	1.2%	0.0%	-1.1%	-2.3%
	130%	3.9%	2.5%	1.3%	0.0%	-1.2%	-2.5%
	140%	4.2%	2.7%	1.4%	0.0%	-1.3%	-2.6%
	150%	4.5%	2.9%	1.5%	0.0%	-1.4%	-2.8%
	160%	4.8%	3.1%	1.6%	0.0%	-1.5%	-3.0%

Table 7.2

Necessary Permanent Primary Surplus

	i	5.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	1.4%	1.0%	0.7%	0.3%	0.0%	-0.3%
	40%	1.6%	1.2%	0.8%	0.4%	0.0%	-0.4%
	45%	1.8%	1.3%	0.9%	0.4%	0.0%	-0.4%
	50%	2.0%	1.5%	1.0%	0.5%	0.0%	-0.5%
	55%	2.2%	1.6%	1.1%	0.5%	0.0%	-0.5%
	60%	2.4%	1.8%	1.2%	0.6%	0.0%	-0.6%
	65%	2.6%	1.9%	1.3%	0.6%	0.0%	-0.6%
	70%	2.8%	2.1%	1.4%	0.7%	0.0%	-0.7%
	75%	3.0%	2.2%	1.5%	0.7%	0.0%	-0.7%
	80%	3.2%	2.4%	1.6%	0.8%	0.0%	-0.8%
	85%	3.4%	2.5%	1.7%	0.8%	0.0%	-0.8%
	90%	3.6%	2.6%	1.7%	0.9%	0.0%	-0.8%
	95%	3.8%	2.8%	1.8%	0.9%	0.0%	-0.9%
	100%	4.0%	2.9%	1.9%	1.0%	0.0%	-0.9%
	110%	4.4%	3.2%	2.1%	1.1%	0.0%	-1.0%
	120%	4.8%	3.5%	2.3%	1.2%	0.0%	-1.1%
	130%	5.1%	3.8%	2.5%	1.3%	0.0%	-1.2%
	140%	5.5%	4.1%	2.7%	1.3%	0.0%	-1.3%
	150%	5.9%	4.4%	2.9%	1.4%	0.0%	-1.4%
	160%	6.3%	4.7%	3.1%	1.5%	0.0%	-1.5%

Table 7.3

Necessary Permanent Primary Surplus

	i	6.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	1.7%	1.4%	1.0%	0.7%	0.3%	0.0%
	40%	2.0%	1.6%	1.2%	0.8%	0.4%	0.0%
	45%	2.2%	1.8%	1.3%	0.9%	0.4%	0.0%
	50%	2.5%	2.0%	1.5%	1.0%	0.5%	0.0%
	55%	2.7%	2.2%	1.6%	1.1%	0.5%	0.0%
	60%	3.0%	2.4%	1.7%	1.2%	0.6%	0.0%
	65%	3.2%	2.5%	1.9%	1.3%	0.6%	0.0%
	70%	3.5%	2.7%	2.0%	1.3%	0.7%	0.0%
	75%	3.7%	2.9%	2.2%	1.4%	0.7%	0.0%
	80%	4.0%	3.1%	2.3%	1.5%	0.8%	0.0%
	85%	4.2%	3.3%	2.5%	1.6%	0.8%	0.0%
	90%	4.5%	3.5%	2.6%	1.7%	0.9%	0.0%
	95%	4.7%	3.7%	2.8%	1.8%	0.9%	0.0%
	100%	5.0%	3.9%	2.9%	1.9%	1.0%	0.0%
	110%	5.4%	4.3%	3.2%	2.1%	1.0%	0.0%
	120%	5.9%	4.7%	3.5%	2.3%	1.1%	0.0%
	130%	6.4%	5.1%	3.8%	2.5%	1.2%	0.0%
	140%	6.9%	5.5%	4.1%	2.7%	1.3%	0.0%
	150%	7.4%	5.9%	4.4%	2.9%	1.4%	0.0%
	160%	7.9%	6.3%	4.7%	3.1%	1.5%	0.0%

Table 7.4

Necessary Permanent Primary Surplus

	i	7.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	2.1%	1.7%	1.4%	1.0%	0.7%	0.3%
	40%	2.4%	2.0%	1.6%	1.2%	0.8%	0.4%
	45%	2.7%	2.2%	1.7%	1.3%	0.9%	0.4%
	50%	3.0%	2.5%	1.9%	1.4%	1.0%	0.5%
	55%	3.3%	2.7%	2.1%	1.6%	1.0%	0.5%
	60%	3.6%	2.9%	2.3%	1.7%	1.1%	0.6%
	65%	3.9%	3.2%	2.5%	1.9%	1.2%	0.6%
	70%	4.2%	3.4%	2.7%	2.0%	1.3%	0.7%
	75%	4.5%	3.7%	2.9%	2.2%	1.4%	0.7%
	80%	4.8%	3.9%	3.1%	2.3%	1.5%	0.8%
	85%	5.0%	4.2%	3.3%	2.5%	1.6%	0.8%
	90%	5.3%	4.4%	3.5%	2.6%	1.7%	0.8%
	95%	5.6%	4.7%	3.7%	2.7%	1.8%	0.9%
	100%	5.9%	4.9%	3.9%	2.9%	1.9%	0.9%
	110%	6.5%	5.4%	4.3%	3.2%	2.1%	1.0%
	120%	7.1%	5.9%	4.7%	3.5%	2.3%	1.1%
	130%	7.7%	6.4%	5.0%	3.8%	2.5%	1.2%
	140%	8.3%	6.9%	5.4%	4.0%	2.7%	1.3%
	150%	8.9%	7.4%	5.8%	4.3%	2.9%	1.4%
	160%	9.5%	7.8%	6.2%	4.6%	3.0%	1.5%

Table 7.5

Necessary Permanent Primary Surplus

	i	8.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	2.4%	2.1%	1.7%	1.3%	1.0%	0.7%
	40%	2.8%	2.4%	1.9%	1.5%	1.1%	0.8%
	45%	3.1%	2.6%	2.2%	1.7%	1.3%	0.8%
	50%	3.5%	2.9%	2.4%	1.9%	1.4%	0.9%
	55%	3.8%	3.2%	2.7%	2.1%	1.6%	1.0%
	60%	4.2%	3.5%	2.9%	2.3%	1.7%	1.1%
	65%	4.5%	3.8%	3.2%	2.5%	1.9%	1.2%
	70%	4.9%	4.1%	3.4%	2.7%	2.0%	1.3%
	75%	5.2%	4.4%	3.6%	2.9%	2.1%	1.4%
	80%	5.5%	4.7%	3.9%	3.1%	2.3%	1.5%
	85%	5.9%	5.0%	4.1%	3.3%	2.4%	1.6%
	90%	6.2%	5.3%	4.4%	3.5%	2.6%	1.7%
	95%	6.6%	5.6%	4.6%	3.7%	2.7%	1.8%
	100%	6.9%	5.9%	4.9%	3.8%	2.9%	1.9%
	110%	7.6%	6.5%	5.3%	4.2%	3.1%	2.1%
	120%	8.3%	7.1%	5.8%	4.6%	3.4%	2.3%
	130%	9.0%	7.6%	6.3%	5.0%	3.7%	2.5%
	140%	9.7%	8.2%	6.8%	5.4%	4.0%	2.6%
	150%	10.4%	8.8%	7.3%	5.8%	4.3%	2.8%
	160%	11.1%	9.4%	7.8%	6.2%	4.6%	3.0%

Table 7.6

Necessary Permanent Primary Surplus

	i	9.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	2.8%	2.4%	2.0%	1.7%	1.3%	1.0%
	40%	3.2%	2.7%	2.3%	1.9%	1.5%	1.1%
	45%	3.6%	3.1%	2.6%	2.2%	1.7%	1.3%
	50%	4.0%	3.4%	2.9%	2.4%	1.9%	1.4%
	55%	4.4%	3.8%	3.2%	2.6%	2.1%	1.6%
	60%	4.8%	4.1%	3.5%	2.9%	2.3%	1.7%
	65%	5.1%	4.5%	3.8%	3.1%	2.5%	1.8%
	70%	5.5%	4.8%	4.1%	3.4%	2.7%	2.0%
	75%	5.9%	5.1%	4.4%	3.6%	2.9%	2.1%
	80%	6.3%	5.5%	4.7%	3.8%	3.0%	2.3%
	85%	6.7%	5.8%	5.0%	4.1%	3.2%	2.4%
	90%	7.1%	6.2%	5.2%	4.3%	3.4%	2.5%
	95%	7.5%	6.5%	5.5%	4.6%	3.6%	2.7%
	100%	7.9%	6.9%	5.8%	4.8%	3.8%	2.8%
	110%	8.7%	7.5%	6.4%	5.3%	4.2%	3.1%
	120%	9.5%	8.2%	7.0%	5.8%	4.6%	3.4%
	130%	10.3%	8.9%	7.6%	6.3%	5.0%	3.7%
	140%	11.1%	9.6%	8.2%	6.7%	5.3%	4.0%
	150%	11.9%	10.3%	8.7%	7.2%	5.7%	4.2%
	160%	12.7%	11.0%	9.3%	7.7%	6.1%	4.5%

Table 7.7

Necessary Permanent Primary Surplus

	i	10.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	3.1%	2.7%	2.4%	2.0%	1.7%	1.3%
	40%	3.6%	3.1%	2.7%	2.3%	1.9%	1.5%
	45%	4.0%	3.5%	3.1%	2.6%	2.1%	1.7%
	50%	4.5%	3.9%	3.4%	2.9%	2.4%	1.9%
	55%	4.9%	4.3%	3.7%	3.2%	2.6%	2.1%
	60%	5.3%	4.7%	4.1%	3.5%	2.9%	2.3%
	65%	5.8%	5.1%	4.4%	3.8%	3.1%	2.5%
	70%	6.2%	5.5%	4.8%	4.0%	3.3%	2.6%
	75%	6.7%	5.9%	5.1%	4.3%	3.6%	2.8%
	80%	7.1%	6.3%	5.4%	4.6%	3.8%	3.0%
	85%	7.6%	6.7%	5.8%	4.9%	4.0%	3.2%
	90%	8.0%	7.1%	6.1%	5.2%	4.3%	3.4%
	95%	8.5%	7.5%	6.5%	5.5%	4.5%	3.6%
	100%	8.9%	7.8%	6.8%	5.8%	4.8%	3.8%
	110%	9.8%	8.6%	7.5%	6.3%	5.2%	4.2%
	120%	10.7%	9.4%	8.2%	6.9%	5.7%	4.5%
	130%	11.6%	10.2%	8.8%	7.5%	6.2%	4.9%
	140%	12.5%	11.0%	9.5%	8.1%	6.7%	5.3%
	150%	13.4%	11.8%	10.2%	8.7%	7.1%	5.7%
	160%	14.3%	12.5%	10.9%	9.2%	7.6%	6.0%

Table 7.8

Necessary Permanent Primary Surplus

	i	11.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	3.5%	3.1%	2.7%	2.4%	2.0%	1.7%
	40%	4.0%	3.5%	3.1%	2.7%	2.3%	1.9%
	45%	4.5%	4.0%	3.5%	3.0%	2.6%	2.1%
	50%	5.0%	4.4%	3.9%	3.4%	2.9%	2.4%
	55%	5.4%	4.9%	4.3%	3.7%	3.1%	2.6%
	60%	5.9%	5.3%	4.7%	4.0%	3.4%	2.8%
	65%	6.4%	5.7%	5.0%	4.4%	3.7%	3.1%
	70%	6.9%	6.2%	5.4%	4.7%	4.0%	3.3%
	75%	7.4%	6.6%	5.8%	5.0%	4.3%	3.5%
	80%	7.9%	7.1%	6.2%	5.4%	4.6%	3.8%
	85%	8.4%	7.5%	6.6%	5.7%	4.9%	4.0%
	90%	8.9%	7.9%	7.0%	6.1%	5.1%	4.2%
	95%	9.4%	8.4%	7.4%	6.4%	5.4%	4.5%
	100%	9.9%	8.8%	7.8%	6.7%	5.7%	4.7%
	110%	10.9%	9.7%	8.5%	7.4%	6.3%	5.2%
	120%	11.9%	10.6%	9.3%	8.1%	6.9%	5.7%
	130%	12.9%	11.5%	10.1%	8.8%	7.4%	6.1%
	140%	13.9%	12.4%	10.9%	9.4%	8.0%	6.6%
	150%	14.9%	13.2%	11.7%	10.1%	8.6%	7.1%
	160%	15.8%	14.1%	12.4%	10.8%	9.1%	7.5%

Table 7.9

Necessary Permanent Primary Surplus

	i	12.0%					
		GDP growth rate					
		1.0%	2.0%	3.0%	4.0%	5.0%	6.0%
Public debt to GDP	35%	3.8%	3.4%	3.1%	2.7%	2.3%	2.0%
	40%	4.4%	3.9%	3.5%	3.1%	2.7%	2.3%
	45%	4.9%	4.4%	3.9%	3.5%	3.0%	2.5%
	50%	5.4%	4.9%	4.4%	3.8%	3.3%	2.8%
	55%	6.0%	5.4%	4.8%	4.2%	3.7%	3.1%
	60%	6.5%	5.9%	5.2%	4.6%	4.0%	3.4%
	65%	7.1%	6.4%	5.7%	5.0%	4.3%	3.7%
	70%	7.6%	6.9%	6.1%	5.4%	4.7%	4.0%
	75%	8.2%	7.4%	6.6%	5.8%	5.0%	4.2%
	80%	8.7%	7.8%	7.0%	6.2%	5.3%	4.5%
	85%	9.3%	8.3%	7.4%	6.5%	5.7%	4.8%
	90%	9.8%	8.8%	7.9%	6.9%	6.0%	5.1%
	95%	10.3%	9.3%	8.3%	7.3%	6.3%	5.4%
	100%	10.9%	9.8%	8.7%	7.7%	6.7%	5.7%
	110%	12.0%	10.8%	9.6%	8.5%	7.3%	6.2%
	120%	13.1%	11.8%	10.5%	9.2%	8.0%	6.8%
	130%	14.2%	12.7%	11.4%	10.0%	8.7%	7.4%
	140%	15.2%	13.7%	12.2%	10.8%	9.3%	7.9%
	150%	16.3%	14.7%	13.1%	11.5%	10.0%	8.5%
	160%	17.4%	15.7%	14.0%	12.3%	10.7%	9.1%

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