金融風險管理季刊
民96，第三卷，第四期，105-120

DERIVATIVES, MONEY AND REAL GROWTH

Submitted Date:96.02.01
Accepted Date:96.06.04

Paolo Savona
Ban ca di Roma and Luiss Guido Carli

Abstract

This paper analyzes the derivatives market from the point of view of the effects it exerts on the definition of money and the efficacy of monetary policy. An hypothesis is also put forward on the role played in the capital accumulation. Empirical evidence is provided which does not reject the hypothesis that derivatives function as the speculative demand for money, contributing to determine interest rates and, in this way, influencing real and financial investment decisions according to the paradigm proposed by Tobin.

Key Words: derivatives market, monetary policy, capital accumulation.
JEL Classification: G11

* The author appreciates three anonymous referees' suggestions.
**Contact Information : Paolo. Savona@bancaroma.it

1.*Premiss*

In his recent address at Jackson Hole, Alan Greenspan (2003) stated that derivatives have blurred the definition of money and made it hard to conduct monetary policy. His exact words were: In the past two decades, what constitutes money has been obscured by the introduction of technologies that have facilitated the proliferation of financial products and have altered the empirical relationship between economic activity and what we define as money, and in doing so has inhibited the keying ofmonetary policy to the control of the measured money stock.

Prior to that, in the Annual Report for 2002 to the shareholders of Berkshire Hathaway Inc (2003) Warren Buffet described derivatives as "a time bomb", reiterating a previous similar statement by George Soros. In his words (page 13): Charlie (CEO of the company) and I are of one mind in how we feel about derivatives and the trading activities that go with them: we view them as a time bombs, both/or parties that deal in them and the economic system.

More recently, the former chairman of ABI (the Italian Banking Association), Tancredi Bianchi (2003), has written: "It comes the season of wise, prudent but not renunciative management of an important resource as savings. Meanwhile it will continue the hangover of derivatives, which are the results of the attempt to hedge risks linked to open markets but still not integrated. This financial products should not be used to speculate to obtain profits from expected different values. Also doctors prescribe products to fight the pain, but not to transform the patient into a dependent."

On the other hand, the larg part of economists, monetary authorities and operators have almost always declared the undoubtedly utility of derivatives, arguing (Office of the Controller of the Currency 1994; Angeloni and Massa 1994; Cohen 1999, Hunter and Marshall 1999; Hunter and Smith 2002) that they have:

(a) a stabilization effect on the volatility of the pnces of monetary and financial assets, making forecasts more precise;

(b) good price discovery properties, reducing the uncertainty of market operators and thus improving the rational base of their decisions;

(c) the ability to lower and potentially eliminate asymmetric information, making the market more efficient;

(d) the characteristic of lowering the bid-ask spread and reducing the exchange noise component, inducing even greater market efficiency.

The objection that - especially regarding property d) - speculation in derivatives may easily outrun the undoubted utility of the

instrument, is met with the counter that while this may sometimes occur, it ultimately has stabilizing effects in the long run since it lowers the rigidity of the markets to adapt to imbalances and, in any case, improves their functioning through the properties a), b) and c) above. This debate therefore harks back to the endless, unresolved dispute among economists over the role played by free speculation.

The only serious note of discord in the properties for the derivatives market was sounded in the past by two studies commissioned by the Associazione Guido Carli, Rome: these, in two researches performed by Fratianni et al. (1998) and Savona (2000), both conducted in honour of Guido Carli[1], concluded that (Savona and Maccario, 1998; Savona et al., 2000):

a.l)the behaviour of at least a part of derivatives resembled that of the demand for money for speculative motives (the so-called "liquidity preference") identified by Keynes;

b.l)the monetary targets selected by the central banks had to take into account the existence of the derivatives;

c.l)knowledge of economics and monetary policy needed to be reinterpreted at the logical level but, at the practical level, the statistical data on derivatives were inadequate to the task';

d.l) there were well-founded doubts as to whether derivatives enjoyed stabilizing and predictive powers as innate characteristics, since they had the ability to influence rather than predict the behaviour of the variables taken as reference of the contracts, taking advantage of the low cost and the opportuneness of implementing them without rewuiring financial resources beforehand'.[23]

The Chairman of the Fed has now reached the same conclusions as in point b.l), on the basis of his vast empirical knowledge of the

---

[1] Guido Carli, Governor of the Bank of Italy (1960-1975), played a leading role in the attempts to redesign the international monetary system during the 1960s and foresaw the collapse of the Breton" Woods system. In March 1971 he foretold the fall of the dollar, only a few months before the Nixon administration declared its unconvertibility on the 15th of August of that year. His speech was printed in the BNL Quarterly Review, March 1971, under the title "Eurodollars: a paper pyramid?" whose underline analysis was developed by Michele Fratianni and Paolo Savona in their "La Liquidita Internazionale - proposta per la ridefinizione del problema", II Mulino, Bologna 1972

[2] One problem that only marginally concerns the conclusions of this work, but is an integral part of the problem raised, is that only a modest amount of the derivatives market is traded on the stock exchanges and is subject to their regulations, whereas the greatest part of the dealings take place outside the official markets (OTC-Over the Counter) in compliance with voluntary codes of conduct. Statistics collected every three years by the Bank for International Settlement of Basle ate available, which represents more data than are collected by other sources, whose methodology and significance are hard to ascertain.

[3] In the judgement of George Soros, as mentioned at the start of this paper, speculation, including that in derivatives, determines the macrovariables rather than being determined by them. This implies that the price discovery power of derivatives is a price inducement.

money market, but without the logical basis of point a.l) and without drawing the conclusions as per point c.l), which can be seen as an inevitable corollary of his conclusions on the problems involved in the management of monetary policy by the diffusion of derivate contracts.

The study by the Associazione Guido Carli[4] found a pendent in the ambit of the Permanent Advisory Committee on Euros & Dollars (PACE&D) by the late George Sutija, a fine economist of Slavic origin, naturalized American and teacher at Florida International University, whose contribution to the reflections on the defects in the working of the international monetary system we would wish to recall here", The conclusions of this research found a place at the G8 Forum organized by John Kirton of the University of Toronto, the proceedings of which were published in the Ashgate Global Finance Series edited by Fratianni et al. (2002). Starting out from J.R. Hicks's observation that theory is developed and perfected in close relation with the trends of the market and the evolution of the monetary and financial institutions, Savona (2002) raised the question as to why the monetary authorities have failed to address the reality of derivatives in order to be in step with the pace of events, and pinpointed one of the reasons for the delay in the lack of theoretical elaboration of the problem on the part of economists. The conclusions reached by Savona in that work are quite similar as those in the present paper.

Studies hitherto performed had put forward some working hypotheses on the fact that derivatives, through their influence on interest rates, might also play an important role in the mechanism of transmission of the monetary and financial effects to the real economy - suggesting that these arguments be integrated within the more general paradigm of capital accumulation advanced by Tobin and Brainard (1976) in their celebrated "q", i.e. the coefficient linking the activity of real investment with the behaviour of the stock markets. This hypothesis will be subjected to verification, together with the conclusions hitherto attained by a working group comprising Curt Hunter, Iftekar Hasan, Aurelio Maccario, Chiara Oldani, Paolo Savona and Cristiano Zazzara, whose aims are set forth in

[4] In October 2001 at Venice, the Associazione Guido Carli and the PACE&D held an international conference on the working of the derivatives market, the proceedings of which were unfortunately never published, owing to the onset of the illness that led to Prof. Sutija's untimely death. George Sutija had however collaborated with the author of this paper in the publication of two collections of articles, Eurodollars and International Banking (MacMillan, London 1985) and Strategic Planning in International Banking (MacMillan, London 1986). He was also responsible for organizing the Conference whose proceedings, edited by Enzo Grilli and Paolo Savona, were published with the title World Trade: Monetary Order and Latin America, MacMillan, London 1990.

the next two paragraphes[5].

2. Derivatives and liquidity preference : a first empirical evidence

As said previously, there exist first econometric results that justify Greenspan's assertion of the upsetting effects exerted by derivatives on the definition of money and the management of monetary policy. Following Savona and Maccario (1998), Savona, Maccario and Oldani (2000) and Oldani (2002) we can show up some results about the relationship between the interest rate and the derivatives price on the relevant market. Looking at the euro area, from the 1st of January 1999 the LIBOR rate has been replaced by the Euribor rate and it represents the interest rate of the European monetary policy. The relevant derivative contract (in the stock exchange) is the future on the Euribor rate and is traded on the Eurex eletronic floor. The period of observation chosen is from January 1999 to September 2003 at monthly level; database is Datastream and data refers to the Euribor interest rate and to the future price on Euribor with 1month maturity (rolled-over continuous price). Complete econometric results can be found in the appendix.

The first step is to check for causality relationship and after that we can deal with estimates. The Granger causality test is the starting point, and it shows that the Euribor rate Granger-cause the future on Euribor, but vice versa is not accepted. This evidence of imperfect two ways relationship can be explained with non-perfect financial market hypothesis in terms of expectations, which influence the future price. Feuribor (Future on Euribor) goes from 95 to 98, while Euribor from2 to 5. Euribor is then the dependent variable and Feuribor the independent. To avoid any scale problem and have meaningful estimates we use logs, so that we obtain elasticity as a result.

Then we checked for stationarity of variables and the ADF test shows that both variables are I(1) processes; if they are cointegrated, a stable relationship can be found. We apply the Engle-Granger two step method to look for cointegration and the first step (OLS estimates) gives:

$$\text{Log(Euribor)} = \underset{(25.39)}{119.99} - \underset{(-25.13)}{25.99}\ \text{Log(Feuribor)}$$

[5] Cfr. "La finanza dei derivati", Enciclopedia del Novecento of the Istituto dell'Enciclopedia Italiana Treccani. forthcoming . An English translation of this entry can be obtained upon request from p<}(:ll(),0!i.Y {)Il;i.(WP0~:'lJL,.H

Residuals of the OLS estimates are 1(0), according to the ADF test and then a stable cointegration relationship can be found to represent the dynamic.

The Johansen test says that the VEC function has the intercept but no trend and 4 lags of endogenous variables (based on Lagrange Multiplier test). The dynamic relationship found can be represented as:

Log(Euribor) + 29.40890 Log(Feuribor)
(17.8716)
- 135.5907 = 0
(-18.0389)

or

Log(Euribor)
= + 135.5907 - 29.40890Log(Feuribor)
(18.389) (-17.8716)

Determinant Residual Covariance	4.40E-09
Log Likelihood	362.6210
Log Likelihood (d.f. adjusted)	352.7387
Akaike Information Criteria	-12.75918
Schwarz Criteria	-11.97118

The goodness of fit ofthe equation can be seen on the LogLikelihood, which is distributed like a Chi Square with 2 degrees of freedom (critical value is below 10).

The long-run relationship shows that the Future on Euribor reacts like the monetary base in a Fratianni-Savona (1972) definition framework, in the sense that this relationship is inverse with respect to the reaction of interest rate to money supply.

Similar results, with the main aim of testing the validity of the price discovery property of derivatives, have been reached by Fung and Leung (1993), Hull (1994) and Craig et al. (1995) for other financial activities and other section of derivatives markets, though without drawing the consequences that concern us for monetary policy.

There is, however, no equal evidence of derivatives being "time bombs", if by this concept is meant that financial systems run the risk of an explosive crisis, like the 1924 Great German inflation and the 1929-33 USA-World Great Depression. At the level of individual operating unit, be it bank or firm, failure to control the operativity of those dealing with derivatives or using them to achieve targets of profitability instead of hedging or portfolio diversification may seriously undermine corporate accounts, as has happened in the past. Buffet's assertion probably refers to this deep-seated aspect of the derivatives market, either (a) for their accounting are confined under the line of balance sheet total among "commitments and risks" rather than to be accounted among the assets of banks (and this is a very serious matter) or firms (which is less

so, even if it always eludes conscious assessment of managers by shareholders) and (b) for the delay of authorities in preparing themselves theoretically and operationally to face the problem created by the huge and uncontrolled amounts of these financial innovations.

3. *Derivatives and the capital accumulation mechanism: an hypothesis*

Research on derivatives has mainly focused on technical assessment of their performance and convenience. Not by chance have some authors of these studies received Nobel prizes (Black and Scholes 1973 and Merton, 1973). These studies were undoubtedly crucial for the diffusion of the instruments, but were all the more upsetting for monetary policy and for balanced portfolios or, if you like, for the functioning of the real and financial markets to the same extent as these studies, confined to the technical-practical aspect, were successful.

In going further, addressing the problem of the effects of derivatives on the economy as a whole, the studies concentrated on the monetary and financial aspects since the object of the contracts was mainly the interest and exchange rates, credit and equity market prices. Actually, specific references to derivatives on commodities were not lacking, but were always confined to the related market and did not regard the functioning of the economy in general. Now that derivatives concern a huge mass of operations and have reached the point of being used to "betting".on economic predictions (as announced by Goldman Sachs and Deutsche Bank), research on them cannot stop short at technical or financial level but must also investigate how they impact on the real economy[6].

Some research has been done on the real effects of derivatives and some of their transmission channels have been identified. A study performed by Vrolijk (1997) at the International Monetary Fund and one by Barone (2002) at the Bank of Italy appear very promising, but they are often ignored since the transmission mechanisms of the impulses continue to be a matter for debate among economists who view this subject as a black box where, unlike that of areoplanes, it is difficult to interpret what has occurred and what is going on.

For the moment, then, one must proceed at the level of pure logic, for an empirical test

[6] See Economic Derivatives - Options on Economic Statistics, Goldman, Sachs & Co. and Deutsche Bank AG, Internet Document 2002.

requires an underpinning hypothesis, whereas an hypothesis does not require an underpinning empirical test. To entrust econometrics with the task of settling the disputes between economists over the various topics that arise in the course of their profession is merely a convention - undoubtedly useful but incapable of irrefutably smoothing away the objections on either side for reasons that modem logic has time and again made clear. Economists would do well to reflect on the wisdom contained in the latest message on the use of mathematics in economics from the reviewer of the 2003 Royal Economic Society Conference[7].

With that premiss, the line of research suggested here - resting for the moment on a purely logical argument, but starting from a limited empirical basis, the search for existing relations between derivatives and interest rates - is developed as follows. If derivatives contribute to determining interest rates, as well as including them - totally or partially - in the monetary targets, they need to be considered in the determination of the portfolio equilibria between monetary and financial assets in their reciprocal effects and as against real assets.

In short, in order to study their macroeconomic effects, derivatives must be examined above all regarding the effects on substitution rates among portfolio assets. Instead of buying a share today I purchase an option that allows me to make a more cautious appraisal of the general economic situation and of the firm I intend to buy, thus relieving me of the commitment if the evaluation tends towards the negative and giving me the right to purchase if the contrary.

Assuming that this argument is logically sound, the next step must be to examine the logical chain running from derivatives to interest rates and from the latter to Tobin's "q" which explains, or more prudently aims to explain, how the modem capital accumulation mechanism works: it supposes that I purchase a firm on the market or invest directly in a production plant according to the existing relation between return on real capital and return on financial capital. In this process the derivatives are by now constantly present and their role must be assessed not only by their influence on the rate of interest, but also by that on the rate of substitution between financial assets and real assets.

This central mechanism of the market economy is the cue for a series of problems still unsolved, having to do with economic policy, but also with the correct working of the markets. As Nobel laureate Franco Modigliani

[7] See Richard Reeves, "Conference Report", RES Newsletter, n. 122, July 2003,pp. 5-8.

has taught us with his "putty-clay model", in the modem economy everyone wishes to maintain the putty (i.e., financial assets) and no-one the clay (i.e., real investment): in other words, everyone tries to remain liquid and invest in readily liquidable assets representing productive capital. Thus occurs the liquidity paradox mentioned above, with worse problems for the monetary authorities, in a divide between production and finance worlds that needs to be bridged if the economic systems are to be stabilized.

4. *Conclusions*

While the utility of derivatives, as of money, cannot be in doubt, there have always been and always will be doubts as to the correct use of derivatives, like that of money, expecially when they exceed the needs of productive economy. After two centuries of debate between the monetary school, in favour of controls, and the banking school, against it, at the start of the twentieth century the rational solution of money control prevailed and increasingly sophisticated techniques and increasingly appropriate institutional set-ups were developed to the point where highly indipendent monetary authorities currently yield instruments and techniques of intervention to avoid monetary and banking crises, and also to deal with the breakdown of the monetary standard, if they are able and willing to do so.

As regards derivatives, the arguments between the two schools continue to crop up regularly. Despite authoritative pronouncements by policy makers and market operators like those mentioned at the outset of this paper - which testify to their awareness ofthe requirement that derivatives be governed - very little in-depth investigation has been made as to their placement on the monetary demand side and supply side, not to mention the role they play in the mechanism of transmission of monetary and financial effects to the real economy. This also because economists have lagged behind in studying the problem and have continued to defend positions (as "derivatives don't matter" parallel to the same sentence for money!) that are less and less defeasible.

All the knowledge and "certitude" accumulated in the past cannot sidestep the presence of this new monetary reality, financial and real, that has established itself on the domestic and, above all, international markets. This involves integrating derivatives in the mathematical models employed for economic forecasting, highlighting their role in the transmission channels, whether at theoretical or practical level. The econometric relations need to be re-appraised in search of the corrections to be applied to the parameters that link among

themselves at least the large macrovariables and the prices of factors (money and interest rate and/or- prices; credit and economic and investment activity; the financial leverage ofthe economy, values of the firms, etc.).

Let us reiterate the utility of derivatives for the possibility they provide to hedge against the own risks of the market, of minimizing the costs of holding money and of achieving better portfolio diversification. All this is not in doubt. Derivatives have improved and may further improve the climate of business worldwide so long as they are used in pursuit of the three functions indicated, but they do involve problems for the authorities, especially the monetary authorities. Suffice it to think of the worsening of the liquidity paradox already remarked by Keynes for money: even in derivatives everyone feels liquid, but the system is not. When speculation gets the upper hand, even if fuelled by objective imbalances (for example, in exchange rates, interest rates or credit lending), the economy may find itself unbalanced to the point of collapse in some point of the system. In such a case the authorities are enforced to intervene to avoid a diffusion of single crisis to the entire system (or systemic crisis), as did the Fed with the LTCM default. The case of the credit and currency crisis of the countries of Far East Asia confirms the existence of the possibility that the national and supranational authorities were not prepared to tackle crisis which derivatives are involved, and for which they continue to be unprepared.

To sum up, the problem of derivatives, like all problems in economics, is one of choosing the .right measure. Since there seems to be no doubt that the money and financial market, unlike the real economy, is unable to find this right measure - i.e. to redress itself when operators or the authorities themselves err - the derivatives market must be governed according to rules similar to, though not the same as, those followed for money. The Bank of Italy, for instance, in the statistical basis for calculating the compulsory bank reserves and capital has included a percentage amount of derivate contracts held by the banks, but it is not known on what bases and why this percentage is calculated. It is not known, therefore, which are the rules similar, but not identical, to those currently followed in the monetary governance, since we do not have available either the necessary statistical basis, or the theoretical knowledge on the transmission mechanism of the effects of derivatives, or the technical experience to extend the rules of "traditional" monetary governance to the governance of these markets in full awareness. Nonetheless, it is by now quite clear that while they may not play the role of time bomb they do exert an unsettling effect on monetary amounts and the policies related to them as Greenspan frankly admitted.

References

Angeloni, 1., and Massa, M. (1994), "Mercati Derivati e Politica Monetaria", in Moneta e Finanza, Giacomo Vaciago (ed.), II Mulino, Bologna, pp. 259-272.

Barone, E. (2002), La valutazione dei prodotti derivati: una rassegna della letteratura, Bank of Italy, mimeo.

Berkshire Hathaway Inc. (2003), Annual Report for 2002, Omaha, NE, USA. Bianchi, T. (2003), "Congedo", Banche e Banchieri, 5, pp. 387-389.

Black, F., Scholes, M. (1973), "The Pricing of Options and Corporate Liabilities", Journal of Political Economy, vol. 81, Issue 3(May-June), pp. 637-659.

Cohen, B. (1999), "Derivatives, volatility and price discovery", International Finance, 2:2, pp. 167-202.

Craig, A., Dravid, A., and Richardson, M. (1995), "Market Efficiency Around the Clock: Some Supporting Evidence Using Foreign-based Derivatives", Journal ojBanking and Finance, 15,pp. 647-664.

Fratianni, M., Salvatore, D., and Savona, P., editors (1998), Ideas for the future of the international monetary system, Open Economies Review, Special Supplemental Issue, Volume 9 (reprinted by Kluwer Academic Publishers, BostonIDordrechtiLondon 1999).

Fung, H.G., and Leung, W. (1993), "The pricing Relationship of Eurodollar Future and Eurodollar Deposit Rates", Journal ofFuture Markets, 13(2), pp. 115-126.

Greenspan, A. (2003), Monetary Policy Under Uncertainty, Federal Reserve Bank of Kansas City, Jackson Hole's Speech, August 29, Wyoming, USA

Hull, 1. (1999), Options, Futures and Derivatives Security, 4th Ed., Prentice Hall.

Hunter, W.C., and Marshall, D. (1999), Thoughts ofFinancial Derivatives, Sistemic Risks and Central Banking: Some Recent Developments, Federal Reserve Bank of Chicago, Working Paper no. 20.

Hunter, w.e., and Smith, S.D. (2002), "Risk management in the global economy: A review essay", Journal ofBanking and Finance, 26, pp. 205-221.

Merton, R. (1973), "Theory of Rational Option Pricing", Bell Journal oj Economics and Management Science, vol. 4, Spring, pp. 141-183.

Oldani, C. (2002) The pricing relationship of Euribor future and Euribor rate: a policy approach, Economia, Societa e Istituzioni, Luiss, n. 3, 2002.

Office of the Controller of the Currency (1994), Risk Management of Financial Derivatives, Washington, D.C.

Savona, P., editor (2000), "The New Architecture of the International Monetary System", Open Economies Review, Supplemental Issue, Volume 11 (reprinted by Kluwer Academic Publishers, BostonIDordrecht/London 2000).

Savona, P. (2002), "On Some Unresolved Problems of Monetary Theory and Policy", Governing Global Finance - New challenges, G7 and IMF contributions, Edited by Fratianni, M., Savona, P., and Kirton, J.1., Global Finance Series, Ashgate Publishing Limited, A1dershot, pp. 177-183.

Savona, P., and Maccario, A. (1998), "On the

Relation between Money and Derivatives and its Application to International Monetary Market", Ideas for the Future of the International Monetary System, Open Economies Review, edited by: M. Fratianni, D.

Salvatore and P. Savona, Special Supplemental Issue, Volume 9 (reprinted by Kluwer Academic Publishers, BostoniDordrecht/ London 1999), pp. 267-294.

Savona, P., Maccario, A., and Oldani, C. (2000), "On Monetary Analysis of Derivatives", in "The New Architecture of the International Monetary System", Edited by: Savona, P., Open Economies Review, Supplemental Issue, Volume 11 (reprinted by Kluwer Academic Publishers, BostoniDordrecht/London 2000).

Tobin, J., and Brainard, W.C. (1976), Assets Markets and the Cost of Capital, Cowles Foundation Paper no. 440, North Holland.

Vrolijk, C. (1997), Derivatives Effect on Monetary Policy Transmission, IMF Working Paper n. 121, International Monetary Fund, Washington, D.C.

Econometric Appendix

TABLE 1

Pairwise Granger Causality Tests

Sample: 1999:01 2003:09

Lags: 4 (choice of number of lags is based on LM test)

Null Hypothesis:	Obs	F-Statistic	Probability
LOG(Euribor) does not Granger Cause LOG(Feuribor)	53	0.88128	0.48295
LOG(Feuribor) does not Granger Cause LOG(Euribor)		11.2248	2.3E-06

TABLE 2

Unit root test on variables:Euribor at level

ADF Test Statistic	-0.619243	1% Critical Value*	-2.6048
		5% Critical Value	-1.9465
		10% Critical Value	-1.6189

Euribor at first difference

ADF Test Statistic	-3.825016	1% Critical Value*	-2.6055
		5% Critical Value	-1.9467
		10% Critical Value	-1.6190

Feuribor at level

ADF Test Statistic	0.348119	1% Critical Value*	-2.6048
		5% Critical Value	-1.9465
		10% Critical Value	-1.6189

Feuribor at first difference

ADF Test Statistic	-3.355804	1% Critical Value*	-2.6055
		5% Critical Value	-1.9467
		10% Critical Value	-1.6190

*MacKinnon critical values for rejection of hypothesis of a unit root.

TABLE 3

Engle-Granger OLS first step estimates.

Dependent Variable: LOG(Euribor)

Method: Least Squares

Sample: 1999:01 2003:09

Included observations: 57

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	119.9893	4.725682	25.39090	0.0000
LOG(Feuribor)	-25.99230	1.034210	-25.13252	0.0000

R-squared	0.919900	Mean dependent var	1.221250
Adjusted R-squared	0.918444	S.D. dependent var	0.244961
S.E. of regression	0.069956	Akaike info criterion	-2.447440
Sum squared resid	0.269162	Schwarz criterion	-2.375754
Log likelihood	71.75205	F-statistic	6 31.6433
Durbin-Watson stat	0.552203	Prob(F-statistic)	0.000000

TABLE 4

Unit root test on residuals of OLS estimation

ADF Test Statistic	-2.567679	1% Critical Value*	-2.6048
		5% Critical Value	-1.9465
		10% Critical Value	-1.6189

*MacKinnon critical values for rejection of hypothesis of a unit root.

TABLE 5

Vector Error Correction Estimates, Engle-Granger second step.

Sample(adjusted): 1999:062003:09

Included observations: 52 after adjusting endpoints

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq: CointEq1

LOG(Euribor -1)	1.000000
LOG(Feuribor -1)	29.40890
	(1.64557)
	[17.8716]
C	-135.5907
	(7.51659)
	[-18.0389]

Error Correction:	D(Log Euribor)	D(Log Feuribor)
CointEql	-0.482906	0.000371
	(0.15407)	(0.00618)
	[-3.13438]	[0.06000]
D(Log Euribor -1)	-0.127104	0.007776
	(0.16823)	(0.00674)
	[-0.75555]	[1.15316]
D(Log Euribor -2)	0.006943	-0.000436
	(0.15635)	(0.00627)
	[0.04440]	[-0.06965]
D(Log Euribor -3)	0.071639	-0.001407
	(0.13868)	(0.00556)
	[0.51658]	[-0.25314]
D(Log Feuribor -1)	-7.590509	0.473490
	(5.44645)	(0.21830)
	[-1.39366]	[2.16894]
D(Log Feuribor-2)	-2.814993	0.156740
	(5.68487)	(0.22786)
	[-0.49517]	[0.68788]
D(Log Feuribor -3)	1.228380	0.179068
	(5.37293)	(0.21536)
	[0.22862]	[0.83149]
D(Log Feuribor -4)	5.371570	0.037553
	(5.20740)	(0.20872)
	[1.03153]	[0.17992]

R-squared	0.575842	0.312538
Adj. R-squared	0.496929	0.184638
Sum sq. resids	0.074559	0.000120
S.E. equation	0.041640	0.001669
F-statistic	7.297163	2.443611
Log likelihood	96.44781	263.7230
Akaike AIC	-3.363377	-9.797038
Schwarz SC	-3.025662	-9.459323
Mean dependent	-0.003581	8.08E-05
S.D. dependent	0.058709	0.001848

Determinant Residual Covariance	4.40E-09
Log Likelihood	362.6210
Log Likelihood (d.f. adjusted)	352.7387
Akaike Information Criteria	-12.75918
Schwarz Criteria	-11.97118