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EXCHANGE-RATE REGIMES IN TRANSITION: ITALY 1974

by

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I. Introduction

From August, 1971, when the U.S. suspended dollar convertibility, until February, 1973, when the dollar was devalued another 10 per cent, the Bretton Woods System was in the final stage of collapse. During the transition period from fixed but adjustable exchange rates to managed floating, some major European countries adopted a middle-ground position, instituting some sort of two-tier exchange market, with separate exchange rates for current-account and capital-account transactions. The authorities generally pegged the commercial exchange rate and allowed the financial exchange rate to be determined by market forces. It was hoped that the two-tier exchange market would relieve pressure on official reserves caused by massive shifts in capital flows. At the same time, it would insulate commercial transactions from exchange-rate fluctuations and eliminate the need for discretionary restrictions on capital transactions. Insulation of foreign trade from exchange-rate fluctuations seems to have been a less pressing objective for some countries during this period, since they pursued a two-tier float where the commercial rate was allowed to float in its own tier.

Italy, France, the Belgium-Luxembourg Economic Union (BLEU), the U.K. and the Netherlands were the major European practitioners of two-tier exchange markets in the early 1970s, although the BLEU has operated such a system continuously since 1957 and France adopted a modified version again in the spring of 1981.

Existing studies of two-tier exchange markets (e.g., Fleming (1971, 1974), Barattieri and Ragazzi (1971), Argy and Porter (1972), Lanyi (1975), Decaluwe and Steinherr (1976), Flood (1978), Marion (1981), and Flood and Marion (1981)) have focussed on the operation of a two-tier exchange market, with special emphasis on such topics as the ability of the system to insulate an economy from foreign disturbances and the formulation of expectations under such a regime. Neglected in all these studies is the fact that the two-tier markets of the early 1970s represented an intermediate step in the transition from fixed (but adjustable) exchange rates to flexible (but managed) exchange rates. The transitional nature of these regimes -- their perceived temporariness -- may help to explain the behavior of exchange rates under such regimes which cannot be otherwise explained by standard market fundamentals.

A case in point is the strange behavior of Italian exchange rates during the transition from a two-tier float to a uniform flexible exchange rate on March 22, 1974. Table I illustrates the behavior of Italian exchange rates during the December 1973-March 1974 period. It also includes data for France, which made a similar transition from a two-tier float to a uniform flexible exchange rate on March 21, 1974. The table shows the percentage premia of the financial lira over the commercial lira and the financial franc over the commercial franc.

Note that the spread between the financial and commercial franc narrowed steadily as the March 21 transition date approached. The French data exhibit exactly the pattern predicted by a simple rational expectations model of a two-tier float. If agents expect that the exchange markets will be unified on a fixed future date, then the bidding away of expected speculative profits will drive the financial and commercial exchange rates together, with any gap between the two rates vanishing the instant before market unification.

The Italian data, on the other hand, pose an interesting puzzle. The spread between the financial and commercial lira did not narrow steadily. In fact, it grew from around 2% at the beginning of 1974 to 9% on March 4, 1974. The two rates then moved together somewhat during the period March 4-21, but on March 21, the final day of the Italian two-tier float, a 2.7% discount in the financial **lira** remained. Chart I shows that Italian exchange rates were also quite volatile prior to the March 22 transition date.

The purpose of this paper is to present a model of an exchange-rate regime in transition which is consistent with the Italian data. We hypothesize that forward-looking agents believed the Italian two-tier float to be temporary, but they were uncertain about the type of exchange-rate regime the authorities would next adopt. Our model shows that expectations of a transition in regime, combined with uncertainty about the nature of the post-transition regime, can cause a jump in the exchange rates at the moment of transition as well as extreme volatility in exchange rates prior to the transition. Moreover, the presence of a discrete jump in the exchange rates at the time of transition implies only that speculative profits were made ex-post, not that they were expected ex-ante.

Several items illustrate the nature of the confusion surrounding Italy's exchange-rate regime transition. First, agents in the lira markets had seen the French abandon their two-tier float and move to a unified flexible rate. Undoubtedly agents believed the same sort of move could take place in Italy. Second, agents apparently believed that a return to a standard two-tier exchange market with a pegged commercial rate was possible. Rushing (1974), for example, wrote at the time:

> "In February, 1973, Italy adopted a two-tier exchange-rate structure . . . Currently (March, 1974), both rates are floating against all currencies. Presumably, the rationale for maintaining the two-tier structure even though both rates are floating is the expectation of an eventual return to a fixed rate for noncapital (i.e., current-account) transactions."

Confusion was also generated by the Italian authorities. For example, in a March, 1974, letter of intent backing an Italian request for a $1.2B International Monetary Fund stand-by credit, the Italian Treasury Ministry reaffirmed its intention to maintain controls on capital movements "for a certain period," and this included keeping some sort of two-tier exchange market mechanism.

With agents confused about the nature of the post-transition regime, political events in early 1974 could only heighten their confusion. OPEC's fourfold increase in oil prices in early 1974 was expected to cause severe balance-of-payments difficulties for Italy, and agents were unsure of how the authorities would respond. Then in March, 1974, a new center-left coalition government was established in Italy whose specific foreign-exchange market policies could hardly have been known to agents in the foreign-exchange markets.

Our strategy in modeling Italy's exchange-rate regime transition is first to develop a general model capable of describing the relevant exchange-rate regime alternatives for Italy. This general model is presented in Section II. In Section III we provide exchange-rate solutions for each type of exchange-rate regime. In Section IV we parameterize the "confusion" surrounding the Italian transition. We then examine Italy's actual transition from a two-tier float to a unified flexible exchange rate given that agents thought a transition to either a two-tier regime with a fixed commercial rate or to a uniform float was possible. Section V provides some concluding remarks and highlights an important conclusion of the analysis: the "temporariness" of an exchange-rate regime should be treated as a market fundamental, and agents' subjective probabilities about the nature of a transition may be a key explanatory variable of exchange-rate movements prior to the transition.

II. The General Model

Italy adopted a two-tier exchange market with a fixed commercial rate in January, 1973, after substantial outflows of private capital, coupled with expectations of a devaluation of the lira, led to mounting pressure on official reserves. From February, 1973 until March, 1974, when the two-tier regime was abolished, the commercial rate was allowed to float in its own tier. In this section, we present a macro model general enough to incorporate the three exchange-rate regime alternatives for Italy:

(1) the two-tier float (TTF), which was the regime in effect prior to the transition,

(2) the two-tier exchange market with a fixed commercial rate (TT), which the Italians operated in January, 1973, and which agents believed could become the post-transition regime,

(3) the uniform flexible exchange-rate regime (FLEX), which agents believed was a possible post-transition regime and which, in fact, was adopted on March 22, 1974.

Because of turmoil in the foreign-exchange markets, including the pressures of massive interest-sensitive and speculative capital flows, the uniform fixed exchange-rate regime was never a viable option for Italy during this period.

In the model presented below, the domestic economy is assumed to be small both in commodity markets and in the market for internationally-traded financial assets.

Notation

Lower case letters generally denote logarithms of variables; a dot over a variable indicates the time derivative; a bar over a variable indicates that it is held constant; an asterisk indicates "foreign."

d	Domestic component of monetary base
g	International reserve component of monetary base
i	Domestic interest rate (level)
k	Domestic stock of traded securities
m	Monetary base
p	Domestic price level
ε	Uniform flexible exchange rate (home currency/foreign currency)
s	Commercial exchange rate
x	Financial exchange rate
w	Domestic real financial wealth
y	Domestic real output
t	Time

The Model

Monetary Sector

(1) $m(t)-p(t) = \alpha_0 - \alpha_1 i(t) + \alpha_2 y(t); \quad \alpha_1, \alpha_2 > 0$

(2) $i(t) = i^*(t) + \gamma(s(t)-x(t)) + \dot{x}(t); \quad \gamma > 0$

(3) $m(t) = \theta g(t)+(1-\theta)d(t); \quad 0 \leq \theta \leq 1$

(4a) $\dot{m}(t) = \dot{d}(t) = \dot{g}(t) = 0$ (FLEX, TTF)

(4b) $\dot{m}(t) = \theta\dot{g}(t); \; \dot{d}(t) = 0$ (TT)

Saving

(5) $\dot{w}(t) = \Psi_0 + \Psi_1(y(t)-w(t)) + \Psi_2(i(t)-\dot{p}(t)); \quad \Psi_1, \Psi_2 > 0$

(6) $w(t) = \eta m(t)+(1-\eta)(x(t)+k(t))-p(t); \quad 0 \leq \eta \leq 1$

Foreign-Exchange Market

(7a) $s(t) = x(t) = \varepsilon(t)$ (FLEX)

(7b) $s(t) = \bar{s}$ (TT)

Prices

(8) $p(t) = p^*(t) + s(t)$

Exogenous Variables

(9) $y(t) = \bar{y}$

(10) $d(t) = \bar{d}$

(11) $p^*(t) = \bar{p}^*$

(12) $i^*(t) = \bar{i}^*$

(13) $k(t) = \bar{k}$ (TT, TTF)

Equation (1) depicts money-market equilibrium. It equates the real monetary base, $m(t)-p(t)$, to money demand, which depends negatively on the opportunity cost of holding money and positively on real output.

Equation (2) specifies the opportunity cost of holding money. It is general enough to encompass the three alternative exchange-rate regimes. In the case of two-tier exchange rates, the principal on foreign bonds must be acquired and repatriated at the financial rate, X (level), but interest income, a current-account item, must be repatriated at the commercial rate S (level). To derive Equation (2), we consider the opportunity cost of holding money for a time period of length h and then let $h \to 0$ to obtain our continuous-time expression.

At the beginning of a period of length h, one unit of domestic money will buy $1/X(t)$ units of financial foreign exchange which may be repatriated at the end of the period at the rate $X(t+h)$. During the period, the $1/X(t)$ units of foreign exchange earn $hi^*(t)/X(t)$ in interest income which may be repatriated into domestic money in amount $S(t+h)hi^*(t)/X(t)$. These two elements of return can be combined to give an overall return of $\frac{X(t+h)}{X(t)}(1 + \frac{S(t+h)hi^*(t)}{X(t+h)})$. Hence, the opportunity cost of holding domestic money from time t to time (t+h) is $hi(t)$ in the expression

$$(14)\quad 1 + hi(t) = \frac{X(t+h)}{X(t)}\left(1 + \frac{S(t+h)hi^*(t)}{X(t+h)}\right).$$

A logarithmic approximation to (14) is

$$(15)\quad hi(t) = x(t+h) - x(t) + \frac{S(t+h)hi^*(t)}{X(t+h)} \quad .$$

Dividing each side of (15) by h and letting $h \to 0$, we obtain

$$(16)\quad i(t) = \dot{x}(t) + \frac{S(t)i^*(t)}{X(t)} \quad .$$

Finally, we approximate $S(t)i^*(t)/X(t)$ in (16) by $i^*(t)+\gamma[s(t)-x(t)]$ to get Equation (2).1/

When we analyze the two-tier float, s(t) and x(t) in Equation (2) are simultaneously determined endogenous variables. When we examine a two-tier market with a fixed commercial rate, s(t) is held fixed at $\bar{s}$ by the domestic monetary authorities. Under unified flexible exchange rates, $s(t)=x(t)=\varepsilon(t)$ and Equation (2) becomes the familiar uncovered interest arbitrage condition with risk neutrality.

Equation (3) states that the nominal domestic monetary base, m(t), is a weighted average of the book value of an international reserve component, g(t), and a domestic component, d(t). Throughout the analysis we hold d(t) constant at $\bar{d}$.2/ We also assume that under the TTF and FLEX regimes, the government does not intervene in the foreign-exchange market, so g(t) is constant at $\bar{g}$. Consequently, Equation (4a) holds for these two regimes. Under the TT regime, the government must intervene in the foreign-exchange market to peg the commercial rate, so g(t) will not be constant. Equation (4b) holds for this regime. Since the foreign-exchange markets are partitioned under the TT regime, the accumulation of reserves, $\dot{g}(t)$, is determined solely by the current-account surplus. Consequently, g(t) is a continuous variable and does not make discrete jumps as it might under a uniform fixed exchange rate.

Equation (5) equates real wealth accumulation to planned saving. Planned saving depends positively on the output-wealth ratio, $y(t)-w(t)$, and positively on the real rate of interest, $i(t)-\dot{p}(t)$.

Equation (6) specifies the logarithmic linearization of real wealth, with nominal wealth being a weighted average of nominal money, m(t), and the nominal domestic-currency value of traded securities, $x(t)+k(t)$. Net domestic holdings of traded securities are assumed to be nonnegative.[3/]

The exchange-rate regime in effect dictates the channels through which the economy alters its real stock of wealth. Indeed, the way in which wealth is acquired is the most significant difference between the TTF, TT, and FLEX regimes.

Under the TTF regime, the flexible commercial rate keeps the current-account in balance while the flexible financial rate prevents net capital flows. Since we have also assumed that there is no change in the domestic component of the money base, equations (4a), (10) and (13) are relevant and real wealth accumulation under the TTF regime is

$$(17)\quad \dot{w}(t) = (1-\eta)\dot{x}(t) - \dot{p}(t).$$

Under the TT regime, real wealth accumulation becomes

$$(18)\quad \dot{w}(t) = \eta\theta\dot{g}(t) + (1-\eta)\dot{x}(t) - \dot{p}(t).$$

Equation (18) differs from (17) by the term $\eta\theta\dot{g}(t)$, which gives the wealth effect of a current-account surplus or deficit and the extent of current-account intervention to peg $s(t)$ at $\bar{s}$. Under the FLEX regime, we have

$$(19)\quad \dot{w}(t) = (1-\eta)(\dot{x}(t) + \dot{k}(t)) - \dot{p}(t),$$

where $\dot{k}(t)$ need not equal zero.

Equations (7a) and (7b) describe exchange-rate relationships under the various regimes. Equation (7a) states that for the FLEX regime, there is one uniform exchange rate; (7b) states that for the TT regime the commercial rate is pegged. Under the TTF regime, no set relation between the commercial and financial rates exists independently of private behavior. Under the TT regime, the financial rate is flexible and the model determines the relationship between $\bar{s}$ and x.

Equation (8) is the goods arbitrage condition. In logs, the price of domestic output, p(t), equals the foreign output price plus the commercial exchange rate. Since commodity trade is a current-account transaction, it is appropriate to specify the arbitrage condition using the commercial exchange rate.

Equations (9)-(12) list the model's exogenous variables.

This completes the exposition of the general model. Our aim is to use the model to study the expected transition from a temporary TTF regime to either the TT or the FLEX regime. To accomplish our aim, we find in the next section the exchange-rate solutions of our model for the various regimes. In Section IV we model the expected transition by taking the general exchange-rate solutions of the TTF regime (s(t) and x(t)) and using a weighted average of the TT and FLEX exchange-rate solutions as our terminal conditions. Further, since our motivation for this study comes from the Italian experience in 1974, we will indicate in our analysis any additional assumptions which limit the generality of our model in order to make it more directly applicable to the Italian case.

III. Exchange-Rate Solutions

In this section we use the general model to derive exchange-rate solutions for the three regimes, TTF, TT and FLEX. We do so by solving a system of linear differential equations for each regime. In Section IV we model the expected regime transition.

III.1 The TTF Solution

Equations (1)-(3), (4a), (5)-(6), (8)-(13) of the general model are used to derive the two primary equations of the TTF regime. These two equations represent semi-reduced forms of money-market equilibrium and planned saving behavior:

$$(20)\quad \bar{m}-\bar{p}^*-s(t) = \alpha_0 - \alpha_1[i^* + \gamma(s(t) - x(t)) + \dot{x}(t)] + \alpha_2\bar{y}$$

$$(21)\quad (1-\eta)\dot{x}(t)-\dot{s}(t) = \Psi_0$$

$$+\Psi_1(\bar{y}-\eta\bar{m}-(1-\eta)(x(t)+\bar{k})+\bar{p}^*+s(t))$$

$$+\Psi_2(i^*+\gamma(s(t)-x(t))+\dot{x}(t)-\dot{s}(t)).$$

Equations (20) and (21) are a pair of simultaneous linear differential equations in the exchange rates s(t) and x(t).

In our investigation of conditions actually prevailing in Italy in late 1973 and early 1974, we discovered that Branson and Halttunen (1979) had constructed a time series on the level of Italian net foreign assets which encompassed the late 1973- early 1974 period. Their data indicate that during this period, Italian net foreign assets were approximately zero. Since we are interested in the Italian case, it seems reasonable to specialize our solutions to account for the Branson-

Halttunen data. Hence, we specialize our solutions by reporting the limiting case of the solutions with $(1-\eta)\to 0$.[4/]

The exchange-rate solutions for the TTF regime are:

$$(22)\quad x(t) = C_1 e^{\gamma t} + \frac{(1-\alpha_1\gamma)}{\alpha_1(\mu-\gamma)} C_2 e^{\mu t} + \hat{x}$$

$$(23)\quad s(t) = C_2 e^{\mu t} + \hat{s} ,$$

where

$$\mu = \frac{(\Psi_1 + \frac{\Psi_2}{\alpha_1})}{\Psi_2 - 1}$$

$$\hat{x} = \frac{(1-\alpha_1\gamma)B_2}{\gamma\alpha_1\mu} - \frac{B_1}{\gamma}$$

$$\hat{s} = \frac{-B_2}{\mu}$$

$$B_1 = \frac{1}{\alpha_1}[\alpha_0 - \alpha_1\bar{i}^* - \bar{m} + \bar{p}^* + \alpha_2\bar{y}]$$

$$B_2 = \frac{\Psi_0 + \Psi_1(\bar{p}^* - \bar{m} + \bar{y}) + \Psi_2(\bar{i}^* + B_1)}{\Psi_2 - 1}$$

and we assume $(\Psi_2 - 1) \neq 0$.

In Equations (22) and (23), $\hat{x}$ and $\hat{s}$ are the steady-state values of $x(t)$ and $s(t)$, respectively, μ and γ are the two distinct roots of the system, and C_1 and C_2 are as yet undetermined coefficients.

Since $x(t)$ and $s(t)$ are both simultaneously-determined, "forward-looking" variables, the model of the TTF regime does not in general have the now familiar saddle point property which often occurs when one endogenous variable is predetermined and the other is "forward-looking." Note that if μ is positive, then the system contains two positive roots, and the TTF model is formally an unstable node. Under these circumstances, non-zero values for C_1 and C_2 will prevent the financial and commercial exchange rates from ever reaching their steady-state values. Instead, they will both ride a speculative bubble indefinitely.

If the TTF regime were expected to be <u>permanent</u>, then the condition of no speculative bubbles would require agents to set $C_1=0$ and to set $C_2=0$ when $\mu>0$. However, since agents expect the TTF regime to be <u>temporary</u>, the coefficients C_1 and C_2 need not be set at zero. As we shall see in Section IV, agents will set C_1 and C_2 at values where a transition to some more permanent regime -- either the TT or FLEX -- can be made without expected speculative profits.

III.2 <u>The TT Solution</u>

Equations (1)-(3), (4b), (5)-(6), (7b), (8)-(13) from the general model are used to derive the semi-reduced forms of the money-market equilibrium condition and planned saving behavior for the TT regime:

$$(24)\quad (1-\theta)\bar{d}+\theta g(t)-\bar{p}^{*}-\bar{s} = \alpha_0-\alpha_1(\bar{i}^{*}+\gamma(\bar{s}-x(t))+\dot{x}(t))+\alpha_2\bar{y}$$

$$(25)\quad \eta\theta\dot{g}(t)+(1-\eta)\dot{x}(t) =$$

$$\Psi_0+\Psi_1\{\bar{y}-\eta[(1-\theta)\bar{d}+\theta g(t)]$$

$$-(1-\eta)[x(t)+\bar{k}]+\bar{p}^*+\bar{s}\}$$

$$+\Psi_2(\bar{i}^*\gamma(\bar{s}-x(t))+\dot{x}(t)).$$

Recall that under the TT regime, the financial exchange rate is flexible but the government pegs the commercial exchange rate. The government's foreign-exchange market intervention to peg $s(t)$ at $\bar{s}$ alters the international reserve component of the monetary base over time. Consequently, Equations (24) and (25) represent a pair of simultaneous linear differential equations in $g(t)$ and $x(t)$.

The exchange-rate and reserves solutions for the TT regime are:

$$(26)\quad g(t) = (g(T)-\hat{g})e^{-(\Psi_1+\frac{\Psi_2}{\alpha_1})(t-T)}+\hat{g};\quad t \geq T$$

$$(27)\quad x(t) = \lambda g(t)+\hat{x}-\lambda\hat{g};\quad t \geq T$$

where

$$\lambda = \frac{\theta}{\alpha_1(\Psi_1+\frac{\Psi_2}{\alpha_1}+\gamma)}$$

$$\hat{g} = \frac{B_3}{\Psi_1+\frac{\Psi_2}{\alpha_1}}+\frac{\bar{s}}{\theta}$$

$$\hat{x} = \frac{\theta B_3}{\gamma\alpha_1(\Psi_1+\frac{\Psi_2}{\alpha_1})}-\frac{B_4}{\gamma}+\bar{s}$$

$$B_3 = \frac{1}{\theta}[\Psi_0 + \Psi_1(\bar{y} + \bar{p}^* - (1-\theta)\bar{d}) + \Psi_2(\bar{i}^* + B_4)]$$

$$B_4 = \frac{1}{\alpha_1}[\alpha_0 - \alpha_1\bar{i}^* + \alpha_2\bar{y} - (1-\theta)\bar{d} + \bar{p}^*]$$

and where T is defined as the transition date. The terms $\hat{g}$ and $\hat{x}$ are the steady-state values of $g(t)$ and $x(t)$, respectively.

Unlike the TTF regime, the TT regime exhibits saddle-point stability. The value of $g(t)$, which represents the book value of international reserves, is given by history at an instant in time. The financial exchange rate, $x(t)$, is not predetermined; rather, it is a currently determined "forward-looking" variable.

Since T represents the transition date -- the initial instant of the TT regime -- $g(T)$ is the initial condition for our solution of the time path of $g(t)$, $t \geq T$.

The initial condition for our solution of the time path of $x(t)$ is found by invoking the requirement that the model place itself on the stable branch leading to the steady state. Equation (27) is the stable branch of the equation system (24), (25). Equation (26) traces the motion of $g(t)$. The motion of $x(t)$ is obtained by substituting (26) into (27).

The final component in our solution of the TT model is the setting of commercial rate at $\bar{s}$. If agents believe during the operation of a TTF regime that the authorities will switch to a TT regime, then they must form beliefs about the level at which s will be set under the TT regime. These beliefs are subjective, but some guidance can be obtained from public policy announcements just prior to the transition. For example, in Italy's March, 1974, letter of intent to the IMF, it firmly undertook to eliminate its non-oil current-account deficit. Hence, agents may reasonably have believed that the commercial exchange rate would be set at a level designed to achieve some current-account target, Z, at time T. Let

$$(28)\quad Z=\dot{g}(T) = -(\Psi_1 + \frac{\Psi_2}{\alpha_1})(g(T)-\hat{g}),$$

where the final equality in (28) follows from differentiating (26).

To find the value of $\bar{s}$ which will yield current-account target Z, substitute the definition of $\hat{g}$ into (28) to obtain

$$(29a)\quad Z = (\Psi_1 + \frac{\Psi_2}{\alpha_1})(-g(T) + \frac{B_3}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})} + \frac{\bar{s}}{\theta}.$$

Rearranging (29a), we get

$$(29b)\quad \bar{s} = \theta g(T) + \frac{\theta(Z-B_3)}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})}.$$

Equation (29b) has the sensible property that a larger current-account surplus target (a smaller current-account deficit target) requires a higher price for commercial foreign exchange, since

$$\frac{d\bar{s}}{dZ} = \frac{\theta}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})} > 0.$$

The complete solution of the TT model is obtained in the following manner. First, substitute (29b) into the definitions of $\hat{g}$ and $\hat{x}$. This gives:

$$(30a) \quad \hat{g} = \frac{B_3}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})} + g(T) + \frac{Z - B_3}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})}$$

$$(30b) \quad \hat{x} = \frac{\theta B_3}{\gamma\alpha_1(\Psi_1 + \frac{\Psi_2}{\alpha_1})} - \frac{B_4}{\gamma} + \theta g(T) + \frac{\theta(Z-B_3)}{(\Psi_1 + \frac{\Psi_2}{\alpha_1})} .$$

Next, substitute (30a) and (30b) into the solutions for g(t) and x(t) in Equations (26) and (27). We now have a complete solution to the TT regime conditional on the current-account target Z and the model placing itself on the stable branch leading to the steady state.[5/]

III.3 The FLEX Solution

Under the FLEX regime, the general model of Section II decomposes, and we need only know the money-market equilibrium condition to determine the value of the exchange rate. Equations (1)-(3), (4a), (7a) and (9)-(12) of the general model can be combined to derive the semi-reduced form of the money-market equilibrium for the FLEX regime:

$$(31) \quad \bar{m} - \bar{p}^* - \varepsilon(t) = \alpha_0 - \alpha_1(\bar{i}^* + \dot{\varepsilon}(t)) + \alpha_2\bar{y}, \ t \geq T .$$

Equation (31) is a linear differential equation in $\varepsilon(t)$. In the absence of speculative bubbles, the solution to (31) is

(32a) $\varepsilon(t) = \bar{m} - \bar{p}^* + \alpha_1 \bar{i}^* - \alpha_2 \bar{y} - \alpha_0, \; t \geq T$.

Since $\varepsilon(t)$ in (32a) is a constant, it will be the exchange rate in effect at the initial instant the authorities switch to a FLEX regime. Hence,

(32b) $\varepsilon(T) = \bar{m} - \bar{p}^* + \alpha_1 \bar{i}^* - \alpha_2 \bar{y} - \alpha_0$.

IV. The Transition from a TTF Regime

In this section we will study the expected transition from a TTF regime to either a FLEX regime or a TT regime. Prior to the transition, the market will set exchange rates at levels such that speculators could not anticipate making speculative profits by entering the market the instant before the transition.

As an example of what is meant by the absence of expected speculative profits, suppose that at the instant after the regime switch financial foreign exchange would be worth 700 lire per dollar if the switch were made to the FLEX regime or 800 lire per dollar if the switch were made to the TT regime. The absence of expected speculative profits requires

$$x(T_-) = \pi 700 + (1 - \pi)800 ,$$

where T_- represents the instant before the transition and π is the subjective probability attached by speculators to an actual transition to the FLEX regime. The above expression states that financial foreign exchange just prior to the transition will be a weighted average of the price of foreign exchange under a FLEX regime at time T and the price of foreign financial exchange under the TT regime at time T.

Figure 1 depicts one possible time path for the value of financial foreign exchange given our example. As seen in figure 1, $x(T_-)$ is set at a level between 700 lire per dollar and 800 lire per dollar such that speculators do not expect to profit from the transition. Of course, once the actual regime switch is announced and instituted on date T, the value of financial foreign exchange will make a discrete jump. If the switch is made to a TT regime, then financial foreign exchange will jump up in value, if the switch is made to a FLEX regime, financial foreign exchange will jump down in value. Consequently, when agents are uncertain about the nature of the post-transition regime, the requirement that there be no expected speculative profits just prior to a regime switch leads to a discrete jump in exchange rates on the transition date.

The condition that speculators bid away expected profits prior to the transition date is the terminal condition which allows us to set C_1 and C_2 in our solution to the TTF regime. In particular, suppose that at time $t < T$ agents attach probability $\pi(t)$ to the event "transition to FLEX" and probability $(1 - \pi(t))$ to the event "transition to TT." The terminal conditions for the TTF model at time t are

$$(33) \quad x^{TTF}(T) = \pi(t)\varepsilon(T) + (1 - \pi(t))x^{TT}(T)$$

$$(34) \quad s^{TTF}(T) = \pi(t)\varepsilon(T) + (1 - \pi(t))\bar{s}^{TT}$$

where x^{TTF} refers to the financial exchange rate of the TTF regime, etc. The variable $\pi(t)$ is the subjective probability attached by agents at time t to an actual transition to the FLEX regime at time T.

Given the terminal conditions (33) and (34), we can now solve for the undetermined coefficients C_1 and C_2 in Equations (22) and (23) and obtain complete exchange-rate solutions for the TTF regime prior to the transition.

Combining (22), (23) with (33), (34), we know that at time $t < T$, the absence of expected speculative profits at time T implies

$$(35) \quad \pi(t)\varepsilon(T) + (1 - \pi(t))x^{TT}(T) =$$

$$C_1(t)e^{\gamma T} + \frac{(1-\alpha_1\gamma)}{\alpha_1(\mu-\gamma)}e^{\mu T} + \hat{x}^{TTF}$$

$$(36) \quad \pi(t)\varepsilon(T) + (1 - \pi(t))\bar{s}^{TT} =$$

$$C_2(t)e^{\mu T} + \hat{s}^{TTF} .$$

Solving these equations for $C_1(t)$ and $C_2(t)$ yields

$$(37) \quad C_1(t) = \{\pi(t)\varepsilon(T) + (1 - \pi(t))x^{TT}(T) - \hat{x}^{TTF}$$

$$- \frac{(1 - \alpha_1\gamma)}{\alpha_1(\mu - \gamma)}[\pi(t)\varepsilon(T) + (1 - \pi(t))\bar{s}^{TT} - \hat{s}^{TTF}]\}e^{-\gamma T}$$

$$(38) \quad C_2(t) = \{\pi(t)\varepsilon(T) + (1 - \pi(t))\bar{s}^{TT} - \hat{s}^{TTF}\}e^{-\mu T} .$$

Because our terminal conditions depend on $\pi(t)$, which may vary with time, we have allowed C_1 and C_2 also to depend on time. Note that at any time t, $\pi(t)$ refers to an event in the future. Agents set $\pi(t)$ at time t at the level which optimally uses all information available. Hence, agents expect $\pi(t)$ to be constant and thus expect $C_1(t)$ and $C_2(t)$ to be constant. However, as new information becomes available, agents may alter π through time.

It is through these possibly time-varying subjective probabilities that we capture another aspect of the confusion in Italy's foreign-exchange market in early 1974. Typical exchange-rate models yield exchange-rate solutions where exchange rates change only when standard market fundamentals such as money supplies, foreign interest rates, foreign prices, output or wealth change, or when agents perceive such market fundamentals will change. Our model stresses a previously neglected source of volatility in exchange rates -- changes in agents' subjective probabilities about the nature of an exchange-rate regime transition. Our model recognizes the inherently temporary nature of the Italian TTF regime in 1973-74, and it demonstrates that changes in agents' subjective probabilities of a transition to either a TT or a FLEX regime may account for erratic exchange-rate movements under the TTF regime not otherwise explained by standard market fundamentals.[6/]

During early 1974, the political situation in Italy was quite unsettled, and agents must have been forming beliefs about exchange-rate regime transition based on relatively little information. This situation is exactly the one where rumors and announcements can have dramatic effects on agents' probabilities over a transition. According to the complete solution of our TTF model for $t < T$, dramatic movements in $\pi(t)$ may cause dramatic movements in $C_1(t)$ and $C_2(t)$, and dramatic movements in $C_1(t)$ and $C_2(t)$, according to Equations (22) and (23), may cause dramatic movements in exchange rates.

Thus, through movements in $\pi(t)$, our model is consistent with the erratic fluctuations in Italian exchange rates just prior to the transition, and because of uncertainty about which regime would be adopted after the transition, our model is consistent with the discrete jump observed in the Italian financial rate at the time of the transition.

In our discussion of the Italian case, we have focussed on just one source of uncertainty -- the nature of the transition. We have assumed that agents know with certainty both the transition date, T, and the government's current-account target, Z.

It turns out that our results are completely unaffected by assuming that agents do not know the transition date. Neither the state variables nor the terminal conditions (33) and (34) depend on the transition date T; consequently the exchange-rate solutions for the TTF regime will not depend on the transition date T.[7/]

However, our solutions will be altered if agents did not know for certain the government's current-account target, Z. Therefore, a more complete treatment of uncertainty in the Italian case would require more general terminal conditions than (33) and (34).

These new terminal conditions could be developed by recognizing that at any date $t < T$, agents must have formed some subjective probability density function $f(Z|t)$ over the random variable Z. The more general terminal conditions would then be obtained by integrating the terminal conditions (33) and (34) over Z. The undetermined coefficients $C_1(t)$ and $C_2(t)$ of our TTF solutions could then be calculated by applying these more general terminal conditions.

We have not pursued this extension because it merely reinforces our point that volatility in agents' subjective probabilities about the nature of a transition can result in exchange-rate volatility prior to the transition.

V. Concluding Remarks

The two-tier exchange markets of the early 1970s represented an intermediate step in the transition from fixed but adjustable exchange rates to flexible but managed exchange rates. Our attempt to explain the behavior of the lira during the operation of the Italian two-tier exchange market in 1973-74 has led us to develop a model of exchange-rate regimes in transition.

On the assumption that the market will set exchange rates so as to eliminate expected speculative profits at the time of transition, our model indicates that expectations of a transition, combined with uncertainty about the nature of the post-transition regime, can cause a jump in exchange rates at the moment of transition as well as volatile exchange-rate movements prior to the transition. The model suggests that the <u>perceived temporariness</u> of an exchange-rate regime should be treated as a market fundamental. Moreover, agents' time-varying subjective probabilities about the nature of a transition can account for exchange-rate movements not explained by standard market fundamentals.

Table I

FRANCE

Dates[1]	S[2]	X[3]	ℓn(S/X)[4]
731203	4.5133	4.697	-.0399
731204	4.5457	4.7114	-.0358
731205	4.5417	4.717	-.0379
731206	4.5196	4.6849	-.0359
731207	4.5416	4.6904	-.0322
731210	4.5596	4.7048	-.0313
731211	4.5508	4.7026	-.0328
731212	4.5366	4.6893	-.0331
731213	4.5572	4.6893	-.0286
731214	4.5632	4.7148	-.0327
731217	4.5815	4.5777	.0008
731218	4.6209	4.8031	-.0387
731219	4.6023	4.7858	-.0391
731220	4.6142	4.795	-.0384
731221	4.6286	4.7608	-.0282
731226	-	-	-
731227	4.6965	4.8614	-.0345
731228	4.6956	4.8924	-.0411
740102	4.7565	4.931	-.0360
740103	4.8442	4.9801	-.0277
740104	4.8183	4.9813	-.0333
740107	4.8875	5.0403	-.0308
740108	5.0113	5.1813	-.0334
740109	4.8945	5.1203	-.0451
740110	4.8802	5.08	-.0401
740111	4.8766	5.0761	-.0401
740114	4.9153	5.1086	-.0386
740115	4.9991	5.1733	-.0343
740116	4.9767	5.1573	-.0356
740117	4.9691	5.148	-.0354
740118	4.9736	5.1653	-.0378
740121	5.22	5.3763	-.0295
740122	5.2125	5.3362	-.0235
740123	5.2313	5.3276	-.0183
740124	5.2275	5.3404	-.0214
740125	5.2275	5.3562	-.0243
740128	5.195	5.2875	-.0176
740129	5.2225	5.3	-.0147

Dates	S	X	ℓn(S/X)
740130	5.1638	5.26	-.0185
740131	5.1075	5.1975	-.0175
740201	5.035	5.06	-.0050
740204	5.005	5.0725	-.0134
740205	4.9755	5.035	-.0119
740206	5.0467	5.15	-.0203
740207	5.0364	5.1325	-.0189
740208	5.01	5.1086	-.0195
740211	5.0174	5.1151	-.0193
740212	4.9854	5.08	-.0188
740213	5.0046	5.0852	-.0160
740214	5.0064	5.08	-.0146
740215	4.9949	5.0761	-.0161
740219	4.9494	5.005	-.0112
740220	4.9351	4.9913	-.0113
740221	4.9201	4.9591	-.0079
740222	4.8164	4.7847	.0066
740225	4.8996	4.92	-.0042
740226	4.8824	4.8769	.0011
740227	4.8103	4.7966	.0029
740228	4.8111	4.8146	-.0007
740301	4.8819	4.9035	-.0044
740304	4.8811	4.896	-.0030
740305	4.8504	4.8461	.0009
740306	4.8258	4.8485	-.0047
740307	4.8413	4.8426	-.0003
740308	4.8561	4.8414	.0030
740311	4.8375	4.9068	-.0142
740312	4.8013	4.8065	-.0011
740313	4.7938	4.8008	-.0015
740314	4.82	4.8263	-.0013
740315	4.8363	4.835	.0003
740318	4.8519	4.8757	-.0049
740319	4.8515	4.8685	-.0035
740320	4.849	4.8555	-.0013
740321	-	-	-
740322	-	-	-

Notes:

1. Year, month, day
2. Commercial exchange rate, francs/dollar
3. Financial exchange rate, francs/dollar
4. ℓn(S/X) is approximately equal to the percentage difference between S and X.
5. Data Source: IMF Desk Sheets

Table I

(continued)

ITALY

Dates[1]	S[2]	X[3]	ℓn(S/X)[4]	Dates	S	X	ℓn(S/X)
731203	606.75	628.75	-.0356	740130	663	694.69	-.0467
731204	610.8	633.73	-.0369	740131	662.5	694.2	-.0467
731205	611.75	630.72	-.0305	740201	658.5	691.56	-.0490
731206	608.5	630.72	-.0359	740204	657	691.56	-.0513
731207	608	628.73	-.0335	740205	654	689.66	-.0531
731210	610	628.73	-.0302	740206	659.5	693.48	-.0502
731211	608	627.35	-.0313	740207	661.25	698.08	-.0542
731212	605.2	624.22	-.0309	740208	660.5	697.59	-.0546
731213	605.125	624.02	-.0307	740211	660.5	696.86	-.0536
731214	606.125	618.43	-.0201	740212	657.25	695	-.0558
731217	605.85	623.05	-.0280	740213	657.75	697.11	-.0581
731218	606.75	616.33	-.0157	740214	657.5	698.08	-.0599
731219	605.25	608.83	-.0059	740215	656	696.86	-.0604
721220	604.5	604.41	.0001	740219	650	691.56	-.0620
731221	604.38	605.69	-.0022	740220	649.88	690.85	-.0611
731226	-	-	-	740221	650.25	690.85	-.0606
731227	606	610.87	-.0080	740222	649.05	687.29	-.0572
731228	608	616.14	-.0133	740225	649.5	693.24	-.0652
740102	612.5	623.05	-.0171	740226	648	694.69	-.0696
740103	619.5	632.91	-.0214	740227	648.25	696.14	-.0713
740104	620	630.12	-.0162	740228	647.75	700.04	-.0776
740107	630	636.54	-.0103	740301	654.5	708.72	-.0796
740108	636.5	642.67	-.0096	740304	652.75	715.82	-.0922
740109	628.75	636.74	-.0126	740305	650	710.48	-.0890
740110	630	636.54	-.0103	740306	648.125	703.23	-.0816
740111	628.5	-	-	740307	650	701.51	-.0763
740114	630.75	637.15	-.0101	740308	648	681.43	-.0503
740115	637.5	643.09	-.0087	740311	645	670.02	-.0381
740116	639.5	644.12	-.0072	740312	641	660.72	-.0303
740117	641.5	652.1	-.0164	740313	640.75	668	-.0416
740118	650	663.35	-.0203	740314	640.75	673.63	-.0500
740121	653	677.51	-.0368	740315	639.75	674.08	-.0523
740122	671	694.68	-.0347	740318	639	674.54	-.0541
740123	675	696.62	-.0315	740319	635	670.47	-.0544
740124	674.5	702.49	-.0407	740320	633.375	670.69	-.0572
740125	673.5	708.47	-.0506	740321	625.5	642.67	-.0271
740128	664.5	702.99	-.0563	740322	623.75	-	-
740129	668.25	698.81	-.0447				

Notes:

1. Year, month, day
2. Commercial exchange rate, lire/dollar
3. Financial exchange rate, lire/dollar
4. ℓn(S/X) is approximately equal to the percentage difference between S and X.
5. Data Source: IMF Desk Sheets

Chart I

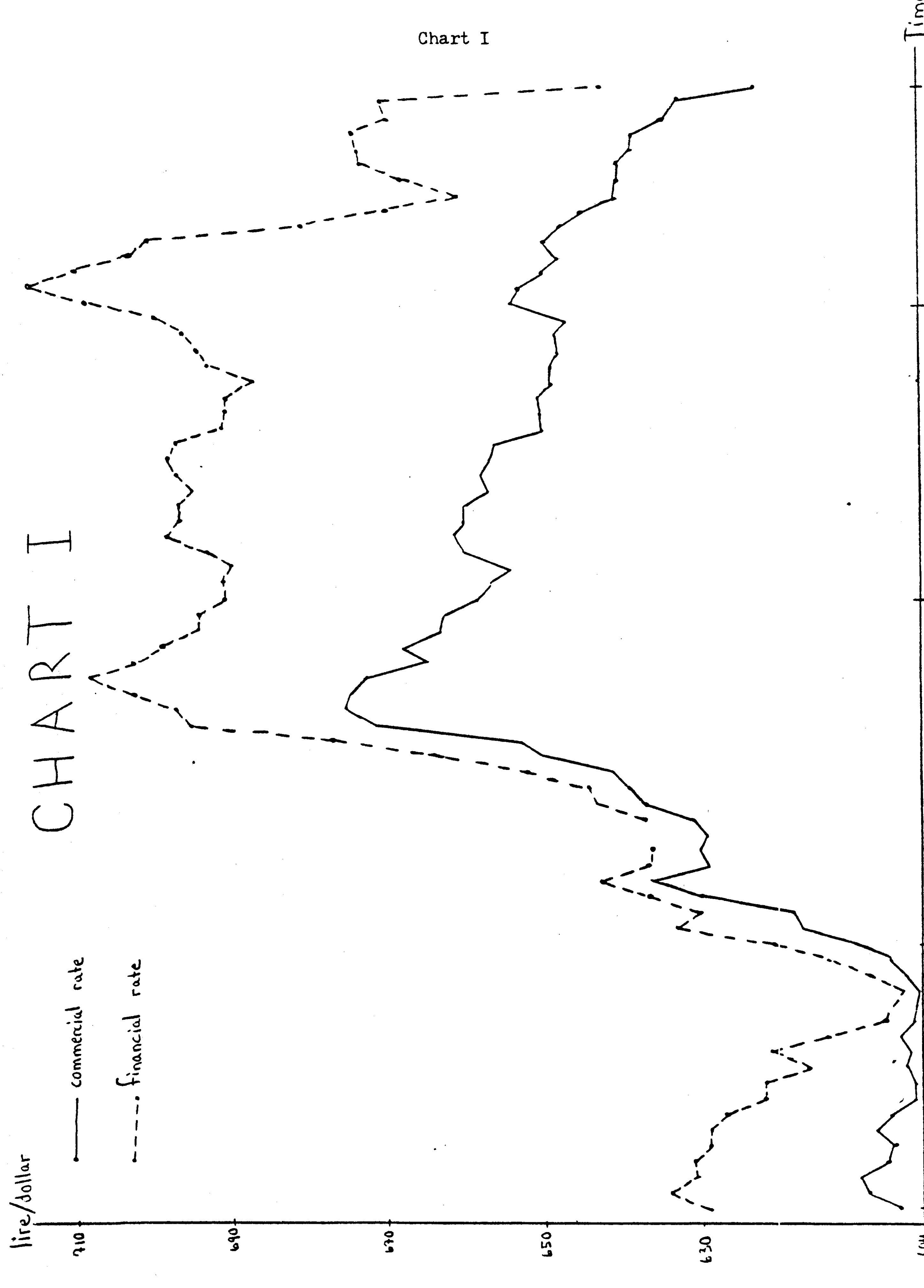
CHART I
lire/dollar
commercial rate
financial rate
710
690
670
650
630
12-3-73
1973
1-2-74
2-1-74
1974
3-1-74
3-21-74
Time

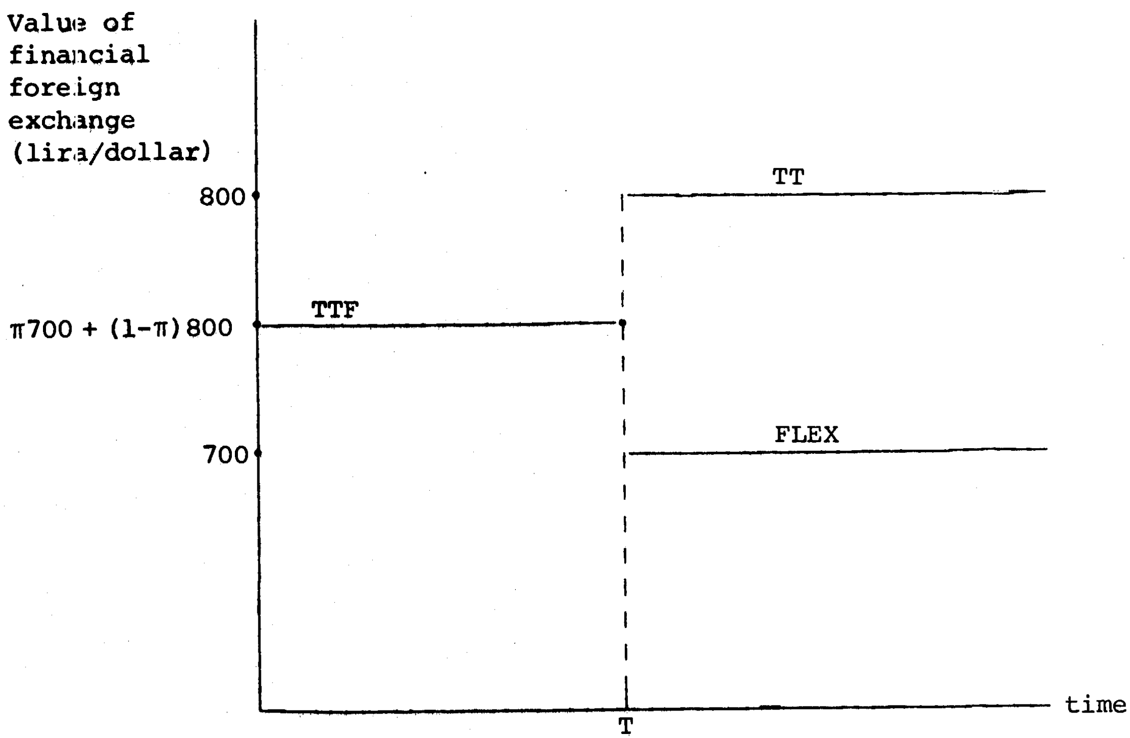
Value of financial foreign exchange (lira/dollar)
800
$\pi 700 + (1-\pi) 800$
700
TTF
TT
FLEX
T
time

Figure 1

Footnotes

*Board of Governors of the Federal Reserve System and the University of Virginia, and Dartmouth College, respectively.

[1]We have used two logarithmic approximations in obtaining Equation (2). First, for small $h\dot{i}(t)$, $\ln(1 + h\dot{i}(t)) \approx h\dot{i}(t)$. Second, $S(t)i^*(t)/X(t) \approx i^*(t) + i^*(t)[s(t) - x(t)]$. We have used $i^*(t)[s(t) - x(t)] \approx \gamma[s(t) - x(t)] + \chi i^*(t) + \gamma\chi$, where γ is the mean value of $i^*(t)$ and χ is the mean value of $[s(t) - x(t)]$. For simplicity, we have chosen the normalization $\chi = 0$.

[2]We recognize that during the 1973-early 1974 period, the domestic component of the Italian money supply was growing rapidly. Incorporation into the model of a constant money growth path or a nonconstant but exogenous money growth path would be no more difficult than assuming the domestic component is fixed at $\bar{d}$; however, it would not substantially change any of our results. Incorporation of a nonconstant, endogenous money growth path would be much more difficult to handle, since it would require solving a higher order linear differential equation system.

[3]See the evidence cited in Section III.1 on the Italian net foreign asset position during this period.

[4]The solutions for the general case where $(1 - \eta) \neq 0$ are available from the authors on request. The solutions reported in the text are simpler and not substantively different from the more general solutions.

[5]We realize that it is unreasonable for agents to have had precise knowledge of the government's target current-account, Z. In the next section, we will not require agents to know Z exactly prior to the transition.

[6]In fact, our model of the TTF regime treats standard market fundamentals as constant (Equations (4a), (9)-(13)), highlighting the role of volatile subjective probabilities about a transition in generating volatile exchange-rate movements.

[7]If we had not assumed our exogenous variables to be constant prior to the transition, then the exchange-rate solutions for the TTF regime would depend on the time of transition, and T would be an additional source of uncertainty.

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