Fiscal policy, debt management and exchange rate credibility: Lessons from the recent Italian experience

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Abstract

This paper explores some potential determinants of exchange rate credibility with reference to the Italian experience of the 1990s. The analysis relies on a nonlinear framework emphasizing shifts between credible and non-credible states, and assuming a significant degree of persistence in the above regimes. Almost all fiscal and debt management indicators display significant effects on devaluation expectations. The main policy implications of the paper are that a restrictive fiscal stance, a lengthening of average debt maturity and an increase in the share of foreign-denominated debt are crucial to stabilize the Lira exchange rate and to qualify Italy in the former group of countries which will join EMU. © 2000 Elsevier Science B.V. All rights reserved.

JEL classification: E62; E65; F31

Keywords: Fiscal policy; Debt management; Credibility; Exchange rate; EMS; Italy

1. Introduction

It is well known from the public finance literature that policy-ineffectiveness, namely the irrelevance of government financial policy, relies on the assumption

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that all markets are complete; lacking this crucial feature, market equilibria will not be invariant to government financial choices (Pagano, 1988). Focusing on debt maturity, the set of equilibrium outcomes will not change if the assumption of market completeness holds in the presence of a commitment technology forcing policy-makers to stick to a previously announced financial strategy. Building on the seminal work of Lucas and Stokey (1983), many contributions have relaxed the assumption of policy precommitment, showing how the implied time-consistency problems can be neutralized through a careful choice of debt maturity (see, among others, Calvo and Guidotti, 1990). With an eye to Italian debt management policies of the 1980s, Alesina et al. (1990) provide a model of debt runs where the likelihood of a confidence crisis, leading to outright debt repudiation, is lower with a long and balanced maturity structure.

As discussed in this literature, debt management policies may also have strong implications on the credibility of a fixed exchange rate peg. In an open-economy setting with free capital mobility and where monetary authorities are committed to defend a given parity, the maturity structure of public debt can crucially affect the likelihood of a confidence crisis, leading to an exchange rate devaluation. This point is forcefully made in Giavazzi and Pagano (1990) in a model where the public is imperfectly informed about government preferences and, driven by exogenous beliefs, occasionally triggers a speculative attack against the Central Bank.

There is currently a growing body of empirical studies exploring the credibility of fixed or quasi-fixed exchange rate pegs and its eventual links with macroeconomic fundamentals. Although relatively large, this literature has so far neglected the testable implications associated to debt-management models. This shortcoming is all the more relevant with reference to the Italian experience in the early 1990s. As it has authoritatively been maintained, this was actually a typical situation where a highly indebted government, with mostly short-term and nominal debt, and facing a sharp increase in the fiscal burden as a consequence of bad market expectations, might have been tempted to devalue its domestic-currency debt (Obstfeld, 1996). Applied research dealing with the 1992 EMS crisis has suggested that, besides a deterioration in Italy’s external position, growing imbalances in public finances might have played a prominent role in triggering the speculative attacks which temporarily drove the Lira out of the EMS (Eichengreen and Wyplosz, 1993; Vaciago, 1993). Yet, the above intuition has not been submitted to rigorous econometric investigation.

This paper tries to fill this gap in the literature. We focus on the period since Italy’s entry inside the narrow EMS band, assessing the influence of fiscal and debt management policies on the credibility of the LIT/DM parity. To this purpose, we propose a new research strategy which significantly departs from the standard drift-adjustment approach.
The remainder of the paper is organized as follows. Section 2 sets the stage for the empirical analysis, focusing on debt management models of currency crises. We discuss the theoretical motivations underlying their policy prescriptions and summarize their testable implications. Section 3 outlines our research strategy, which relies on a nonlinear filter modelling switches between credible and non-credible exchange rate regimes. Section 4 contains our empirical findings. The nominal interest rate differential between Italy and Germany is treated as a stochastic process shifting between alternative regimes, with state transitions governed by a first-order Markov process with constant transition probabilities. We then relax the above assumption, exploring the links between exchange rate credibility and alternative fiscal and debt indicators. Section 5 concludes the paper.

2. Debt management models of currency crises

The main contribution in this area is due to Giavazzi and Pagano (1990), where a basic expectations-shift process outlined in Calvo (1988) is suitably recast in an open economy setting. These authors posit perfect capital mobility and a fixed exchange rate commitment in a model where private agents, driven by exogenous beliefs, occasionally trigger speculative attacks against the domestic currency. Private sector expectations shift between a “normal” state (with agents assigning zero probability to a devaluation outcome) and “confidence crises” (characterized by a positive probability of devaluation). Given the budget constraint, a government facing a confidence crisis can either issue debt at more unfavourable terms or turn to an emergency credit line at the Central Bank, monetizing a fraction (unknown to the public) of the increase in debt service. 1

Multiple equilibria arise in this setup (with zero or positive probability of devaluation); moreover, given the ratio of public debt to reserves and the size of expected devaluation, there is always a critical maturity for public debt above which no confidence crisis occurs. This crucial theoretical result enables to derive a set of policy prescriptions reinforcing Central Bank’s position in case of a confidence crisis and therefore its commitment to a fixed exchange rate parity. More specifically, the following policy prescriptions would prevent, in this context, a speculative run on the domestic currency:

• A lengthening of the average maturity of public debt;
• A smooth time pattern of maturing debt;

1 Absent this temporary overdraft facility, the level of reserves would be sufficient to fend off a speculative attack. See Giavazzi and Pagano (1990, Section 3.3), for a formal derivation of the probability of devaluation.
• The development of a deep market for public debt denominated in foreign currencies;
• A strengthening of international cooperation among Central Banks.

As pointed out in Obstfeld (1990), the model developed in Giavazzi and Pagano (1990) is essentially static so that any intertemporal consideration is bound to be left implicit. Moreover, lacking a social welfare function, government actions are not driven by a clear optimizing behavior. These shortcomings are addressed in Obstfeld (1994), where the above framework is extended in a two-period horizon, explicitly accounting for the distorting effects associated to the (ex-post) inflation rate and to the tax rate. This intertemporal perspective reproduces the basic features of the previous model, supporting its main policy implications albeit with some relevant qualifications.

In line with Giavazzi and Pagano (1990), this framework yields multiple equilibria; more specifically, it entails a “good” equilibrium, with a low domestic interest rate and low expected (and actual) depreciation, and a “bad” equilibrium in which the reverse occurs. Appropriate debt management policies are again crucial, in this setting, to dampen the occurrence of a speculative attack.

The logic underlying debt management prescriptions associated to these models may be grasped by focusing on the expression defining the government’s preferred depreciation rate ($\varepsilon$) in period two, as formally derived in Obstfeld (1994):

$$
\varepsilon = \frac{(d_1 + \delta d_2 + k\gamma)(d_2 + \delta d_2 + g_2 - \delta f_2 - \delta f_2)}{(d_2 + \delta d_2 + k\gamma)^2 + \phi y^2},
$$

where $d_i$ denotes the real value, at the period one price level, of the domestic government debt payment promised on date $i$ for date $j > i$; $f_j$ are foreign-denominated assets acquired in period $i$ and accruing in period $j$; $g_2$ is real government consumption in period two; $k$ is the income elasticity of money demand; $\phi$ is a (positive) parameter expressing the weight placed on currency depreciation relative to other taxes in the government loss function.

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2 Strictly speaking, the presence of an optimizing government qualifies Obstfeld (1994) as an escape-clause model. Nevertheless, given its strong emphasis on debt management policies consistent with exchange rate stability, this paper fits as much naturally inside the debt management literature.

3 This reflects the dynamic inconsistency problem faced by the government which cannot credibly promise not to follow a high-devaluation policy and, consequently, cannot prevent the bond market from setting on the high-devaluation equilibrium’s interest rate. Multiple equilibria are determined by the intersections of the government reaction function and the interest rate parity curve (see Obstfeld, 1994, Section 3.1, for details).
The new debt incurred by the government in period one is given by

\[ 1d_2 = (1 + i)(\alpha d_1 + g_1 - \alpha f_1 + \frac{1f_2}{1 + i^*}), \]  

(2)

where \( i \) and \( i^* \) are, respectively, nominal returns on domestic and foreign financial assets. As shown by Eqs. (1) and (2), a crucial feature of this set-up is that the domestic interest rate \( i \) enters the government reaction function only via \( 1d_2 \) (i.e. the new domestic debt incurred in period one). Since it is the presence of the domestic interest rate which give rise to multiple equilibria (see footnote 3), the only way to prevent bad devaluation expectations is to have \( 1d_2 = 0 \), namely to avoid, in period one, new debt issues. Assuming, for the sake of simplicity, that the net foreign asset position is zero, Eq. (2) implies that the above condition is met if \( (\alpha d_1 + g_1) = 0 \). This shows, in line with Giavazzi and Pagano (1990), that a self-fulfilling currency crisis, with agents coordinating on a “bad equilibrium”, is less likely when all government debt is long term \( (\alpha d_1 = 0) \). 4

Consistently with another crucial policy implication derived in Giavazzi and Pagano (1990), Eq. (2) highlights the strategic role played by official foreign borrowing in these models. Setting \( 1f_2/(1 + i^*) = -(\alpha d_1 + g_1 - \alpha f_1) \), the government has a zero total cash flow on date one, thus removing the possibility of multiple equilibria. By taking net positions in foreign currencies, the government can sidestep the domestic bond market in particularly adverse periods, thus neutralizing incentives to devalue through a particular kind of debt indexation. 5

3. Exchange rate credibility: A nonlinear framework

The applied literature has usually assessed credibility inside a linear econometric framework. Following Svensson (1993), most papers compute realignment expectations subtracting the expected rate of depreciation within...
the band from the nominal interest rate differential (drift-adjustment approach). Realignment expectations are then regressed on some set of macroeconomic variables to investigate the underlying determinants of exchange rate credibility.

Differently from the drift-adjustment approach, we do not extract realignment expectations from the nominal interest differential and focus on the overall expected rate of depreciation as relevant credibility variable. We assume that the interest differential shifts between “low” and “high” values denoting, respectively, “credible” (low expected depreciation) and “not credible” (high expected depreciation) exchange rate regimes. Moreover, we assume that the above process exhibits a significant degree of persistence, i.e. that credible and not credible states tend to cluster over time.

This alternative, nonlinear framework is highly consistent with the recent EMS experience, where long tranquil periods have suddenly been interrupted by massive speculative attacks generating extreme turbulences on currency markets. As forcefully documented in Engel and Hakkio (1996), volatility clustering is a prominent feature of currencies participating to the ERM. Referring to previous work in this area disregarding persistency effects, these authors observe:

The more significant difference is that we are not modelling the unconditional probability of the volatile state as a function of the position in the exchange rate band. Rather, in addition to depending on this location of the exchange rate in the band, we model the probability of the volatile state as being conditional on the current state (.........). We capture the idea of volatility clustering with the Markov-switching model, because being in the volatile state makes it more likely to remain in the volatile state. This property is not in the independent switching model or the diffusion-jump model (Engel and Hakkio, 1996, p. 62).

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6 The expected rate of depreciation within the band, in turn, is estimated in a linear context, using variations in exchange rate's deviations from the central parity as regressand (Svensson, 1993, Section 3).
7 See e.g. Rose and Svensson (1994) for an application of this approach to the 1992 EMS crisis.
8 One reason for this choice is that, along the second half of our sample period (i.e. from September 1992 up to August 1995), the Lira has been freely floating on foreign exchange markets. Absent an explicit target zone, realignment expectations cannot obviously be computed. The focus on the nominal interest rate differential, however, can also be justified on more general grounds. For all major EMS currencies, time series of raw interest differentials mirror very closely expected realignment rates (see Rose and Svensson, 1994, Figs. 2 and 9). The alternative credibility measure employed in this paper, therefore, does not significantly affect our inferences about the nature of target zone credibility and its underlying determinants.
The point we are raising has close affinities with the above remarks; whereas these authors stress the relevance of volatility clustering, the present paper underlines the persistency of periods of high and low credibility.

On this basis, we model the interest differential as a two-state Markov process, namely we treat this variable as a stochastic process whose realizations are drawn by a mixture of two i.i.d. distributions: the former holds whenever the process is in the credible state, while the latter holds when the process is in the not credible state.

A recent econometric approach developed in Hamilton (1988, 1989) is the natural candidate to carry out our empirical investigation since it emphasizes persistency effects in alternative states. This approach assumes that regime shifts are not directly observable and that probabilistic inferences about them can be drawn on the basis of the past behavior of the series. The parameters of the autoregressive process governing the evolution of the series depend, in this context, on an unobserved random variable, defined as the state or regime that the process was in at date \( t \). This state, in turn, is a discrete random variable, whose changes are modelled relying upon the theory of Markov chains.\(^9\) Hamilton (1988, 1989) suggests a convenient procedure to estimate the vector of relevant parameters (namely the autoregressive coefficients and the means and standard deviations of alternative states); this procedure entails an iterative nonlinear filter providing an optimal inference about the current state given its past values: the outcome of the filter is then used to generate future forecasts of this variable.\(^10\)

Hamilton’s original filter posits constant transition probabilities across alternative states, an assumption which can be somewhat restrictive in some particular contexts.\(^11\) This is the case in the framework of the present paper, since we are interested in exploring if fiscal and debt variables significantly affect the probability of remaining in a credible (or not credible) exchange rate regime.

This taken into account, our analysis includes a relevant extension of the Hamilton filter, allowing transition probabilities to be affected by different exogenous variables (as motivated in Section 4.2.2, our empirical investigation is carried out assessing, one at a time, the influence of each exogenous variable). Assuming that state transitions evolve as logistic functions of these variables, and specializing the above framework to the topics addressed in this paper, conditional probabilities may be parametrized as:

\[^9\] See Hamilton (1994, Section 22.2).

\[^10\] Hamilton’s nonlinear filter and the related maximum likelihood procedure to get parameters estimates are fully described in Hamilton (1988, Sections 2.2–2.4), and Hamilton (1989, Section 4).

\[^11\] Examples are business cycle models, where this assumption cannot adequately cope with inherent asymmetries characterizing output fluctuations. Some papers account for this limitation, see, for instance: Ghysels (1993), Durland and McCurdy (1994) and Filardo (1994).
\[ p_t = \frac{\exp(\text{consp} + \beta_1 x_{t-1})}{1 + [\exp(\text{consp} + \beta_1 x_{t-1})]} \]  
\[ q_t = \frac{\exp(\text{consq} + \beta_2 x_{t-1})}{1 + [\exp(\text{consq} + \beta_2 x_{t-1})]} \]

where \( p_t \) and \( q_t \) are, respectively, the time-varying conditional probabilities of state one (\( s_t = 1 \); non-credible exchange rate regime) and state zero (\( s_t = 0 \); credible regime); \( \text{consp}, \text{consq} \) are constant terms; and \( \beta_1, \beta_2 \) are parameters governing transition probabilities. In the above formulas, moreover, \( \{x_{t-1}\} \) denotes an appropriately chosen fiscal or debt indicator potentially affecting exchange rate credibility.

The above extension entails an iterative EM algorithm to maximize the conditional likelihood function. The parameter vector is initialized selecting a preliminary set of values. The EM algorithm involves then an expectation step (\( E \)), where smoothed state probabilities are derived for every period of the sample; this step is followed by a maximization step (\( M \)), producing an updated vector of parameters, until convergence is eventually achieved. 12

In line with the above discussion, the next section applies a Markov-switching approach to the interest rate differential. Drawing on Section 2, we select a set of fiscal and debt indicators. We then estimate a switching model with constant state transitions; subsequently, we relax this assumption, turning to a framework with time-varying transition probabilities.

4. Debt management and exchange rate credibility: Evidence from Markov-switching models

4.1. Selection of debt and fiscal indicators

We select two debt indicators, namely the ratio of short-term debt to total debt and the corresponding ratio for foreign debt. As discussed in Section 2, a lengthening of average debt maturity and an increase in the share of foreign-denominated debt should reinforce government’s commitment to a fixed exchange rate policy. 13

12 See Diebold et al. (1994) for a more detailed and technical presentation. Tronzano (1996) applies the above framework to the recent French experience in the EMS. This paper rejects the inherently self-fulfilling character of speculative attacks against the French Franc implied by some recent contributions, documenting how various macroeconomic fundamentals did actually play a significant role during the 1992–1993 EMS crisis.

13 Under some circumstances, a lengthening of the average maturity may actually not be desirable. As shown in Missale et al. (1997), given asymmetric information about government types, it may actually be optimal for a government carrying out a fiscal stabilization to issue short-term debt. In this context, the shortening of debt maturity acts as a signalling device, pointing out the government’s resolve to implement sensible spending cuts in future periods. It must however be noted that these authors do not explore the implications of different maturity structures on exchange rate credibility.
The set of debt variables may be profitably enlarged including some fiscal indicators usually employed in the applied literature. In line with some papers relying on the drift-adjustment approach, we insert government deficit and public debt (both normalized on GDP) among the variables potentially affecting exchange rate credibility. Differently from previous indicators, these ratios are not explicitly related to a specific theoretical framework. Their inclusion is motivated by the consideration that highly-indebted countries might be tempted to inflate away, through an exchange rate devaluation, the portion of debt denominated in domestic currency. Alternatively, if inflationary expectations are already accounted for, these fiscal ratios should capture a (presumably small) default risk component of the interest rate differential.

Some research departing from the drift-adjustment approach documents how a relevant decline in fiscal policy credibility triggered repeated speculative attacks along the 1992 EMS crisis; this credibility decline, in turn, was driven by an apparently unsustainable dynamics of real public debt. This finding motivates the inclusion of real public debt among the set of fiscal variables affecting the commitment to a fixed exchange rate parity.

4.2. Empirical results

We focus on the one-month nominal interest rate differential between Italy and Germany, using monthly data spanning from January 1990 to August 1995. Approximately half of the sample is therefore characterized by a target zone for the LIT/DM exchange rate; along the latter half, conversely, the Lira was allowed to float freely on foreign exchange markets. As mentioned above, since we do not quantify realignment expectations, the existence of an official fluctuation band is not a crucial prerequisite for our empirical investigation; the extension of the sample beyond September 1992, moreover, significantly widens the degrees of freedom.

Fig. 1 plots $(i - r^i)$ along our sample period. The January 1990 realignment, which marked the entry of the Lira inside the narrow EMS band, was followed
by a consistent reduction in the interest differential. A sharp turnabout is apparent along the first quarter of 1991, as a consequence of an upsurge in domestic inflationary pressures and of a worsening in public finances. A further, more pronounced, increase characterizes the September 1992 currency crisis, whereas subsequent months display, on average, a consistent reduction in the expected depreciation of the LIT/DM parity.

4.2.1. Fixed transition probabilities

Preliminary trials to select the appropriate lag structure revealed lack of residual serial correlation (Lagrange Multiplier tests); on the other hand, the Jarque and Bera (1980) statistics strongly rejected the hypothesis of normally distributed disturbances. Moreover, in Markov-switching specifications allowing for different variances across alternative states, the iterative algorithm for numerical maximization of the conditional log-likelihood did not converge.

Given these results, we estimated a Markov-switching model with innovation variance independent of the state, using a $t$-distribution to compute asymptotic standard errors. The order of the autoregressive process driving the stochastic representation of $(i - i')$ was set to one. The above specification proved robust to a broad set of start-up values, while convergence to the global maximum yielded parameters estimates reported in Table 1.

On the whole, all estimated coefficients are highly significant, and this Markov-switching model succeeds in separating a low-mean, credible state $(s_t = 0)$, from a high-mean, not credible exchange rate regime $(s_t = 1)$. As indicated in Table 1, the estimated mean of the former state $(z_0)$ is equal to 2.975, while the correspondent value for the latter state is significantly higher $(z_0 + z_1 = 4.74)$. In line with our previous discussion, both states are fairly

Fig. 1. One-month nominal interest rate differential between Italy and Germany.
persistent; consistently with the pattern of \((i - i^*)\) displayed in Fig. 1, the probability of staying in the credible state \(q = 0.95\) is higher than that of staying in the alternative regime \(p = 0.82\). These estimates imply that, on average, a credible exchange rate regime will persist for 20 months \((1/(1 - q) = 20)\), while the correspondent value for the not credible regime is of about 5–6 months \((1/(1 - p) = 5.5)\). Ergodic probabilities, finally, are respectively equal to 0.78 (state zero) and to 0.22 (state one). 17

Fig. 2 plots the raw interest differential \((i - i^*)\) together with the estimated probability of a not credible exchange rate regime, based on currently available information. As documented in this figure, this regime-switching model tracks quite accurately the pattern of the Italian–German interest rate differential along the sample period. The inferred probability of state one reaches notably high values along the first quarter of 1991 and, again, from July to October 1992.

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17 The vector of ergodic probabilities can be viewed as indicating the unconditional probability of each of the \(N\) different states. For the two-state Markov-chain considered here \((N = 2)\), ergodic probabilities are given by: \(\pi_0 = P[s_i = 0] = (1 - p)/(2 - p - q)\); \(\pi_1 = P[s_i = 1] = (1 - q)/(2 - p - q)\). See Hamilton (1994, Section 22.2, pp. 681–684), for further details on Ergodic Markov chains.

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Table 1
Markov-switching model on Italian–German interest rate differential (Constant transition probabilities, Monthly data: January 1990–August 1995)\(^a\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>(t)-Statistic</th>
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<td>(11.69)</td>
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<tr>
<td>(x_1)</td>
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<td>(\sigma)</td>
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<td>(p)</td>
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<tr>
<td>DF</td>
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\(^a\) Note: \(t\)-statistics in parentheses below parameter estimates; State Zero \((s_i = 0)\): credible state; State One \((s_i = 1)\): non-credible state; \(x_0, x_1\) are the coefficients related to the means of the two states. These means are parametrized as follows: \(\mu_0 = x_0\) (mean in state zero); \(\mu_1 = x_0 + x_1\) (mean in state one); \(\sigma\) is the innovation standard deviation (assumed to be equal across alternative states); \(p\) and \(q\) are the (constant) transition probabilities of remaining, respectively, in the “not credible” and “credible” exchange rate regimes; DF is the degrees of freedom parameter since, due to the existence of not normally distributed errors, asymptotic standard errors are computed through a \(t\)-distribution.
4.2.2. Time-varying transition probabilities

Parameters estimates in this section are obtained by inserting each forcing macrovariable one at a time. This approach has sound motivations both from the theoretical and the empirical viewpoint. As regards the former aspect, a multivariate analysis would not be appropriate, in our context, since the set of forcing macrovariables does not belong to a unified theoretical framework. As previously discussed, many fiscal indicators we are considering (ratio of government deficit to GDP, ratio of public debt to GDP, real debt), although widely employed in applied work, do not play any role in debt management models of currency crises outlined in Section 2. On the empirical side, the approach taken in this section is consistent with most regime-switching research relying on time-varying transition probabilities (see, for instance, Diebold et al., 1994; Durland and McCurdy, 1994). As pointed out in this literature, the functional form implied by models with time-varying transition probabilities considerably complicates the evaluation in the maximization step. Consequently, in this set up, a multivariate analysis can easily preclude convergence in the EM estimation algorithm described in Section 3. 18

18 Note, at this purpose, that simulation experiments performed in Diebold et al. (1994), where conditional probabilities are driven by a single forcing variable, show that convergence in the EM algorithm is achieved only after 462 iterations. In order to simplify computational issues, Durland and McCurdy (1994) estimate a Markov model of US GNP growth where the only variable affecting state transitions is "duration" (defined as the number of periods that the system has been in a particular inferred state).
Table 2 summarizes maximum-likelihood estimates from Markov-switching models with time-varying transition probabilities. The first three columns refer to fiscal indicators commonly used in applied work: the ratio of government deficit (or surplus) to GDP, the change in the ratio of public debt to GDP, and variations in real debt. The last three columns, on the other hand, report variables affecting government’s commitment to a fixed exchange rate parity in debt management models.

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<td>(0.88)</td>
<td>(0.74)</td>
<td>(0.75)</td>
<td>(1.04)</td>
<td>(0.72)</td>
<td>(1.00)</td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-59.88</td>
<td>-57.32</td>
<td>-59.43</td>
<td>-60.25</td>
<td>-59.72</td>
<td>-57.37</td>
</tr>
</tbody>
</table>

Note: See explicative notes to Table 1 for definitions of parameters $x_0$, $x_1$, $\sigma$, AR(1), DF. Betas coefficients ($\beta_1$, $\beta_2$) quantify the effects of each variable on the (time-varying) probabilities ($p_t$, $q_t$) of remaining, respectively, in the “not credible” and “credible” exchange rate regimes (see Section 3). The variables appearing in this table are defined as follows: DEF: Ratio of Government Deficit (or Surplus) to GDP (monthly GDP proxied by Industrial Production Index); ADEBT: Change in the ratio of Public Debt to GDP (monthly GDP proxied by Industrial Production Index); ARDEBT: Change in Real Public Debt (Public Debt deflated through Consumer Price Index); SHORT: Ratio of Short-Term Government Debt to Total Market Debt; LONG: Ratio of Medium-Long Term Government Debt to Total Market Debt; FOR: Ratio of Foreign Debt to Total Public Debt.

Table 2 summarizes maximum-likelihood estimates from Markov-switching models with time-varying transition probabilities. The first three columns refer to fiscal indicators commonly used in applied work: the ratio of government deficit (or surplus) to GDP, the change in the ratio of public debt to GDP, and variations in real debt. The last three columns, on the other hand, report variables affecting government’s commitment to a fixed exchange rate parity in debt management models. 19

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19 Short and medium–long-term debt shares have been computed from “Supplemento al Bollettino Statistico, Finanza Pubblica”, Tav. 3, Consistenza del debito del settore statale (Bank of Italy). Due to minor balance-sheet items, the above shares do not fully exhaust total domestic debt. Since these series do not exactly complement each other, average debt maturity was expressed using both short and medium–long-term ratios of government debt to total domestic debt (Table 2, fourth and fifth columns).
In line with Table 1, the first three lines of Table 2 provide information about conditional moments of \((i-i')\), i.e. the means and the innovation standard deviation (again restricted to be equal across alternative states). All values are remarkably similar to those obtained for the fixed transition probability model, thus corroborating our previous results. Turning to betas coefficients, our estimates show a clear influence of fiscal and debt indicators on the expected depreciation of the LIT/DM parity. On the whole, only one out of six variables (variations in real debt) does not display any significant effect. As far as other indicators are concerned, betas coefficients reveal appreciable influences upon devaluation expectations, although only in two out of five cases both conditional probabilities turn out to be statistically significant. Overall, this evidence denotes some innovative features with respect to existing contributions. Previous research about the Italian experience has seldom explored the role of fiscal imbalances, reaching anyhow poor results.\(^{20}\)

Focusing on the former group of variables (Table 2, first three columns), an improvement in government deficit, i.e. a deficit reduction or a switch from deficit to surplus, lowers the conditional probability of a not credible state \((\beta_1\) negatively signed, as expected, and statistically significant). The debt/GDP ratio, on the other hand, exhibits a stronger influence on exchange rate credibility. A positive variation in this ratio increases the conditional probability of a not credible state, while decreasing the correspondent probability for a credible regime (both \(\beta_1\) and \(\beta_2\) are significant and correctly signed).

The time pattern of conditional probabilities reveals further interesting insights. As shown in Figs. 3 and 4, the probabilities of remaining in a non-credible state are highly unstable along the sample, pointing out abrupt credibility changes (note that, in both plots, a decrease represents a credibility upturn). Various switches from near-unitary estimates to values lower than 0.5 are recorded for these conditional probabilities.

Figs. 5 and 6 plot the above estimates together with the fiscal indicators respectively assumed as forcing macrovariables. It is apparent that all major

\(^{20}\) Past applied work has analyzed some periods preceding the September 1992 EMS crash. Drawing on the drift-adjustment approach, Chen and Giovannini (1994) document a modest influence of the relative change in budget surplus (or deficit) towards Germany along the 1979.3–1992.1 interval. Focusing on a restricted sample (1987.9–1992.1), moreover, the above influence disappears. Using the same methodology on a larger time span (1981.1–1992.2; quarterly data), Thomas (1994) reports a significant influence of the debt/GDP differential towards Germany, although the correspondent parameter is wrongly signed. According to the author, this “reflects the fact that expected devaluation has gradually fallen over time as the relative government debt/GDP ratio has widened” (p. 279). Focusing on a restricted sample (1987.1–1992.2, quarterly data), however, the above influence is no more statistically significant. As remarked in Section 1, some papers analyzing the first half of the 1990s claim that imbalances in public finances exerted negative effects on the Lira exchange rate (Rose and Svensson, 1994; Vaciago, 1993). However, these papers do not support this argument through formal econometric investigation.
credibility gains are associated to sensible improvements in domestic public finances in the immediately preceding month. Consider, for instance, the ratio of public deficit (or surplus) to GDP (Fig. 5). Positive spikes in this variable, denoting an improvement in the government fiscal position, are recorded in June 1991 and, again, in December 1992 and mid-1993. As documented in Fig. 5 (upper plot), all positive spikes are followed by a nearly halving of the probability of remaining in a non-credible regime, thus denoting a dramatic
increase in exchange rate credibility. A similar result holds for the debt/GDP ratio (see Fig. 6).

Turning to the latter group of variables (Table 2, last three columns), the
policy implications associated to debt management models are broadly consis-
tent with our estimates. This is an interesting result, since possible links
between debt management policies and confidence crises on foreign exchange markets have so far been disregarded in applied research. It is also worthwhile stressing, in this perspective, that theoretical work in this area has largely been inspired by the recent Italian experience. 21

One basic policy prescription from the theoretical literature is that the average maturity of public debt should be lengthened in order to prevent successful speculative attacks (see Section 2). As shown in Table 2, although not all beta coefficients are statistically significant, our evidence supports the above point. An increase in the share of short-term debt lowers the conditional probability of a credible state \((\beta_2\text{ negatively signed, as expected, and statistically significant})\); an increase in the share of long-term debt, conversely, positively affects exchange rate credibility \((\beta_2\text{ positively signed, as expected, and statistically significant})\).

Another crucial policy prescription is that the government should increase the share of public debt denominated in foreign currencies. As outlined in Section 2 (see in particular Eq. (2)), the increase in foreign-currency debt plays a strategic role in debt management models, loosening a crucial constraint which could potentially trigger an exchange rate devaluation. This intuition is fully consistent with our empirical findings. Letting state transitions depend on the share of foreign currency debt (Table 2, last column), both betas coefficients turn out to be significant and correctly signed. An increase in the above share lowers the conditional probability of a not credible state \((\text{negative } \beta_1)\), while increasing the correspondent probability for a credible exchange rate regime \((\text{positive } \beta_2)\). Accordingly, as predicted by the theoretical literature, a larger market for foreign-currency debt lowers devaluation expectations.

The time profile of conditional probabilities is again particularly revealing. Consider the role of the average maturity of public debt. Fig. 7 plots the conditional probability of a credible state, assuming the share of short-term debt as forcing macrovariable. Fig. 8 provides the same information with reference to the medium–long-term debt share (showing the relevant forcing variable in the lower plot). 22 Conditional state transitions display remarkably similar patterns, as a consequence of the complementary character of the

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21 Reference to Italy, as well as to other high-debt EC countries (Spain, Portugal, Greece) is made by Giavazzi and Pagano (1990) when summarizing the main policy rules derived in their paper (see Section 6, pp. 140–141). A still more explicit reference is made in Obstfeld (1994), where domestic and foreign financial assets are respectively labelled in “liras” and “marks”. Consider, moreover, the following quotation: “The model set out above captures aspects of the Italian crisis in September 1992, when the government was forced to rely heavily on Bank of Italy financing to cover sharply higher cash-flow requirements” (Obstfeld, 1994, Section 3.1, p. 37).

22 Note that, differently from Figs. 3 and 4, an increase in these conditional probabilities captures a rise in the credibility of the LIT/DM parity.
associated debt shares. Differently from Figs. 3 and 4, moreover, these plots are much smoother, reflecting the different features of the underlying forcing variables.\textsuperscript{23}

\textsuperscript{23} As shown in Fig. 8 (lower plot), debt share dynamics is smooth and highly trended over time. Previous indicators, by contrast, were computed as a rate of change or as the ratio of government deficit (or surplus) to GDP. These variables display high short-term volatility and a typically untrended pattern over time (see Figs. 5 and 6).
After the Lira entry inside the narrow EMS band, both conditional probabilities denote a marked increase in target zone credibility, lasting up to the first half of 1992. The above trend is reversed in July 1992, pointing out a sharp credibility decrease reaching an all-time low at the beginning of 1993. Since then, conditional probabilities rise again, reaching near-unitary values towards the very end of the sample.

This evolution is particularly revealing in view of the current evidence about the 1992 EMS turmoil. According to the drift-adjustment approach, the above crisis was largely unanticipated, since no indication of a pending crisis did generally emerge until late August 1992 (Rose and Svensson, 1994). Although Italy is a potential exception, denoting a slight anticipatory increase in realignment expectations, Rose and Svensson (1994) claim that “the Italian data were comparable to what had been previously experienced during the ‘New EMS’” (p. 1211). Our findings do not fully support the above interpretation. In line with Rose and Svensson (1994), we detect some anticipatory signals of the forthcoming crisis only since mid-1992.\(^{24}\) According to our estimates, however, these precursory signals represent something peculiar along Italy’s experience in the “New EMS”. As documented in Figs. 7 and 8, they follow a long trend of credibility increase, suggesting that an important variable identified in debt management models did actually play a crucial role during the Lira crisis in September 1992.\(^{25}\)

Consider, finally, the role of the share of public debt denominated in foreign currency (Fig. 9). In this case, the associated conditional probability provides stronger anticipatory signals about the impending currency turmoil. As shown in Fig. 9, this conditional probability rises very fast since the Lira entry in the narrow EMS band, while credibility remains exceptionally high along the first three quarters of 1991. A trend inversion is then apparent: at first very slow, the decrease becomes progressively more substantial, with credibility reaching a relative low in September 1992. The steady credibility decline occurred in 1992 can be traced back to a marked decrease in the share of foreign-denominated debt. The subsequent recovery is likewise explained by an impressive increase in the share of foreign debt, almost doubling between January 1993 and the very end of the sample. These findings complement our evidence about the 1992 Lira crisis, reiterating the crucial role played by debt management indicators at that time.

\(^{24}\) Note, however, as we will discuss in a moment, that these anticipatory signals are much stronger when the percentage of foreign debt is used as forcing macrovariable.

\(^{25}\) Actually, as documented in Fig. 8, the time profile of the conditional probability closely mimics the evolution of the share of medium–long-term debt over total market debt along the sample period (an almost specular pattern holds with reference to the correspondent share for short-term debt).
5. Concluding remarks

The drift-adjustment approach has been unable to detect significant links between exchange rate credibility and macroeconomic fundamentals during the 1992 EMS crisis (Rose and Svensson, 1994). As it has authoritatively been maintained, one possible reason for this disappointing result is the absence of fiscal policy indicators from the set of relevant macroeconomic variables (Branson, 1994). Focusing on the Italian experience, some authors have suggested that growing imbalances in public finances might have played an important role in fostering devaluation expectations. Yet, notwithstanding strong evidence about the low credibility of the LIT/DM target zone (Fratianni and Artis, 1996), these potential sources of speculative pressures have not been submitted to rigorous econometric investigation.

This paper tries to fill this gap in the literature. Relying on uncovered interest parity, but departing from the drift-adjustment approach, it provides a nonlinear framework to investigate the role of fiscal imbalances on the credibility of the LIT/DM parity along the first half of the 1990s. This research strategy emphasizes shifts between credible (low expected devaluation) and not credible (high expected devaluation) states; moreover, in line with the EMS evidence, it assumes a significant degree of persistence in the above regimes.

Overall, our findings highlight a crucial role of alternative fiscal and debt indicators. A higher government deficit or a rise in the debt/GDP ratio, negatively affect devaluation expectations (increasing the conditional probability

Fig. 9. Foreign debt as a percentage of total public debt and conditional probability of a credible state.
of a not credible exchange rate regime). On the other hand, consistently with debt management models, a larger share of long-term or of foreign-denominated debt positively affect credibility (increasing the conditional probability of a credible exchange rate regime).

The time profile of conditional probabilities driven by debt management indicators discloses original insights into the underlying determinants of the Lira devaluation in September 1992. Assuming the shares of long-term and foreign-denominated debt as forcing macrovariables, conditional state transitions show clear anticipatory signals of the impending currency turmoil (particularly in the case of the latter debt indicator). This result deserves special attention, since the drift-adjustment approach fails to detect relevant anticipatory evidence about the 1992 EMS crisis (Rose and Svensson, 1994).

Our analysis entails various policy prescriptions, both at the macro level and in terms of debt management strategies. The impact of government deficit and of the debt/GDP ratio on devaluation expectations suggests that a restrictive fiscal policy, coupled with structural reforms in key government sectors such as welfare and health services, is a crucial requirement to a permanent stabilization of the Lira exchange rate. This policy is all the more relevant in the present context, after Italy re-entry in the EMS and along the final stage to qualify for EMU. Some theoretical developments maintain that a credible and long-lasting reduction in public expenditure has expansionary effects on aggregate demand and output, due to the predominant influence of private sector discounted future disposable income (see, among others, Fels and Froehlich, 1987). On the other hand, complementary research based on the present framework shows that increases in domestic output exert favourable effects on target zone credibility (Tronzano, 1996). To the extent that the above “expectations view” finds empirical support, and that positive output influences hold also for the Italian Lira, our results imply that a restrictive fiscal policy might further enhance exchange rate credibility, through indirect effects induced by real output growth. We still observe, in passing, that the stabilizing influence associated to a readjustment in public finances underlines the consistency, in terms of credibility effects, of some Maastricht macroeconomic criteria, complementing research pointing out their relevance as a contractual device to confer commitment to policy prior to EMU (Winkler, 1996).

Debt management implications associated to the present paper are clear-cut. Our empirical evidence shows that a lengthening of average debt maturity and a deeper market for public debt denominated in foreign currencies display positive credibility effects. As a consequence, one important lesson from the recent Italian experience is that the likelihood of successful speculative attacks in currency markets can significantly be reduced through appropriate debt management policies.
Acknowledgements

The authors wish to thank an anonymous referee for valuable comments and advice on an earlier version of this paper. The usual disclaimer applies. Although the topics addressed in this research reflect common discussion between the authors, Sections 1 and 5 were written by Amedeo Amato, while Sections 2–4 were written by Marco Tronzano.

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