4 Public confidence and debt management: a model and a case study of Italy

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1 Introduction

With a public debt projected to remain close to 100% of GNP for several years in the future, the Italian authorities face two goals: first, to keep the cost of debt service as low as possible; second, to guarantee monetary and financial stability while carrying out the financial liberalization required by the EC accords. This paper investigates the role of public debt management in the achievement of these two goals.

Section 2 of the paper briefly summarizes the debt management policies followed in Italy during the 1980s. Even though in the first half of the decade these policies were quite successful, they may have planted the seeds of the difficulties of the Summer of 1987, which marked a turning point. Unlike in the pre-87 period, the government has been unable to issue long-term debt at low cost. A difficult dilemma has arisen: should the government pay a premium in order to prevent a shortening of the maturity of its debt; and what kind of debt instruments should be issued?

The answers to these questions depend on the nature of the risk premium currently paid on long-term debt. Section 3 asks whether the return on the Italian public debt currently incorporates a premium against the risk of a confidence crisis, or more generally of a government default. This is a difficult question, and any attempt to answer it must be regarded as tentative and not conclusive. However, we do find some evidence that such a premium may exist and may have been rising in recent years.

Section 4 analyses a simple model that begins to address some of the questions relating to debt management and confidence crises. The central result is that the maturity structure of public debt may influence the likelihood of a confidence crisis on the debt: the shorter and more concentrated are the maturities, the more likely is a confidence crisis. This suggests that it may be worth it initially to pay a relatively high interest rate to lengthen the maturity structure: doing so can reduce the risk

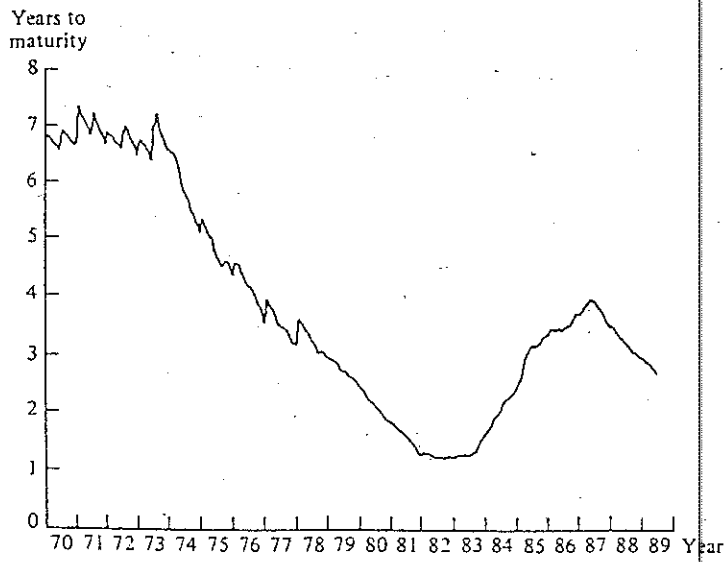

Figure 4.1 Average maturity of Italian government debt, Jan. 1970–June 1989.
Source: Bank of Italy

premium on the whole stock of debt outstanding, since it makes a confidence crisis less likely.

Finally, Section 5 concludes the paper with a discussion of some normative implications of our model about debt management policies.

2 Debt management in Italy during the 1980s

As shown in Figure 4.1, Italy approached the 1980s with a short and rapidly declining maturity of public debt. In 1981, about 60% of the debt had a maturity of less than a year; the average maturity of the whole debt outstanding was less than one and a half years. Virtually all of it was nominal domestic debt. Investors had suffered capital losses during the late 1970s, due to rising inflation and high nominal interest rates. Afraid of repeating the same mistakes, they were reluctant to hold long-term fixed-interest nominal debt (see Pagano, 1988).

In order to lengthen the maturity of public debt, the authorities could choose between three instruments: foreign currency debt, debt indexed to the price level, or debt indexed to some short-term nominal interest rate. The fourth option, fixed nominal interest debt, would have demanded an excessively high premium against the inflation risk. The authorities opted heavily for the third alternative. As indicated in Table 4.1, between 1982

	Total (% of GDP)	BOT	CCT	BTP (% of total Issues)	Foreign currency	Others
			Gross			
1980	35.97	90.78	9.21	0.01	0.00	0.00
1981	46.70	91.39	4.25	2.54	0.00	1.83
1982	59.71	83.95	14.51	0.94	0.44	0.16
1983	56.46	74.89	20.99	3.66	0.18	0.28
1984	47.34	66.51	27.82	5.18	0.49	0.00
1985	47.62	66.64	25.28	4.50	0.88	2.71
1986	44.96	66.39	19.79	13.30	0.52	0.00
1987	41.45	78.25	13.73	4.68	0.72	2.62
1988	42.27	77.01	5.14	14.19	3.23	0.43
			Net			
1980	6.24	104.64	11.04	−6.96	0.00	−8.72
1981	8.90	79.80	6.65	9.23	0.00	4.32
1982	10.32	56.80	47.70	−2.84	2.49	−4.15
1983	12.79	13.80	83.10	4.66	0.79	−2.35
1984	10.04	12.83	78.29	11.64	2.33	−5.09
1985	13.20	12.42	74.05	3.74	3.17	6.61
1986	10.87	9.98	55.10	36.05	2.14	−3.27
1987	8.57	30.17	42.28	16.07	3.48	8.00
1988	9.50	35.36	−7.65	58.31	15.21	−1.23

Table 4.1. Gross and net issues of Italian public debt, 1980–88

Note: Foreign currency = BTE + CTE.
Source: Bank of Italy.

and 1987 they increased considerably the net issues of CCT (Treasury Credit Certificates), medium-term notes whose coupons are indexed to the returns on 6-months or 1-year Treasury Bills (TBs). As shown in Figure 4.1, they succeeded in lengthening the average maturity of government debt from a minimum of 14 months in 1982 to a maximum of almost 4 years in the summer of 1987.

The authorities preferred financial indexation to price level indexation on the grounds that the latter would have reduced the Treasury's incentives to fiscal adjustment and it would have affected the credibility of their anti-inflationary policy (an essential part of which was a reduction of wage indexation). These concerns are clearly indicated in the 1981

'concluding remarks' of the Governor of the Bank of Italy (see Banca d'Italia 1981). These issues are also discussed in Spaventa (1988).

Other less compelling reasons have been suggested to explain this choice in favour of CCTs. It has been argued that financial indexation is preferred by the investor to price-level indexation or to foreign currency debt, and hence demands a lower premium, because it protects against inflation risk as well as against changes in the short-term real interest rate. However, this cannot be an argument for issuing *only* financially indexed long-term debt. An additional explanation is the fear that issuing real or foreign currency debt makes it impossible to reduce the burden of the debt by means of inflation or devaluation in case of an emergency. However, the government still retains other escape clauses, such as wealth taxation, forced consolidation, or outright repudiation. We discuss this issue in Section 5.

The almost exclusive reliance on financial indexation had two negative effects. First, it magnified the repercussions of monetary policy on the government budget. Any change in the short-term interest rate automatically affected the interest payments on a large fraction of the government debt. Thus, one of the purposes of lengthening the maturity was defeated.

Second, the choice of the indexation parameter (the rate on Treasury Bills) gave rise to a time-inconsistency problem. The value of this parameter is under the control of the authorities. Thus they have a temptation to keep it high at first, when the debt is issued, and to reduce it once the private sector is locked into an irreversible investment decision, thereby inflicting a capital loss on the debt holders. After 1985, perhaps the authorities were succumbing to this temptation. As indicated in Figure 4.2, after 1985 the rate of return on the 1-year TBs (to which much of the debt was indexed) remained systematically below that on the shorter-term TBs, right up to the crisis of 1987. At the same time, as shown in Figure 4.3, the return on the 1-year TBs was also generally below that on medium-term government bonds. The positive differential between 3-month (or 6-month) and 1-year TBs is particularly striking in the first half of 1987, just prior to the crisis. Presumably, at that time the market was expecting higher nominal rates in the future; and yet the authorities were not allowing the 1-year rate to budge.

As pointed out by Bencini and Tabellini (1987) and Ministero del Tesoro (1989), the perception of this time-inconsistency was probably one of the causes of the crisis in the Summer of 1987, even though other factors have played an important role.[1] In the few months after July 1987, the secondary market price of CCTs plummeted by more than 3 percentage points. Since then, the market for this debt instrument has not recovered, and the authorities have been unable to replace all of the CCTs as they became

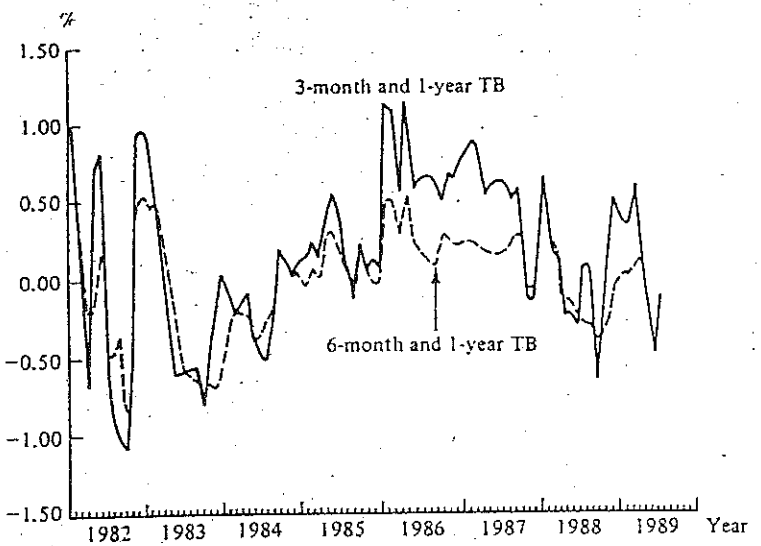

Figure 4.2 Interest differentials on Italian Treasury Bills (TB), 1982–89.
Source: Bank of Italy.

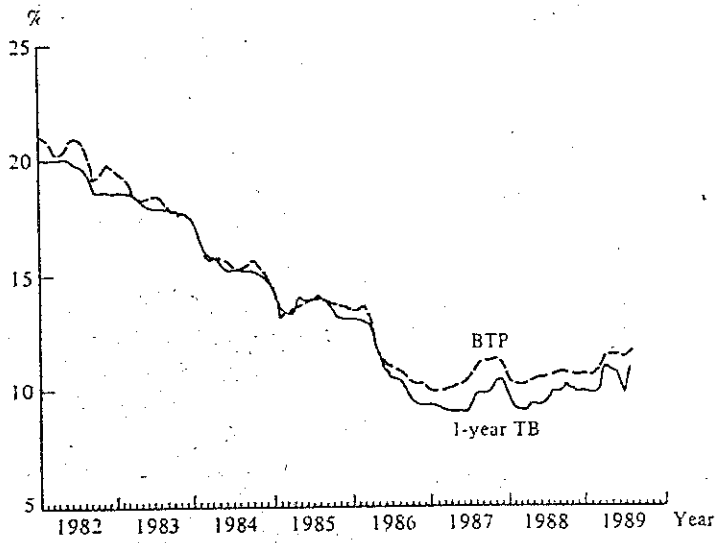

Figure 4.3 Rate of return on Italian medium-term government bonds and 1-year Treasury Bills, 1982–89.
Source: Bank of Italy.

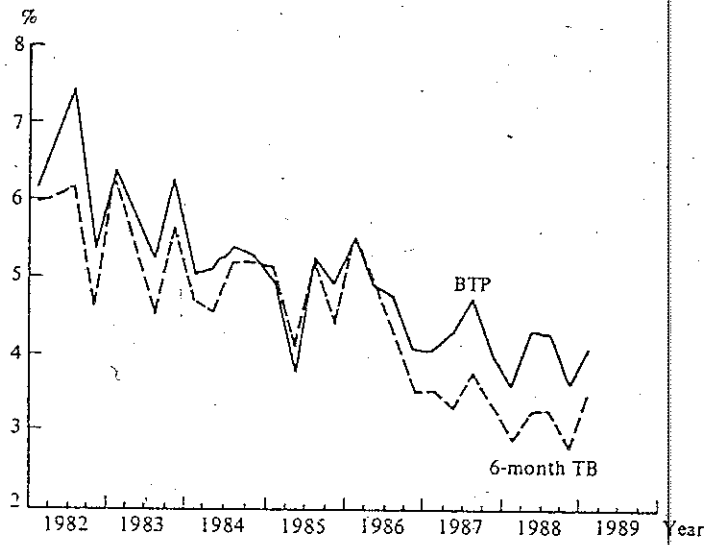

Figure 4.4 *Ex ante* real returns on Italian medium-term government bonds (BTP) and 6-month Treasury Bills, 1982–89.
Source: Bank of Italy and *Forum-Mondo Economico* (see text).

due. Since the summer of 1987, the sales of CCTs to the public have never been fully subscribed. At times the market bought even less than 50% of the amount offered.

This crisis marked a turning point. The previous strategy of financing the deficit by issuing CCTs had to be discontinued. Perhaps a new debt management strategy has not yet emerged. As indicated in Table 4.1, in 1988 the government had to resume the old policy of issuing large amounts of short-term Treasury Bills, implying a fall of the average maturity of the debt. The government also issued large amounts of medium-term fixed nominal-interest debt of a high interest rate. Figure 4.4 compares the *ex ante* real rates of return net of taxes on fixed-interest government bonds (BTP) and on 6-months Treasury Bills. Both rates display a common declining trend that reflects a decrease in real interest rates throughout the world. But since the Summer of 1987, the BTP have paid almost 1 percentage point in real terms more than Treasury Bills. A similar pattern emerges if one compares the real yield on the CCT and on the 6-months Treasury Bills.[2] Clearly, the market is unwilling to hold medium-long-term debt without compensation.[3]

The criticial question is: what is the nature of this risk premium? If the premium represents the expectation of forthcoming inflation and our measures of the *ex ante* real rates are wrong, then the course of action for

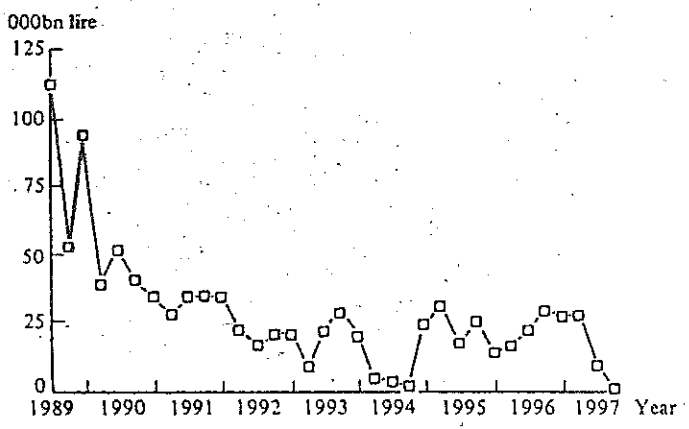

Figure 4.5 Maturing Italian government debt in 1989–97, as of April 1989. 000 mn lire: quarterly data at par value.
Source: Bank of Italy.

the government is clear. Foreign currency and real (i.e., indexed) debt should be issued in much larger amounts. This policy has been advocated by a committee of Italian economists, established by the Treasury ministry in 1988 – see Ministero del Tesoro (1989). There is however a second possibility. The high real interest rates currently paid on the Italian long-term debt may represent also a premium against a more general and vague risk of a financial crisis. In this second case, changing the nature of the debt instrument would not reduce the risk premium.

By financial crisis we do not mean that the government deliberately and unexpectedly chooses to default on its debt. This possibility seems very remote. In the current Italian situation it would probably have very high political costs, by disrupting the system of financial intermediation and causing arbitrary wealth redistribution. What we have in mind instead is the possibility of a crisis initiated by a reluctance of investors to roll over the public debt. In such an event, default or consolidation may be the only way out. But the realization that, in the event of a confidence crisis, the government would be forced to a default, may be enough to trigger a crisis. A run on government debt could be self-fulfilling, just like a bank run (see also Bencini and Tabellini, 1988). Figure 4.5 suggests that even disregarding the primary deficits, in the next few years the government is called on to roll over a large fraction of its outstanding debt. The authorities may be able to withstand a temporary crisis, as they did in 1982, when a large part of the maturing debt was bought by the Bank of Italy, who then resold it to the financial markets in the form of repurchase

agreements. But would the system be able to survive a more prolonged confidence crisis? And even if the answer is positive, would the public believe that the system can survive? We now turn to some evidence suggesting that private investors may already fear negative answers to these questions.

3 Rates of return on the Italian public debt

This section asks what is the nature of the risk premium on the Italian public debt. We attempt to discriminate between two alternative sources of risk. (a) Inflation risk, due to the fact that most of the outstanding debt is nominal; (b) risk of a financial crisis leading up to public debt consolidation or default. To do so, we compare the returns on public debt to those on equivalent private financial instruments. We always find that the public debt pays a higher interest rate. This suggests that it is the identity of the debtor, and not the nature of the instrument, that is feared by the market.

3.1 Interest rate differentials on short-term debt

The only financial instruments similar to Treasury Bills (TBs) are the Certificates of Deposit (CDs) of corresponding maturity issued by banks. The differentials between the interest rates net of taxes paid on three- and twelve-month TBs and the interest rates on CDs of corresponding maturity are shown in Figures 4.6 and 4.7.[4]

These figures are striking. The TBs pay interest rates which are between two and four points above the interest rates paid on CDs. The differentials relative to 12-month TBs indicate again an increasing trend starting in 1987. It is also worth noting the peaks of March and April 1989, which reflect the issue difficulties of those months accompanied by a one-point increase of the official discount rate. A very similar pattern is followed by the differential between 6-month TBs and 6-month CDs.

This differential between TBs and CDs is high by international standards, as shown in Table 4.2. The high-debt countries are those in which the Treasury Bills pay a higher rate, while in the low-debt countries the relationship is reversed. We should note however that the size of the Italian differential could also be attributed to the illiquidity of the secondary market for TBs and to the possible existence of informal repurchase agreements for CDs between banks and depositors, which would make the CDs more liquid than the TBs. Since the Italian market for the CDs developed only recently, it is impossible to compute a differential before mid-1984. In that period the closest substitute for TBs was saving deposits. Figure 4.8 shows the interest differential between TBs and savings deposits for the

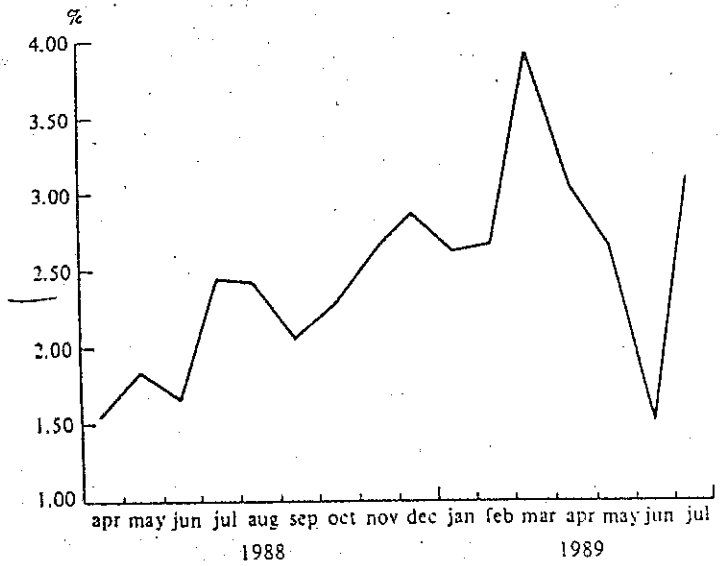

Figure 4.6 Interest differential between Italian 3-month Treasury Bills and 3-month certificates of deposit (CD), April 1988–July 1989.
Source: Bank of Italy.

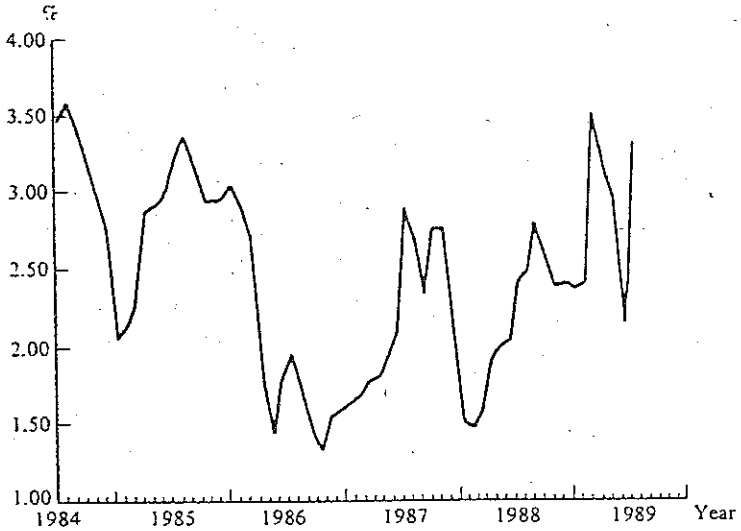

Figure 4.7 Interest differential between Italian 12-month Treasury Bills and 12-month certificates of deposit (CD), 1984–89.
Source: Bank of Italy.

	Debt/GDP (%)	TB3–CD3 Differential
Belgium	126	2.2
Italy	95	1.0 (2.7)[a]
Netherlands	80	0.9
Canada	69	−0.1
Japan	68	−2.1
United States	52	−1.1
Great Britain	45	−0.4
Germany	45	−0.1

Table 4.2. Short-term interest differential and debt–GNP ratios in selected countries, 1988

[a]All differentials are gross of taxes (the net of taxes Italian differential is reported in parenthesis and it is the 1988 average of the differential in Figure 4.6). For Belgium, Canada, Germany and the Netherlands, the interest rate on 3-month CDs corresponds to the interest rate on 3-month time deposits.
Source: Bank of International Settlements Databank.

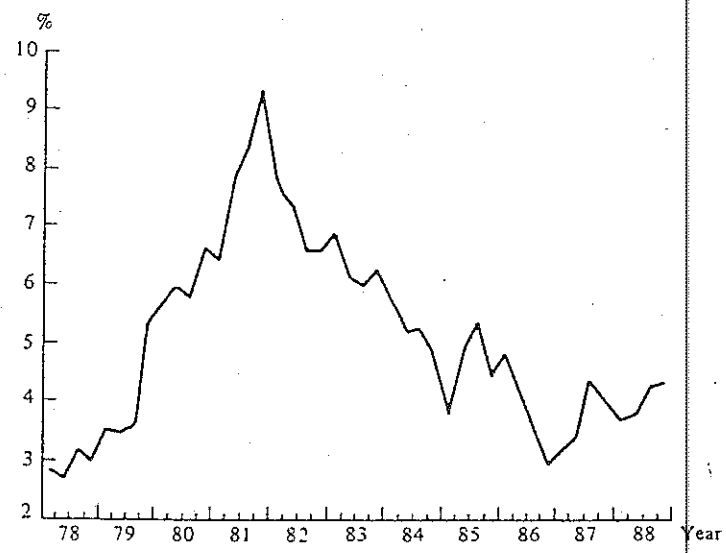

Figure 4.8 Interest differential between Italian 1-year Treasury Bills and savings deposits, 1978–88.
Source: Bank of Italy.

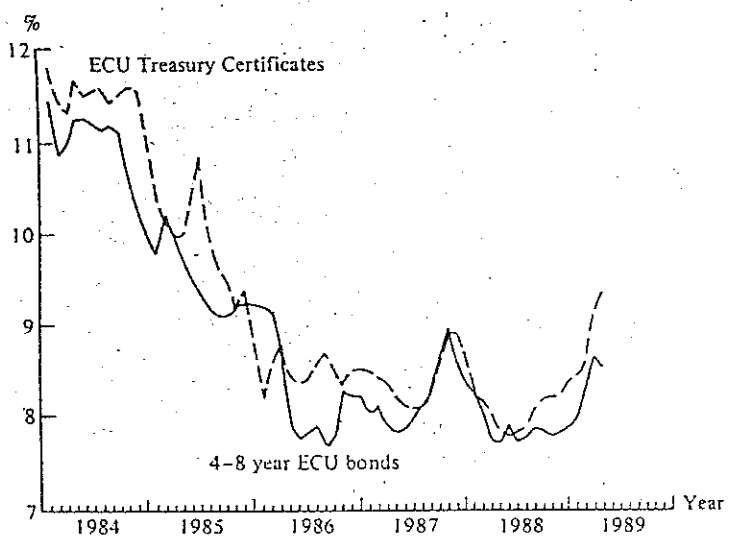

Figure 4.9 Secondary market yields of ECU bonds, 1984–89.
Source: Bank of Italy.

3.2 *Interest differentials on medium/long-term debt*

period 1978–88.[5] The differential is negatively correlated with the average maturity of government debt. This negative correlation is consistent with the predictions of our theoretical model of debt runs.[6]

The possibility of a risk premium on the Italian government debt can also be investigated by comparing the yield on ECU-denominated government bonds (CTE) with the average yield of ECU bonds of corresponding maturity (4–8 years). Figure 4.9 indicates that the yield net of taxes on the Italian bonds was higher on average than the yield on ECU bonds. The differential diminished and almost disappeared in 1987; since 1988, however, we can note again a premium on CTE. This evidence is again consistent with the view that the risk premium varies inversely with the average maturity of the debt. Note that the yield on CTE is net of taxes while that on ECU bonds is gross of taxes, so that the after-tax differential should be even more favourable to CTE.

Figure 4.10 shows the interest rates at issue on 2–3 year BTPs and 18–24 month certificates of deposit issued by special credit institutions. The differential is always favourable to the BTPs with peaks in 1987 and in the first months of 1989. The differential is even more remarkable if one considers that 1988 was a boom year for certificates of deposit of the

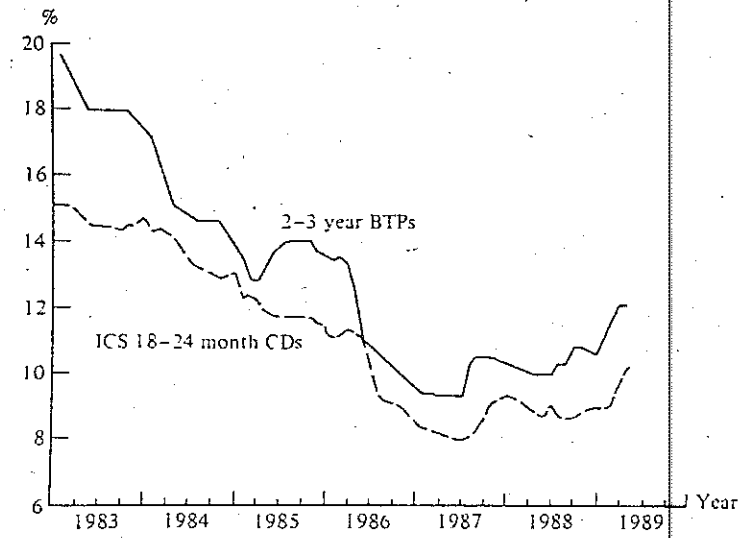

Figure 4.10 Interest rates at issue on Italian 2–3 year BTP and 18–24 month CD issued by special credit institutions, 1983–89.
Source: Bank of Italy.

special credit institutions: in spite of the differential, this kind of CDs increased by 41% relative to 1987.

Summarizing, this evidence suggests that private investors may fear a confidence crisis on the Italian public debt. We now turn to a theoretical model that analyses how such a crisis might take place.

4 A model of debt runs

The basic result of this section is that a crisis of confidence in the public debt can be self-fulfilling, like a bank run; but it is less likely to occur if the public debt has a long and balanced maturity structure.

4.1 *Introduction and review of the literature*

The idea that there may be an analogy between a bank run and a run on government debt has a long tradition, but the most recent treatments are in Parcu (1986) and Calvo (1988). The latter studies a two-period model of a small open economy: if the government repudiates its debt, it bears a cost proportion to the amount repudiated. Calvo shows that two equilibria exist: a 'good' equilibrium in which the government honours its debt, and a 'bad' equilibrium, in which investors expect the government to partially

repudiate and demand a higher interest rate, and the government fulfills these expectations. Calvo's 'bad' equilibrium is similar to the banking panic studied by Diamond and Dybvig (1983); it reflects a coordination problem among investors making *simultaneous* portfolio decisions. If an investor expects all the other investors to demand a risk premium, he realizes that the government will be forced to partially repudiate in the future; thus, his optimal response is also to demand a risk premium.

The confidence crisis that we study in this paper, instead, reflects a coordination problem among individuals making investment decisions *at different dates*. We study an infinite-horizon model in which the optimal government policy is to roll over its debt for ever. There are two equilibria. In one this optimal policy is expected by investors and carried out by the government. In the other current investors refuse to buy any public debt, in the anticipation that future investors will do likewise, and the government is forced to repudiate. A second difference between Calvo's model and ours is in the specification of the cost of default. These differences imply that in our model, unlike in Calvo's, the larger is the stock of debt maturing in a given period, the greater is the range of parameter values for which a crisis can occur. This feature of our model provides a role for debt management.

Giavazzi and Pagano (this volume) derive results related to ours. However, in their paper, unlike in ours, the policy that gives rise to the debt run is not derived from the government optimization problem but is postulated exogenously. In addition, they focus on repudiation by means of exchange-rate devaluation; whereas we consider outright repudiation. Prati (1989) models a confidence crisis along lines similar to this paper, but focuses on nominal debt and disregards debt management.

4.2 *The model*

A small open economy is inhabited by an infinitely-lived representative consumer, maximizing:

$$U = \sum_{t=0}^{\infty} \beta^t u(c_t) \quad 1 > \beta > 0 \tag{1}$$

where c_t denotes consumption and $u(\cdot)$ is a well-behaved concave utility function. In each period he receives one unit of non-storable output and pays a distorting tax τ_t to the government. This tax is distorting: in addition to paying the tax, the consumer loses an amount $f(\tau_t)$ every time the tax is collected, where $f(0) = 0$, $f'(\cdot) >$, $f''(\cdot) > 0$. Thus, the consumer's disposable income in each period is

$$F(\tau_t) \equiv 1 - \tau_t - f(\tau_t) \tag{2}$$

This specification and, in particular, the convexity of $f(\cdot)$ captures in a very simple way the well-known idea that 'tax smoothing' is desirable. Alternatively, one could introduce a labour supply decision with a distortionary income tax. Such a model, however, introduces subtle time-consistency problems which we want to abstract from (see Lucas and Stokey, 1983, and Persson and Tabellini, 1990, on this point).

Consumers have access to perfect international capital markets in which they can borrow or lend at a risk-free gross real interest rate equal to their discount factor, $1/\beta$. External tax-free assets held by the consumers at the beginning of period t are denoted e_t. The government only issues one-period discount debt and there is no domestic government debt held abroad. With no loss of generality, there is no government spending. In each period the government decides how much tax revenue to raise and whether or not to honour its outstanding debt obligations; thus, policy commitments are ruled out. Debt repudiation is costly: the first time some debt is repudiated, the economy bears a cost proportional to output (which is normalized to 1); that is, output is reduced by a fraction $\alpha > 0$ in the period in which repudiation occurs for the first time. This cost represents the economic disruptions that may be brought about by a default on government debt, such as bankruptcies in financial markets, uncertainty, and disruption in the allocation of resources. With no change in the results, we could assume that this cost affects government utility rather than its budget constraint.

Based on these assumptions, we can write the private sector and the government intertemporal budget constraints respectively as:

$$q_t b_{t+1} + \beta e_{t+1} + c_t \leq F(\tau_t) + e_t + b_t(1 - \theta_t) - D(\theta_t) \tag{3}$$

$$b_t(1 - \theta_t) \leq \tau_t + q_t b_{t+1} \tag{4}$$

where b_t denotes the stock of domestic government debt at the beginning of period t, q_t is the market price at which new debt is issued, θ_t is the fraction of debt repudiated at time t, and $D(\theta_t)$ denotes the cost of repudiation. Our assumption about the costs of default is summarized by

$$D(\theta_t) = 0 \quad \text{if} \quad \theta_t = 0 \quad \text{or} \quad \theta_{t-i} = 1, \quad i > 0 \tag{5}$$

$$D(\theta_t) = \alpha \quad \text{otherwise}$$

Within each period, the timing of events is as follows. First, the government announces a price q_t at which it stands ready to sell the debt, and the maximum amount for sale. Then, on the basis of that price, the private sector chooses how much debt to buy. Finally, the government chooses the combination of τ_t and θ_t that satisfies the government budget constraint, given the amount of debt outstanding, b_t, and the debt just sold, b_{t+1}.

Alternatively, the timing of events could be as follows. First, the government announces the maximum amount of debt for sale. Then, the private sector chooses the price at which it is ready to buy the debt offered (β or zero, corresponding to $\theta^e_{t+1} = 0$ or $\theta^e_{t+1} = 1$, where e superscript denotes private expectations). Finally the government chooses the combination of τ_t and θ_t that satisfies the government budget constraint. The two timings correspond to different auction techniques. The technique used to auction TBs in Italy until March 1989 is very similar to the first timing of events, since the government announced a minimum price and an amount offered before the public made its bids. Since March 1989, the technique used to auction TBs corresponds to the second timing of events, since the government announces *only* the amount offered. Both timing assumptions guarantee the separation between the time at which the debt is offered and the time at which the public makes its bids, that is crucial for our results. Section 4.5 discusses alternative timing assumptions.

All private agents have the same (perfect) information as the government. Thus, a no-arbitrage condition between the returns on domestic and foreign assets implies

$$q_t = \beta(1 - \theta^e_{t+1}) \tag{6}$$

At time 0 a positive stock of debt outstanding b_0 is held by the consumer. For a discussion of this point see Section 4.5. Finally, the government maximizes the utility of the consumer.

An equilibrium is defined as a situation in which, in each period and for all sequences of previous aggregate histories: (i) The price q_t is optimal for the government, given the private sector reaction to the announced price. (ii) The private sector portfolio decision is optimal, given the price q_t announced by the government and the expected future equilibrium outcomes. (iii) The choice of taxes τ_t and θ_t is optimal for the government, given the private current investment decision and the effect of the current policy on the expected future equilibrium outcomes.[7]

4.3 *Multiple equilibria with one-period debt*

Any equilibrium must have the following properties: (a) Either $\theta_t = 0$ or $\theta_t = 1$. This is due to the lump-sum nature of the costs of defaulting.[8] Equation (6) then implies that the price at which investors are willing to buy government debt is either $q_t = \beta$ (if no default is expected) or $q_t = 0$ (otherwise). (b) If the government defaults, it always does it in period 0. Delaying the default does not reduce its cost, but it brings about more tax distortions while the debt is serviced.

We now characterize the 'good' equilibrium: by Property (b) we only need to consider period 0. If at time 0 the government defaults, then the consumer's consolidated budget constraint from time 0 onward is:

$$e_0 + \frac{1}{1-\beta} - \alpha \geq \sum_{t=0}^{\infty} \beta^t c_t \tag{7}$$

Standard results of consumption theory imply that the optimal consumption path is constant, and by (7) it is:

$$c_t = (1-\beta)e_0 + 1 - \alpha(1-\beta) \equiv c^d \quad t = 0, 1, \ldots \tag{8}$$

Suppose instead that $\theta_t = \theta^e_{t+1} = 0$ for every t. The optimal policy is to raise taxes to pay interest on the debt and roll over the principal:

$$\tau_t = (1-\beta)b_0 \equiv \tau^* \quad t = 0, 1, \ldots \tag{9}$$

Equation (9) captures the basic result of 'optimal tax smoothing'. The consumer now maximizes (1) subject to (2), where $D(\theta_t) = 0$, and chooses:

$$c_t = (1-\beta)e_0 + 1 - f[(1-\beta)b_0] \equiv c^* \quad t = 0, 1, \ldots \tag{10}$$

That is, in every period consumption is equal to disposable income plus the interest payments on the initial foreign assets.

In period 0, the government will choose *not* to repudiate if and only if:

$$c^* \geq c^d \tag{11}$$

(without loss of generality we assume that an indifferent government chooses *not* to repudiate). Using (8) and (10), condition (11) implies that repudiation occurs if and only if it costs less than the present value of the tax distortions needed to service the debt:

$$\alpha \geq \frac{1}{1-\beta} f[(1-\beta)b_0] \equiv \underline{\alpha} \tag{12}$$

A confidence crisis is triggered by the investor's beliefs that in the next period the government will *not* be able to roll over the debt and will be forced to default. Thus, if a crisis occurs in period t, $\theta^e_{t+1} = 1$; investors require immediate full repayment of the principal and invest in foreign assets. For the moment we take these expectations as exogenous; we show below under what conditions they are rational and self-fulfilling. Faced by a confidence crisis, the government has two choices:[9] (1) to raise taxes and repay the debt; (2) to default immediately. If the government chooses to default, from then onward consumption is c^d as defined in (8). If the government chooses to raise taxes, income falls by the amount of the tax distortions, $f(b_0)$. Clearly, raising taxes in response to a confidence crisis is superior to defaulting if and only if

$$\alpha \geq f(b_0) \equiv \bar{\alpha} \tag{13}$$

Lemma 1: $\bar{\alpha} > \underline{\alpha}$

Proof. $\bar{\alpha} > \underline{\alpha}$ is equivalent to $(1+\beta)f(b_0) > f((1-\beta)b_0)$. This inequality follows immediately from the strict convexity of $f(\cdot)$ and from $f(0) = 0$.

Q.E.D.

Proposition 1: *(i) If $\alpha < \underline{\alpha}$ there is a unique equilibrium in which default occurs in the first period: $\theta_0 = 1$, (θ_t^e, θ_t are indeterminate for $t > 0$). (ii) If $\alpha \geq \bar{\alpha}$ there is a unique equilibrium in which default never occurs, and $\theta_{t+1}^e = \theta_t = 0$ $\forall t$. (iii) $\underline{\alpha} \geq \alpha < \bar{\alpha}$ there are two Pareto-ranked equilibria. In the good equilibrium, default never occurs, i.e., $\theta_{t+1}^e = \theta_t = 0$ $\forall t$. In the bad equilibrium default occurs in the first period, i.e., $\theta_0 = \theta_1^e = 1$.*

Proof. (i) Follows immediately from (12). (ii) From (13) $\theta_t = \theta_{t+1}^e = 0$ is an equilibrium. To prove uniqueness, consider the event of a crisis: from (13), if $b_{t+1} = 0$, then $\theta_t = 0$ and taxes are raised to repay the debt. By (5) it then follows that $\theta_{t+1} = 0$. Hence $\theta_{t+1}^e = 1$ cannot be an equilibrium, since it violates rational expectations. (iii) By (12), $\theta_t = 0$ if $q_t = \beta$ and all the debt is rolled over. Hence, $\theta_t = 0$ is the government best response to $\theta 2_{t+1}^e = 0$. And $\theta_{t+1}^e = 0$ is the private sector best response to $\theta_{t+2}^e = 0$. But by (13), $\theta_t = 1$ if $\theta_{t+1}^e = 1$ and no debt is sold. Hence $\theta_t = 1$ is the government best response to $\theta_{t+1}^e = 1$. By repeating the same argument for period $t+1$, $\theta_{t+1} = 1$ is the government best response to $\theta_{t+2}^e = 1$, irrespective of the value of θ_t – see also (5). As a consequence $\theta_{t+1}^e = 1$ is the private sector best response to $\theta_{t+2}^e = 1$. Q.E.D.

The crucial point is that if $\underline{\alpha} \leq \alpha < \bar{\alpha}$ there are two equilibria, with and without default, depending upon the occurrence of a confidence crisis.[10]

The proof relies on the lump-sum nature of these repudiation costs, which rules out partial default. Suppose that the repudiation costs were linear in the amount defaulted, and consisted of both a fixed and a variable component. The good equilibrium with no default would still be described as in Proposition 1. However, a confidence crisis could now take other forms in addition to those described in that Proposition. In particular, confidence crisis similar to those of Calvo (1988) would also be possible, in which a partial default occurs because investors fear a fall in the demand for public debt in the current period.

4.4 *Multiple equilibria with multi-period debt*

Let us assume that there exist 'short-term' debt (i.e., of one period) and 'long-term' debt (i.e., two periods). The consumer maximizes the same objective function as above, subject to the following new budget constraint, where ${}_ib_j$ $(i < j)$ indicates debt issued in period i which matures in period j and ${}_iq_j$ is its market price:

$$c_t + \beta e_{t+1} + {}_tq_{t+1}\,{}_tb_{t+1} + {}_tq_{t+2}\,{}_tq_{t+2} \leq F(\tau_t) + e_t - D(\theta_t) + {}_{t-1}b_t(1-\theta_t) + {}_{t-2}b_t(1-\theta_t) \tag{14}$$

In (14) we assume that the default parameter (θ_t) is the same for both types of debt maturing at time t. The budget constraint of the government is:

$${}_{t-1}b_t(1-\theta_t) + {}_{t-2}b_t(1-\theta_t) \leq \tau_t + {}_tb_{t+1}\,{}_tq_{t+1} + {}_tb_{t+2}\,{}_tq_{t+2} \tag{15}$$

The no arbitrage conditions require:

$${}_tq_{t+1} = \beta(1-\theta_{t+1}^e) \quad {}_tq_{t+2} = \beta^2(1-\theta_{t+2}^e) \tag{16}$$

Let us consider first under what conditions the government does not default in the absence of a crisis. The discounted present value of the debt outstanding at the beginning of period 0 is:

$$b \equiv {}_{-1}b_0 + {}_{-2}b_0 + \beta_{-1}b_1 \tag{17}$$

Hence the optimal tax rate is:

$$\tau_t = (1-\beta)b \equiv \tau^*, \quad t = 0, 1, \ldots \tag{18}$$

Repeating the same argument illustrated in the previous subsection, we can conclude that the government will not repudiate in the absence of a crisis if the previous condition $\alpha \geq \underline{\alpha}$ holds, where $\underline{\alpha}$ is defined as in (12), except that now b replaces b_0.[11]

Consider now a confidence crisis in period t. Suppose first that the private sector followed an open-loop strategy, in the sense that the private expectations θ_{t+i}^e, $i > 0$, do not depend on the aggregate history of the game in previous periods. If $\theta_{t+i}^e = 1$, $i > 0$, then in period t the government can either default, in which case consumption from then onward is c^d as in (8), or it can repay the debt. In the latter case, since by hypothesis private expectations are given and equal to 1, taxes have to be as follows:

$$\tau_t = {}_{t-1}b_t + {}_{t-2}b_t \tag{19}$$

$$\tau_{t+1} = {}_{t-1}b_{t+1} \tag{20}$$

$$\tau_s = 0, \quad s > t+1 \tag{21}$$

If the government chooses to repay, consumption from t onwards (C^R) is:

$$c_s^R = 1 + e_t(1-\beta) - (1-\beta)[f({}_{t-1}b_t + {}_{t-2}b_t) + \beta f({}_{t-1}b_{t+1})] \quad s \geq t \tag{22}$$

From (8) and (22) it follows that in the event of a crisis the government chooses to repay if and only if:

$$\alpha \geq [f({}_{t-1}b_t + {}_{t-2}b_t) + \beta f({}_{t-1}b_{t+1})] \equiv \bar{\alpha}_t \tag{23}$$

As in the previous subsection, it can be shown that, since no debt is repaid between periods 0 and t, $\bar{\alpha}_t > \underline{\alpha}$ for all t. Hence, if $\bar{\alpha}_t > \alpha \geq \underline{\alpha}$, there exists an (open-loop) equilibrium in which a confidence crisis occurs in period t or earlier.[12]

Clearly, by (23), $\bar{\alpha}_t$ depends on the maturity structure of public debt.

Proposition 2: *If the private sector plays an open-loop strategy, the equilibrium with a confidence crisis is least likely to exist if only long-term debt is issued, and if the same amount of debt matures in each period.*

Proof: By definition, $\underline{\alpha}$ depends only on the present value of the total debt outstanding, and not on its maturity composition. Consider the sequence $\{\bar{\alpha}_t\}$, $t = 0, 1, \ldots$, and define $\bar{\alpha}^*$ as the maximal element of that sequence. We want to find the maturity structure that minimizes $\bar{\alpha}^*$, for a given net present value of the total debt outstanding. A constant net present value of debt implies:

$$ {}_{t-1}b_t + {}_{t-2}b_t + \beta_{t-1}b_{t+1} \equiv b, \quad t = 0, 1, \ldots \tag{24}$$

Consider the problem of minimizing $\bar{\alpha}_t$ as defined in (23), by choice of ${}_{t-2}b_t$, ${}_{t-1}b_t$ and ${}_{t-1}b_{t+1}$, subject to (24). The first order conditions of this problem imply:

$$ {}_{t-1}b_t + {}_{t-2}b_t = {}_{t-1}b_{t+1} \tag{25}$$

The maximal element $\bar{\alpha}^*$ is minimized when all the elements of the sequence $\{\bar{\alpha}_t\}$ are minimized, which happens when (25) holds for all t. Combining (24) and (25) we then obtain that ${}_{t-1}b_t = 0$ and ${}_{t-2}b_t = {}_{t-1}b_{t+1}$ for all t. Only two-period debt must be issued, in equal amounts in each period. Q.E.D.

This result is due to the convexity of the tax collection costs. When a large amount of debt falls due in a given period, the cost of repaying it in the event of a confidence crisis is high. Hence, a crisis is more likely to result in default. By holding a long and balanced maturity structure, the government reduces the cost of responding to a crisis by raising taxes, since the tax burden is distributed over several periods.

Proposition 2 can easily be generalized to a debt of more than two periods. In the limit, if all debt is consols, a confidence crisis is ruled out and $\bar{\alpha} = \underline{\alpha}$. In this limiting case, there is no need to roll over the principal, and taxes are raised just to pay interest on the debt.

Next, consider the case in which the private sector plays a feedback strategy. Thus, θ^e_{t+1} is now allowed to depend on the aggregate history up to period $t + i - 1$. In particular, in a sequentially rational Nash equilibrium, θ^e_{t+1} is a function of the stock of debt outstanding in the previous period, b_{t+i-1}. Suppose that $\theta^e_{t+1} = 1$. If the government chooses not to repudiate the debt, in period t it has to raise taxes in the amount:

$$ \tau_t = {}_{t-1}b_t + {}_{t-2}b_t \tag{20'}$$

But now, the total stock of debt outstanding next period is ${}_{t-1}b_{t+1}$. Servicing this debt or even repaying it all at once entails smaller tax distortions. Hence, the continuation of the confidence crisis beyond period t is now less likely. If ${}_{t-1}b_{t+1}$ is sufficiently small (so that $\underline{\alpha} > ({}_{t-1}b_{t+1})$), the continuation of the crisis past period t is ruled out altogether. Thus, when the private sector plays a feedback strategy, long-term public debt has an additional advantage besides that discussed with reference to Proposition 2. Namely, it enables the government to regain the confidence of investors by partially repaying some of the debt outstanding. This point is developed by Lars Svensson, in his comments on this paper.

4.5 *Extensions and discussion*

4.5.1 Government spending, or where does the initial debt come from?

An alternative interpretation of our results is as follows. Suppose that there is no initial debt, but the government needs to issue debt to finance a temporarily high level of spending in period 0. The optimal policy is to issue debt in period 0 and roll it over for ever, so as to smooth tax distortions over time. If α is sufficiently high (higher than $\bar{\alpha}$) debt can be issued regardless of 'confidence'; if $\alpha < \underline{\alpha}$ debt cannot be issued and no tax smoothing can be achieved. In the intermediate case, $\underline{\alpha} \leq \alpha < \bar{\alpha}$, debt can be issued only as long as confidence crises do not occur. Thus, the possibility of confidence crises restricts the range of parameter values for which optimal tax smoothing can be achieved by issuing debt.

4.5.2 Debt auctions

The timing of events postulated in the previous pages corresponds to a particular method for selling government debt. Namely, the government fixes a base price and lets the market determine the amount bought. The nature of the equilibrium, and in particular the possibility of a confidence crisis, depends criticially on the features of this auction. Suppose for instance that government debt is sold through the following more sophisticated auction method: the government fixes a base price for short-term debt; if any short-term debt remains unsold, then the government sells the remaining debt as consols, at whatever interest rate the market will require to absorb it. As remarked above, if all debt was consols, a confidence crisis would never occur in this simple model. Hence, in the event of a confidence crisis, the government would always be able to sell consols with no risk premium. Knowing that the government can rely on this option rules out the bad equilibrium with the confidence crisis, for *any maturity* of the debt outstanding: the maturity of the outstanding debt is completely irrelevant! What matters is only that the government retains the *possibility* of selling long-term debt.

However, in a more realistic environment, where long- and short-term instruments are not perfect substitutes from the point of view of investors, this alternative auction method may not rule out completely the bad equilibria. But this example suggests that a careful selection of auction methods may contribute to ensure financial stability in a high-debt economy. A more careful study of this issue is an important task for future research.

4.5.3 Risk premium

Our model is deterministic, thus it is impossible to address the issue of the risk premium in a precise way. More generally, in a model with some uncertainty a risk premium on government debt might be requested by the investors. Giavazzi and Pagano (this volume) have analysed this issue. We conjecture that the nature of their results would carry over to our optimizing framework.

Suppose that a confidence crisis occurs in every period with probability Q_t, exogenously given. That is, in every period t, $\theta^c_{t+1} > 0$ with probability Q_t and $\theta^c_{t+1} = 0$ with probability $1 - Q_t$.[13] Assume that the true value of α is unknown to the consumer, who only assigns a probability distribution to α, $\phi(\alpha)$. If $\theta^c_{t+1} = 0$ no default occurs with certainty, but if $\theta^c_{t+1} = 1$ the probability of a default is equal to $\text{Prob}(\alpha < \bar{\alpha}) \equiv \phi(\bar{\alpha})$ where $\bar{\alpha}$ has the same interpretation as above. Thus, in every period t, the probability of default is $\phi(\bar{\alpha})Q_t$. If a confidence crisis occurs and $\alpha \geq \bar{\alpha}$ the government repays the debt; if $\alpha < \bar{\alpha}$ the government defaults. In either case there is no debt left after the crisis. Until a confidence crisis occurs, the government has to pay a risk premium on its liability to compensate for the default risk. As shown above, $\bar{\alpha}$ is lower the 'more balanced' and the longer is the maturity structure of the debt. Thus, the risk premium can be reduced by lengthening and balancing the maturity structure of government debt.

4.5.4 Consolidation

A third option, in addition to repudiating or raising taxes, is available to the government in the event of a confidence crisis: to consolidate the debt. 'Consolidation' is defined as a compulsory transformation of short-term debt due for maturity into long-term debt. If the secondary market for public debt is perfectly efficient, a consolidation would cause only a minor capital loss by the current holders of the debt. Thus, if private investors could be sure that the government would respond to a crisis by consolidating the debt rather than by repudiating it, they would not 'fear' the crisis. But this in turn would seem to make the occurrence of a crisis less likely. Indeed, it can be shown that if the secondary market is perfectly efficient, allowing the government to consolidate its debt in the event of a crisis eliminates the bad equilibrium in which a crisis occurs. This is similar to a suspension of payments during a banking panic, as in Diamond and Dybvig (1983).

There are however two counterarguments, at least in the Italian situation. First, even though the market is much more efficient now than it used to be, it is interesting to recall what happened during the Italian forced consolidation of 1926. At that time, the secondary market price of government debt plummeted by about 30% (even though it later recovered, and debt holders who did not liquidate the consolidated debt did not suffer high losses – see Alesina, 1988, and Confalonieri and Gatti, 1986). This suggests that consolidation is still likely to be very fearsome for private investors. Second, to the extent that the political and economic costs of consolidation are smaller than those of outright repudiation, the panic equilibrium may be made more (rather than less) likely by the option of consolidating the debt. In terms of the model, the parameter α would drop, which in turn makes a crisis more likely.

5 Conclusions

Our theoretical and empirical findings suggest a tentative explanation of the recent difficulties in rolling over the Italian public debt: the fear of a confidence crisis on the debt. If correct, this explanation has some novel policy implications. All of them enhance the chance of surviving a confidence crisis without defaulting on the debt.

First of all, the quantity of debt coming due at each date is more important than the composition of the debt by category of debt instrument. To diminish the perceived likelihood of a confidence crisis, the stock of debt coming due at each date should be minimized. This calls for issuing debt of long maturity and evenly concentrated at all future dates. In the current Italian situation, it also means that the authorities should, up to a point, 'bite the bullet'. They should issue long-term debt even at relatively high interest rates, since accepting a shortening of the average maturity may be counterproductive: by increasing the possibility of a confidence crisis, it may lead to larger risk-premium and a higher average cost of servicing the total outstanding debt.

Second, like in the case of banking panics, there is a role for a lender of last resort. Here this role could be fulfilled by foreign governments or international organizations, through the promise of a credit line to the country hit by the debt panic. Gaining access to such a credit line would increase the chances of surviving a crisis without defaulting, thereby making the occurrence of the crisis less likely. A similar point is raised by Grilli and Alesina (1990) with reference to speculative attacks against the exchange rate.

There is a third option, often used in the past: to rely on financial controls and monetary policy in order to artificially increase the demand for public debt. However, the European accords will severely constrain the use of both instruments. This constraint is more likely to be a blessing than a drawback. It is true that imposing financial controls and monetizing part of the debt would make it easier to withstand a debt run. But on the other hand, resorting to these instruments too frequently distorts the incentives of the government, by hiding the costs of deficit finance and creating a confusion of responsibility between budgetary policy and monetary policy. As often argued in the Italian policy debate, these incentive effects could slow down the process of debt stabilization and thus further undermine the credibility of the government.

NOTES

We are grateful to Silvio Bencini, John Black, Rudiger Dornbusch, Mario Draghi, Douglas Gale, Lars Svensson and several other conference participants for many helpful comments. This paper was revised while Alesina was an Olin Fellow at the NBER: he gratefully acknowledges financial support from the Olin and Sloan Foundations. None of the institutions with which the authors are affiliated bears any responsibility or necessarily shares the views expressed in this paper.

1 First, the lags in the indexation mechanism of CCT determined capital gains as long as inflation and interest rates were falling, but, when they started to increase, the same lags determined capital losses and heavy disinvestments of banks and mutual funds. Second, technical innovations in the newly issued CCT and a change in taxation contributed to the fall of the market price of CCT in the secondary market. Finally, the unusually large redemptions that the mutual funds were facing forced them to liquidate part of their assets.

2 The *ex ante* real returns have been computed by using a survey of inflation expectations published by *Forum-Mondo Economico*, which provides quarterly expected inflation data for the current and following quarter. Naturally, the real return differential in Figure 4.5 should be interpreted with caution, since we are using the same deflator for short- and long-term government debt (we simply analyse the six-months expected inflation from the survey).

3 The shortening maturity and the persisting high real rates indicate that the debt management problems continued throughout 1988; it should be noticed, however, that the demand for government bonds varied largely among the sectors of the economy. In 1988, the disinvestments of the commercial banks (which can in part be attributed to the abandonment of administrative controls, such as the ceiling on loans and the securities investment requirement) and of the mutual funds were compensated by the very large investments of the private sector; the latter, in fact, increased its holdings of government bonds by an amount greater than the net issues.

4 The time series of the differential relative to the 3-month CD starts only in April 1988, since this kind of financial instrument was first introduced at that date.

5 Note that the definition of saving deposits includes the CDs. The interest rate on saving deposits used to compute the differential in Figure 4.8 is a weighted average of the interest rate on CDs and on other kinds of savings deposits (the CD component will evidently be relevant only since 1984).

6 However, the movements of the differential between TBs and saving deposits correspond quite closely to those of the nominal interest rate. As a consequence, part of the differential can also be attributed to the tax levied on banks by means of the reserve requirement. This tax, in fact, varies together with the nominal interest rate; as long as the banks transfer part of the tax on depositors, the differential with TBs widens when the nominal interest rates increase and it shrinks when they decline.

7 An equilibrium satisfying these two conditions is a sequentially rational Nash Equilibrium, as defined in Persson and Tabellini (1989).

8 Suppose that the government chooses $0 < \theta_{t+1} < 1$. Then it incurs the costs of default as if $\theta_{t+1} + 1$ *and* some remaining debt has to be serviced with distortionary taxation.

9 In principle a third option would be available: consolidation. We will discuss this option below, in Section 4.5. For the moment we rule it out by assuming that the cost α applies to both default *and* consolidation. More fundamentally, this simple model with one-period debt and no uncertainty is not well equipped to handle the issue of consolidation.

10 In this determininistic model a multiplicity of equilibria cannot occur in any period other than the first without violating a rationality condition. In fact if a confidence crisis had to occur at time $t > 0$, nobody would hold debt at time $(t-1)$, $(t-2)$ and so on. Thus, the crisis would ravel backward at time zero. Thus, the criticial assumption is that b_0 exists *before* the planning horizon begins.

11 By (5), the cost of repudiation is borne only once. Thus, if $\theta_0 = 1$, then $\theta_1 = 1$ also.

12 If $\bar{\alpha}_s > \underline{\alpha}$, $s < t$, the confidence crisis unravels to the period immediately preceding that for which $\bar{\alpha}_s > \underline{\alpha}$ for the first time.

13 Remember that given our specification of the costs of default, no value of $\theta \in (0, 1)$ can be a rational expectations equilibrium.

REFERENCES

Alesina, A. (1988). 'The end of Large Public Debts'. In F. Giavazzi and L. Spaventa, eds., *High Public Debt: the Italian Experience*. Cambridge: CEPR and Cambridge University Press.

Banca d'Italia (1981). *Considerazioni Finali del Governatore*, Rome: Banca d'Italia.

Bencini, S. & G. Tabellini (1987). 'Per i CCT una Politica Diversa'. *Il Sole 24 Ore*, July 17th.

(1988). 'Una Ricetta per il Debito'. *Mondo Economico*, December 17th.

Calvo, G. (1988). 'Servicing the Public Debt: the Role of Expectations'. *American Economic Review* 78, 647–61.

Confalonieri, A. and E. Gatti (1986). *La Politica del Debito Pubblico in Italia, 1919–43*. Bari: La Terza.

Diamond, D.W. and P. Dybvig (1983). 'Bank Runs, Deposit Insurance and Liquidity'. *Journal of Political Economy* 91, 401–19.

Giavazzi, F. and M. Pagano (1988). 'Confidence Crises and Public Debt Management'. This volume.
Grilli, V. and A. Alesina (1990). 'Avoiding Speculative Attacks in the EMS'. *Il Giornale degli Economisti*, forthcoming.
Lucas, R. and N. Stokey (1983). 'Optimal Fiscal and Monetary Policy in an Economy without Capital'. *Journal of Monetary Economics* 12, 55–93.
Ministero del Tesoro (1989). *Rapporto sull'attivita del Comitato Consultivo Scentificio sul Debito Pubblico.*
Pagano, M. (1988). 'The Management of Public Debt and Financial Markets'. In F. Giavazzi and L. Spaventa, eds., *High Public Debt: the Italian Experience.* Cambridge: CEPR and Cambridge University Press.
Parcu, P.L. (1986). 'Bank Panics of the Third Kind'. *Moneta e Credito.*
Persson, T. and G. Tabellini (1990). *Macroeconomic Policy, Credibility and Politics.* London: Harwood, forthcoming.
Prati, A. (1989). 'Self-fulfilling Debt Crises'. Chapter 2. Ph.D. dissertation, UCLA.
Spaventa, L. (1988). 'Discussion'. In F. Giavazzi and L. Spaventa, eds., *High Public Debt: the Italian Experience.* Cambridge: CEPR and Cambridge University Press.

Discussion

MARIO DRAGHI

Maturity structure does matter and it should be of particular concern for the management of public debt. The Italian authorities should, up to a point, "bite the bullet". They should issue long-term debt even at relatively high interest rates, since accepting a shortening of the average maturity may be counterproductive: by increasing the possibility of a confidence crisis, it may lead to a larger risk premium and a higher average cost of servicing the total outstanding debt' (Alesina *et al.*, in this volume).

Alesina, Prati and Tabellini reach these policy conclusions in their brilliant and provocative paper and support them by two major empirical claims intended to show the reluctance of the Italian authorities to follow this harsh course.

(1) After 1985 the interest rate on the one-year Treasury Bill, to which a good part of the CCT (Certificates of Treasury) are indexed, was – thanks to the type of auction system used – being manipulated so as to keep it

artificially lower than the short-term 3-months Treasury Bill. The authorities, after having kept it higher when the debt was issued, were succumbing to the temptation 'to reduce it once the private sector is locked into an irreversible investment decision, thereby inflicting a capital loss on their debt holders' (ibidem). Therefore they created a time inconsistency and caused an investors' confidence crisis which led to a funding crisis in 1987 and ultimately to the issue of maturities much shorter and/or more expensive.

One could claim that other readings of these data are equally plausible. First, the existence of inverted yield curves is not *per se* a symptom of confidence crisis. They may occur for a variety of reasons, for instance because short-term and long-term inflationary expectations differ, and/or because of tensions on the foreign-exchange market; both examples would fit Italian financial markets during 1985–87. Second, the evidence of manipulation would be a bit stronger if one, like Bencini and Tabellini (1987), could find evidence of a V-shaped yield curve with a minimum at the rate used for indexing public debt. But the last three years data fail to confirm any strong regularity of this kind. This should not be surprising since peaks and bottoms in the yield curves are to be observed in many other countries where no thought is ever given to defaulting on government debt. Third, since March 1989 the method used to auction the Treasury Bills to which the CCT are indexed, has become purely competitive, thus strongly reducing any potential time inconsistency, but returns, contrary to the implication one would draw from the paper, after an initial increase, abated and then followed a path more likely dictated by other considerations. The same thing can be said about investors' subscriptions of CCT after the change in the auction system took place: until very recently they were far from peaking, and in general they did not follow any prior that might be inferred from the paper.

(2) The persistence of a positive and substantial interest-rate differential between the 3-month Treasury Bill and the commercial banks' certificates of deposits having the same maturity, would show that there is indeed a problem of confidence in the paper issued by the government.

Although this evidence cannot be disputed, one could observe that such a differential always existed, even at times when the fiscal policy's soundness was not an issue. Its causes might have a structural character and be related in part to market segmentation, and in part to the placement techniques utilized by the commercial banks. Since they are in the almost unique position of acting at the same time as main agents for the sale of government paper and as issuers of their own paper having similar characteristics, they would use non-price arguments to induce their clients to buy their own paper instead of Treasury bonds. This explanation, as it

is entirely based on financial market imperfections lasting for several years, cannot be entirely satisfactory in today's capital markets. But the authors' motivation for the existence of a premium on the government paper is also not fully persuasive, since one could claim that the commercial banks' paper is as sound as that of their major shareholder, the Italian government.[1] The authors could possibly strengthen their point if they were to look into foreign issues by the Italian government, where the domestic placing power of the Italian banking system is not a problem.

The authors present also a thereotical model intended to help the policy maker with 'optimal' advice on how to manage public debt. It is clear and probably unavoidable that some of the results contained in this section depend too closely on certain extreme assumptions like the absence of reputational considerations and the lump-sum nature of the default costs. For example, since reputation is worthless in this model, to defend it would be a waste, and therefore default always comes to be optimal at time zero. One may also conjecture that partial defaults, besides being a more realistic equilibrium, are superior to some of the equilibria described in the paper, but, as the authors themselves observe, they are ruled out by the lump-sum nature of the default costs.

More problematic is this section's treatment of confidence crisis as an exogenous event, when it really should not be so. This approach does not affect as much the theorems' internal consistency, as their interpretation. Consider Proposition 2 saying that an 'equilibrium with a confidence crisis is least likely to exist if only long-term debt is issued, and if the same amount of debt matures in each period'. The authors show that the distortionary costs from having to repay debt under a confidence crisis regime are minimized when debt is only long-term and evenly distributed over time. It is an interesting and useful result, but it does not say that a confidence crisis is least likely to happen under such a circumstance. It does say instead that, *if* you happen to be in a confidence crisis then it costs less to repay a debt having the characteristics just mentioned. This point has a direct bearing on the major policy conclusion reported at the beginning of this discussion. It may well be true that Italian authorities should issue long-term debt at relatively high interest rates in order to avoid a confidence crisis. But such prescription does not follow from the authors' analysis where a confidence crisis is an exogenous occurrence independent of the maturity structure of public debt, and bearing on the costs of such a crisis were it to occur, not on its likelihood.

NOTE

1 Italian commercial banks have always made large investments in their government paper, and, in case of its hypothetical default, they would certainly need a recapitalization in order to be able to continue their banking activity. But their major shareholder is in the vast majority of the cases the same government which by assumption is unable to service its bonds. The banks would then be sold, and it is not clear that the holders of the banks' CDs would be more protected than the government bond holders.

REFERENCE

Bencini, Silvio and Guido Tabellini (1988). 'Una Ricetta Per Il Debito', *Mondo Economico*, December 17.

Discussion

LARS E.O. SVENSSON

I very much enjoyed reading the paper by Alesina, Prati and Tabellini (henceforth APT), and I feel I learned a lot about both empirical and theoretical aspects of the Italian debt problem.

The paper consists of three major sections: two empirical sections on Italian debt management during the 1980s and on risk-premia on government bonds, followed by a theoretical section with a model of debt runs.

I found the section on Italian debt management most interesting, but I certainly do not have the institutional knowledge necessary to discuss it in detail. In the section with empirical results on risk premia, I was astounded by the big risk-premia reported. Again, lack of institutional knowledge prevents me from discussing to what extent the government and private bonds compared are really otherwise good substitutes, and whether markets are sufficiently competitive for the assets compared to allow for meaningful comparisons of returns.

The theoretical section presents a most interesting model of debt runs, government default, and their relation to the maturity structure of the debt. What is being discussed is outright default on indexed debt, not the more common implicit default on nominal debt via inflation and devaluation. Also, default is modelled as all or nothing: partial default does not occur in the model. This is in contrast to historical experience, where we more often see partial default via renegotiation and rescheduling rather than complete default. Whether any default in the model is

complete or partial of course depends on the nature of the cost of default: if the cost is fixed there will be complete default, if any; if the cost is increasing in the amount of default, there may be partial default. I think we all agree that the microeconomics of the default costs are worthy of further study, for instance to clarify which of fixed or variable default costs is a better first approximation.

The main result of the paper, derived in a clear and convincing way, is that issue of long-term debt, and a balanced composition of the debt, reduces the risk of debt runs and defaults. In the model the optimal policy of the government is actually to issue only long-term debt, and no short-term debt at all.

I shall demonstrate that this result can be modified and somewhat strengthened, in that the government may actually reduce the risk of debt runs and default further by *buying* short-term bonds, that is lending in short-term bonds, and increase even further the issue of long-term bonds. That result is reminiscent of a result in a paper by Mats Persson, Torsten Persson and myself (1987), namely that the government in order to reduce the incentive to a surprise inflation should buy nominal assets and issue indexed debt.

The modification of the APT result can be understood as follows: the discounted present value of debt outstanding at the beginning of period t is (from APT equation (24))

$$b = {}_{t-1}b_t + {}_{t-2}b_t + \beta\, {}_{t-1}b_{t+1} \tag{1}$$

Suppose now that a debt crises arises, that is that private agents at t expects the government to default at $t+1$, which we denote ${}_t\theta_{t+1} = 1$ ($\theta_{t+1} = 1$ in APT notation). Consequently the government cannot issue any new debt in period t, and has to raise taxes to fulfill

$$\tau_t = {}_{t-1}b_t + {}_{t-2}b_t \tag{2}$$

When period $t+1$ begins, the only outstanding debt is then ${}_{t-1}b_{t+1}$. APT then assumes that the government raises taxes to repay also this debt, and that no new debt is issued. That is,

$$\tau_{t+1} = {}_{t-1}b_{t+1} \tag{3}$$

In the future there is no debt oustanding and taxes will be zero henceforth.

Via these operations the government has tackled the debt crisis and avoided default. It is now straightforward to see that in order to smooth taxes in the event of a debt crises, it is best to choose

$${}_{t-1}b_t = 0 \tag{4a}$$

and

$${}_{t-2}b_t = {}_{t-1}b_{t+1} = b/(1+\beta), \quad \text{for all } t \tag{4b}$$

That is, no short-term bonds should be issued, and the composition of long-term bonds should be balanced. This smoothes and minimizes the amount of debt that matures each date.

Note, however, that in the previous reasoning, the government does honour its debt maturing in period $t+1$ ($\theta_{t+1} = 0$), counter to expectations that it would default in period $t+1$ (${}_t\theta_{t+1} = 1$). Suppose the fact that the government does not default in period $t+1$ makes private agents believe that the government will honour its debt in periods after $t+1$, that is,

$${}_{t+1}\theta_s = 0 \quad \text{for} \quad s \geq t+2, \quad \text{when } \theta_{t+1} = 0 \tag{5}$$

This assumption is at least as plausible as the assumption that the private agents continue to believe in future default in spite of the government honouring its current debt.

If (5) holds, the government can actually issue new debt in period $t+1$, and the optimal tax level is then just to pay the interest on the outstanding debt. Then (3) is replaced by

$$\tau_{t+1} = (1-\beta)\, {}_{t-1}b_{t+1} \tag{3'}$$

It then follows from (1), (2) and (3′) that tax smoothing requires that

$${}_{t-1}b_t = -\beta b < 0 \tag{6a}$$

and

$${}_{t-2}b_t = {}_{t-1}b_{t+1} = b > b/(1+\beta), \quad \text{for all } t \tag{6b}$$

That is, the government should indeed buy short-term bonds and increase further its issue of long-term bonds.

In conclusion, with or without this extension, I find the main result that long maturity and balanced composition of the national debt reduces the risk of a debt crisis convincing and important. It should be emphasized, however, that this result refers to the case of indexed debt only, and there are other aspects to the choice of government debt instruments as well. For instance, long maturities of nominal debt increase the incentive to default by inflation, which provides an argument for issuing indexed or foreign currency debt rather than nominal home currency debt.

Long-term indexed and foreign currency debt may, however, have undesirable risk characteristics. This is an argument for the government's issuing of different assets with more desirable risk characteristics.

It is of interest in this context to note that with a passive monetary policy

and flexible exchange rates, nominal bonds have risk characteristics like a share in output. That is, their return is positively correlated with output. This is so since the price level will be negatively correlated with output, and the real return to nominal bonds will be the sure nominal return deflated by the risky price level. Hence, the choice between indexed and nominal debt is to some extent a choice between credibility and desirable risk characteristics, something that has been explored in recent work by Henning Bohn (1988).

We may also recall the result of Robert Lucas and Nancy Stokey (1983) that indexed debt of all maturities is needed to resolve one aspect of the time-consistency problem in a barter economy, and the extension by Persson, Persson and myself (1988) that in a monetary economy both indexed and nominal assets of all maturities are necessary to resolve the time-consistency problem in a monetary economy, including the incentive to surprise inflation.

A synthesis of these different aspects seems most desirable, for instance along the lines suggested in Maurice Obstfeld's Discussion. Before that synthesis is completed, it seems clear that APT have made an important and convincing point about some advantages of long-term government debt.

REFERENCES

Bohn, Henning (1988). 'Why Do We Have Nominal Government Debt', *Journal of Monetary Economics* 21, 127–40.

Lucas, Robert E. Jr. and Nancy L. Stokey (1983). 'Optimal Fiscal and Monetary Policy in an Economy Without Capital', *Journal of Monetary Economics* 12, 55–93.

Persson Mats, Torsten Persson and Lars E.O. Svensson (1987). 'Time Consistency of Fiscal and Monetary Policy', *Econometrica* 55, 1419–31.