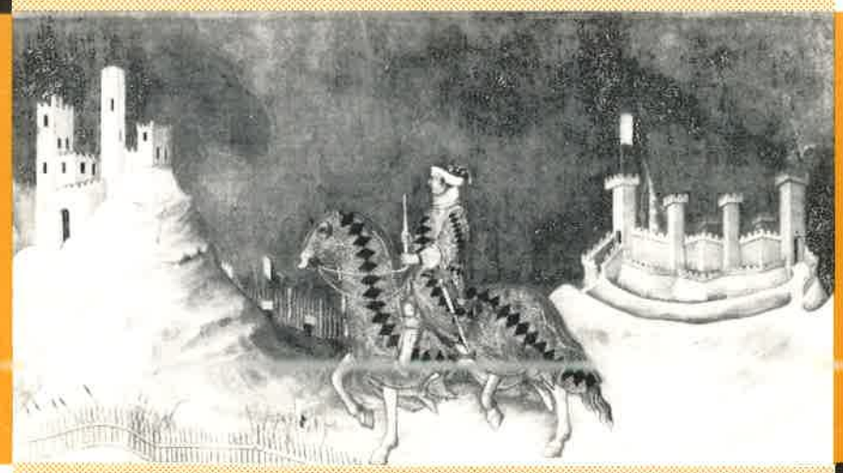
UNIVERSITÀ DEGLI STUDI DI SIENA

157

QUADERNI DEL DIPARTIMENTO
DI ECONOMIA POLITICA

Giulio Cifarelli

SYSTEMATIC FORWARD FORECAST ERRORS, EX ANTE REAL INTEREST RATE DIFFERENTIALS AND EX ANTE REAL EXCHANGE RATE CHANGES. AN EMPIRICAL ANALYSIS.



QUADERNI DEL DIPARTIMENTO DI ECONOMIA POLITICA

Redazione: **Dipartimento di Economia Politica**, Piazza S. Francesco, 17 - 53100 Siena - tel.0577/298620

La Redazione ottempera agli obblighi previsti dall'Art.1 del D.L.L. 31.8.45 n.660

Le richieste di copie della presente pubblicazione dovranno essere indirizzate alla Redazione

I **Quaderni del Dipartimento di Economia Politica** dell'Università di Siena vengono pubblicati come servizio atto a favorire la tempestiva divulgazione di ricerche scientifiche originali, siano esse in forma provvisoria o definitiva. I **Quaderni** vengono regolarmente inviati a tutti gli istituti e dipartimenti italiani, a carattere economico, nonché a numerosi docenti e ricercatori universitari. Vengono altresì inviati ad enti e personalità italiane ed estere. L'accesso ai **Quaderni** è approvato dal Comitato scientifico, sentito il parere di un referee.

(Dal 1979 a tutto il 1987 la denominazione della presente Collana è stata: **"Quaderni dell'Istituto di Economia"**. La numerazione progressiva rimane tuttavia la stessa).

Giulio Cifarelli

SISTEMATIC FORWARD FORECAST ERRORS, EX ANTE REAL INTEREST RATE DIFFERENTIALS AND EX ANTE REAL EXCHANGE RATE CHANGES. AN EMPIRICAL ANALISIS.

Siena, Ottobre 1993

Giulio Cifarelli è Professore associato di Economia e Politica Monetaria presso la Facoltà di Scienze Politiche dell'Università degli Studi di Firenze.

1. Introduction*

In this paper we consider the determinants of the (systematic) deviations from the unbiased efficiency hypothesis on forward exchange rate behaviour that have been observed in the 1980s. We expand an approach set out by R.A. Korajczyk (1985) to analyse the pricing of forward exchange rate in three ways:

(i) we assess directly the relevance of ex ante real interest rate equality across currencies and of the efficient market version of purchasing power parity;

(ii) we introduce explicitly ex ante real exchange rate changes in the estimation framework;

(iii) we use a more flexible Generalised Method of Moments estimation approach, which is robust both to conditional heteroskedasticity and to serial correlation of the residuals.

Section 2 describes the economic rationale of the relationships that are to be estimated with the help of a simple model. Section 3 provides an empirical analysis of the behaviour of ex ante real interest rate differentials and of ex ante real exchange rate changes. Section 4 investigates the links between these factors and ex ante forward forecast errors.

The empirical findings suggest that the discrepancies

*The author would like to thank A. Calamanti, F. Casprini, F. Cesarano, R. Riti and D. Salvatore for their useful suggestions. Financial support from the M.U.R.S.T.(fondi 60%) is gratefully acknowledged.

between forward and future spot exchange rates are due to ex ante real exchange rate changes in the first half of the decade and - to a lesser extent - to risk premia on nominally riskless bonds in the second half. The determinants of systematic exchange rate forecast errors change over time and from one currency to the other.

2. Forecast Errors, Real Interest Rates and Real Exchange Rate Changes

The unbiased expectations hypothesis on forward exchange rate behaviour holds if

$$(1)\quad E[(s_{t+1} - f_t)|\Phi_t] = 0$$

where s_{t+1} is the logarithm of the spot exchange rate at time t+1, f_t is the logarithm of the corresponding one period ahead forward exchange rate set at time t, Φ_t is the information set available at time t and E(.) is the expectations operator.[1]

Following R.A. Korajczyk (1985) we set out an estimable expression for equation (1) in terms of expected differences, across countries, in real interest rates and of expected deviations from relative purchasing power parity.

The covered interest parity condition implies that

$$(2)\quad i_{t+1} - i^*_{t+1} = f_t - s_t$$

where i_{t+1} and i^*_{t+1} are the yields (from t to t+1) on one period nominally riskless bonds denominated in the home and foreign currencies respectively.

The logarithm of the deviations from purchasing power parity, d_t, can be expressed as

$$(3)\quad d_t = s_t - P_t + P^*_t$$

where P_t and P^*_t are the logarithms of the domestic and foreign price levels. d_t can also be defined as the logarithm of the real exchange rate at time t. The nominal rate of interest from a one period bond can be decomposed as

$$(4)\quad i_{t+1} = E(r_{t+1}|\Phi_t) + E(\Delta P_{t+1}|\Phi_t)$$

$$(5)\quad i^*_{t+1} = E(r^*_{t+1}|\Phi_t) + E(\Delta P^*_{t+1}|\Phi_t)$$

where r_{t+1} and r^*_{t+1} are - respectively - the real returns on default free domestic and foreign bonds maturing at time t+1. ΔP_{t+1} and ΔP^*_{t+1} are the domestic and foreign inflation rates from time t to t+1.

Combining equations (2), (3), (4) and (5) we can express the (ex post) exchange rate forecast error as

$$(6)\quad (s_{t+1} - f_t) = E[(r^*_{t+1} - r_{t+1})|\Phi_t] + [\Delta P_{t+1} - E(\Delta P_{t+1}|\Phi_t)] - [\Delta P^*_{t+1} - E(\Delta P^*_{t+1}|\Phi_t)] + \Delta d_{t+1}.$$

Taking expectations, we can define the expected deviations of s_{t+1} from f_t conditional on Φ_t as

$$(7)\quad E[(s_{t+1} - f_t)|\Phi_t] = E[(r^*_{t+1} - r_{t+1})|\Phi_t] + E[\Delta d_{t+1}|\Phi_t].$$

The right hand side is null and the unbiased expectations hypothesis holds if (i) the ex ante real returns on nominally riskless bonds are equal across countries and (ii) the ex ante rate of change of the real exchange rate is zero.

Condition (i) is generally believed not to hold (see e.g. R.J. Hodrick (1979), R.E. Cumby, M. Obstfeld (1984), F.S. Mishkin (1984.a, 1984.b), J.J. Merrick, A. Saunders (1986) and others). In order to hold the asset denominated in the more risky currency, an investor must be compensated with a risk premium, i.e. a higher expected real return.[2]

Condition (ii), the efficient market version of the purchasing power parity hypothesis, is usually believed to hold (see e.g. R.J. Rogalski, J.D. Vinso (1977), R. Roll (1979) and M. Adler, B. Lehmann (1983)). It implies that ex ante real returns are independent of the country of residence.[3]

If we assume a priori - following R.A. Korajczyk (1985), G.W. Evans (1986) and R. Levine (1989) - that condition (ii) holds and that $E[\Delta d_{t+1}|\Phi_t] = 0$, equation (7) becomes

(8) $E[(s_{t+1} - f_t)|\Phi_t] = E[(r^*_{t+1} - r_{t+1})|\Phi_t]$.

Forecastable deviations from unbiased expectations should be equal to the forecastable difference in real returns across bonds denominated in different currencies. The relevance of this assertion can be assessed empirically by estimating the following relationship

(9) $(s_{t+1} - f_t) = a_0 + a_1 E[(r^*_{t+1} - r_{t+1})|\Phi_t] + u_{9t+1}$

where $u_{9t+1} = (s_{t+1} - f_t) - E[(s_{t+1} - f_t)|\Phi_t]$.

The theory would require that $a_0 = 0$, $a_1 = 1$ and $E[u_{9t+1}|\Phi_t] = 0$. Rejection of these restrictions is thus a rejection of the joint hypothesis that risk premia on nominally riskless bonds are the cause of deviations from the unbiased expectations hypothesis and that $E[\Delta d_{t+1}|\Phi_t] = 0$.

If we assume a priori that condition (i) holds and that $E[(r^*_{t+1} - r_{t+1})|\Phi_t] = 0$, equation (7) becomes

(10) $E[(s_{t+1} - f_t)|\Phi_t] = E[\Delta d_{t+1}|\Phi_t]$.

Expected deviations from unbiased expectations should reflect the forecastable change in the real exchange rate. The empirical relevance of this assertion can in turn be assessed by estimating the following relationship

(11) $(s_{t+1} - f_t) = b_0 + b_1 E[\Delta d_{t+1}|\Phi_t] + u_{11t+1}$

where $u_{11t+1} = (s_{t+1} - f_t) - E[(s_{t+1} - f_t)|\Phi_t]$.

Here too the null hypothesis is that $b_0 = 0$, $b_1 = 1$ and $E[u_{11t+1}|\Phi_t] = 0$. Rejection of these restrictions is here a rejection of the joint hypothesis that ex ante real exchange rate changes cause deviations from the unbiased expectations hypothesis and that ex ante real interest rates on nominally riskless bonds are equal across countries.

Neither $E[(r^*_{t+1} - r_{t+1})|\Phi_t]$ nor $E[\Delta d_{t+1}|\Phi_t]$ are observable. However, consistent and asymptotically efficient parameter estimates may be obtained with the help of instrumental variables, following a methodology analysed, among others, by B.T. McCallum (1976), M.R. Wickens (1982) and M.H. Pesaran

(1987, pp. 164 - 170). The GMM estimator approach of L.P. Hansen (1982) becomes relevant when the residuals turn out to be conditionally heteroskedastic and/or serially correlated.

3. Empirical Results: Ex Ante Real Interest Rates Equality and Ex Ante Relative Purchasing Power Parity

We have investigated the behaviour of the exchange rate between the U.S. dollar and four major currencies, the British pound, the German mark, the Japanese yen and the Italian lira over the periods January 1981 - February 1985 and March 1985 - October 1992.[4] We have used - with the exception of Italy - Eurocurrency interest rates, which are less affected by capital controls.[5] Consumer price indexes are used to derive the inflation rate series. Data are sampled monthly. The forward and spot exchange rate time series have been provided by the Bank of Italy. The consumer prices and the Italian interbank interest rate time series are published in the O.E.C.D. "Main Economic Indicators". The Eurocurrency time series (the interest rates on three-month deposits labelled in U.S. dollars, in Japanese yens, in German marks and in British pounds in London) are reported in the O.E.C.D. "Financial Statistics".

We investigate at first whether the conditions $E[(r^*_{t+1} - r_{t+1})|\Phi_t] = 0$ and $E[\Delta d_{t+1}|\Phi_t] = 0$ - which are crucial for the choice of unbiased expectations hypothesis model - hold over the two time periods of interest.

Ex ante real interest rate parity across countries (condition (i) of the previous section) implies, using equations (4) and (5)

(12) $i_{t+1} - E[\Delta P_{t+1}|\Phi_t] = i^*_{t+1} - E[\Delta P^*_{t+1}|\Phi_t]$.

Equation (12) can be expressed in regression format as

(13) $(\Delta P_{t+1} - \Delta P^*_{t+1}) = \alpha + \beta(i_{t+1} - i^*_{t+1}) + u_{13t+1}$

where $u_{13t+1} = (\Delta P_{t+1} - \Delta P^*_{t+1}) - E[(\Delta P_{t+1} - \Delta P^*_{t+1})|\Phi_t]$. A test of the null hypothesis $\alpha = 0$, $\beta = 1$ is a test of the hypothesis that expected real interest rates are equal across countries. The instrumental variables estimates of this

TABLE 1

(13) $(\Delta P_{t+1} - \Delta P^*_{t+1}) = \alpha + \beta(i_{t+1} - i^*_{t+1}) + u_{13t+1}$

	1981:1-1985:2					1985:3-1992:10				
	α	β	R^2	H_0	n	α	β	R^2	H_0	n
U.S./U.K.	-0.002	0.74	0.02	5.90	0	0.003	1.34	0.002	7.39*	0
	(-2.78)	(2.34)				(1.46)	(2.15)			
U.S./GERMANY	-0.01	2.65	0.31	11.12*	0	0.0001	0.93	0.002	24.95*	0
	(-3.58)	(3.66)				(0.01)	(1.39)			
U.S./JAPAN	-0.001	0.60	0.07	2.73	0	0.0002	0.81	0.0002	24.79*	0
	(-0.60)	(1.56)				(0.18)	(1.34)			
U.S./ITALY	-0.003	0.71	0.17	5.63	0	-0.0001	0.34	0.001	28.09*	0
	(-1.72)	(2.44)				(-0.02)	(1.13)			

n : NUMBER OF AUTOCORRELATION TERMS USED IN COMPUTING THE COVARIANCE MATRIX OF ORTHOGONALITY CONDITIONS.

H_0: TEST OF THE NULL HYPOTHESIS THAT $\alpha = 0$, $\beta = 1$. THE TEST STATISTIC IS DISTRIBUTED ASYMPTOTICALLY AS $\chi^2(2)$.

* : SIGNIFICANT AT THE 5% LEVEL.

relationship are set out in table 1. The instruments are the time t differentials between the nominal U.S. interest rate and the nominal interest rates of the four currencies of the sample. We have applied the GMM estimator procedure since conditional heteroskedasticity seems to affect the residuals.[6] In the presence of serially correlated disturbances the standard GMM estimates will be consistent, but not asymptotically efficient if the weighting matrix is not appropriately modified. We have used therefore the positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix estimator of W.K. Newey,K.D. West (1987).[7] The bound on the number of sample autocovariances used to compute the covariance matrix of orthogonality conditions (the weighting matrix) has been assessed with the help of the automatic bandwidth parameter selection procedure set out by D.W.K. Andrews (1991).[8] (For an analogous approach, using however the prewhitening kernel method of D.W.K. Andrews, J.C. Monahan (1992), see B.E. Hansen (1992).)

The quality of fit declines significantly in the second half of the decade. The estimates suggest that ex ante real interest equality has to be rejected over the period March 1985 - October 1992 for all the countries of the sample. Over the period January 1981 - February 1985 the null hypothesis has to be rejected in the case of Germany only. A significant constant term suggests - however - that the ex ante U.S.-U.K. interest rate differential may have been constant but different from zero.

The hypothesis that $E[\Delta d_{t+1}|\Phi_t] = 0$ implies that the innovations in the real exchange rate, Δd_{t+1}, are serially uncorrelated and that $E[d_{t+1}|\Phi_t] = d_t$, i.e. that the real

exchange rate follows a random walk process. We found, however, that Δd_{t+1} could be modelled as a stable function of a constant, of its own lagged value and of the time t forward premium in the period January 1981 - February 1985 (equation (14)), and as a function of its own lagged value and of the lagged forward forecast error in the period March 1985 - October 1992 (equation (15))

(14) $\Delta d_{t+1} = \gamma_0 + \gamma_1 \Delta d_t + \gamma_2 (f_t - s_t) + u_{14t+1}$

(15) $\Delta d_{t+1} = \delta_0 \Delta d_t + \delta_1 (s_t - f_{t-1}) + u_{15t+1}$.[9]

The ex ante relative purchasing power parity hypothesis holds if $\gamma_0 = \gamma_1 = \gamma_2 = 0$ and u_{14t+1} is white noise in equation (14) and if $\delta_0 = \delta_1 = 0$ and u_{15t+1} is white noise in equation (15). As can be seen from the estimates of table 2, these hypotheses are always rejected. Expected real exchange rate changes do not seem to be unpredictable.

The validity of the specification of equation (14) is further corroborated by the dynamic simulations set forth in table 3. Both the R.M.S.E. and the correlation coefficients (between actual and simulated values of the dependent variable) suggest that this equation reproduces the effective behaviour of the real exchange rate better than the random walk model in the period January 1981 - February 1985.[10] (Over the period March 1985 - October 1992 the results are less clearcut, since both the correlation coefficients and the R.M.S.E. statistics suggest that the random walk outperforms equation (15) in reproducing the effective real exchange rate behaviour.)

TABLE 2

1981:1-1985:2

(14) $\Delta d_{t+1} = \gamma_0 + \gamma_1 \Delta d_t + \gamma_2 (f_t - s_t) + u_{14t+1}$

	γ_0	γ_1	γ_2	R^2	S.E.	D.a.	F_{H_0}
£/$	-0.01	-0.27	-7.86	0.19	0.0338	-0.46	4.04*
	(-1.81)	(-1.53)	(-2.38)				
DM/$	-	-	-2.26	0.02	0.0307	0.11	-
			(-2.21)				
Y/$	-	-	-1.66	0.05	0.0329	-0.26	-
			(-1.68)				
LIT/$	-0.03	-0.24	-3.12	0.15	0.0261	-1.59	3.12*
	(-3.93)	(-1.58)	(-3.15)				

1985:3-1992:10

(15) $\Delta d_{t+1} = \delta_0 \Delta d_t + \delta_1 (s_t - f_{t-1}) + u_{15t+1}$

	δ_0	δ_1	R^2	S.E.	D.a.	F_{H_1}
£/$	-0.31	0.48	0.07	0.0412	-0.99	6.65*
	(-1.54)	(2.22)				
DM/$	-0.37	0.43	0.06	0.0385	-1.60	4.35*
	(-1.86)	(2.13)				
Y/$	-0.58	0.66	0.13	0.0396	-2.37*	11.54*
	(-2.37)	(2.54)				
LIT/$	-0.33	0.47	0.06	0.0387	-1.65	5.45*
	(-1.52)	(2.02)				

t RATIOS COMPUTED WITH HETEROSKEDASTICITY CONSISTENT STANDARD ERRORS.

D.a.: DURBIN'S ALTERNATIVE TEST FOR FIRST ORDER SERIAL CORRELATION.

F_{H_0}: F TEST OF THE NULL HYPOTHESIS H_0: $\gamma_0 = \gamma_1 = \gamma_2 = 0$.

F_{H_1}: F TEST OF THE NULL HYPOTHESIS H_1: $\delta_0 = \delta_1 = 0$.

* : SIGNIFICANT AT THE 5% LEVEL.

TABLE 3

1981:1-1985:2

	EQUATION (14)		RANDOM WALK[11]	
	$\rho_{d_{t+1}\tilde{d}_{t+1}}$	R.M.S.E.	$\rho_{d_{t+1}\tilde{d}_{t+1}}$	R.M.S.E.
£/$	0.948	0.063	0.899	0.069
DM/$	0.932	0.044	0.930	0.070
Y/$	0.724	0.079	0.611	0.098
LIT/$	0.870	0.098	0.753	0.055

1985:3-1992:10

	EQUATION (15)		RANDOM WALK	
	$\rho_{d_{t+1}\tilde{d}_{t+1}}$	R.M.S.E.	$\rho_{d_{t+1}\tilde{d}_{t+1}}$	R.M.S.E.
£/$	0.868	0.222	0.779	0.081
DM/$	0.714	0.414	0.886	0.067
Y/$	0.740	0.430	0.940	0.050
LIT/$	0.917	0.366	0.917	0.071

$\rho_{x_t \tilde{x}_t}$: CORRELATION COEFFICIENT BETWEEN THE HISTORICAL AND THE SIMULATED VALUES OF THE DEPENDENT VARIABLE x_t.

R.M.S.E. (ROOT MEAN SQUARE ERROR) : $\sqrt{\frac{1}{T}\sum_{t=1}^{T}(\tilde{x}_t - x_t)^2}$

WHERE T IS THE NUMBER OF OBSERVATIONS, $\tilde{x}_t$ AND x_t ARE THE SIMULATED AND HISTORICAL VALUES OF THE VARIABLES OF INTEREST.

4. Empirical Results: the Unbiased Efficiency Hypothesis, the Real Interest Rates Differentials and the Real Exchange Rate Changes

The results of the previous section contradict the hypotheses that are accepted a priori in the studies mentioned above, viz. that condition (ii) holds and that condition (i) is always rejected. Ex ante real interest rates on nominally riskless bonds differ across countries, violating condition (i), in the March 1985 - October 1992 period only, and condition (ii) is clearly violated in the period January 1981 - February 1985. (In the period March 1985 - October 1992 we obtain mixed results: the random walk restrictions on equation (15) are rejected but, at the same time, the random walk outperforms the alternative specification in the dynamic simulations.)

We want to assess whether these results can be used to explain the (observed) systematic discrepancies between forward and future spot exchange rates with the help of the model set out in section 2 above. Indeed, we want to check whether the forecastable deviations from forward exchange rate unbiasedness are equal to the forecastable change in the real exchange rate in the period January 1981 - February 1985 and whether they are equal to the forecastable difference in real returns on nominally riskless bonds across currencies in the period March 1985 - October 1992.[12]

We have replaced the ex ante real interest rate differences of equation (9) by their realised values $(r^*_{t+1} - r_{t+1})$ and have applied an errors in variables estimation method. We have obtained consistent and asymptotically efficient estimates of

the resulting equation (16) below with the help of the generalised instrumental variables estimation approach. (We use as instruments in deriving the orthogonality conditions a constant, the lagged real interest rates differential across the two countries of interest, the lagged inflation rate differential, the forward premium and the average value - over the previous twelve months - of the real interest rate differential.) We have introduced the GMM methodology since a preliminary analysis suggested that the estimates might be affected by conditional heteroskedasticity.[13] Here too we have applied the bandwitdth selection procedure of D.W.K. Andrews and have adjusted accordingly the covariance matrix of orthogonality conditions.

$$(16)\quad (s_{t+1} - f_t) = c_0 + c_1(r^*_{t+1} - r_{t+1}) + u_{16t+1}$$

Instrumental variables:
constant, $(r^*_t - r_t)$, $(\Delta P^*_t - \Delta P_t)$, $(f_t - s_t)$, $[\frac{1}{12}\sum_{i=1}^{12}(r^*_{t+1-i} - r_{t+1-i})]$.

The estimates set out in table 4 indicate that in the period March 1985 - October 1992 (in which condition (i) does not hold) some of the forecastable deviations in the unbiased expectations hypothesis can indeed be explained by ex ante real interest rate differentials in the case of the deutschemark-dollar and lira-dollar exchange rates. The hypothesis that $c_0 = 0$ and $c_1 = 1$ in equation (16) is never rejected. The power of the test is low, however, in the case of the yen-dollar exchange rate given the low value of the multiple correlation coefficient. In the period January 1981-February 1985 condition (i) seems to hold and, as expected,

TABLE 4

(16) $(s_{t+1} - f_t) = c_0 + c_1(r^*_{t+1} - r_{t+1}) + u_{16t+1}$

1981:1-1985:2

	c_0	c_1	R^2	S.E.	D.W.	H_0	n
£/$	-0.01	2.74	0.01	0.0396	1.86	7.52*	0
	(-0.70)	(0.62)					
DM/$	-0.02	-1.75	0.02	0.0297	1.79	3.52	0
	(-1.78)	(-0.61)					
Y/$	-0.01	-0.45	0.004	0.0332	1.89	1.58	0
	(-0.75)	(-0.10)					
LIT/$	-0.01	-1.91	0.02	0.0275	1.90	6.80*	0
	(-2.16)	(-1.31)					

1985:3-1992:10

	c_0	c_1	R^2	S.E.	D.W.	H_0	n
£/$	0.01	0.36	0.04	0.0384	1.64	1.20	1
	(1.63)	(1.21)					
DM/$	0.01	0.54	0.07	0.0362	1.90	0.83	1
	(2.02)	(2.33)					
Y/$	0.01	-0.06	0.004	0.0348	1.91	0.87	0
	(2.20)	(-0.49)					
LIT/$	0.01	0.48	0.04	0.0357	1.76	1.46	1
	(2.12)	(2.11)					

n : NUMBER OF AUTOCORRELATION TERMS USED IN COMPUTING THE COVARIANCE MATRIX OF THE ORTHOGONALITY CONDITIONS.

H_0 : LIKELIHOOD RATIO-LIKE TEST OF THE NULL HYPOTHESIS $c_0 = 0$, $c_1 = 1$.

* : SIGNIFICANT AT THE 5% LEVEL.

the overall quality of fit of the estimates declines as ex ante real interest rate differentials exert no effect on forward forecast errors.

As pointed out in section 2, systematic forward forecast errors may also be due to anticipated real exchange rate changes, an hypothesis rejected a priori in the empirical analyses mentioned above. We report in table 5 the generalised instrumental variables estimates of equation (17) below, in which we have replaced the ex ante real exchange rate changes of equation (11) by their realised values. (We use as instruments the regressors of equations (14) and (15) in the two relevant time periods.)

(17) $(s_{t+1} - f_t) = e_0 + e_1 \Delta d_{t+1} + u_{17t+1}$.[14]

Instumental variables:
constant, Δd_t, X_t, where
$X_t = (f_t - s_t)$ in the period January 1981 - February 1985
$X_t = (s_t - f_{t-1})$ in the period March 1985 - October 1992.

The GMM estimates indicate that in the period January 1981 - February 1985 (in which condition (ii) is violated) a relevant fraction of the deviation from the unbiased expectations hypothesis can be attributed to the expectation of deutschemark, pound sterling, yen and lira real depreciation by financial market participants.[15] The overall quality of fit is good and the relevant coefficients have the appropriate signs. The null hypothesis that $e_0 = 0$ and $e_1 = 1$ is rejected. This is due to the presence of constant terms that are significantly different from zero. Indeed, the null hypothesis that $e_1 = 1$ is always accepted, with the exception of the lira

TABLE 6

(17) $(s_{t+1} - f_t) = o_0 + o_1 \Delta d_{t+1} + u_{17t+1}$

1981:1-1986:2

	o_0	o_1	R^2	S.E.	D.W.	H_0	H_1	n
£/$	-0.002	1.06	0.98	0.0062	1.94	8.85•	2.45	0
	(-2.51)	(20.97)						
DM/$	-0.01	0.74	0.99	0.0078	1.79	26.62•	3.63	0
	(-5.77)	(7.11)						
Y/$	-0.001	1.23	0.96	0.0107	1.79	9.62•	2.72	0
	(-1.13)	(9.39)						
LIT/$	0.001	1.22	0.96	0.0085	1.71	7.16•	5.74•	0
	(0.84)	(13.14)						

1985:3-1992:10

	o_0	o_1	R^2	S.E.	D.W.	H_0		n
£/$	0.004	0.25	0.65	0.0312	1.80	3.24		2
	(2.08)	(0.68)						
DM/$	0.001	-0.24	0.61	0.0456	1.82	0.54		3
	(0.71)	(-1.05)						
Y/$	0.001	0.16	0.63	0.0300	1.89	1.46		3
	(0.64)	(1.31)						
LIT/$	0.005	-0.22	0.61	0.0434	1.73	9.53•		2
	(2.26)	(-0.79)						

n : NUMBER OF AUTOCORRELATION TERMS USED IN COMPUTING THE COVARIANCE MATRIX OF THE ORTHOGONALITY CONDITIONS.

H_0: LIKELIHOOD RATIO-LIKE TEST OF THE NULL HYPOTHESIS $o_0 = 0$, $o_1 = 1$.

H_1 : LIKELIHOOD RATIO-LIKE TEST OF THE NULL HYPOTHESIS $o_1 = 1$.

• : SIGNIFICANT AT THE 5% LEVEL.

dollar exchange rate. Deviations from the unbiased expectations hypothesis are not caused exclusively by ex ante real exchange rate changes.

We have seen in the previous section that the random walk outperforms the alternative specification in reproducing real exchange rate behaviour in the period March 1985 - October 1992. This finding is reflected in the estimates of equation (17): the quality of fit declines and ex ante real exchange rate changes have no systematic effect on ex ante forward forecast errors.

5. Conclusion

In this paper we have shown that systematic forward forecast errors have to be associated with ex ante real exchange rate changes in the period January 1981 - February 1985. A possible interpretation of this finding is that the four currencies under investigation paid a negative risk premium vis a' vis the dollar due to expected (national) real depreciation. The failure of the unbiased expectations hypothesis seems to be the result of goods market inefficiency insofar as the association of non zero ex ante real exchange rate changes with goods market inefficiency holds.

In the period March 1985 - October 1992 ex ante real interest differentials explain a fraction of the systematic forward forecast errors of the dollar exchange rate with the E.M.S. currencies of the sample, the deutschemark and the lira. (Britain joined the E.M.S. only in 1990.) This finding is probably connected with the rigidities introduced into

financial markets by the E.M.S. itself. Ex ante real exchange rate differentials are not reflected in systematic forward forecast errors in the case of the yen-dollar and sterling-dollar exchange rates, a result in line with the growing efficiency of international capital markets. On the whole the empirical findings suggest that the link of systematic forward forecast errors with financial risk premia is rather weak.

notes

(1) Under the maintained hypothesis of rational expectations the deviations of $E[(s_{t+1}- f_t)|\Phi_t]$ from zero are to be interpreted as (minus) the exchange risk premium.

(2) A differential in ex ante real returns may also be due to barriers to capital movements across countries, which prevent complete arbitrage and - temporarily - to systematic exchange rate manipulation by central banks.

(3) R.E. Cumby, M. Obstfeld (1984), D. Longworth (1986) and R.D. Huang (1987), however, found evidence contrary to the ex ante relative purchasing power parity hypothesis. In this case expected real returns on nominally riskless bonds will depend upon the currency in which they are evaluated. This will affect the forward exchange rate, which will differ from the future spot rate expected by the market.

(4) As shown in a previous paper (G. Cifarelli (1992)) the dollar behaviour seems to have been affected by a regime shift in February 1985. In the period 1981 - 1985 market forces seem to have played a dominant role in causing its

appreciation. In the period 1985 - 1992 central banks have influenced its behaviour, essentially with the help of more or less coordinated interest rate manipulation.

(5) F. Giavazzi, M. Pagano (1985) and L.E. Mohlo (1990) have found that, in the case of Italy, capital controls have not been binding on average. The behaviour of the Eurolira interest rates does not differ in a significant way from the behaviour of equivalent short run onshore interest rates.

(6) Conditional heteroskedasticity seems to affect the residuals over the period March 1985 - October 1992. Conditional homoskedasticity implies that $E(u^2_{13t+1}|\Phi_t)$ = constant. It requires that in the regression $u^2_{13t+1}= \theta_0+ \theta_1 u_{13t}+ \theta_2 u^2_{13t}+ e_{t+1}$ the estimates of the coefficients θ_1 and θ_2 be insignificantly different from zero. We obtain the following F test results, where u_{13t+1} is set equal to $(\Delta P_{t+1}- \Delta P^*_{t+1}) - (i_{t+1}- i^*_{t+1})$, under the assumption that the null hypothesis of ex ante real interest rate equality be valid in equation (13) above:

$F_{\theta_1=\theta_2=0}$	U.S./U.K.	U.S./GERMANY	U.S./JAPAN	U.S./ITALY
1981:1-1985:2	2.42	0.26	0.24	0.24
1985:3-1992:10	31.50*	38.36*	33.99*	36.74*

* : SIGNIFICANT AT THE 5% LEVEL.

The conditional homoskedasticity restrictions are rejected in the period March 1985 - October 1992.

(7) L.P. Hansen, K.J. Singleton (1982) proposed a modified weighting matrix for the case of serially correlated disturbances pointing out, however, that it was no longer positive definite by construction. This shortcoming might bias asymptotic confidence interval formation and hypothesis testing. Heteroskedasticity and autocorrelation consistent

covariance matrix estimators have been set out by H. White (1984, pp. 147 - 161), A.R. Gallant (1987, p. 533), W.K. Newey, K.D. West (1987) and others. They introduce the use of various kernels to guarantee positive semi-definiteness in finite samples. We apply in this paper the Bartlett kernel (suggested by Newey and West) to smooth the sample autocovariance function.

(8) D.W.K. Andrews (1991) suggests the following guidelines for the selection of a bandwidth (lag truncation) parameter. First, one estimates p univariate first order autoregressive AR(1) models for the p elements of the Kronecker product of the residuals of the GMM model estimates with the vector of instruments (p is the number of orthogonality conditions). Then one computes

$$\hat{\alpha} = \sum_{a=1}^{p} \frac{4\hat{\rho}_a^2\hat{\sigma}_a^4}{(1-\hat{\rho}_a)^6(1+\hat{\rho}_a)^2} \Bigg/ \sum_{a=1}^{p} \frac{\hat{\sigma}_a^4}{(1-\hat{\rho}_a)^4}$$

where $\{(\hat{\rho}_a,\ \hat{\sigma}_a^2),\ a=1,...,p\}$ denote the autoregressive and innovation variance estimates for the a^{th} element.

The automatic bandwidth parameter in the case of the Newey-West approach is given by $\hat{M} = 1.1447(\hat{\alpha}T)^{1/3} - 1$, where T is the sample size. In this paper we have used integer-valued lag truncation parameters only and have replaced $\hat{M}$ by the corresponding closest integer.

(9) Analogous attempts to model real exchange rate changes behaviour can be found in J.A. Frankel, A.T. MacArthur (1988) and R. Levine (1989). A nonzero expected real exchange rate change is interpreted by W.H. Branson (1988) as representing a lack of goods market integration. L.E. Mohlo (1990) suggests that serial correlation in the real exchange

rate changes may be due to incomplete credibility on the nonaccommodating exchange rate policy (to the inflation differentials) of the monetary authorities.

(10) The estimates of equations (14) and (15) explain the behaviour of the change in the real exchange rate. We have thus replaced Δd_{t+1} by $d_{t+1} - d_t$ and have used d_t as a predetermined variable.

(11) Random Walk models used in the simulations:

$d_{t+1} = \tau + \psi d_t + e_{t+1}$

	1981:1-1985:2					1985:3-1992:10				
	τ	ψ	R^2	S.E.	D.h.	τ	ψ	R^2	S.E.	D.h.
£/$	0.02	0.94	0.95	0.0358	-0.46	0.06	0.91	0.89	0.0410	0.61
	(0.77)	(21.94)				(3.07)	(27.99)			
DM/$	-	1.01	0.93	0.0311	0.25	-0.05	0.92	0.93	0.0377	-0.72
		(220.66)				(-2.50)	(33.09)			
Y/$	-	1.001	0.01	0.0337	0.41	-0.42	0.92	0.92	0.0393	-0.13
		(1175.18)				(-3.21)	(36.56)			
Lit/$	-0.59	0.92	0.68	0.0271	0.31	-0.46	0.93	0.94	0.0381	-0.27
	(-1.84)	(20.18)				(-2.84)	(38.87)			

t RATIOS COMPUTED WITH HETEROSKEDASTICITY CONSISTENT STANDARD ERRORS.

(12) We could not assess the joint effect of ex ante real interest differentials and of ex ante real exchange rate changes on forward forecast errors because of a severe multicollinearity problem. For an economic interpretation of the correlation between these two regressors, see J.Y. Campbell, R.H. Clarida (1987).

(13) Conditional heteroskedasticity seems to affect the residuals of equation (16) in the period March 1985 - October 1992. We have applied the test set out in note (6) above to the residuals of equation (16), $u_{1501:}$ and have obtained the

following F statistics, where $u_{16t+1} = (s_{t+1} - f_t) - (r^*_{t+1} - r_{t+1})$.

	£/$	DM/$	Y/$	LIT/$
1981:1-1985:2	0.05	0.26	1.28	0.29
1985:3-1992:10	3.52*	1.03	9.60*	1.70

* : SIGNIFICANT AT THE 5% LEVEL.

(14) We have applied the conditional homoskedasticity tests also to the residuals of equation (17), u_{17t+1}. We obtain the following F statistics, where $u_{17t+1} = (s_{t+1} - f_t) - \Delta d_{t+1}$.

	£/$	DM/$	Y/$	LIT/$
1981:1-1985:2	2.25	0.03	0.19	0.30
1985:3-1992:10	31.70*	38.56*	0.36	1.62

* : SIGNIFICANT AT THE 5% LEVEL.

(15) We provide in this way a possible interpretation of a phenomenon - the systematic underprediction of the dollar strength from 1981 to 1985 - that has been intensively investigated. G.W. Evans (1986) labels it a "bubble" but provides no definite explanation of its causes. J.A. Frankel, K.A. Froot (1987) interpret the systematic forward forecast errors as evidence of market irrationality. K.K. Lewis (1989) attributes these errors to rational (bayesian) learning by market participants about the increase in the U.S. money demand of the early 1980s.

References

Adler M., Lehmann B. (1983), "Deviations from Purchasing Power Parity in the Long Run", **Journal of Finance**, 38, n. 5, (December), pp. 1471-1487.

Andrews D.W.K. (1991), "Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimation", **Econometrica**, 59, n. 3, (May), pp. 817-858.

Andrews D.W.K., Monahan J.C. (1992), "An Improved Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimator", **Econometrica**, 60, n. 4, (July), pp. 953-966.

Branson W.H. (1988), Comments to "Political vs. Currency Premia in International Real Interest Rate Differentials" by J.A. Frankel, A.T. MacArthur, **European Economic Review**, 32, n. 5, (June), pp. 1119-1121.

Campbell J.Y., Clarida R.H. (1987), "The Dollar and Real Interest Rates", in K. Brunner, A.H. Meltzer (eds.) "Empirical Studies of Velocity, Real Exchange Rates, Unemployment and Productivity", **Journal of Monetary Economics**, Supplement n. 27, pp. 103-139.

Cifarelli G. (1992), "Fundamentals, Regime Shifts and Dollar Behaviour in the 1980s. An Empirical Analysis", **Quaderni del Dipartimento di Economia Politica**, n. 142, Universita' di Siena.

Cumby R.E., Obstfeld M. (1984), "International Interest Rate and Price Level Linkages under Flexible Exchange Rates: A Review of Recent Evidence", in J.F.O. Bilson, R.C. Marston (eds.) "Exchange Rate Theory and Practice", University of Chicago Press, Chicago.

Evans G.W. (1986), "A Test for Speculative Bubbles in the Sterling-Dollar Exchange Rate: 1981-1984", **American Economic Review**, 76, n. 4, (September), pp. 621-636.

Frankel J.A., Froot K.A. (1987), "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations", **American Economic Review**, 77, n. 1, (March), pp. 133-153.

Frankel J.A., MacArthur A.T. (1988), "Political vs. Currency Premia in International Real Interest Differentials. A Study of

Forward Rates for 24 Countries", **European Economic Review**, 32, n. 5, (June), pp. 1083-1114.

Gallant A.R. (1987), "Nonlinear Statistical Models", Wiley, New York.

Giavazzi F., Pagano M. (1985), "Capital Controls and the European Monetary System", in F. Giavazzi (ed.) "Capital Controls and Foreign Exchange Legislation", **Euromobiliare Occasional Papers**, n. 1.

Hansen B.E. (1992), "Tests for Parameter Instability in Regressions with I(1) Processes", **Journal of Business and Economic Statistics**, 10, n. 3, (July), pp. 321-335.

Hansen L.P. (1982), "Large Sample Properties of Generalized Method of Moments Estimators", **Econometrica**, 50, n. 4, (July), pp. 1029-1054.

Hansen L.P., Singleton K.J. (1982), "Generalized Instrumental Variables Estimation of Nonlinear Rational Expectations Models", **Econometrica**, 50, n. 5, (September), pp. 1269-1286.

Hodrick R.J. (1979), "Some Evidence on the Equality of Expected Real Interest Rates Across Countries", Working Paper, Graduate School of Industrial Administration, Carnegie-Mellon University.

Huang R.D. (1987), "Expectations of Exchange Rates and Differential Inflation Rates: Further Evidence on Purchasing Power Parity in Efficient Markets", **Journal of Finance**, 42, n. 1, (March), pp. 69-79.

Korajczyk R.A. (1985), "The Pricing of Forward Contracts for Foreign Exchange", **Journal of Political Economy**, 93, n. 2, (April), pp. 346-368.

Levine R. (1989), "The Pricing of Forward Exchange Rates", Journal of International Money and Finance, 8, n. 1, (March).

pp. 163-179.

Lewis K.K. (1989), "Changing Beliefs and Systematic Rational Forecast Errors with Evidence from Foreign Exchange", **American Economic Review**, 79, n. 4, (September), pp. 621-636.

Longworth D. (1986), "Exchange Risk Premiums, Real Interest Rate Differentials, and Ex Ante Purchasing Power Parity", Bank of Canada, Ottawa.

McCallum B.T. (1976), "Rational Expectations and the Estimation of Econometric Models: An Alternative Procedure", **International Economic Review**, 17, n. 2, (June), pp. 484-490.

Merrick J.J., Saunders A. (1986), "International Expected Real Interest Rates. New Tests of the Parity Hypothesis and U.S. Fiscal Policy Effects", **Journal of Monetary Economics**, 18, n. 3, (November), pp. 313-322.

Mishkin F.S. (1984.a), "The Real Interest Rate: A Multi - Country Empirical Study", **Canadian Journal of Economics**, 17, n. 2, (May), pp. 283-311.

Mishkin F.S. (1984.b), "Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions", **Journal of Finance**, 39, n. 5, (December), pp. 1345-1357.

Mohlo L.E. (1990), "The Italian Lira in the Narrow Exchange Rate Mechanism Band: The Challenge of Credibility", **Giornale degli Economisti e Annali di Economia**, 49, n. 11-12, (November-December), pp. 501-525.

Newey W.K., West K.D. (1987), "A Simple Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", **Econometrica**, 55, n. 3, (May), pp. 703-708.

Pesaran M.H. (1987), "The Limits to Rational Expectations", Basil Blackwell, Oxford.

Rogalski R.J., Vinso J.D. (1977), "Price Level Variations as Predictors of Flexible Exchange Rates", Journal of International Business Studies, (Spring-Summer), pp. 71-81.

Roll R. (1979), "Violations of Purchasing Power Parity and Their Implications for Efficient International Commodity Markets", in M. Sarnat, G.P. Szego (eds.) "International Finance and Trade", Ballinger, Cambridge Mass.

White H. (1984), "Asymptotic Theory for Econometricians", Academic Press, New York.

Wickens M.R. (1982), "The Efficient Estimation of Econometric Models with Rational Expectations", Review of Economic Studies, 49, n. 1, (January), pp. 55-67.

Elenco dei Quaderni pubblicati

n.1 (febbraio 1979) **MASSIMO DI MATTEO,** Alcune considerazioni sui concetti di lavoro produttivo e improduttivo in Marx
n.2 (marzo 1979) **MARIA L.RUIZ,** Mercati oligopolistici e scambi internazionali di manufatti. Alcune ipotesi e un'applicazione all'Italia
n.3 (maggio 1979) **DOMENICO MARIO NUTI,** Le contraddizioni delle economie socialiste: una interpretazione marxista
n.4 (giugno 1979) **ALESSANDRO VERCELLI,** Equilibrio e dinamica del sistema economico-semantica dei linguaggi formalizzati e modello keynesiano
n.5 (settembre 1979) **A. RONCAGLIA - M. TONVERONACHI,** Monetaristi e neokeynesiani: due scuole o una?
n.6 (dicembre 1979) **NERI SALVADORI,** Mutamento dei metodi di produzione e produzione congiunta
n.7 (gennaio 1980) **GIUSEPPE DELLA TORRE,** La struttura del sistema finanziario italiano: considerazioni in margine ad un'indagine sull'evoluzione quantitativa nel dopoguerra (1948-1978).
n.8 (gennaio 1980) **AGOSTINO D'ERCOLE,** Ruolo della moneta ed impostazione antiquantitativa in Marx: una nota
n.9 (novembre 1980) **GIULIO CIFARELLI,** The natural rate of unemployment with rational expectations hypothesis. Some problems of estimation
n.10 (dicembre 1980) **SILVANO VICARELLI,** Note su ammortamenti, rimpiazzi e tasso di crescita
n.10 bis (aprile 1981) **LIONELLO F. PUNZO,** Does the standard system exist?
n.11 (marzo 1982) **SANDRO GRONCHI,** A meaningful sufficient condition for the uniqueness of the internal rate of return
n.12 (giugno 1982) **FABIO PETRI,** Some implications of money creation in a growing economy
n.13 (settembre 1982) **RUGGERO PALADINI,** Da Cournot all'oligopolio: aspetti dei processi concorrenziali
n.14 (ottobre 1982) **SANDRO GRONCHI,** A Generalized internal rate of return depending on the cost of capital
n.15 (novembre 1982) **FABIO PETRI,** The Patinkin controversy revisited
n.16 (dicembre 1982) **MARINELLA TERRASI BALESTRIERI,** La dinamica della localizzazione industriale: aspetti teorici e analisi empirica
n.17 (gennaio 1983) **FABIO PETRI,** The connection between Say's law and the theory of the rate of interest in Ricardo
n.18 (gennaio 1983) **GIULIO CIFARELLI,** Inflation and output in Italy: a rational expectations interpretation
n.19 (gennaio 1983) **MASSIMO DI MATTEO,** Monetary conditions in a classical growth cycle
n.20 (marzo 1983) **M. DI MATTEO - M.L. RUIZ,** Effetti dell'interdipendenza tra paesi produttori di petrolio e paesi industrializzati: un'analisi macrodinamica
n.21 (marzo 1983) **ANTONIO CRISTOFARO,** La base imponibile dell'IRPEF: un'analisi empirica
n.22 (gennaio 1984) **FLAVIO CASPRINI,** L'efficienza del mercato dei cambi. Analisi teorica e verifica empirica
n.23 (febbraio 1984) **PIETRO PUCCINELLI,** Imprese e mercato nelle economie socialiste: due approcci alternativi
n.24 (febbraio 1984) **BRUNO MICONI,** Potere prezzi e distribuzione in economie mercantili caratterizzate da diverse relazioni sociali
n.25 (aprile 1984) **SANDRO GRONCHI,** On investment criteria based on the internal rate of return
n.26 (maggio 1984) **SANDRO GRONCHI,** On Karmel's criterion for optimal truncation
n.27 (giugno 1984) **SANDRO GRONCHI,** On truncation "theorems"
n.28 (ottobre 1984) **LIONELLO F. PUNZO,** La matematica di Sraffa
n.29 (dicembre 1984) **ANTONELLA STIRATI,** Women's work in economic development process
n.30 (gennaio 1985) **GIULIO CIFARELLI,** The natural rate of unemployment and rational expectation hypotheses: some empirical tests
n.31 (gennaio 1985) **SIMONETTA BOTARELLI,** Alcuni aspetti della concentrazione dei redditi nel Comune di Siena
n.32 (febbraio 1985) **FOSCO GIOVANNONI,** Alcune considerazioni metodologiche sulla riforma di un sistema tributario
n.33 (febbraio 1985) **SIMONETTA BOTARELLI,** Ineguaglianza dei redditi personali a livello comunale
n.34 (marzo 1985) **IAN STEEDMAN,** Produced inputs and tax incidence theory
n.35 (aprile 1985) **RICHARD GOODWIN,** Prelude to a reconstruction of economic theory. A critique of Sraffa
n.36 (aprile 1985) **MICHIO MORISHIMA,** Classical, neoclassical and Keynesian in the Leontief world
n.37 (aprile 1985) **SECONDO TARDITI,** Analisi delle politiche settoriali: prezzi e redditi nel settore agroalimentare
n.38 (maggio 1985) **PIETRO BOD,** Sui punti fissi di applicazioni isotoniche
n.39 (giugno 1985) **STEFANO VANNUCCI,** Schemi di gioco simmetrici e stabili e teoremi di possibilità per scelte collettive
n.40 (luglio 1985) **RICHARD GOODWIN,** The use of gradient dynamics in linear general disequilibrium theory
n.41 (agosto 1985) **M. MORISHIMA** and **T. SAWA,** Expectations and the life span of the regime.
n.42 (settembre 1985) **ALESSANDRO VERCELLI,** Keynes, Schumpeter, Marx and the structural instability of capitalism
n.43 (ottobre 1985) **ALESSANDRO VERCELLI,** Money and production in Schumpeter and Keynes: two dichotomies
n.44 (novembre 1985) **MARCO LONZI,** Aspetti matematici nella ricerca di condizioni di unicità per il Tasso Interno di Rendimento
n.45 (dicembre 1985) **NIKOLAUS K.A. LAUFER,** Theoretical foundations of a new money supply hypothesis for the FRG.
n.46 (gennaio 1986) **ENRICO ZAGHINI,** Una dimostrazione alternativa dell'esistenza di equilibri in un modello di accumulazione pura
n.47 (febbraio 1986) **ALESSANDRO VERCELLI,** Structural stability and the epistemology of change: a critical appraisal
n.48 (marzo 1986) **JOHN HICKS,** Rational behaviour: observation or assumption?
n.49 (aprile 1986) **DOMENICO MARIO NUTI,** Merger conditions and the measurement of disequilibrium in labour-managed economies
n.50 (maggio 1986) **SUSAN SENIOR NELLO,** Un'applicazione della Public Choise Theory alla questione della riforma della Politica Agricola Comune della CEE
n.51 (maggio 1986) **SERENA SORDI,** Some notes on the second version of Kalecki's Business Cycle Theory
n.52 (giugno 1986) **PIERANGELO GAREGNANI,** The classical theory of wage and the role of demand schedules in the determination of relative prices
n.53 (luglio 1986) **FRANCO BIRARDI,** Crescita, sviluppo ed evoluzione: l'affermazione dei nessi strutturali sistematici e la combinazione di scienza, tecnologia ed economica nelle prime industrializzazioni
n.54 (agosto 1986) **M. AMENDOLA - J.L. GAFFARD,** Innovation as creation of technology: a sequential model
n.55 (settembre 1986) **GIULIO CIFARELLI,** Exchange rates, market efficiency and "news". Model specification and econometric identification
n.56 (settembre 1986) **ALESSANDRO VERCELLI,** Technological flexibility, financial fragility and the recent revival of Schumpeterian entrepreneurship
n.57 (ottobre 1986) **FABIO PETRI,** The meaning of the Cambridge controversies on capital theory: an attempt at communication
n.58 (ottobre 1986) **DANIELE CHECCHI,** The international coordination of counter-cyclical policies
n.59 (novembre 1986) **ALESSANDRO VERCELLI,** Probabilistic causality and economic models: Suppes, Keynes, Granger
n.60 (dicembre 1986) **LIONELLO F. PUNZO,** J. Von Neumann and K. Menger's mathematical colloquium
n.61 (dicembre 1986) **MICHAEL BACHARACH,** Three scenarios for fulfilled expectations
n.62 (gennaio 1987) **J. ESTEBAN** and **T. MILLAN,** Competitive equilibria and the core of overlapping generations economies
n.63 (gennaio 1987) **ROBERT W. CLOWER,** New directions for keynesian economics
n.64 (febbraio 1987) **MARCO P. TUCCI,** A simple introduction to flexible functional forms and consumer behaviour theory
n.65 (marzo 1987) **NICOLA DIMITRI,** Generalizations of some continuos time epidemic models

n.66 (aprile 1987) **MASSIMO DI MATTEO,** Goodwin and the Evolution of a Capitalistic Economy: An Afterthought
n.67 (maggio 1987) **MASSIMO DI MATTEO,** Early Discussions on Long Waves
n.68 (giugno 1987) **MASSIMO DI MATTEO,** Warranted, Natural, and Actual Rates of Growth: Reflections of a Perplex
n.69 (settembre 1987) **LUISA MONTUSCHI,** Inward-Looking development and import substitution in the Argentine Economy 1950-1980
n.70 (dicembre 1987) **GIANCARLO GANDOLFO** and **PIETRO CARLO PADOAN,** The Mark V version of the Italian continuos time model
n.71 (dicembre 1987) **SILVANO VICARELLI,** Impatience to consume, the utility of wealth and the rate of interest
n.72 (gennaio 1988) **OMAR CHISARI,** Worker's assets, foreign debt and the dynamics of an economy
n.73 (febbraio 1988) **STEFANO VANNUCCI,** On exactly strong-Nash-implementable power allocations
n.74 (marzo 1988) **PIER LUIGI LANDI,** Aspetti economici della società anonima della strada ferrata Empoli-Siena o Centrale Toscana fino al 1859
n.75 (aprile 1988) **FRANCO BIRARDI,** Generating the space of physical characteristics by means of elements which are discrete and limited over time (A note on innovation in chemical technologies)
n.76 (maggio 1988) **LILIA COSTABILE,** Politica monetaria, debito pubblico e tasso di interesse
n.77 (giugno 1988) **GIUSEPPE DELLA TORRE,** L'evoluzione dei sistemi finanziari nell'approccio contabile di Raymond Goldsmith.
Alcune considerazioni analitiche
n.78 (luglio 1988) **FRANCESCO FARINA,** Fattori tecnologici e transazionali nella divisione interindustriale del lavoro
n.79 (ottobre 1988) **FRANCESCO FARINA,** Gli obiettivi della Banca d'Italia e i tassi d'interesse sul debito pubblico
n.80 (novembre 1988) **GIULIO CIFARELLI,** La razionalità del tasso di cambio a termine e le "notizie": una analisi empirica
n.81 (dicembre 1988) **MAURO CAMINATI,** Cyclical growth in a long-period perspective
n.82 (gennaio 1989) **LUIGI LUINI,** Crescita esterna dell'impresa e teorie economiche
n.83 (marzo 1989) **LUIGI M. TOMASINI,** A Scheme to Allocate Wastewater Rights
n.84 (aprile 1989) **STEFANO VANNUCCI,** On Consistency Properties of some Strongly Implementable Social Choice Rules with Endogenous Agenda Formation
n.85 (maggio 1989) **AGOSTINO D'ERCOLE,** Economia e Moneta in Schumpeter
n.86 (maggio 1989) **CHARLES GOODHART,** What do Central Banks Do?
n.87 (giugno 1989) **PAOLO DEL GIOVANE,** Foreign Firms' Behavior in the United States Market during the Dollar Cycle
n.88 (giugno 1989) **GÉRARD DUMÉNIL** and **DOMINIQUE LÉVY,** The classical legacy and beyond
n.89 (luglio 1989) **RICCARDO FIORITO,** Inventory accounting and profit evaluation
n.90 (settembre 1989) **NICOLA DIMITRI,** On the robustness of the rational expectations hypothesis
n.91 (settembre 1989) **PIERMARIO PACINI,** Expectations, learning and equilibrium in a non-walrasian model: a constructive approach
n.92 (ottobre 1989) **AGOSTINO D'ERCOLE,** Sulla teoria monetaria del tasso di interesse di Schumpeter
n.93 (ottobre 1989) **UGO PAGANO,** Firms, co-ordination and disequilibrium
n.94 (novembre 1989) **UGO PAGANO,** Determinazione endogena dei diritti di proprietà in una economia di mercato
n.95 (dicembre 1989) **UGO PAGANO,** Property rights, asset specificity, and the division of labour under alternative capitalist relations
n.96 (dicembre 1989) **MICHIO MORISHIMA,** Wage differentials in Japan: 1958-1985
n.97 (gennaio 1990) **PIERPAOLO PIERANI - PIER LUIGI RIZZI,** An econometric analysis of the olive oil market in Italy
n.98 (febbraio 1990) **ENRICO GIOVANNINI,** Squilibri settoriali e dinamica macroeconomica di breve periodo: il caso dell'industria italiana
n.99 (maggio 1990) **GIULIO CIFARELLI** Sui determinanti degli errori di previsione a termine nel mercato dei cambi
n.100 (maggio 1990) **EDITED BY MASSIMO DI MATTEO** Celebrating R.M. Goodwin's 75 birthday
n.101 (maggio 1990) **OMAR O. CHISARI - JOSE' M. FANELLI** Three-gap models, optimal growth and the economic dynamics of highly indebted countries
n.102 (giugno 1990) **FRANCESCO FARINA** Italy's monetary policy inside the european monetary system
n.103 (giugno 1990) **STEFANO VANNUCCI** On the closure operators of an effectivity function
n.104 (giugno 1990) **STEFANO VANNUCCI** Struttura del mercato, giochi semplici e potenziali monopolistici
n.105 (luglio 1990) **STEFANO VANNUCCI** A note on ergodic and vnm-stable sets of abstract games
n.106 (luglio 1990) **SIMONETTA BOTARELLI** I nuovi estimi catastali: motivazioni ed effetti distributivi
n.107 (luglio 1990) **PIETRO PUCCINELLI** Impresa e mercato un approccio dinamico
n.108 (agosto 1990) **UGO PAGANO** Braverman, Harry (1920-1976)
n.109 (agosto 1990) **UGO PAGANO** Property rights equilibria and institutional stability
n.110 (settembre 1990) **STEPHAN R. EPSTEIN** Cities, regions and the late medieval crisis: Sicily and Tuscany compared
n.111 (ottobre 1990) **MAURO CAMINATI** On the stability of long-period positions: an introductory note
n.112 (ottobre 1990) **MAURO CAMINATI** Cicli endogeni in disequilibrio e congetture
n.113 (ottobre 1990) **AGOSTINO D'ERCOLE** Il concetto di integrazione finanziaria internazione, Problemi e prospettive
n.114 (ottobre 1990) **LIONELLO F. PUNZO** Hilbert's mathematical formalism and the neoclassical revolution
n.115 (ottobre 1990) **BRUNO MICONI - PIER MARIO PACINI** Price systems, bargaining theory and social relations
n.116 (ottobre 1990) **LIONELLO F. PUNZO** J.-M. Grandmont on "temporary equilibrium: money, expectations and dynamics". Some Comments.
n.117 (novembre 1990) **GIULIO CIFARELLI** Cointegration and the unbiased efficiency of the forward exchange rate
n.118 (novembre 1990) **SIMONETTA BOTARELLI** L'imposizione delle imprese minori: problemi di determinazione della base imponibile nei sistemi forfettari. Una nota
n.119 (dicembre 1990) **GIUSEPPE DELLA TORRE** Teoria economica e contabilità sociale. Il «national bureau of economic research» (1920-1945)
n.120 (dicembre 1990) **ELISABETTA CROCI ANGELINI - SECONDO TARDITI** Ec Enlargement and trade liberalization in the vegetable oils market
n.121 (dicembre 1990) **ELISABETTA CROCI ANGELINI** Costs and benefits of the common agricultural policy to the member countries
n.122 (dicembre 1990) **GIANCARLO MARINI - PASQUALE SCARAMOZZINO** Inflation expectations, price flexibility, and output variability in macro models
n.123 (dicembre 1990) **RAUL de LUZENBERGER - GIANCARLO MARINI** The sustainability of public debt: tests and indicators
n.124 (dicembre 1990) **MARCO P. TUCCI** Time-varying parameters: a critical introduction
n.125 (dicembre 1990) **GIOVANNI FERRI** Preferences and technology in the real business cycle
n.126 (dicembre 1990) **SILVANO VICARELLI** Preferenza per la liquidità e valore dell'informazione
n.127 (gennaio 1990) **FABIO CESARE BAGLIANO - GIANCARLO MARINI** On the role of monetary factors in business cycle models
n.128 (febbraio 1991) **LUIGI TOMASINI** Due modelli di controllo dell'evasione fiscale
n.129 (giugno 1991) **MASANAO AOKI - RICCARDO FIORITO** Analysis of us real GNP and unemployment interactions: state space approach
n.130 (luglio 1991) **PIERPAOLO PIERANI - PIER LUIGI RIZZI** Produttività totale dei fattori e progresso tecnico nell'agricoltura italiana: un confronto Nord-Sud
n.131 (settembre 1991) **AGOSTINO D'ERCOLE** L'integrazione finanziaria internazionale e la relazione risparmi-investimenti
n.132 (settembre 1991) **GIULIO CIFARELLI** Le fluttuazioni del dollaro negli anni ottanta. Una analisi econometrica
n.133 (novembre 1991) **STEFANO VANNUCCI** On Stable standards of behaviour
n.134 (novembre 1991) **LUIGI M. TOMASINI** Politica dei redditi e compartecipazione
n.135 (dicembre 1991) **NICOLA DIMITRI** Asymptotic consensus with partitions
n.136 (gennaio 1992) **MAURIZIO BAUSSOLA - RICCARDO FIORITO** Regional Unemployment in Italy: sources and cures

n.137 (febbraio 1992) **STEFANO VANNUCCI** Implementation Theory and Ethics
n.138 (febbraio 1992) **MASSIMO DI MATTEO** Forms of trade control in an equilibrium north-south model : a comparative evaluation
n.139 (febbraio 1992) **MASSIMO DI MATTEO** E' veramente da criticare una politica export-led? Alcuni risultati usando un modello di equilibrio nord-sud
n.140 (maggio 1992) **BERNHARD BÖHM** An Introduction into environmental econimics (lecture notes)
n.141 (settembre 1992) **RICCARDO FIORITO - FLAVIO PADRINI** Unemployment components in the G7 countries
n.142 (ottobre 1992) **GIULIO CIFARELLI** Fundamentals, regime shifts and dollar behaviour in the 19805. An empirical analysis
n.143 (ottobre 1992) **FRANK HAHN** A Remark on incomplete market equilibrium
n.144 (ottobre 1992) **NICOLA DIMITRI** Generalized information structures: some theoretical and methodological issues
n.145 (ottobre 1992) **FRANCESCO FARINA** Distributive justice as a coordination problem
n.146 (ottobre 1992) **MAURIZIO FRANZINI** The role of the market in a complex institutional order
n.147 (novembre 1992) **FRANCESCO PULITINI** Le vestali del mercato. Qualche appunto sull'antitrust italiano
n.148 (novembre 1992) **VALERIA DE BONIS** On stabilisation Policy in a single currency area. An IS-LM-AS Model
n.149 (dicembre 1992) **FRANK HAHN** An Economist's view of higher education
n.150 (gennaio 1993) **GIANROCCO TUCCI** Integrazione tra efficienza ed equità-come-assenza-di invidia in un'analisi costi-benefici non tradizionale
n.151 (gennaio 1993) **BERNHARD BÖHM** An introduction into environmental economics - Reprint-
n.152 (febbraio 1993) **NICOLA DIMITRI** Learning partitions
n.153 (marzo 1993) **SERENA SORDI** Nonlinear models of the business cycle and chaos theory: a critical analysis
n.154 (maggio 1993) **UGO MARANI-RICCARDO AZZOLINI** Svalutazione e politica economica . Osservazioni sulla crisi valutaria del 1992
n.155 (giugno 1993) **CARLO ZAPPIA** The notion of private information in a modern perspective: a re-appraisal of hayek's contribution
n.156 (settembre 1993) **FABIO PETRI** The impermanence problem in general equilibrium analyses

Alla presente Collana "gialla" di quaderni il Dipartimento di Economia Politica affianca una Collana "celeste" di monografie. I numeri pubblicati a tutt'oggi sono i seguenti:

1) **GIUSEPPE DELLA TORRE,** Istituzioni creditizie ed Accumulazione del Capitale in Italia (1948-81), 1984.

2) **SANDRO GRONCHI,** Tasso Interno di Rendimento e Valutazione dei Progetti: una Analisi Teorica, 1984.

3) **ALDINO MONTI,** La Proprietà Immobiliare a Bologna in Età Napoleonica (1797-1810), 1984.

4) **GIULIO CIFARELLI,** Equilibrium and Disequilibrium Interpretations of Inflation, 1985.

5) **STEPHAN E. EPSTEIN,** Sicily and its markets: 1300-1500 economic growth and social transformation

6) **ROBERT SOLOW,** Siena Lectures on Endogenous Growth Theory, edited by Serena Sordi

7) Guida alle attività del Dipartimento di Economia Politica

Stampato nel 1993 dalla
COPISTERIA EMMECI, Via Pantaneto 132 - Siena -