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EMPIRICAL STUDIES OF NIGERIA'S FOREIGN EXCHANGE PARALLEL MARKET
II: SPECULATIVE EFFICIENCY AND NOISY TRADING

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AFRICAN ECONOMIC RESEARCH CONSORTIUM

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Empirical studies of Nigeria's foreign exchange parallel market
II: Speculative efficiency and noisy trading

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Abstract

Previous studies on the Nigerian parallel market found "return predictability". Based on this finding, we quantify, using Hansen's GMM estimation technique, the risk-return characteristics implicit in the simplest trading strategy of "buy and hold" an optimal portfolio of currencies. The risk-return profile suggests that profitable trading opportunities found in the Nigerian market may not indeed be exploitable.

Also, we reexamine the evidence on the presence of destabilizing activities in the Nigerian parallel market. Using the noise-trader approach, we find no significant evidence of bandwagon expectations that may drive prices gradually away from fundamentals.

The overall implication of our findings is clear. If the emerging characteristics of the new autonomous market are similar to the parallel market that it seeks to absorb, then an activist intervention policy, based mainly on market-stability imperatives, should be resisted strongly.

I. Introduction

We pursue two issues relating to market efficiency. First we test empirically for the existence of profitable trading opportunities based on the apparent *weak-form* inefficiency of the Nigerian foreign exchange parallel market. Second, we investigate the presence of destabilizing speculative activities. An asset market is efficient if prices fully reflect all available information so that economic profits can not be earned through exploiting this information set. Different levels of efficiency can be distinguished depending on how much information is used to form expectations about future prices – weak form, semi-strong form and strong form (Fama, 1970). Subsequently, Fama reclassified forms of efficiency under the general titles of return *predictability, events study and tests for private information* (Fama, 1991). Bandwagons or destabilizing expectations occur when market participants extrapolate the most recent trend in exchange rates. On the other hand, regressive expectations occur when agents expect a currency to return to some equilibrium level. The importance of distinguishing between destabilizing speculation and regressive expectation has long been recognized in the literature. One view, proposed initially by Freidman (1953), is that because speculators buy low and sell high, their activity ensures that exchange rates reflect the fundamental or long-run determinants of currency values. Another strand of literature led by Nurske (see Froot and Thaler, 1990) holds that speculation in foreign exchange can be destabilizing and that excess volatility imposes large costs on producers, who consequently make less efficient allocative decisions[1].

In developing countries, the perception of policy makers on this debate is important, as it may lead to positions that could trigger market interventions. Consider, for example, that the potential cost of exchange rate instability includes the possibility that investors may adopt a wait-and-see attitude when confronted with uncertain future exchange rate changes. This is particularly likely in import-dependent small economies with essentially one main export commodity. More recently, Dixit and Pindyck (1994) analysed the effect of uncertainty on investment behaviour. One of their major insights is that "changing economic conditions that affect the perceived riskiness of future cash flows can have a large impact on investment spending, larger than, say a change in interest rates." Undoubtedly, volatile exchange rates affect future cash flows.

Two previous studies (Ogiogio, 1994; Ayogu 1995) on the foreign exchange markets in Nigeria addressed the issue of market efficiency and speculative activities in the parallel market. Ogiogio (1994) finds dependence between successive price changes in the foreign exchange markets using an autocorrelation test on monthly data from 1989 to 1993. Ogiogio (1994) also analysed the relative contributions from expectations and from economic fundamentals to the movement of exchange rates. The study concluded that "the most significant factor in the movement of the nominal exchange rate in Nigeria is speculation by dealers".

Ogiogio (1994) regressed exchange rates (using OLS) on the ratio of inflows to outflows of foreign currencies. The intuition is that the relative flow of currencies summarizes the supply and demand conditions in the market, so that any residual from such regression could be attributed to speculative activities. The analysis did not explain how data on the flow variables were constructed given that, in such an informal market, the only accessible data are transaction prices. Also, no discussion was made on the econometric issues involved in using such an approach. What is more important, the study did not make clear how speculative activities (if present) were to be detected from the residuals.

These issues aside, the claim that speculative activities are significant in the market differs from the finding of no price level bubbles by Ayogu (1995). Ayogu (1995) uses vector autoregression analysis and the nonlinear algorithm of Hamilton (1989) to search for trend processes in exchange rate data filtered through economic fundamentals. This paper, which extends that result, equally fails to find evidence of significant noise trading in the market.

This present paper is organized as follows. Section II reviews the development of the parallel forex market in Nigeria and Section III looks at the risk/return characteristics implicit in this simplest trading strategy of "buy and hold" an optimal portfolio of currencies. Section IV examines the issue of speculative dynamics–the presence of noise traders in the market. Noise trading [Black (1986), Campbell and Kyle (1988), De Long, Bradford, Shleifer, Summers and Waldmann (1989, 1990a,b)] has become a popular alternative to the efficient-markets approach. Moreover, the approach accommodates within the same analytical framework, the two competing views–Friedman and Nurske–on the effect of speculative activities on the economy. According to the accommodating view, both types of traders coexist. The issue is whether the activities of noise (as opposed to rational) traders are significant, or dominate the market. Our study ends with a summary and the conclusions from our findings in Section V. We begin with presenting a background on the nature of the parallel market that we analyse.

II. The parallel forex market in Nigeria

The evolution of foreign exchange markets in Nigeria has influenced by several factors over time, including political dynamics, the changing pattern of international trade and institutional changes in the economy (such as structural shifts in production). It is a fair characterization to say that Nigeria's foreign exchange rate management policy varied according to episodic changes in its fortunes. For example, during the 1970s when the country enjoyed economic prosperity from the oil boom, the supply of foreign currency was not an issue of great concern, and an administered exchange rate regime existed without a formal criterion for rationing demand. Nevertheless, in the 1980s, as part of the reform process designed to restore the economy on a growth path including access to international capital, a new foreign exchange policy thrust was evident. Specifically, in 1986 a floating rate mechanism linked to market forces was introduced.

The earliest history of transactions in Nigeria's parallel market was at the outbreak of World War II, mainly in United States dollars and Swiss francs; Switzerland at the time was for Nigerians a preferred haven for money laundering. Nevertheless, the development of the market is rooted in the myriad of exchange controls in existence then. Examples include controls on payments for imports; on payments for, and proceeds from, invisibles; on the treatment of proceeds from exports (cocoa, rubber, palm produce, hides and skins, cotton, groundnut, and tin ore were major exports at the time); and on both direct and portfolio investments. Initially the participants were mainly expatriate entrepreneurs (Lebanese traders were prominent), exporters, politicians and some importers.

During the Nigerian civil war (1966–1970) and after, the Central Bank of Nigeria continued to control the operation of the formal market with the goal of stabilizing the value of the naira, but the parallel market premium continued to increase monotonically. The result was a variety of regulatory-induced behaviour such as under invoicing of exports and over invoicing of imports. Other effects were capital flight and the arbitraging of foreign currencies acquired at below market-clearing rates in the official market. However, the prominence of the parallel market in the scheme of economic activities is rooted in the early 1980s when the economy swung into distress.

Between 1986 and February 1992, various foreign exchange reforms were introduced and experimented with.[2] Unfortunately, the government was unable to reverse the continuous depreciation of the nation's currency as reflected in the almost monotonically increasing parallel market premium (see figure 1). Presumably as an ultimate solution to a disturbing trend, the authorities in March 1992 opted for a complete deregulation of the system of foreign exchange trading. Consequently the parallel market premium reduced to what was probably only a transaction-costs differential. Subsequently it became obvious that the convergence was transient because the inter-bank foreign exchange market continued to be characterized by excess demand for foreign currencies.[3] In recent times, the importance of this market has grown tremendously as transaction prices (both wholesale and retail) in the real and service sectors including embassies and foreign missions in Nigeria are implicitly indexed to the parallel rate. Nigeria has become a nation of foreign exchange watchers. It is not a national pastime. It is a full-time watch.

No formal organization of the parallel market exist. To say that the market is ubiquitous is a true characterization. It is to be found on the curbs, under staircases, on the landings of staircases between floors of storied buildings, inside shacks, in business bureaus, inside restaurants, hotel lobbies, airport lounges, outside on parking lots, and so forth. Any imaginable place qualifies as a dealing spot providing the parties to the resulting transaction feel secure. As the market gained in importance, and became more lucrative, it attracted a variety of entrants. Noteworthy are entrepreneurs who adapted their enterprises to the booming "money-changing business". Entry into the business and the competition it engendered greatly improved the reputation and infrastructure of the market. Within a given area, more transactions began to occur in fixed locations with a greater weight of reputational capital attached to transactions. The count accuracy of notes exchanged and the genuineness of currencies traded became important dimensions of competition in the market.

This is a long way in a short span of time for a market that was previously operated by a collection of footloose agents, some operating for own accounts and others as agents for politically powerful principals. Perhaps this diversity, coupled with the boom times that the market continued to enjoy, promoted the growth in the diversity of trading posts. These posts varied from street corners to air conditioned shacks. The shacks featured "bosses" fully decked with business cards, cellular telephones, regular telephones, facsimile machines and desk-top personal computers. Those who did not have telephones installed could easily reach one, and some curbside agents were linked to their principals through cellular phones. As more profits induced entry, which increased competition, profit margins narrowed. So, dealers began to take advantage of economies of scope to offer complementary business services such as facsimile transmission, outgoing telephone call service and photocopying. Although the precise volume of trade in the parallel market is unknown, it is estimated at below that of the official market. Nonetheless, the number of deals completed in the parallel market undoubtedly exceeds that of the official market as the parallel market is the "only market of resort" for most agents. Moreover, some of the currencies traded in the official market are supplied, through the arbitrage process, to the parallel market.

This review describes the state of the parallel market before January 1995. In January 1995, as part of a new agenda of "guided deregulation of the foreign exchange market", the government effected a key foreign exchange policy change. The gist of the policy change is contained in the Foreign Exchange (Monitoring and Miscellaneous Provisions) Decree 1995 otherwise known as Decree No. 17 of 1995. Essentially the decree introduced the Autonomous Foreign Exchange Market while retaining the official exchange at the pegged rate of 22 naira per US dollar. All purchasers of foreign currencies from then on

Figure 1: Parallel market premium

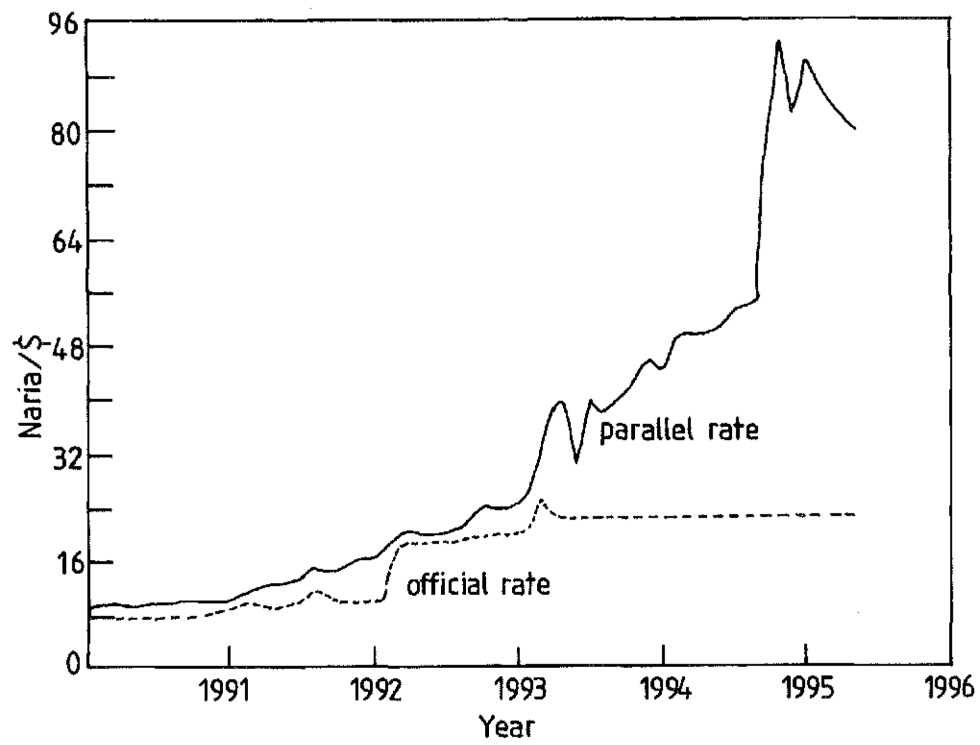


Table 1: Rate Profile in the Foreign Exchange Markets: 1995:QI

	Official	AFEM	Bureaus	Parallel
January	21.996	–	21.770*	80.340
February	21.996	82.000	81.200	80.640
March	21.996	82.000	83.760	83.390

Source: NDIC Quarterly, March 1995.
AFEM = autonomous foreign exchange market. * denotes buying rate.

were required to transact at rates that would be freely determined in the autonomous market. However, "designated government transactions" continue to be processed at the central bank using the fixed rate. No individuals or organizations unless authorized are to deal in foreign exchange; so the parallel market remains proscribed.

The introduction of the autonomous market has prompted a reconfiguration – changes in the number and size distribution of the firms and operators – of the parallel market. Many of the "well-connected" principals and the fancy shacks with fax machines and desk-tops are either restructuring as *de novo* forex bureaus or are consolidating (through mergers or buyouts) with existing outfits. In either case, they retain their remote probes (curbside operators and agents) to solicit business. As things stand, it is no longer clear where the parallel market ends and the forex bureau begins. Table 1 shows the rate profile in the market for the first quarter after the regime change.

III. Speculative efficiency

Next, we turn to the measurement of the risk-return profile implicit in the parallel market. The method used requires a model describing how returns are generated (i.e., a return forecasting equation) under the assumed null hypothesis that the market is"efficient". In the empirical literature, efficiency is usually equated with rational expectations plus the martingale model (Leroy, 1989). We consider the hypothesis independently of its implications for rational expectations, so we use the term speculative efficiency to stress the focus on opportunities for risk adjusted excess returns.

The speculative-efficiency approach boasts extensive literature. The growth of the literature is motivated by the search for alternative formulations of market efficiency, and in particular for those formulations aimed at directly testing for the existence of profitable trading opportunities, quite independent of the implications for rational expectations. Examples are Bilson (1981), Dooley and Shafer (1982), Bilson and Hsieh (1983), and Hodrick and Srivastava (1984). Presumably these formulations attempt to reduce the interpretive problems associated with the rejection of market efficiency (and so the ambiguity in constructing alternatives to the null of efficiency). These ambiguities arise because failure to find evidence in favour of the null may imply either a rejection of the information set, perhaps on the basis that agents are rational but have the wrong model, or that the information set contains all relevant information but agents are (irrationally?) failing to use all available information.

Empirical methodology

To parameterize the null hypothesis, we specify a model that characterizes the process determining the future evolution of the parallel rate. We preface our specification by noting that economic models have generally not done well in explaining movements in exchange rates. Similarly, the profession has not reached a consensus on the appropriate set of fundamental factors to include in an exchange rate equation (Meese, 1990). A large and growing literature argues that the standard theoretical models of exchange rate determination – the flexible – price monetary model of Frenkel (1976), which assumes both purchasing power parity (PPP) and uncovered interest parity (UIP), and the sticky-price overshooting model of Dornbusch (1976) that assumes only UIP–do not explain empirically the actual exchange rate behaviour in post 1973 regimes of floating exchange rates. Following a suggestion in Mussa (1979) that a random walk outperforms a wide array of structural models in out-of-sample forecasts, Meese and Rogoff (1983a/b) found that even the random walk is not a very good predictor of exchange rate behaviour. Koedijk and Schotman (1990) and Somanath (1986) have argued that the use of lagged adjustments in structural models can lead to forecasts outperforming the random walk models. Such results have been explained as responses to shocks in a learning process that is slow (Tabellini, 1988; Lewis, 1989a,/b). More recent works on exchange rate movements have used the error correction model. Examples are Kim and Mo (1995) and Naka and Whitney (1995).

Other efforts to improve our understanding of exchange rate changes have tried to exploit the statistical properties of exchange rates. For example, the distributions of exchange rates generally exhibit various non-normalities. Evidence of leptokurtosis in exchange rates has been found by various researchers (Westerfield, 1977; Boothe and Glassman, 1987). Cumby and Obstfeld (1984) first noticed the existence of volatility clustering or conditional heteroscedasticity. Efforts to model this volatility cluster have been made by Domowitz and Hakkio (1985) and Diebold (1988), using the ARCH technique of Engle (1982). Also, efforts have been made by McCurdy and Morgan (1989) and Hodrick (1989) using the EARCH technique of Bollerslev (1986). Boothe and Glassman (1987) and Hsieh (1988) have fit Student and mixed normals but found shifting parameters over time. Tucker and Pond (1988) and Akgiray and Booth (1988) found the mixed diffusion-jump process of Clark (1973) and Merton (1976) to be superior to the mixed normals, although the latter found parameters changing with policy regime shifts. This apparent non-normality and volatility, along with the obvious failure of standard structural models, led to a search for other possible explanations for the behaviour of exchange rates.

We do not attempt to resolve the issue here. Instead, we have tried to provide a perspective on how, based on the state of the literature, the choice of a model can vary considerably. Our choice of forecasting equation is a more general empirical specification that allows both for a random walk, with or without a drift, and for a stationarity around a trend function (Perron, 1989). By defining y_{it} as the spot rate of naira per unit of foreign currency i for period t, e_{it} as a purely random error term, and t as the trend component, we may specify a forecasting equation under the null hypothesis that the market is weak-form efficient.

$$y_{it}+1=b_{i0}+b_{i1}t+b_{i2}y_{it}+e_{it+1,}\ \ i=1,\ldots,n. \tag{1}$$

Appropriately parameterized, the null hypothesis that "you can't beat the market" asserts H_0: $(b_0,b_1,b_2)=(0,0,1)$. If the null is true, however, it cannot be tested as specified because the distribution is unknown and does not converge to a Gaussian process asymptotically. Therefore the null hypothesis is reparameterized by specifying the following empirical models based on tests proposed in Dickey and Fuller (1981):

$$\nabla^1 Y_t = \alpha + \beta t + \theta Y_{t-1} + \sum_{i=1}^{\kappa} \gamma_i \nabla^1 Y_{t-i+e_t} \quad \text{(Model U)} \tag{2}$$

and

$$\nabla^1 Y_t = \sum_{i=1}^{\kappa} \gamma_i \nabla^1 Y_{t-i+e_t} \quad \text{(Model R)} \tag{3}$$

where $\theta = (b_2 - 1)$ and ∇^i denotes the ith difference of $\{Y_t\}$. $e_t \sim$ iid $(0,\sigma^2)$. The composite null hypothesis H_0' asserts $(\alpha, \beta, \theta) = (0,0,0)$, and γ_i's $= 0$ ($i = 1,..., \kappa$), which implies the weaker martingale property that expected changes in the time series $\{Y_t\}$ are zero. The test statistic ϕ_2 is the likelihood ratio test of $(b_0, b_1, b_2) \neq (0,0,1)$ against the alternative $(b_0, b_1, b_2) \neq (0,0,1)$. The critical values – found in Table V of Dickey and Fuller (1981) – for the 5% (1%) level test are $\phi_2 = 4.88$ (6.50) for sample size $T \in (100,360)$. These statistics are computed as a standard F test of this restriction; the restricted regression is labelled Model R and the unrestricted is labelled Model U.[4] The significance of γ's is assessed by appealing to the fact that the asymptotic distributions of t statistics on γ_i's ($i = 1,..., \kappa$) are standardized normal.

The result of the specification test is tabulated in Table 2. Reported p-values are for the lagged exchange rates. The values imply statistically significant coefficients. The computed Dickey and Fuller ϕ_2 statistics indicate $(b_0, b_1, b_2) \neq (0,0,1)$.Together, these specification test results lead us not to set to zero any of the coefficients in the forecasting equation. Accordingly, our forecasting equation is specified as:

$$y_{it+1} = \beta_{0i} + y_{it} + \sum_{j=1}^{\kappa} \gamma_{ij} \nabla^1 y_{it-j} + \varepsilon_{it+1} \; i = 1,...,n, \tag{4}$$

where ε_{it} is an error term. This error term may follow a more complicated process that captures market characteristics such as volatility cluster (i.e., the presence of ARCH). Furthermore, by defining a vector of portfolio weights $\mathbf{W} = (w_1...w_n)'$, where $w_i \equiv$ a non negative proportion of the speculators' wealth invested in currency i, we may express the speculators' problem: To minimize the level of diversifiable risk ρ in the portfolio of foreign currencies given a target level of return Π^*. The non negativity restriction on the portfolio weights rules out "short selling".

Formally, the traders need to find $\mathbf{W}^*$ so that there exists no other portfolio with either (1) a higher return and a lower risk, (2) a higher return at the same level of risk, or (3) the same level of return at a lower risk. That is, $\mathbf{W}^*$ solves the following quadratic programming problem:

$$\min_{W^*} \rho = w' \Lambda W \tag{5}$$

$$\text{subject to} \begin{cases} (i) \ W'1 = 1 \\ (ii) \ W'\varepsilon = \Pi^* \end{cases}$$

where Λ is the variance-covariance matrix of forecast errors generated by estimating Equation 4. The estimation method assumes the following error structure. The disturbance term for a given currency follows a pth order autoregressive process; the variance of the disturbance can differ among currencies and within the same currency across periods, and the disturbances for different currencies are contemporaneously correlated (i.e., ε_{it} heteroscedastic and autocorrelated). Also, the following cross-equation restrictions hold:

$$\beta_{0it}, \beta_{1it}, \beta_{2it}) = (\beta_{0i}, \beta_1, \beta_2) = (\beta_{0i}, 0, 1).$$

The cross-equation restrictions and the assumptions together say that all coefficients are constant and have the same value across all currency types (except possibly for the intercepts), and that the disturbance vector is assumed to capture differences over time and currencies. An efficient estimation method is Hansen's generalized method of moments (GMM). As implemented, GMM allows for conditional heteroscedasticity of the disturbances, and when the option is invoked (in the TSP routine [Hall, 1995]) computes the correct weighting matrix to ensure asymptotically efficient estimators in the presence of serial correlation. A similar approach to the same problem was used in Hodrick and Srivastava (1984), although Bilson (1982) obtains his estimates using SUR and GLS procedure.

Constraint (i) in Equation 5 simply says that agents are required to exhaust their wealth. This requirement ensures that the portfolio choices are optimal given wealth constraints. The constraint also represents our priors that even if some risk-neutral or risk-loving speculators exist, they are likely to confront liquidity (wealth) constraints. The assumption of limited access to capital seems highly in accord with empirical observations on capital markets, and consistent with theories of capital markets under asymmetric information (Stiglitz and Weiss, 1981). In fact, liquidity constraint is an important consideration in the literature on speculative dynamics. Shleifer and Summers (1990) argue that if agents have finite horizons and wealth constraints are binding, then arbitrage is limited. Such limitation prevents the process of arbitrage from completely driving prices toward fundamentals. In any event, the market that we analyse operates a *cash—in—advance* scheme with little if any "short selling" of currencies occurring as a regular feature.

Constraint (ii), which defines required return as $\Pi^* = W'\varepsilon$, may be interpreted as the agents' *reservation return*, below which they are unwilling to hold a portfolio. The portfolio-efficient frontier is constructed by varying Π^*. The efficient frontier provides the framework for the analysis of the optimal risk/return trade-offs implicit in the parallel market.

Data and empirical analysis

We use weekly data on four major trading currencies – dollar, sterling, Deutsche mark, and French franc – collected over the period 1 January 1990 to 31 December 1993. Our coverage begins in 1990 simply because that was how far back we could go to obtain clean data. As stated in the institutional description, parallel market activities became more tolerated in 1989 when *forex bureaus* were introduced. This development encouraged a more active habit of publishing parallel market rates. Publication and dissemination halted in January 1994 when the government became intolerant of the parallel market. The present data set was compiled from published rates in Nigerian periodicals – the *Guardian* and the *Business Times*. The choice of data frequency is made to approximate the holding period horizon of traders. Traders in this market rarely hold positions in currencies for more than several days at a time.

Table 3 presents summary descriptive statistics of the data set. Table 4 reports the estimates of the mean (ex post) forecast errors, $\hat{\varepsilon}$, which is the proxy for the expected forecast error. Table 5 contains the standardized variance-covariance matrix of the residuals (Λ).[5]

A basic feature of the portfolio-efficient frontier (Figure 2) is that the representative investor's minimum variance portfolio implied in the frontier is diversified – 53% in dollars and 47% percent in Deutsche marks.[6] While it is generally reassuring to have an outcome consistent with theory (our benchmark portfolio conforms with the doctrine that diversification is beneficial when returns are less than perfectly correlated), that fact is only of passing interest in the present study. The reason is that in the market we analyse, few investors if any are likely to hold the minimum variance portfolio in the presence of a risk-free asset that yields a higher return. Therefore, what we seek instead is to establish the equilibrium portfolio for the investor. The existence of a risk-free asset with a positive yield enables us to construct a market opportunity line for our representative investor. We use a typical yield on treasury bills issued over the period spanned by the data. Within this period, yields have varied from 16.65% to 28%. For treasury rates below 25.5%, and assuming that regularity conditions concerning the investor's preferences are satisfied, portfolio equilibrium involves a positive position in the parallel market.[7] When returns are above 25.5%, investors can obtain a risk-return combination that Pareto dominates that of the parallel market. This volatile investment opportunity, which is due to the linear efficient frontier, is consistent with Hodrick and Srivastava (1984). That study concluded that "it would appear from [looking to] the volatility of the risk-return tradeoffs at different points in time that a speculator in foreign exchange must be willing to bear a considerable amount of risk".

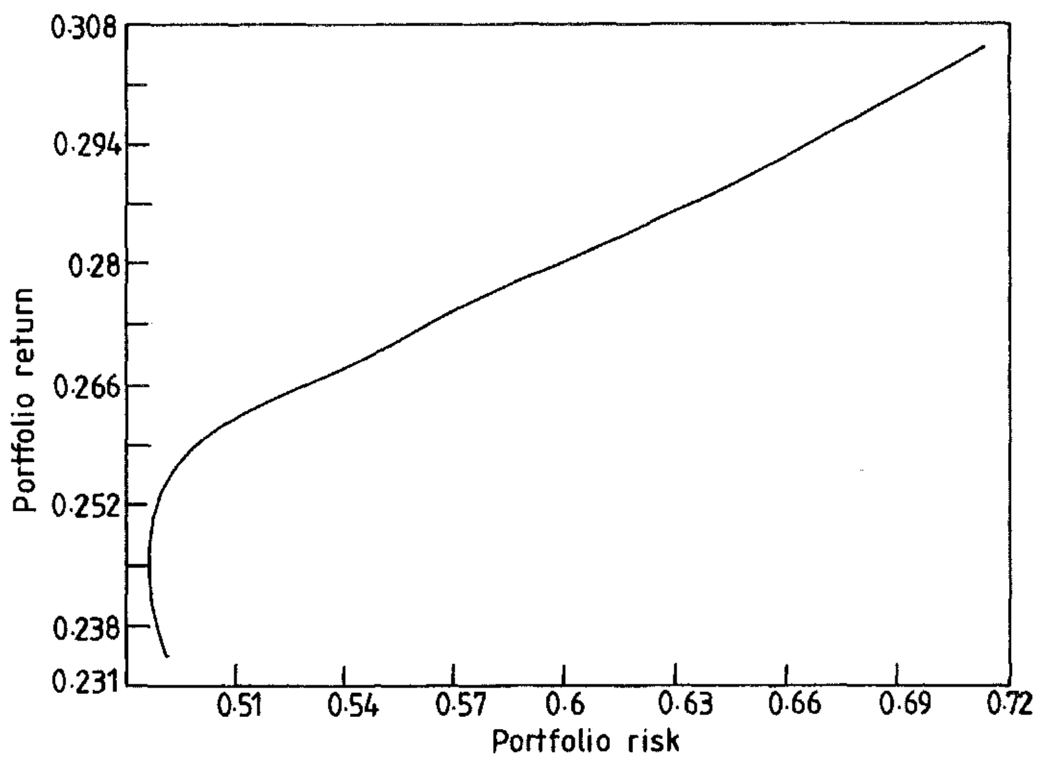
Whether agents hold "positions" is an empirical question that cannot be answered from the data. However, a survey of the market participants sheds some light on the issue. Evidence from an informal survey of dealers and views from market observers tell that traders rarely accumulate or short currencies based chiefly on expectations of future movements in those currencies. Therefore, readers must be circumspect in assessing the survey outcome, given that "demand characteristics" influence the reliability of survey responses. On the other hand, anecdotal evidence from periodicals that cover Nigerian financial markets (*Business Times*, for example) suggests that offers-for-sale of treasury securities during open market sessions are usually oversubscribed. The feeling is that some authorized foreign exchange dealers who are successful at purchasing currencies at the highly subsidized official rates promptly dispose of these assets in the parallel market. After that, the proceeds are invested in treasury securities, rather than used in speculative trading of currencies. Although we do not know whether there are many passive investors (those who "buy and hold" foreign exchange), we know (judging from a description of the market structure) that there are agents who "make a market" in currencies. What is also well known is that for most Nigerians the parallel market is the only de facto accessible foreign exchange market. Therefore, it is not surprising that many dealers trade to satisfy customers' orders for foreign currencies to finance international trade and other similar transactions.

There is also the possibility of "currency substitution" as part of the portfolio demand for currencies. Increased use of foreign currencies in many countries has led to a substantial literature on "currency substitution" and its implications for seignorage. Heavy usage of foreign currencies generally has occurred in countries with high and variable inflation rates and where the rate of currency depreciation has been high and variable as well. In such economies the opportunity costs of holding domestic currency are high, leading residents to use foreign currency for savings and even transactions. Various studies have documented the hypothesized positive association between exchange rate depreciation and the extent of "dollarization", as the phenomenon has been known, particularly in Latin America.[8]

The next issue is whether there is money to be made based on the apparent market inefficiency. To address this question, we calculated the risk-return trade-offs implicit in the market, with our estimates confined to the standardized profits (return/risk) generated along the portfolio-efficient frontier. Similar estimates were made in Bilson (1981), Bilson and Hsieh (1983), and Hodrick and Srivastava (1984). According to estimates from the portfolio frontier, the mean value of the standardized profit is 0.4789 with a standard error of 0.0349. Chi-squared test for normality is rejected for the standardized profits series. Consequently, we use Chebyshev's rule for placing the confidence interval. Using the three-standard-deviations criterion, a standardized profit of 0.50 from the market implies that with 88.90% confidence, we can infer that for every dollar speculators expect to make, they can expect anything from a loss of $2.50 to a gain of $3.50. This may be quite a swing, especially if the prospect is restated as anything from a loss of $250 to a gain of $350. On its own merit, the outcome is better than a fair bet, but compared with estimates of profits from developed markets, this profit potential implicit in the Nigerian market is far from enticing. Bilson (1981) reports a mean value of 0.929 for standardized profits. Bilson's value is approximately twice the return from our market, although Boothe and Longworth (1986) report that Bilson and Hsieh's (1983) simulations yield a mean value of 0.4342.

Considered in absolute terms without knowledge about the preferences of individuals, we are unable to assess whether the disutility from the prospect of losing $2.50 exceeds the utility associated with gaining $3.50. Thus we cannot rule categorically on whether

Figure 2: Portfolio-efficient frontier



the outcome is a favourable gamble to market participants. Thaler (1994) explored this important matter of human behaviour under uncertainty. Thaler's brief uses interesting insights from psychology: concepts such as *status quo bias* (a preference for the current state) and *endowment effects* (the fact that people often demand more to give up an object than they are willing to pay to acquire it). He considers both revealed traits to be anomalies of economic behaviour that nonetheless portray an asymmetry of value. Kahneman and Tversky (1984) call this asymmetry of value, loss aversion}. From our discussion, we may infer that some heavy burden lies on the prospect of profiting from those apparent inefficiencies uncovered in many studies of asset markets.

Table 2: Specification test results for Equations 2 and 3

Currency	ϕ_2	t_γ	p-value	κ
Dollar	6.07	-2.700	0.0075	4
Sterling	8.63	3.241	0.0014	4
Mark	6.66	-4.650	0.0000	7
Franc	7.09	-6.110	0.0000	4

Notes: The currencies are expressed in log units. The equations estimated are $\nabla^1 Y_t = \alpha + \beta t + \theta Y_{t-1} + \Sigma_{i=1}^{K} \gamma_i \nabla Y_{t-i} + \varepsilon_t$ unrestricted and $\nabla^1 Y_t = \sum_{i=1}^{K} \gamma_i \Delta Y_{t-i} + \varepsilon_t$, restricted. For each regression, the selected lag length ensures no autocorrelation in residuals. For each currency t_γ is reported for the most significant lag value. Where values of κ differ across (the restricted and the unrestricted) regressions, reported values are for the longer of the lag lengths.

Table 3: Descriptive statistics of the data 1990:1 1993:52

Currency	Mean	Min	Max	Std deviation	Skewedness	Excess kurtosis
dollar	20.2504	9.1000	48.5000	0.5118	0.4101	-1.0895
sterling	32.9897	15.0000	69.3000	0.4490	0.1757	-1.1609
mark	12.7308	5.2000	28.8000	0.5175	0.3108	-1.2261
franc	3.6054	1.3000	8.5000	0.5225	0.1674	-1.1991

Notes: The mean, minimum (min) and maximum (max) values are from the exchange rate series in their levels. The rest of the statistics relate to the transformed data (log levels). Sample size is 208.

Table 4: GMM estimates of the mean of the forecast errors, $\hat{\varepsilon}$

	$\hat{\varepsilon}$
Dollar	0.0525
Sterling	0.0552
Mark	0.0199
Franc	-0.0064

Table 5: GMM estimates: Matrix of correlation of residuals, $\hat{\Lambda}$

	Dollar	Sterling	Mark	Franc
Dollar	1.0000			
Sterling	0.7848	1.0000		
Mark	0.4877	0.5326	1.0000	
Franc	0.2175	0.2514	0.1919	1.0000

IV. Speculative dynamics

This section (which conceptually relies extensively on Shleifer and Summers, 1990) explores the issue of speculative dynamics – the presence of noise traders in the market, a recent and now popular alternative to the efficient markets approach. The noise-trader approach has been used in the asset market literature to account for the gradual swing of prices away from fundamentals. This is considered more plausible than the explosive divergence of prices from fundamentals implied by the literature on bubbles. The noise-trader approach is based on two assumptions. First, that some investors are not fully rational and that their demand for risky assets is affected by beliefs and sentiments not fully justified by fundamental news. Second, that arbitrage – defined as trading by fully rational investors not subject to such sentiment – is risky and therefore limited (Shleifer and Summers, 1990). Taken together, the two assumptions imply that changes in investor sentiment are not fully countered by abritrageurs and so affect asset returns.

To motivate the discussion, we review two normative issues relevant to the evaluation of noise trading. (1) Should something be done to prevent noise traders from self-destructing? Presumably investors who trade on noise fare worse than if their expectations were rational (De Long et al., 1989, 1990a). If so, why would rational traders not exploit the behaviour, and thus eliminate them?[9] Shleifer and Summers explain that optimal trading by rational agents will completely reverse the effects of irrational trades on prices only if the rational agents are well financed (wealth constraints not binding) and risk-neutral. (2) Do noise traders impose a cost on the rest of the market participants and, if so, how can the cost be reduced? It turns out that noise trading can also affect the welfare of the rest of the community. One such effect is to benefit abritrageurs who take advantage of noise traders. "These benefits accrue to those who bet against noise traders and to those who feed their demand by providing financial services much in the same way as societies institute state lotteries, build casinos and racetracks even though benevolent observers know that they [the gamblers] are being taken to the cleaners (Shleifer and Summers, 1990). Of course some of these benefits to abritrageurs are also social opportunity costs as valuable human and other resources are allocated to separating noise traders from their money. The author is aware of one case in which a highly skilled and successful produce grower and marketer who has been in business for over 30 years turned into a currency dealer by converting his produce outlet into a dealing room.[10] Many other examples abound. Adaptive response of the kind we have in mind has already been described as part of the institutional background of the parallel market.

Our formal analysis of speculative dynamics begins with the argument that the efficient-markets hypothesis obtains only as an extreme case of perfect risk-free arbitrage, which is unlikely to apply in practice. Also, that the foreign exchange market consists of two types of investors: abritrageurs and other investors. Abritrageurs, also called "smart money" and "rational speculators", are defined as investors who form fully rational expectations about asset returns. In contrast, the expectations and trading behaviours of other investors – also known as "noise traders" and "liquidity traders" – may be subject to systematic biases. Trading by abritrageurs drives prices toward fundamentals (at least, so the argument goes).

Unfortunately, however, two types of risk limit arbitrage. The first is fundamental risk – there is always a chance that the market will do very well (perform poorly). The second source of risk, which may or may not be related to the first comes from the unpredictability of future resale price (De Long et al.,1990a). As long as the abritrageurs are thinking of liquidating their position in the future (the abritrageur's horizon is finite), they must bear the risk that at that time, mispricing is more extreme. Fear of loss from either or both types of risk (inherent in uncertainties of the market) limits the size of the abritrageurs' initial position, and so keeps them from moving the price completely toward fundamentals. Furthermore, an abritrageur may not know the fundamental value of the asset (i.e., have the correct model linking information to returns) or in fact be able to detect price changes that reflect deviations from fundamentals. In such a case an abritrageur is then beleaguered by the difficulty of identifying the mispricing, and by the risk of betting against it.

There is growing evidence, mostly from stock market studies (Harris and Gurel, 1986; Shleifer, 1986; Ritter, 1988; French and Roll, 1986; Roll, 1988; Cutler et al., 1989) that news alone does not move asset prices; uninformed changes in demand move them too.[11] Changes in demand can also reflect investors' use of inflexible trading strategies such as obtain with some institutional traders that "go by their rule book". or of "popular models" described in Shiller (1990). [12] One such strategy is trend chasing.

> Proponents of this view argue that the key to investment success is not just predicting future fundamentals, but also predicting the movement of other active investors. We are reminded that market professionals spend considerable resources tracking price trends, trading volume, investor sentiment indexes, and many other gauges of demand for assets. Tracking these possible indicators of demand makes no sense if prices responded only to fundamental news and not to investor demand. They make perfect sense, in contrast, in a world where investor sentiment moves prices and so predicting changes in their sentiment pays. (Shleifer and Summers, 1990).

As persuasive as these arguments may sound, we cannot ipso facto conclude that the foreign exchange parallel market is affected by investor sentiment. In the following sections, therefore, we develop and test implications of this alternative view. Our test is based on the empirical implications of unpredictability or randomness of changes in investor sentiment.

Unpredictability of investor sentiment: testable implication

We construct a test based on the empirical observations that investor sentiment moves in part unpredictably. This un-predictability contributes to resale price risk since the resale price of an asset depends partially on sentiment. If investor sentiment affects a broad range of assets (say, foreign currencies) in the same way, this risk from its unpredictability becomes systematic. Systematic risk has a price in equilibrium. Consequently, assets subject to whims of investor sentiment should yield higher average returns than similar assets not subject to such whims. Put differently, assets subject to unpredictable swings in investor sentiment must be underpriced in the market relative to their fundamental values. Foreign currencies are probably subject to larger fluctuations of investor sentiment than the local currency, naira. Therefore, equilibrium returns on foreign currencies must be higher than warranted by their fundamentals.

In particular, we measure the expected rate of return based on market fundamentals and the required rate of return based on structural characteristics of the market such as whether or not speculators (liquidity traders) exist — the issue is in fact whether the activities of this class of speculators are significant. The intuition is that the presence of noise traders would cause asset prices to overreact and thus yield excess returns. On the other hand, equilibrium returns based on market fundamentals reward only systematic risks. A non trivial problem with this approach is to figure out what are the foreign currency fundamentals. A closely related problem is the absence of some consensus on hypotheses about the equilibrium exchange rate. Whereas several equilibrium return processes could be assumed and tested in respect of equity market, in the foreign exchange market, things are not so clear cut because of a lack of general agreement on the appropriate model of equilibrium pricing.

Consequently, testing whether abritrageurs set the actual spot price equal to its equilibrium rate is difficult unless there is some consensus on what the equilibrium value is and how it is determined. Given that there is no agreement on the fundamental nature of foreign exchange risk, no adequate measure of it and no model that determines the equilibrium fair return for bearing the risk, testing whether risk bearing is rewarded efficiently is problematic (Levich, 1985). On the other hand, the theoretical justification for analysing international asset-pricing problems by using methods from the theory of finance has been demonstrated by Kouri (1977), Fama and Farber (1979), Stulz (1981, 1982, 1984), Hodrick (1981), and Mark (1985), among others. Given these serious shortcomings, we proceed as follows, bearing in mind that inferences from our results must be circumspect.

Empirical methodology

Other explanations have been advanced to explain the existence (if any) of risk premium in the foreign exchange market. Mark (1985) fits a model in which the desire for intertemporal consumption smoothing causes a risk premium to emerge in the market for forward foreign exchange. Frooth and Thaler (1990) survey the status of current models on exchange risk premiums, and find them less than satisfactory. Our empirical methodology is developed to account for the possible existence of a risk premium (excess returns), which we attribute to investor sentiments. The sentiments are noticeable if liquidity traders are significantly present.

For our purpose, excess return on currency i at time t is defined as x_{it}. That is, it is the difference between E_tR_{it}, the expected return on currency i at time t (based on information available at time t), and r_{it}, the realized return on the currency within the same period. y_{it} is the logarithm of weekly exchange rates and

$r_{it} = (y_{it} - y_{it} - 1)$. Letting $E_tR_{it} = \widehat{\Delta y}_{it}$, we have

$$x_{it} = (\widehat{\Delta y}_{it} - r_{it}),$$

with Δ as the differencing operator.

Also, we postulate that if abritrageurs populate the market, they would conduct fundamental pricing according to a forecasting equation. Based on previous specification tests, we chose a simple nonstationary AR(1) process. We have:

$$\widehat{\Delta y}_{it} = \alpha_i + \beta y_{it-1} + \sum_{j=1}^{K} c_{ij} \nabla^1 y_{it-j} + v_{it} \quad i = 1,\dots,4 \tag{6}$$

It is clear from Equation 6 that the fitted value of the return, $\widehat{\Delta y}_{it}$, is our proxy for the expected return, which is then compared with the actual (or realized) return. Actual returns are based on the existing structure of the market, which may or may not include significant elements of speculative activities. The intuition is that the presence in the market of noise traders would cause asset prices to overreact and thus yield a risk premium. On the other hand, equilibrium returns that are based on market fundamentals reward only systematic risks.[13] The null hypothesis *no noise traders* may be parameterized as

$$H_0: x_{it} = 0$$

and tested with the Wald test of exclusionary restrictions. The proper statistic is

$$\omega_i \equiv (\bar{r}_i - \widehat{\Delta y}_i)^2 \, [var\,(r_i) + var\,(\widehat{\Delta y}_i) - 2cov\,(r_i, \widehat{\Delta y}_i)]^{-1}$$

where r_i $(i = 1,\dots,4)$ is the mean realized returns on currency I, and var $(\cdot)$ is the variance of the actual and the fitted returns, respectively. Under H_0, the statistic ω_i is asymptotically distributed $\chi^2_{(1)}$.

Data and empirical analysis

The primary data set consists of weekly observations on the dollar, pound sterling, Deutsche mark and French franc covering the period January 1990 to December 1993.[14] The estimates of the excess returns and the related test statistics are reported in Table 6.

We fail to reject the hypothesis that noise trader activities are not significant. The volatility cluster that is characteristic of the data set (from regression diagnostics, not reported) probably trace more to macroeconomic instability than from the microeconomic effects of market traders. It should be noted that the finding of zero risk premium obviates the need to determine whether indeed the excess returns are due to risk premium that arises from the activities of speculative traders or the desire for intertemporal consumption smoothing, or any of the other reasons advanced in the literature to explain the existence of risk premiums in the exchange market. Thus we are on less ambiguous grounds. In the light of the present empirical evidence and the lack of a consensus on what is the equilibrium value of a currency, the natural policy prescription is to ask that policy makers be hesitant about market interventions designed to correct distortions. This is especially important in the new autonomous foreign market given that it inherits many of the characteristics of the parallel (and free) market. This need to be hesitant on market interventions bears repeating because of the central bank's expressed predilection for occasional intervention in the foreign exchange markets.[15]

Table 6: Wald test for the presence of noise traders

Currency	χ	ω
Dollar	0.00026	0.000
Sterling	0.00013	0.000
Mark	0.00000	0.000
Franc	0.00000	0.000

Notes: Critical values for 1% (5%) level test are 6.63(3.84). χ is the excess return, and ω is the Wald-test statistic.

V. Summary and conclusions

Our study focused on two issues of market efficiency. First, we examined the possibility that there could be an unexploited profit opportunity in the foreign exchange parallel market. This opportunity for profit derives from findings (in earlier studies) that returns in the parallel market are predictable. Since profitable opportunities do not necessarily imply exploitable opportunities, however, we estimated the risk-return profile implicit in the parallel market. The intuition is that these apparent profitable opportunities could, on a risk-adjusted basis, turn out to be unattractive ventures.

We infer that an investor who forecasts future returns from past returns, and holds a "market portfolio", will earn relatively unattractive risk-adjusted returns. Note, however, that our comparison is with results from developed markets. Therefore, the comparison should be viewed as only providing perspectives on the"empirical range" of risk-return profiles.

Whether the standardized profit from the market is favourable to an investor depends on individual preferences to risk. On the ability, for example, to assess if the disutility from the prospect of losing \$250.00 exceeds the utility associated with gaining \$350.00. We are also mindful that there could be other (unexplored) feasible trading strategies that might yield higher risk-adjusted returns. Overall, it is not clear that agents who pursue profitable trading opportunities in the market are irrationally wasting their resources. Although the weight of evidence from markets worldwide seems to lean toward market inefficiency, it is equally not clear that agents could systematically exploit these apparent inefficiencies. We conclude that there is no indictment either way. Investors who pursue the apparent profitable opportunities, and those who do not, can find support for their position from available evidence.

The second part of this study tested for the significant presence of noise traders in the parallel market. The noise-trader approach to finance is a recent and now popular approach to investigating market efficiency, different from the traditional approach that imposes rationality on all market participants. We find no evidence of significant speculative activities that may be assumed to drive prices gradually away from fundamentals (destabilizing expectations). The finding of *no destabilizing expectations* is at variance with Ogiogio (1994). That study considers speculative activities to be the prime movers of the parallel market in Nigeria. However, the present result supports Ayogu (1995), which finds no evidence of price bubbles in the parallel market.

The lack of support for the presence of destabilizing expectation, the lack of evidence for price bubbles and the ambiguity over the ability to exploit the apparent market inefficiency lead us to offer the following suggestion. Policy makers are well advised not to be overly concerned about the allocative implications of apparent inefficiencies uncovered from market studies. The same suggestion applies to a policy debate that seeks market intervention to counter perceived exchange rate instability from trading activities. We do not find support that such instability is caused by traders. Therefore, if the characteristics of the new autonomous market are similar to the parallel market that it seeks to absorb, then an activist intervention policy, based mainly on market stability imperatives, should be resisted strongly.

In closing, we deem it necessary to cast a look to the future of the new foreign exchange market. In the new environment, forex bureaus face several challenges. First, decisions must be made quickly on merger prospects with parallel market operatives. Second, the surviving forex bureaus must confront the challenge of competing on an uneven playing field with banks. Third, all participants face the task of contending with the unknown effects of occasional central bank intervention in the currency market.

It seems inevitable that competitive pressures will lead forex bureaus cum parallel market operators to cut corners to stay profitable. Economic analysis predicts that a change in the economic environment will stimulate a search for innovations that are likely to be profitable. Economic theory of regulation teaches that just as financial institutions change in response to regulation, the regulatory authorities change their regulations in response to financial innovation. Both players (regulators and regulatees) thus "continuously adapt to each other much like riders on a seesaw".[16] Already the reconfiguration that occurred in the parallel market is an example of *structural arbitrage*.

Kane (1984) defines structural arbitrage as adaptive changes in a firm's organizational form designed to lighten its tax and regulatory burdens. Because innovation lags are usually shorter than regulatory lags, businesses often discover and mine loopholes long before the regulators catch on. The challenge to regulators is to anticipate the likely adaptive behaviour that will inevitably arise in the new economic environment. Future research could focus on such strategic behaviour.

Notes

1. Also, see De Long Shleifer, Summers, and Waldmann (1989, 1990b)

2. Odubogun (1995) documents these regime shifts.

3. The Central Bank of Nigeria reports that excess demand for currencies by banks amounted to US$36.9 billion for 1994; at the same time, the value of imports was ₦165.629 and ₦161.027 billion, respectively. As of November 1994, the parallel market premium was 400%, 11 months after the market became proscribed ("less tolerated"). The parallel market was legitimized ("more tolerated") in 1989 with the introduction of *bureaux de change*, which were established to accord legal recognition to small dealers in foreign exchange. The idea was that by allowing a free hand to small dealers, demand pressure on the official market might be attenuated. Furthermore, it was believed that this would increase the size of the formal foreign exchange market (by admitting the informal sector) and thus enhance macroeconomic management. These institutions were permitted to deal in currencies and to purchase travellers cheques but could obtain foreign currency only from private sources excluding resident banks and the central bank.

4. $F = (T - p)\ (RSSR - RSSU)/q(RSSU)$. RSS is the sum of squared residuals, T is the number of observations (sample size), p is the number of estimated parameters in the unrestricted regression and q is the number of parameter restrictions.

5. Estimates of the forecast errors and correlation coefficients of the residuals are input variables in the solution algorithm to the problem summarized in Equation 5.

6. A risky asset is one whose return shows a positive variance. A diversified portfolio is one that contains more than one asset. The minimum-variance portfolio is the mix of an (efficient) portfolio that has the least possible variance.

7. The regularity conditions placed on an investor's indifference curve by the mean-variance theory is that the utility function shows risk aversion and that utility is increasing in expected return. For such individuals, indifference curves in the

expected return/risk space must have a positive slope. The mean-variance theory assumes that the investor cares only about the first two moments of the portfolio, and not about its covariation with other asset returns or the investor's consumption stream.

8. Kamin and Ericsson (1993), Savastano (1992), Rojas-Suarez (1992), Rojas (1992), Melvin (1988), and Ortiz (1983) to name a few.

9. Also, see Friedman (1953).

10. I never found out whether he was reacting to money that could be made in the market through fundamental trading, or to the perceived opportunity to exploit what he considers to be an abundance in the market of "dumb money".

11. Uniformed demand may be defined as changes in demand that do not plausibly reflect any new fundamental information.

12. Such by the-book trading may be viewed as a variety of programmed trading.

13. Frankel (1982) notes that the capital asset pricing model (CAPM) requires an asset's risk premium to be systematically related to that asset's value share in investors' portfolio. His tests reject that prediction in the foreign exchange markets.

14. Descriptive statistics were furnished in Table 3.

15. NDIC Quarterly 5 (1), 1995: 6-8.

16. Kane (1981) calls this phenomenon regulatory dialectic.

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