Foreign Exchange Rate and Risk in Argentina 2002*

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The aim of this paper is to analyse empirically the behaviour of the US dollar market in Argentina in the first quarter of 2002. At first sight from the start of the year 2002, it seemed unlikely for the exchange rate to reach a stable equilibrium because there was a permanent run from the domestic currency to the American dollar. The existing financial freeze was a product of the tremendous financial crisis that took place the year before. It has accentuated the unstable behaviour of economic agents in the foreign exchange market. Therefore, the purpose of the study is to shed some light on the role of expectations and prospects upon the future evolution of the exchange rate.

Even when several authors have shown that forward prices are not good predictors of the future spot rate of exchange, the joint analysis of forward and spot prices for the foreign currency gives information about the changes in the expectations. Besides, those changes usually reflect some individuals' risk evaluation.

The approach used in this paper can be divided into three parts. The first step of the analysis deals with the behaviour of the volatility of the ratio of the forward rate of exchange to the spot. A second step implies going deeper into the role of expected changes in the future spot rate under special assumptions. Finally, in the third step the daily spot market is analysed by separating demand from supply by means of a stochastic model of simultaneous equations. The model identifies the demand for and the supply of US dollars. The three parts of the study provide evidence about the functioning of the markets and display some peculiarities related with the monetary system.

Argentina Now

The Currency-Board System ended in Argentina in the first week of 2002. Then the move towards a flexible exchange rate system started with a depreciation of the domestic currency of 29%. After eleven years of currency-board system in Argentina (named "La Convertibilidad") with a parity of AR$ one to the US$, the country decided to open the road to a flexible exchange rate system. In the first week of January 2002, the Government put the AR$ 1.40 to the dollar. The depreciation of the currency did not stop there and then followed further pressures against the peso. On the other hand, the Central Bank made transactions in the open market to prevent the exchange rate to run out of control. Both the IMF and the Argentine authorities agreed that Argentina should let the exchange rate to float freely.

In fact, a complete free floating was not fully attained yet. The Government feared to lose control of monetary policy in face of the existing inflationary pressures and indeterminacy of the domestic rates of interest ruling in the economy. This situation reflected great confusion among economic agents. The freeze of bank deposits established at the end of November, produced a squeeze of liquidity. By the time savers withdrew their deposits and increased their demand for US dollars. The state of expectations revealed conflicting views. The asymmetrical "pesofication"[1] divided the waters into debtors' and creditors' fields and aggravated the imbalance in the banking

* I am very grateful to Juan Carlos de Pablo, Jorge Galmés and Facundo Crosta for comments and suggestions on a first draft of this paper. Anyway, any mistake left is my own responsibility.

sector. As a consequence there was a continuous run to take advantage of inflation since it was a steady upward trend in the price of the US dollar. Everyday there was a growing and widespread belief that the AR$ lacked the capacity to perform efficiently all functions of money.

I. The Dynamics of Risk: the Volatility in the Forward–to-Spot Rate Ratio

In this paper the daily behaviour of the short-term exchange market was examined since 1998. Most of the relevant variation corresponds to the period in which the exchange rate became flexible. However, it is important to detect if there were traces of uncertainty in the market long before the abandonment of the fixed exchange rate took place. The economic depression developed in times when the currency-board system was operating was influencing the expectations, and this affected the market evolution. So, the choice for a sample period starting in 1998 was aimed to capture important effects over expectations with respect to the future spot rate. Moreover, between January 1998 and December 2001 took place a huge change in the amount and composition of deposits in the banling system. Total deposits amounted AR$ 70,757 million (47% in AR$ and 53% in US$). Deposits climbed to AR$85,594 million in February 2001 and they started a declining trend in the following months. They amounted AR$ 65,601 million in December 2001. At that time 29% of total deposits were denominated in AR$ and 71% were in US$.Some disturbances in the forward-to-spot rates were usually produced by mismanagement of economic policy and political shocks.[2]

By the way, among the factors that influenced expectations about the future spot exchange rate were: the persistent recession on economic activities, the long-term increase in the rate of unemployment, and the ineffectiveness of the government to cope with the foreign indebtedness. All these factors created a climate of insecurity which prevented the attainment of stability in some flex markets such as the exchange rates, stock, bonds and so on.

In the present paper the time series exhibit a daily frequency for over a period extending from 12-31-1997 up to the end of March 2002. Other parts of the research are concerned with different periods depending on both the availability of data at the time of the analysis and other methodological reasons.

In times of operation of the currency-board , the predominant feeling prevailing among economic agents expressed itself in the evolution of the forward exchange rate which varied while the spot rate was kept constant. The relationships between both prices were mainly governed by changes in the rates of interest (domestic and foreign) and changes in the expected future spot rate.

Even when the AR$/US$ parity was one to one, the forward rate of exchange produced interesting information. The variability became larger when the economy was getting closer to default its external debt. Moreover, the changes got sharper when the flexible system was adopted. Nonetheless, this process cast some doubts about a quick convergence of the exchange rate to equilibrium. At the same time, the fears of hyperinflation started to spread over the economy.

Figure 1 shows the series of the forward rate (contracts with 180-day maturity) and the current spot rate.

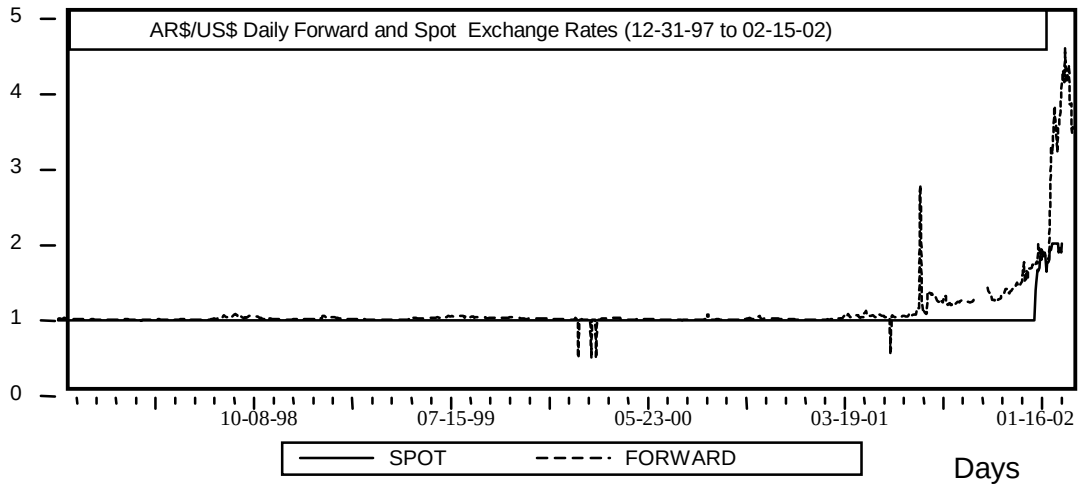

Fig. 1

For a good appraisal of the Argentinian situation and the effectiveness of its economic policies, see Hanke, Schuler and Mussa. Steve H. Hanke (2001) and Kurt Schuler (2002) pointed that the Argentina's economic depression and currency crisis was caused by bad policies of its Government and not by scapegoats like banks, foreign investors, the IMF or other. Schuler thinks that the IMF has given bad advice. Michael Mussa (2002) presented a similar diagnostic. There is a clear expression of this subject in his phrase : "Enumerating the many things that contributed to Argentina's tragedy, however, should not obscure the critical failure of Argentina economic policy that was the fundamental cause of disaster – namely, the chronic inability of the Argentine authorities to run a responsible fiscal policy…Thus, in the management of its fiscal affairs, the Argentine government is like a chronic alcoholic – once it starts to imbibe the political pleasures of deficit spending, it keeps on going until it reaches the economic equivalent of falling down drunk."

The above mentioned authors provide a detailed analysis of the manifold aspects of Argentina's tragedy of a collapsing economy and having difficulties to restructuring its external debt. The present paper does not intend to go deeper into the analysis of the economic situation of Argentina but to concentrate in the short-term functioning of the exchange market. Nevertheless, it may be helpful for the reader to look for a detailed description of Argentina's present problems in the bibliography above mentioned. That literature deals with practical problems of economic policy.

The Covered Interest Parity and Expectations Components in the Short-Term Forward Exchange Rate

The analysis of forward and future spot exchange rates usually resorts to two kinds of interest parity which are frequently considered as "the fundamentals". They are the Uncovered Interest Parity (UIP) and the Covered Interest Parity (CIP). UIP states that the expected change in the rate of exchange for a given period equals the interest rate differentials between the two countries ruling for that period. The underlying assumption of UIP is that the investor's return is independent of the currency composition of their portfolios.

On the other hand, CIP states that the interest rate differentials are equal to the difference between the forward and the spot rates. The present idea is to keep close to

the CIP view and observe some risk components in the ratio between forward and spot exchange rates. (Shelagh Heffernan and Peter Sinclair [1990]).

A measure the dynamic behaviour of the volatility of the CIP equation from the beginnings of the depression was essential for tracing out the role of expectations as the economic situation turned systematically worse. In the first stage of this study the influence of interest rate differentials upon the difference of the logs of forward and spot rates was captured indirectly by the foreign interest rate and the EMBI. This was so because of the impossibility of having a consistent risk-less rate of interest for Argentina during the whole sample period.

In addition, the ratio of forward to spot rates of exchange includes a component of risk which depends heavily on expectations. The risk component was supposed to vary through time and to include a changing risk-premium implicit in the ratio under observation. In symbols, $F_t / S_t = (1+i)\ (1+\rho\ )/(1+i^*)$ where, F_t = forward exchange rate at time t; S_t = spot exchange rate at time t; i and i* = interest rates on nominal bonds both domestic and foreign; and ρ = risk-premium rate.

The sample covers daily data from 12-31-1998 to 02-15-2002 (1021 business days). Data was taken from Bloomberg. The forward exchange rate is measured in ARpeso per US dollar for 6-month period contract. The forward price was calculated as the average of "bid" and "ask" quotations. The following series are provided by the same source. Two proxy variables were used to express interest rates. These were the Annual Rate for investments in Federal Funds (for a period of six months) and the risk indicator of J.P.Morgan (EMBI). These variables were expected to capture the changes in the foreign and domestic risk-less interest rates. The EMBI provided an indirect proxy owing to the reasons given above.

The volatility was conceived as a standard deviation which vary through time. Then a model of generalized autoregressive conditional heteroscedasticity seemed appropriate to describe its dynamic behaviour.

The GARCH-M model was estimated for $f_t - s_t)$ in logs. The specification includes variables corresponding to the interest differentials and exhibits a term depending on the current volatility of $(f_t - s_t)$ and on σ_t, the risk-component part of the equation. In addition, σ_t (the volatility) follows a GARCH(1,1) in mean process through time.

The mean equation is,

$$(f_t - s_t) = a_0 + a_1\ i^* + a_2\ EMBI_t + a_3\ \sigma_t + \varepsilon_t$$

ε_t is the error with zero mean and variable conditional variance. $\varepsilon_t \sim N(0, \sigma^2_t)$

The variance equation is,

$$\sigma^2_t = \omega + \alpha\ \varepsilon^2_{t-1} + \beta\ \sigma^2_{t-1} + \delta\ t$$

The main result here is that while a GARCH process converges up to a long run variance implicit in the constant term of the variance equation, these estimates show that the long-term variance does not exist. The inclusion of a trend variable and the lack of significance of the constant term gives the evidence that there is no long run equilibrium. Therefore, the model becomes unstable in the long run. This expresses

the potentially explosive role of expectations under conditions of persistent recession and gradual proximity to default the foreign debt, apart of the known mistakes of fiscal policies.

In the mean equation coefficients except the constant are significantly different from zero.
The coefficient of the volatility has a positive sign. The larger the current volatility the bigger the ratio of the forward rate with respect to the spot price.

The coefficient of the external interest rate is negative as expected. On the other hand, the positive relationship that should have the domestic rate of interest has been captured by the proxy variable EMBI. These two variables express their influence on the covered interest parity. When the probabilities of Argentina defaulting its debt increased during the year 2001, the choice of some risk-less rate of interest on public bonds became impossible. The effect on the interest parity became notional and an index like the EMBI, expressing the spread over the rates of interest of foreign public bonds, seems to replace successfully the non-existent domestic riskless rate.

Mean Equation				
Variable	Coefficient	Standard dev.	z statistic	Probability
σ_t	0.279310	0.123621	2.259401	0.0239
constant	0.032739	0.049050	0.667478	0.5045
i^*_t	-0.022207	0.007760	-2.881515	0.0042
$EMBI_t$	0.000142	1.06E-05	13.39110	0.0000
Variable	Coefficient	Standard dev.	z statistic	Probability
Variance Equation				
constant	0.000154	0.000178	0.864008	0.3876
ε^2_{t-1}	0.150008	0.036823	4.073765	0.0000
σ^2_{t-1}	0.600012	0.043340	13.84428	0.0000
trend	4.79E-06	6.12E-07	7.855760	0.0000

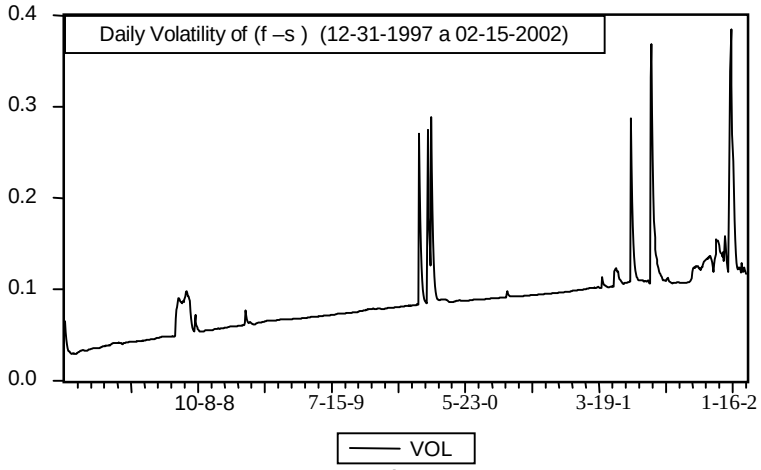

Fig. 2

In addition, the variance equation also presents very significant coefficients. Here, the constant is no significantly different from zero. This is reasonable since there is a trend observed in the conditional variance. This trend is the most surprising element in the model.

The trend in the variance equation implies the market is not well-behaved as it is seen through the spot and forward rates. It includes a growing incidence of risk in the economic decisions. In other words, risk grows through time.

Forward-spot-ratio volatility through time derived from the GARCH-M model is shown in figure 2.

As mentioned before, the most meaningful characteristics of the estimate is the upward trend of volatility. It must be noticed that this component works almost from the beginning of the sampling period, that is, from early 1998. This is a surprising outcome and is also worrying for its implications. It is surprising because the phenomenon also takes place in times of fixed spot exchange rates and continues particularly, in the last part of the period when there was some evidence of government's determination to float the exchange rate.[3] Expectations about the future spot exchange rate pushed forward and spot prices up. As a consequence, the increase in risk was strengthened through time. The peaks observed in particular dates corresponded to disturbances produced by unanticipated changes in the forward and spot exchange rates.

For example the first outstanding peaks in volatility took place between the day 08-24-98 and 09-24-98, induced by the Russian crisis. Later in the middle of January 1999 ther was a little spike produced by the Brazilian crisis. On this change, Facundo Crosta pointed out that external financial shocks are expected to be stronger than commercial shocks. The relationship between Argentina and Brazil is based more on the trading activity than on the financial one. Facundo concludes that this fact allows to open safely foreign trade while one has to be cautious with respect to opening capital account transactions. Crosta's view is illuminating and leads to consider volatility to be more sensitive to the financial than to trading transactions.[4] However. the sensitiveness of the short-term foreign exchange market does not reflect the depth of the real adjustments as Jorge Galmés pointed out. For Argentina the Brazilian depreciation of its currency had a more negative and painful effect on its economy than the Russian crisis.

Next, the second set of significant disturbances happened between February 23 and March 3 in the year 2000. This coincided with the first big tax hike of the de la Rua Administration. The third group of peaks corresponded to the middle of year 2001 and lasted up to July 23. Those disturbances were caused by problems of not fulfilment the commitments with the IMF and the Government's inability to reduce public expenditure. Finally, the last set of alterations took place since December 2001 up to the end of the third week of January 2002. These changes were influenced by the financial freeze, the default of the external debt and the depreciation of the peso.

So far the analysis was performed with the forward rate defined for a contract period of 180 days. Later, a new model was estimated with the same variables but for forward contracts with maturity of 30 days. The aim was to test if the dynamic properties were maintained when the period of forward contracts was reduced. The sample used in this estimate includes 435 observations ranging from 07-21-00 to 03-21-02.[5]

The model obtained kept some characteristics of the previous one though it departed in other aspects. For instance, the mean equation keeps the foreign rate of interest with negative sign and the EMBI with positive sign in its coefficients.
Both are highly significant. But the volatility disappeared as a variable with contemporary effect on the forward-spot price ratio. The volatility followed an ARCH process with trend, which is clearly shown in the figure 3.

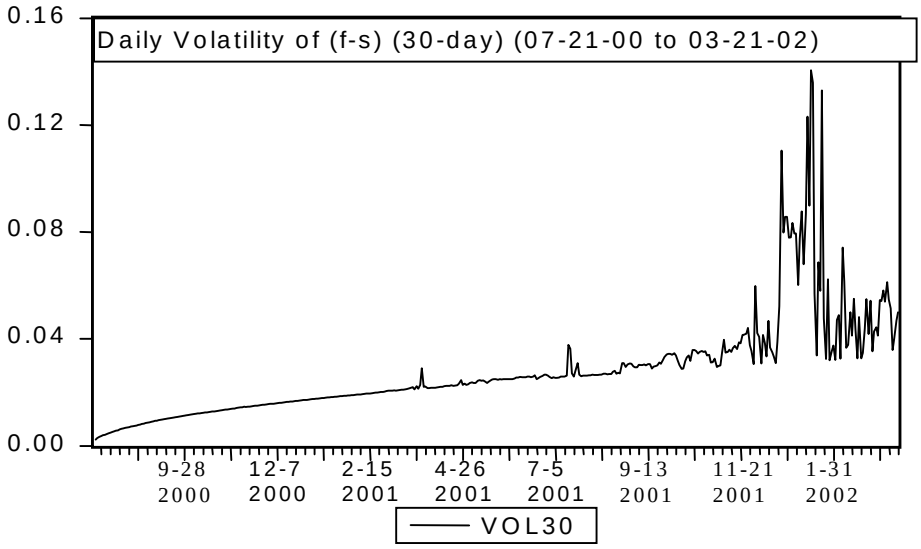

Fig. 3

$$(f_t - s_t) = -0.005586\ i^* + 5.06E\text{-}05\ EMBI_t + \varepsilon_t$$
$$[-25.69961] \qquad [65.15850]$$

The variance equation is,

$$\sigma^2_t = -9.56E\text{-}07 + 0.171971\ \varepsilon^2_{t-1} + 2.59E\text{-}06\ t$$
$$[-0.231193] \qquad [13.27043] \qquad [14.85466]$$

In other words, the mean equation has lost the volatility term. The relevant variables captured the effects of the covered parity through the interest rate differentials. The effect of volatility which remained similar were the heteroscedasticity and its mode of variation through time. The trend in volatility retained some aspects of the previous model. Therefore, it can be concluded that expectations behaved through time in a similar way as it happened with the longer contracts althoughthey were much more sensitive to current innovations.

2. <u>The Expected Future Spot Price of the US Dollar</u>

So far, the analysis has been centred around the volatility of the $f_t - s_t$ other than the CIP or interest differential components. The results are that dynamically the volatility varies through time and it has a trend element in its evolution. The conclusion is that the markets keep and ever-increasing unstable propensity.

Next, it is necessary to specify the way in which the expected spot rate influences the forward and spot markets in order to interpret the evidence. In this section a different approach is presented. Here, the idea is to connect the expectations of the future spot exchange rate with the kind of variation detected in the first part of the study.

Therefore, it is recognised the importance of the CIP factors (named premium from now on) and the assumption of a rational and efficient forecast of the future spot exchange rate made by the market. At this point Fama's approach seems to provide a clear testable instrument and it works under the assumption of rational and efficient market for the exchange rate. For other alternative assumptions see Guy Meredith and Yue Ma (2002).

The Importance of the Covered Interest Parity and the Expectations about the Future Spot Rate of Exchange.

The nominal rates of interest of risk-less bonds can be expressed in the following way:

$i = (1+r)(1+p)$ and $i^* = (1+r^*)(1+p^*)$

Consequently, under the assumption of purchasing power parity linking exchange rates and prices, the forward exchange rate at time t is denoted by,

$$F_t = [(1+r)/(1+r^*)]\, S_t\, (1+p)/(1+p^*)$$

$$F_t = [(1+r)/(1+r^*)]\, S^f_{t+k}$$

where the rates of interest have been decomposed into real rates (r's) and the corresponding expected rates of inflation both domestic and external. The rational and efficient forecast made by the market about the future spot exchange rate at time t+k is denoted by $S^f t+k$. The relationship between expected inflation and spot rates is solved by the assumption of the purchasing power parity theory(PPP). Therefore, the PPP is assumed to give shape to the relationship between price levels and rates of exchange.

The conceptual approach used in the measurement was borrowed from Eugene F. Fama's methodology (1984) for appraising the importance of interest differentials and error of forecast of the spot exchange rate in the variance of $f_t - s_t$. Fama's results were conditional on the rational and efficient behaviour of agents in the forward market. Even when the Argentine case may differ from the countries observed by Fama, the adoption of the hypothesis of rational and efficient behaviour is useful to structure the empirical anlysis.

In his paper, Fama considered the forward exchange rate observed at time t as the certainty equivalent of the future spot exchange rate, so determined by the market.

$$f_t = E(s_{t+k}) + P_t$$

These concepts will be useful to analyse the variation in both components. This expression is in logs and divides the certainty equivalent in two parts: the rational and efficient forecast of the future spot rate and the premium, that is, the differential between the expected real returns on the nominal bonds of the two countries. Fama assumed that E(st+k) is the forecast of the spot rate of exchange at time t+k, being made at time t, conditional on all relevant information available at time t. And this assumption will be essential to give shape to the expectation of the future spor rate of exchange in the present analysis.

$$f_t - s_t = P_t + E(s_{t+k} - s_t)$$

Fama computes two regressions were calculated upon the same basic information. They are,

$f_t - s_{t+k} = \alpha_1 + \beta_1 (f_t - s_t) + \varepsilon_{1,t+k}$

$s_{t+k} - s_t = \alpha_2 + \beta_2 (f_t - s_t) + \varepsilon_{2,t+k}$

Fama's model has the characteristics that the sum of α's is zero, the sum of β's equals 1 and the sum of errors are nil.

Thenceforth, by estimating these two complementary regressions, the variance of ft - st is split into a premium component and the random component of the rational forecast of the spot rate at t+k.[6]

Fama points out that in absence of covariation between P_t and $E(s_{t+k} - s_t)$, β_1 reflects the share of the premium variation in the variance of $(f_t - s_t)$ and β_2 expresses the share of the expected change in the spot rate at time t+k.

On the other hand, if the covariation exists, then it obscures the relationships. The β's do not show the participation in the total variance because of the incidence of the covariance. The latter either overstates or understates the $var(f_t - s_t)$ depending on the sign of the covariance. Besides,the sign of the covariation affects the meaning of the beta coefficients. Anyway, Fama adopts the difference between β's as a criterium to detect which effect is more predominant. In that case, the β's express the shares of both effects as a proportion of net variance, that is the variance corresponding to premium and expected change in the future spot minus the covariation terms.

For the present paper, the two complementary regressions are:

$f_{t-180} - s_t = -0.010635 + 0.579563 (f_{t-180} - s_{t-180})$
[-2.474408] [6.843365] R^2 =0.051739 F = 46.83164
N° obs. = 841

$s_t - s_{t-180} = 0.010635 + 0.420437 (f_{t-180} - s_{t-180})$
[2.47408] [4.964436] R^2 =0.028537 F = 24.64565
N° obs. = 841

The forward and spot series were lagged in 180 days. The procedure is not accurate since the time variable includes business days and the displacement in time is constant over a sequence of business days. Therefore, the actual lags exceeds the sixth-month period and it is not uniform. In order to avoid a complex handling of the data, it was necessary to accept the approximation in the belief that it would not influence significantly the results, given the characteristics of the data.

The application of the Fama's approach renders interesting results. Both beta coefficients are significantly different from zero, and this means that both the premium and the expected change in the spot rate are varying through time. Most of the variance of (ft-180 st-180), the 58% of it reflects the variation in the premium; The other 42% corresponds to the forecast error in the spot. If there is some covariation between both effects, it is negligible. For the sample of 1021 days, the premium effect is bigger than the expectation's effect.

It is interesting to know if the previous conclusions hold when the sample is concentrated in the last part of the period. Then, a new estimate was made upon a sub-period ranging from 08-02-2001 to 02-15-2002 (from observation 890 to 1021 of the original sample).

$f_{t-180} - s_t = 0.120879 - 6.449346 (f_{t-180} - s_{t-180})$
[4.191836] [-9.189479] $R^2 = 0.393788$ F = 84.44653
N° obs. = 132

$s_t - s_{t-180} = -0.120879 + 7.449346 (f_{t-180} - s_{t-180})$
[-4.191836] [10.61435] $R^2 = 0.464281$ F = 112.6644
N° obs. = 132

This sub-period covers most of the problems and the replacement of the currency-board system. These new results are illuminating.Here, the β's are significantly different from zero and this means that premium and expected change in the spot had variation. Next, the sign of beta in the first regression is negative while in the other equation it is bigger than 1. This implies that there is an important negative covariation between $E(s_{t+k})$ and P_t. which blurs the meaning of the beta coefficients.

The betas already do not show the pure shares of both effects in the total variance. However, in cases like this, Fama suggests to calculate $\beta_1 - \beta_2$. This difference is negative, (-1.67) and shows that the expected change in the future spot rate is larger than the premium change.

Finally another application of Fama's methodology was the computation of regression coefficients upon the sample of forward contracts with 30-day maturity, that was used to measure volatility in the first part of this study. The sample includes 404 observations ad the outcome is similar to the previous case.

$f_{t-30} - s_t = 0.010806 - 0.332945 (f_{t-30} - s_{t-30})$
[1.902112] [-6.497466] $R^2 = 0.095037$ F = 42.21706
N° obs. = 404

$s_t - s_{t-30} = -0.010806 + 1.332945 (f_{t-30} - s_{t-30})$
[1.902112] [26.01262] $R^2 = 0.627314$ F = 676.6562
N° obs. = 404

The analysis of the forward exchange rate at 30 days produced consistent results with those obtained above.

In the days of the Convertibility System the variation in the premium, that is, in the interest differentials was predominant as occurred in the international literature. When the economy faced more serious problems like persistent unemployment and depression in economic activity, the role of expectations as a source of variation grew significantly. The regression coefficients - below zero in one case and above unity in the other -shows the direction of the change.

3. The Daily Spot Market of the US$

Finally, in this stage the analysis is focused on the daily spot market of the US dollar in Buenos Aires, after the abandonment of the convertibility system. The demand and supply functions were estimated. Then, the examination of the explanatory variables provided grounds to have a diagnostic about the peculiar way in which the foreign exchange market actually works now in Argentina.

The data used to build the model corresponded to the daily transactions in the open market and are presented in the Annex. They included purchases and sales of US dollars from economic agents including banks and Exchange Houses in Buenos Aires. The period under analysis runs from February 11 to March 27, 2002.

The original data referred to aggregate purchases and sales of exchange institutions. Nevertheless, the information had to be adapted to the model requirements. Therefore, each day the volume transacted was chosen from the purchases and sales series according to the highest figure. This treatment implied that the changes in the foreign exchange balances held by exchange agents were considered as part of the market demand and supply. The price of the day was conceived as the average between the bid and ask rates.

The model consisted of a demand function, a supply function and an equilibrium equality. The influences of the variables considered are contemporary.

The structural equations of the model include the following specification:

Demand for dollars (D_t) depends on the rate of exchange (π_t) and the total amount of banking deposits (DEP_t). The rate of exchange is expressed as the price of one US dollar in domestic currency. The DEP are expressed in millions of AR$.

The supply of dollars (S_t) depends on the rate of exchange (π_t), the index of country-risk from J.P.Morgan ($embi_t$) and on the annual interest rate of Federal Funds Bonds in the USA ($rfedfu_t$).

The model was calculated by applying 3SLS (three stage least squares) to the daily data. N° obs. = 33

$$D_t = \underset{[-1.972\ ]}{-208786.8}\ \pi_t \underset{[-3.462\ ]}{-\ 66.62905}\ DEP_t + \underset{[3.391\ ]}{6038251} + \varepsilon_t\ , \qquad R^2 = 0.5548,\ Chi^2 = 43.918$$

$$\pi_t = \underset{[2.231\ ]}{4.36e\text{-}06}\ S_t + \underset{[2.777\ ]}{.0004415}\ embi_t \underset{[-1.873\ ]}{-\ 6.786928}\ rfedfu_t + \underset{[1.817\ ]}{11.83764} + \eta_t, \qquad R^2 = 0.4152,\ Chi^2 = 49.245$$

$$D_t = S_t$$

All variables are in their levels. Both ε_t and η_t are stochastic terms.The figures between brackets are the z-statistics corresponding to each coefficient. In the Annex more detailed information about the estimates are given.

The first equation corresponds to the demand function, the second is the supply function and the third implies the equilibrium condition.

In the demand equation the price coefficient is negative as expected. The coefficient is significant at the 5% level. The coefficient of the bank deposits is also negative. This means that when deposits rise the demand for dollars shrinks. On the contrary when the bank deposits fall the demand for US dollars rises. This movement has been directly observable in Argentina since the foreign exchange market became flexible. Here the coefficient is significant at the 0.1% level.

The supply relationship shows very significant coefficients for the quantity and embi variables. Both are positive. The quantity coefficient is consistent with the positive price-elasticity in the supply function. Here the embi is associated with the general situation of the economy. An increase in the embi implies a worsening of the critical conditions of the country. Therefore, the change in this variable produces a rise in the supply price of dollars, other things remaining constant. From another angle, a bigger embi means a reduction in the supply, ceteris paribus. The potential suppliers of foreign exchange retain the dollars for themselves. Conversely, whether the embi goes down, the supply increases. In the analysis of forward and spot rates of exchange, the embi was considered as associated with the level of domestic interest rates. In the analysis of daily spot rates this meaning does not already apply. The period is extremely short to capture influences from that variable.

The coefficient of the foreign interest rate on the US Federal Funds is significant at the 6.1% level. However, the meaning of this variable is very interesting since it has implications with forward and spot operations starting on the current day.

A rise in the foreign rate of interest implies a reduction in the supply price other things remaining equal. For a given supply price, the rise in the foreign interest rate enhances the supply of dollars. The increase in the interest rate reduces the forward price of dollars, and the suppliers find convenient to go short on the spot and long on the forward rate. On the other hand, when the foreign interest rate falls, the price of forward dollars rises. The supplier of dollars takes a long position in spot just reducing the spot supply, and a short position in the forward market. The functioning of the model can be depicted by means of the usual linear curves of demand and supply.

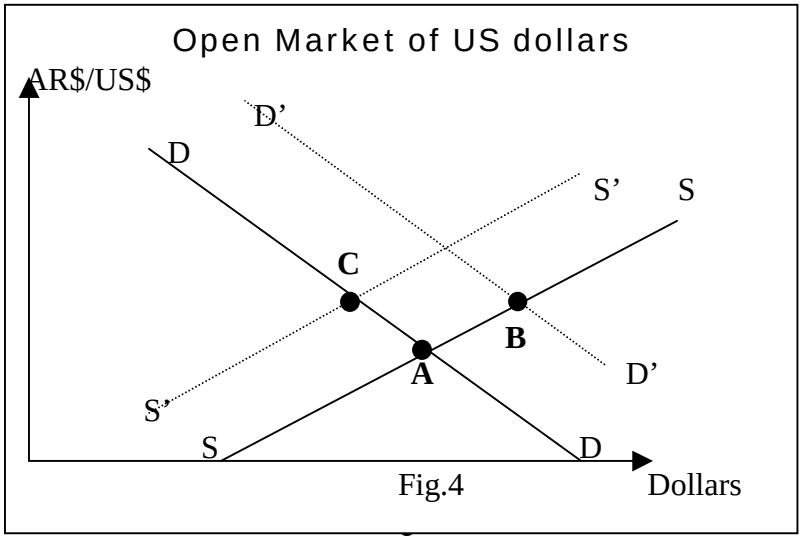

Fig.4

The figure 4 exhibits the demand for foreign exchange (DD) and the supply of the US dollar functions in a given day. These endogenous relationships are expressed in the plane of the exchange rate and the quantity of dollars. The functions presented in the

graph are defined for given values of the remaining exogenous variables included in the respective equations. The dotted lines imply shifts of the function produced by modifications in one of these variables.

Given the values of the exogenous variables, the market clears at the point A, where the price of dollars and the volume of transaction are determined.

Suppose, that bank deposits have fallen. Then the demand function shifts right-wards (DD') generating a new equilibrium price and quantity at the point B. Part of the funds withdrawn from the banks went to the foreign exchange market to buy dollars. An increase in bank deposits is generally associated with a shift of demand in the opposite direction.

On the side of supply, assume that the equilibrium situation is initially placed at A. Assume that the Bank deposits do not change on this day, but the economic recession was worse than it was the day before. This situation can be depicted by a rise of the embi. The increase in the supply price of the dollar means a reduction in the offerings at given prices. Other things being equal, the new equilibrium position shifts to C.

A shift in the supply curve in the same direction like the latter case occurs when the foreign interest rate decreases. The reduction in the rate pushes the forward price of dollars up. Therefore, the suppliers reduce their offering (that is similar to increase their own demand for dollars) and sell forward, thus making a profit.

In this model, the effect of operating simultaneously in spot and forward markets for the dollar, has been set up on the supply of the spot foreign exchange. The reasons are mainly econometric, when defining the restrictions required by the methods of estimating. That is why this effect is understood as produced by an exogenous variable on the supply side.

Concluding Remarks

The main characteristic of the foreign exchange market of Argentina at present is its permanent leaning towards unstability. This can be traced from the start of the year 1998, that is long time before the removal of the Convertibility System. The persistent economic depression and the bad economic policies produced a downward cumulative process of economic activities with tremendous losses of property. Then it was natural that risk considerations had to affect buyers' and sellers' decisions in the foreign exchange market. The economic depression provided the framework within which there was a growing volatility in the relationship between the forward price of the US$ and the spot value of the American dollar in terms of the domestic peso. In the author's opinion this is an early sign of the inability of the domestic peso to perform efficiently the functions of money. He believes with Hanke that it was not necessary to abandon the Currency Board System.

Even when the economy was under the Currency Board System, the economic depression and the gradual inability of the Government to continue with the necessary reforms and implement rational fiscal policies, were weakening the markets confidence in the future stability of the economy. This can be noticed through the evolution of the volatility of the relationship between six-month-forward price of the dollar and the spot rate. The volatility varied during the years around an increasing trend . The estimates

showed this behaviour since the start of 1998, and these features remain today with stronger disruptive effects.

The spot rate was fixed but the markets were aware that things could be worse if the Government failed to put the house in order. The forward rates reflected more than the influence of interest rate differentials. They showed the growing incidence of risk premium adding noise to the forward price of dollar. Even when forward rates are not good predictors of spot rates as many authors have shown, they showed uncertainties in economic decisions by means of an increasing volatility. That volatility did not have a long term limit, and this implies a signal to worry about. An analogous behaviour was observed with forward contracts with monthly maturities. The shorter the period the stronger are influences of contemporary disturbances. The volatility series become noisier.

The explicit connections between volatility and expected future spot exchange rate was made under the assumptions of rational expectations and efficiency of the market. These assumptions gave a specific shape to expectations about the future spot price of the US dollar. In this sense, this work followed the path opened by Eugene Fama in 1984 for testing the influence of interest rate differentials and error of forecasts on the future spot exchange rates.

Argentina's data showed that the importance of expectations was strong and it became stronger when the flexible exchange rate was adopted and the inflationary pressures came back to Argentina after a decade of price stability. The application of Fama's model with a six-month-forward exchange rate gave normal results. The predominant share of the total variance conrresponded to the premium component (interest rate differentials). The forecast error of expected future spot rate correspond to a 42% of total variance.

Another estimates based in a more recent sample including data from early February 2001 till mid. February 2002, presented an overwhelming increase in the importance of expectations. The increasing volatility of the first part of the study can be associated with a continuous increase in variation owing to expectations regarding the future level of the spot exchange rate. Here, similar conclusions are attained with 30-day-forward rates.

The final part of the study was directed to the daily spot market for the US dollar. The computed model described successfully some perverse behaviour regarding the leak of bank deposits aiming to the exchange market. This behaviour became directly observable at first sight in practice. However it is worth noting that with very few observations about a minimum number of variables, a simultaneous equation model was computed with very significant coefficients.

The model fitted exhibits a demand very sensitive to changes in the levels of bank deposits. When deposits shrink there is an increase in the demand for the US dollar. On the other hand, the supply of dollars is influenced by the general economic situation and the change in the foreign rate of interest. The latter variable influences indirectly speculative forward-and-spot simultaneous transactions.

The spot market seen through the variables included in the model exhibits an unstable behaviour for longer periods than the day. In fact, the dollar price does not converge to a stable equilibrium level either in the long or in the mid term. The observed behaviour in the market shows two types of ill influences: The escape from the domestic currency

as a store of value and the negative influence of a persisting disastrous depression in the economy.

These factors aim to an important conclusion: the Argentinian currency does not behave like money. Argentina has not money of its own.[7] During the currency-board system the predominant currency was the US dollar, and after its removal the economic agents did not trust the pesos and still feel attached to the dollar. The results of the present study provide empirical evidence on the same lines.

The likelihood of the peso performing the role of money should have been taken into account before the announcement of the depreciation of the peso at the beginning of 2002. Both the maintenance of the currency-system (or a dollarised version of it) and the crawling peg that effectively followed required consistent approaches of economic policy.

However, the authorities believed that the economy could experience a successful floating of the peso since they did not seem to doubt about that the peso could still perform as money. The Government adopted the flexible exchange system right-away, expecting that the markets would automatically substitute the peso for the US dollar as the only domestic currency. So far the outcome is clear enough. New problems arose and by the time there is no clear ceiling for he dollar price and the chances of return of a serious inflation included more constraints to the difficult situation of Argentina.

It was not the aim of the present paper to explore the economic policies the Government should carry forward to avoid the collapse of the Argentinian economy. Instead the outcome of the paper was the detection of some weakness of the peso through the short-term foreign exchange market and warn about the danger of hyperinflation prevailing under the surface.

Notes

(1) The term "pesofication" meant the conversion of loans and deposits in AR$. However, this was made in an asymmetric way. Bank deposits were converted at the rate of 1.40 pesos per dollar, while loans were converted in pesos at the rate of one peso to the dollar.

(2) For a detailed analysis of the economic situation of Argentina and its failure to implement an efficient policy directed to prepare the conditions of restructuring its external debt, see the works of Mussa, Hanke and Schuller. All of them coincide in the mistakes of fiscal policy incurred by the Government of Argentina. The role of the IMF was also subject to polemics.

(3) If the same specification of the model is computed over a sub-sample ranging up to December 31, 2001, the model keeps its shape and the trend coefficient in the variance equation is highly significant (z statistic = 8.71).

(4) The author is indebted to Facundo Crosta for his comments about the impact of the Brazilian crisis on the Argentine economy and its impact ofn the foreign exchange market.

(5) The author thanks Hernán Sarmiento and Emiliano Basco for kindly collecting and preparing the series used in this study.

(6) Fama expressed the β's coefficients in terms of covariances and variances and these is more clarifying than analogous analysis of previous authors. He wrote: " To my knowledge, however the explicit interpretation of the regression coefficients provided by (5) and (6) [the β's expressions] is not well known. In particular, it is not widely recognized that, given an efficient or rational exchange market, the deviation of β_2 from 1.0 is a direct measure of the variation of the premium in the forward rate." (Fama,1984).

(7) However, at he end of hyperinflation in 1990, the domestic peso was definitely knocked out. The markets just decided to move to another kind of money, much before the Government started the Currency Board System. In 1991 a new exchange system introduced the US dollar as the currency for Argentina. Therefore, the peso played a role absolutely passive. There was only one currency, the dollar. The other (the peso) was a ticket. In fact, no one could tell at that time and also nowadays if the peso could be reborn at the end of the Convertibility System. The fact is that the introduction of a strong currency derives from the market's wishes instead of direct economic policy.

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ANNEX

The following data was used to model the daily market of US dollars in the city of Buenos Aires in the first quarter of 2002.

Annex: Foreign Exchange Data

Observation	**time**	Deposits	embi	Foreign r rfedfu	Quantity (thousands of US$)	π
1	**02/11/02**	83348.40	4350	1.79	57927	1.95390585
2	**02/12/02**	83186.20	4235	1.83	119114	1.89489685
3	**02/13/02**	83121.20	4100	1.83	91487	1.79269005
4	**02/14/02**	82688.60	4013	1.81	157478	1.78656007
5	**02/15/02**	82295.00	3943	1.81	149901	1.87381375
6	**02/18/02**	82080.20	4026	1.81	106711	1.97076307
7	**02/19/02**	81892.00	3987	1.81	183171	1.99913725
8	**02/20/02**	81709.00	3992	1.84	208305	2.04793528
9	**02/21/02**	81792.60	4092	1.8	142008	1.98440154
10	**02/22/02**	81969.60	4168	1.82	139134	1.99553292
11	**02/25/02**	81869.80	4087	1.82	152513	2.02725723
12	**02/26/02**	81858.60	4112	1.83	207747	2.06571081
13	**02/27/02**	81624.80	4123	1.82	211975	2.11376072
14	**02/28/02**	81778.20	4098	1.83	206573	2.08623168
15	**03/01/02**	81496.20	4170	1.85	205598	2.0623873
16	**03/04/02**	81597.20	4144	1.86	204978	2.00340261
17	**0305/02**	81282.20	4222	1.83	237000	2.02250038
18	**03/06/02**	80957.20	4305	1.85	200795	2.04772783
19	**03/07/02**	80800.80	4286	1.85	185367	2.1160223
20	**03/08/02**	80371.60	4407	1.85	170998	2.17407105
21	**03/11/02**	79968.60	4479	1.86	208470	2.23271835
22	**03/12/02**	79866.80	4505	1.86	207376	2.32160736
23	**03/13/02**	79464.20	4656	1.85	205061	2.31616725
24	**03/14/02**	79306.20	4830	1.87	265878	2.36252503
25	**03/15/02**	79009.00	4943	1.84	393822	2.34612265
26	**03/18/02**	78957.20	5155	1.85	226604	2.33421578
27	**03/19/02**	78862.80	5030	1.85	204475	2.37380009
28	**03/20/02**	78740.60	4972	1.86	250004	2.43487769
29	**03/21/02**	78557.00	4958	1.87	328547	2.40913053
30	**03/22/02**	78318.00	5089	1.87	304857	2.66023626
31	**03/25/02**	78180.60	5223	1.84	203684	3.17345516
32	**03/26/02**	78154.40	5290	1.84	280605	2.97530436
33	**03/27/02**	78127.80	5024	1.84	195103	2.84442457

Source: Bloomberg and Central Bank of Argentina.