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THE FOREIGN EXCHANGE MARKET AND THE DUTCH AUCTION SYSTEM IN GHANA

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AFRICAN ECONOMIC RESEARCH CONSORTIUM

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Abstract

The foreign exchange market in Ghana prior to the economic reform process was characterised by three major features, namely, an excessively overvalued official exchange rate; a thriving black foreign exchange market; and an allocation of official foreign exchange based on import licensing arrangement issued by an Import Programming and Monitoring Committee. In order to rationalize the official exchange rate, absorb the parallel sub-market into the legal market, allow the forces of demand and supply to determine the rate and allocation of foreign exchange, and to achieve a convergence of the official and parallel rates, the Government adopted a series of exchange reform measures. Initially, the cedi was devalued in stages, followed by the use of purchasing power parity rule in determining exchange rate on quarterly basis for about three years. Later a weekly auction based on the Dutch auction system was introduced with two windows and later merged into one window. The import licensing arrangement was abolished. The Dutch auction system was utilized for about 6 years (on retail basis for 4 years and wholesale for 2 years). Also, foreign exchange *bureaux* were established to legalize the parallel market operations. Despite the foreign exchange support from several multilateral and bilateral agencies, as well as the extensive institutional reform, and a stable macroeconomic environment, the convergence of the auction and the bureaux rates took over 5 years to achieve.

I Introduction and theoretical frame

Introduction

The centrepiece of the economic reform programme (ERP) in Ghana is the realignment of the foreign exchange market and trade liberalization. This study of reform in the foreign exchange market in Ghana is in five parts: first, we highlight exchange rate policy before the adoption of the ERP in 1983, and we follow this with an exposition of the multiple exchange rate system from April 1983 to January 1986. Third, we discuss the dual exchange regime in a retail auction market based on the Dutch auction system (DAS) and then describe the DAS arrangement prior to the establishment of foreign exchange bureaux in April 1988. Fourth, the merger of the official auction and bureau markets is discussed. Finally, we address the wholesale and interbank system in Ghana.

Apart from two devaluations and one revaluation, the exchange rate was rigidly fixed between 1967 and 1983. Consequently, the cedi was excessively overvalued, as indicated by a divergence of over 4,264 per cent at the end of 1982 from less than 8 per cent in 1967. In order to align the highly overvalued cedi, relieve the shortage of foreign exchange and reduce the size of the parallel exchange market, the government devalued the cedi in phases from C2.75: $1.00 in April 1983 to C90.00: $1.00 by the third quarter of 1986.

These devaluations proceeded side-by-side with the liberalization of the trade sector and adoption of prudent monetary and fiscal policies. The overall impact of the series of devaluations was the narrowing of the divergence to 102 per cent at the end of September 1986.

Between October 1983 and 16 September 1986, all foreign exchange transactions operated under only one window, Window 1. On 16 September 1986, Window 2 was introduced marking the beginning of an independent floating mechanism considered the best way of depoliticizing the issue of exchange rate adjustment. The Window 1 exchange rate was fixed at C90.00: $1.00, while the Window 2 rate was determined in the new weekly auction system conducted by the Bank of Ghana (BOG). The transactions through Window 1 covered imports of petroleum products and essential drugs, while Window 2 covered other transactions. The surrender of exchange earnings to

the BOG also corresponded to the duality of the exchange rates; earnings from exports of cocoa and residual oil products were surrendered at Window 1 and other transactions through Window 2. On 20 February 1987 Window 1 was abolished.

The retail nature of the auction system is underlined by the fact that authorized dealer banks played only an intermediary role and that auctioning of foreign exchange was to final users only. In the event, the official or marginal rate was depreciated from C128.00: $1.00 at the first auction on 19 September 1986 to C152.00: $1.00 at the fourteenth auction on 19 December 1986. The premium of the parallel exchange rate over the marginal rate declined from 41 per cent on the first auction to 20 per cent on the fourteenth auction (at the end of December 1986).

The first auction was based on the marginal pricing auction system (MPAS) in the determination of the exchange rate, in which case all the successful bidders paid the marginal price. But as from the second auction, DAS was adopted. Under DAS, all successful bidders paid the bid price and those whose bid prices were equal to the market-clearing (marginal) rate received a pro-rated amount of the remaining foreign exchange. The marginal rate declared on the auction day (until a new rate was announced) applied to all extra-auction transactions, such as all foreign exchange bought by BOG, allocated to the central Government and other public entities outside the auction, and sold to commercial banks to replenish their working balances.

Following the abolition of Window 1, several categories of imports formerly excluded from bidding on the auction became eligible. A reclassification of the import licences was effected from 1987, while existing restrictions on the demand side of foreign exchange were removed. Eventually, on 14 January 1989, the import licensing system was abolished. During the same period, the retention scheme was also modified to increase the supply of foreign exchange to the auction and to reduce foreign exchange being held in retention accounts. The auction system had four main objectives, and various modifications were implemented between 1987 and 1989. They were intended to achieve an increased supply in foreign exchange to match increased demand, a reduction in the weekly variation of the exchange rate, a decrease in the spread between the highest and lowest bid rates, and a narrowing of the divergence between the auction and the parallel/bureau rates.

The auction market in Ghana has performed erratically given the supportive institutional arrangements and foreign exchange assistance from which it has benefitted. It has also taken longer than anticipated for the realization of the objectives (taking more than 210 auctions spanning 3.25 years of auctioning and seven years of exchange rate and trade stabilization). Despite all this, however, there were many positive developments. For example, the premium

of the parallel rate over the official exchange rate fell from 24.5 per cent in 1986 to 3.32 per cent in 1990.

The key practical objectives in the move to liberalize and stabilize the exchange rate and trade regime of Ghana were finally accomplished by the legalization of the parallel market on 1 February 1988, with the first bureau becoming operative on 8 April 1988. Nevertheless, despite the modifications in, and institutional rearrangements for, the implementation of foreign exchange auctions, divergence between the marginal and parallel rates widened from 24.45 per cent in 1986 to 32.12 per cent in 1987 as a parallel foreign exchange market continued to thrive.

The co-existence of a parallel market, especially with a substantial divergence between parallel and official rates, is indicative of a basic disequilibrium in the foreign exchange market and trade regime. The key objectives behind the institutionalization of the bureaux are to eliminate the parallel market, capture the main market forces directly behind the determination of the cedi-dollar rate, and to absorb the bureau/parallel market into a single foreign exchange market. Despite the wide gap between the auction and the bureau exchange rates, the latter was closer to the parallel rate. The surveys conducted in this study reveal that the gap, which was C10.00 in 1988 after the legalization of the bureaux, narrowed to C2.00 in 1990, indicating a virtual absorption of the parallel sub-market (or "cow-lane" as it is popularly known in Accra) by the bureau market.

By the end of December 1989, the divergence at the 160th auction week was 12.6 per cent. The continued existence of the spread/premium in the bureau market led to the introduction of the wholesale auction arrangement which replaced the retail system with effect from 23 March 1990. The exchange rates quoted in the bureau market exhibited erratic behaviour initially and later became fairly stable, while the spread between the buying and selling rates narrowed. The spread, which averaged C31.26 per week at the end of December 1989, narrowed to C16.50 at the end of April 1990.

From 17 April 1990 the authorized dealer banks and the eligible foreign exchange bureaux were allowed to purchase foreign exchange from BOG for sale to their end-user customers and to meet their own foreign exchange needs; hence, the wholesale nature of the new auction. The authorized dealer banks and eligible bureaux are now allowed to determine freely the structure of their own bids at the wholesale auction and can sell foreign exchange to their customers with a margin that is determined by each authorized dealer. The wholesale auction continued to be based on DAS.

Under the interbank market, authorized dealers (banks and bureaux) may trade in foreign exchange amongst themselves or with their end-user customers; BOG may also participate as a buyer or seller. In order to increase

the supply of foreign exchange, the new surrender requirements make it incumbent on exporters to lodge all proceeds from exports of non-traditional products in a commercial bank in Ghana upon receipt. Other export earnings, apart from electricity, are to be surrendered to BOG. On the demand side, the remaining restrictions on payment for current international transactions involving invisible payments were lifted; this marked significant progress toward the attainment of convertibility of the cedi.

The major impacts of the wholesale auction and the interbank arrangements relate to the narrowing of excess demand in the auction market, reduction in the difference between the highest and lowest bid rates in the auction market, and the convergence of the marginal auction and the bureau exchange rates. The weekly mean excess demand in the auction market which, in absolute terms, was $0.349 million for the second quarter of 1990, fell to a weekly mean of $0.166 million in the last quarter of 1990. A worrying development, however, was the widening of the excess demand gap in the first quarter of 1991 to a weekly mean average of $0.191 million.

The difference between the highest bid rates in the auction market also fell from a weekly mean of C3.63 in the second quarter to C2.20 in the last quarter of 1990, and continued to be fairly low (C2.60) in the first quarter of 1991. The degree of divergence, which was 7.6 per cent at the end of April 1990, was completely eliminated in the last quarter of 1990. The most disturbing fact, however, is that the convergence attained in the auction and bureau markets since 9 November 1990 had started to widen again in the first quarter of 1991. There is, therefore, a need to critically review DAS and improve upon it in order to reduce gyrations in exchange rates and to speed up moves towards achieving and sustaining the unification of the auction and the bureau rates.

In order to put the nature of the foreign exchange auction in proper perspective, it is imperative to examine the exchange policies that existed prior to the introduction of the auction system. A summary of developments in the exchange and trade regimes is provided in Table 1. Table 2 and Figures 1 and 2 cover the paths of, and the divergence between, the official and parallel rate for the period 1956-90.

Table 1 Summary of exchange rate and trade regimes (1966-91)

1966	Kwame Nkrumah (Convention People's Party (CPP)) overthrown. National Liberation Council (NLC) established; A. Afrifa became Chairman.
1967	Cedi devaluation from C0.71: $1.00 to C1.02: $1.00.
1969	Election of K Busia (Progress Party (PP)).
1971	Cedi devaluation from C1.02: $1.00 to C1.82: $1.00 (December)
1972	Busia (PP) overthrown. National Redemption Council (NRC) established; I K Acheampong as Chairman (January). Cedi revaluation from C1.82: $1.00 to C1.28: $1.00. Import and exchange controls strengthened (February).
1975	NRC replaced by Supreme Military Council (SMC); Acheampong as Chairman. Prices and exchange controls rigidly enforced; kalabule developed; and brain drain aggravated.
1977	Consumer price index (CPI) inflation reached an all-time high of 116.5 per cent annual average.
1978	SMC Chairman replaced; Akuffo as Chairman (July). Cedi devaluation from C1.28: $1.00 to C2.75: $1.00 (August). General economic and political unrest; and queues for essential commodities (essenco) grew longer (June 1978 May 1979).
1979	J.J. Rawlings attempted coup and detention (May). Overthrow of SMP by Armed Forces Revolutionary Council (AFRC) (June); Rawlings as Chairman. Fight against kalabule and bribery/corruption; Acheampong, Akuffo and Afrifa executed, Makola market destroyed (June September). Election of H Limann (September).
1981	Limann overthrown. Provisional National Defence Council (PNDC) established; Rawlings as Chairman (31 December). Price and exchange controls reinforced.
1982/3	Bush fires, drought and crop failures. Murder of three judges. Alliance compliance order against Ghanaians in Nigeria. Stiffer price and exchange control measures adopted. Divergence between official and parallel exchange rates reached an all-time high of 4,264 per cent for the period 1966 91.
1983	Economic recovery programme launched (April). Cedi devaluation from C2.75: $1.00 to C30.00: $1.00 (October). CPI inflation reached 122.8 per cent annual average, the highest between 1966 and 1991.
1983/4	Purchasing power parity (PPP) of exchange rate determination on quarterly basis adopted. Trade controls eased.
1986	PPP framework discontinued. Dual retail auction based on Dutch auction system introduced. Window 2 with C128.00: $1.00 exchange rate (September) operated side by side with Window 1 with C90.00: $1.00 exchange rate. New import licensing arrangement introduced (October): "A", "S", "G" licences. (First auction was based on marginal pricing auction scheme but shifted to the Dutch auction system as from second auction.)
1987	Windows 1 and 2 unified at exchange rate C156.00: $100 (February) (Auction 21).
1988	Foreign exchange bureaux established. First bureau (Ladans) became operative (April). Bureaux not allowed to bid in the retail auction.

Table 1 cont ...

1989	Import licensing system and Import Programming and Monitoring Committee abolished following removal of all foreign exchange restrictions on the demand side (January).
1990	Wholesale and interbank auction became operative (March). Bureaux allowed to purchase foreign exchange from the Bank of Ghana through authorized financial institutions. Eleven financial institutions participated in the wholesale market. Unification/convergence of marginal and buying bureau rates (September).
1991	Divergence between marginal rate and the buying bureau rates began to widen (as from January).

Table 2 Divergence between official and parallel rates, 1956-90*

Year	Official exchange rate (MR)	Parallel/ bureau rate (BR)	Degree of divergence B/n BR and MR(%)
1956	0.71	0.56	-21.57
1957	0.71	0.56	-21.57
1958	0.71	0.56	-21.57
1959	0.71	0.56	-21.57
1960	0.71	0.56	-21.57
1961	0.71	0.56	-21.57
1962	0.71	0.56	-21.57
1963	0.71	0.56	-21.57
1964	0.71	0.56	-21.57
1965	0.71	0.80	12.04
1966	0.71	0.90	26.05
1967	1.02	1.10	7.84
1968	1.02	1.10	7.84
1969	1.02	1.40	37.25
1970	1.02	1.15	12.75
1971	1.82	1.20	-33.99
1972	1.28	1.35	5.47
1973	1.15	1.40	21.74
1974	1.15	1.54	33.91
1975	1.15	1.92	66.96
1976	1.15	4.35	278.26
1977	1.15	7.69	568.70
1978	2.75	10.00	263.64
1979	2.75	14.29	419.64
1980	2.75	11.11	304.00
1981	2.75	50.00	1,718.18
1982	2.75	120.00	4,263.64
1983	30.00	97.00	223.33
1984	50.00	120.00	140.00
1985	59.99	170.00	183.38
1986	90.01	181.70	101.87
1987	166.50	219.99	32.13
1988	212.10	263.63	24.30
1989	277.34	335.92	21.12
1990	331.15	342.14	3.32

Source: Bank of Ghana / Ghana Statistical Service. International Financial Statistics of IMF; Pick's World Currency Year Books.

* Between 1956 and 1967 the Ghanaian currency changed from the Ghana pound to an 84-pesewa cedi in 1965 and to the new cedi (= 1.2,of the old cedi), hence some distortions are expected, particularly in the documentation of the parallel rates for this period.

Figure 1 Foreign exchange rate C:$: official and parallel bureau rates

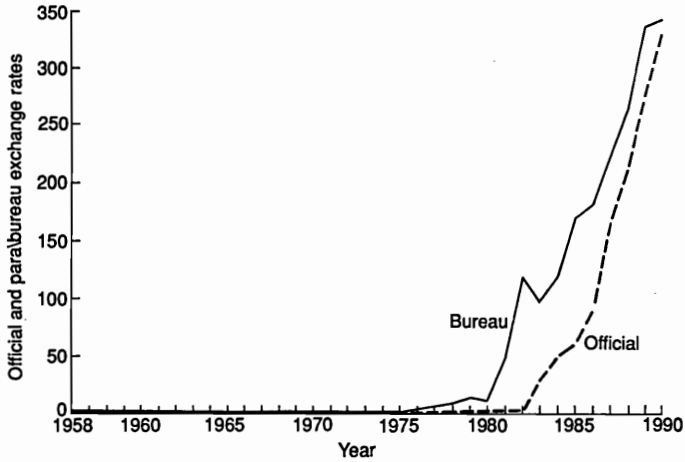
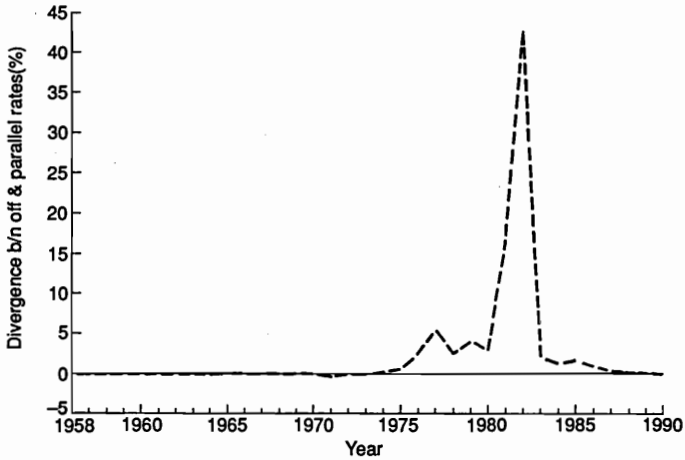


Figure 2 Foreign exchange rate: divergence between official and parallel rates



By way of summary it is crucial to note that the cornerstone of reform in the economic management system in Ghana since 1983 has been the realignment of the foreign exchange market and trade liberalization. Initially, with the launching of the economic reform programme (ERP), a series of large devaluations of the cedi were implemented between 1983 and 1986. During the same period, fiscal and monetary policies were put on an even keel. This series of devaluations was followed by allowing the cedi-dollar exchange rate to be determined by the forces of demand and supply in a weekly auction system. In order to absorb the parallel market into the legal foreign exchange market, foreign exchange bureaux were legalized, followed by merger of the exchange rates in the auction and bureau markets. The Dutch auction system (DAS) was adopted in the weekly auctioning of foreign exchange in the context of a retail arrangement and later in an interbank-cum-wholesale scheme.

The main objective of this paper is to present an account of the nature and working of the foreign exchange market and the Dutch auction arrangement in Ghana from the inception of the ERP in 1983 up to the first quarter of 1991. Before examining and analyzing the foreign exchange market in Ghana, it is necessary to outline a general theoretical framework within which Ghana is considered a special case. We then discuss the exchange rate policy that was in existence before the adoption of ERP in 1983, and follow this with an exposition, in Section II, of the multiple exchange rate system from April 1983 to January 1986. Section III describes the operation of the dual exchange regime in a retail auction market based on DAS, and then discusses the DAS arrangement prior to the establishment of foreign exchange bureaux in April 1988 and Section IV deals with their merger with the auction market. In Section V, we highlight the wholesale and interbank auction systems in Ghana. The paper ends with a brief evaluation and a research agenda.

Theoretical framework

The price of a domestic currency in terms of foreign currency is the exchange rate. This price can be rigidly fixed or, alternatively, allowed to be market-determined. In the latter case, the exchange rate is determined by its demand and supply *vis à vis* the foreign currency.

Demand for foreign currency (say the dollar) takes place when normal residents in a country buy non-domestic goods, services and assets, or lend to non-residents. Thus the demanders of foreign money are essentially the importers in another country. On the other hand, the supply of foreign exchange takes place when the non-residents buy the country's goods, services

and assets and then use foreign currency to effect payment. The main sources of supply, therefore, are the country's exports, short-term and long-term capital flows (influenced mainly by the interest rate prevailing in, and expected future prospects of, the country), as well as foreigners' holdings of local currency.[1]

In this perspective, therefore, the demander of foreign exchange is a supplier of local currency, while a demander of local currency is simultaneously a supplier of foreign exchange to the foreign exchange market. The local and foreign currencies trade for each other at an exchange rate in the framework of different foreign exchange arrangements.

The two well-known auction systems for the determination of the exchange rate are the DAS and the marginal pricing auction system (MPAS); there is a third method known as the reserve pricing approach (RPA).[2] In the DAS, each successful bidder pays his bid price for the foreign exchange until the market clears. The market-clearing price is the marginal exchange rate.

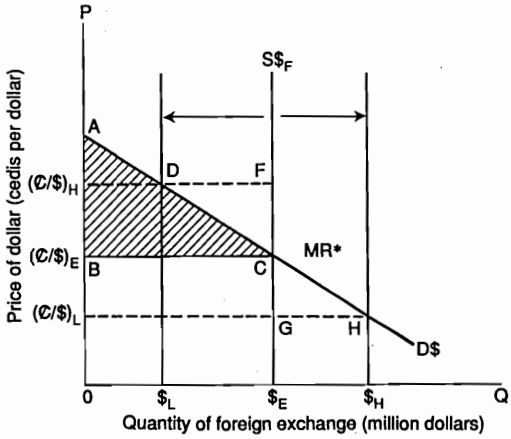
As can be seen in Figure 3, the supply of dollars to the DAS is assumed to be fixed at $S\$_F$, which has to be cleared in one auction. This is not an unrealistic assumption in the context of Ghana. The demand curve, on the other hand, is negative, reflecting the negative relationship between the quantity of foreign currency demanded and the price to be offered for it. The demand curve is labelled D$.

The curves depicting demand for and supply of the foreign exchange intersect at MR^* or $(C/S)_E$, as shown in the diagram. The DAS arrangements enable the authorities to appropriate all the consumer's surplus (which is the area *ABC* below the demand curve). In cases where the total demand at the marginal rate exceeds the supply, the bidders (whose bid prices are equal to the marginal rate) receive a pro-rated amount of the remaining foreign exchange.

At a more depreciated rate, such as $(C/\$)_H$, there is an excess supply (positive excess demand) of foreign exchange by *DF*. Conversely, at a more appreciated exchange rate, such as $(C/\$)_L$, we have (negative) excess demand captured by *GH*. In practice, those whose bid prices are more appreciated than the market clearing exchange rate do not receive any foreign exchange; but those whose bid rates are more depreciated receive all their requests at their bid price.

It is possible for the supply curve to shift in response to changes in the flow of foreign exchange, terms of trade, increase in volume of exports, etc., leading to changes in the equilibrium nominal exchange rates, given the demand curve. In Figure 1 an inward shift or a contraction of foreign exchange supply to $\$_L$ will cause the cedi to depreciate to $(C/\$)_H$ with the market clearing at *D*; alternatively, an outward shift or an increase in supply will induce an appreciation of the cedi to $(C/\$)_L$, with the market clearing at *H*.

Figure 3 Demand and supply of foreign exchange in the Dutch auction system showing market clearing rate (MR)



$(₵/\$)_H$ = higher exchange rate in cedis per dollar, more depreciated than the MR;
$(₵/\$)_E$ = marginal rate = MR*, market-clearing exchange rate;
$(₵/\$)_L$ = lower exchange rate in cedis per dollar, more appreciated than the MR;
ABC = consumer surplus appropriated by monetary authorities.

It is important to note, however, that the auctioneer, in view of the model in the diagram, captures all the surplus in the auction market. But the existence of a positive divergence between the highest auction rates and the (highest) selling bureau rates confers a "surplus" of a kind on the buyers of foreign exchange on the auction market over and above those who purchase foreign exchange on the bureau market. The "surplus" is what we shall designate a "premium" captured by the degree of divergence between the official and the bureau rates.

In the analysis of the relationship between the auction rate and the parallel/bureau rate, the focus is the premium. According to Pinto (1990) the black market foreign exchange premium is a tax on exports, creating a conflict between the partial financing of government spending and the recipients of foreign exchange at the official exchange rate on the one hand, and the allocative goal of stimulating exports on the other. The unification or convergence of the exchange rates in the auction and parallel or bureau

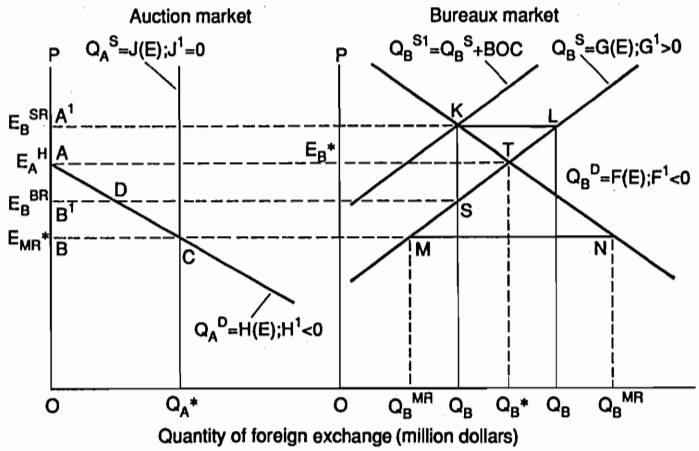
markets, therefore, becomes the major objective of any auction design in order, firstly, to increase exports and eliminate allocative inefficiency and inequity through import licence rents and, secondly, to absorb the black market into the official mainstream through economic incentives rather than unenforceable legislation, thereby raising the credibility of economic policy. The legalization of parallel markets by the establishment of *bureaux de change* as part of trade liberalization is to close the gap between the auction and the parallel rates. The continued existence of the gap is indicative of a basic disequilibrium in the exchange market and, therefore, has the tendency to (i) cause the auction rate to rise, (ii) induce a seepage of exchange from the auction to the bureau/parallel sub-market, (iii) reduce incentive to produce for export, (iv) encourage smuggling or contraband activities, or (v) propel capital flight.

The process of liberalization of the exchange and trade controls, the nature of the auction design, and the soundness of financial/monetary and fiscal policies jointly determine the stability of exchange rates and the pace and speed of unification of the official and black market or parallel exchange rates. Initially, foreign exchange reform will increase uncertainty; this will, in turn, widen the gap between parallel and official rates, with the latter exhibiting extreme gyrations. But it is expected that, as economic agents gain more confidence in the adjustment process, the number of participants in the official auction market will increase, and exchange rate fluctuations will reduce as the divergence narrows, until finally unification is attained.

It is in the light of the above reasoning that Grilli and Kaminsky (1991) postulate that the uncertainty effects should dominate in the short-run, while the increase in the number of traders should make the market thicker and tend to reduce volatility in the longer run. Besides, the gap between the highest and the lowest auction bid rates will be narrowed, while the degree of divergence between the market-clearing rate and the parallel/bureau market exchange rate will be eliminated in the long-run.

This principle is illustrated in Figure 4. The unification of the auction and bureaux markets requires the equality of the market clearing exchange rate E^*_{MR} and equilibrium market exchange rate E^*_B in the auction and bureau markets respectively. But in practice it is very difficult to measure E^*_B. Hence, convergence can be seen instead in terms of equality of the highest auction rate E^H_A and bureaux selling rate E^{SR}_B. Thus the gap in AA^1 in Figure 4 captures the premium enjoyed by buyers of foreign exchange in the auction market over the bureaux.

Figure 4 Relationships between auction and bureau market rates



E_B^{SR} = Bureau selling rate
E_A^H = Auction highest bid rate
E_B^{BR} = Bureau buying rate
E_{MR}^* = Auction marginal rate
E_B^* = Bureau equilibrium rate
BOC = Bureau operating costs
Q_A^* = Auction equilibrium quantity of foreign exchange
Q_B^* = Bureau equilibrium quantity of foreign exchange
Q_A^S = Supply of foreign exchange to the auction market
Q_A^D = Demand for foreign exchange on the auction market
Q_B^S = Supply/purchases of foreign exchange (bureau market)
Q_B^D = Demand/sales of foreign exchange (bureau market)
Q_A = Quantity of foreign exchange in the auction market
Q_B = Quantity of foreign exchange in the bureau market
P = E = exchange rate = price of dollars in cedis per dollar (C:$)

It is, however, important to note that the divergence between the buying and selling rates (even though relevant in exchange risk analysis) is not a central issue here. A more crucial point is that the wedge between these two rates amounts to the bureau operating costs (BOC) (assuming competition). This is depicted by the supply curve $Q_B^{S1} = Q_B^S$. The BOC are going to be present even if there is some leakage from the auction market to the bureaux. Hence the relevant prices for measuring the divergence are E_B^{BR} and E_{MR}^*.

A significant issue, however, is that the auction and bureau markets are, at least partially, segmented in the sense that those required to be seen eligible to buy from the auction market are not the same transactors eligible for the bureau market. Some will switch between the two and these transactors will

have their positions in both markets. Also, there is no necessary relationship between E_A^H and E_B^*

For the above reasons, and from the sellers' point of view, it is when the marginal rate in the auction equals the bureau buying rate E_B^{BR} that we have unification of the two markets. From this perspective the gap BB^1 shows the degree of divergence between the bureaux over the auction market exchange rates. A smaller gap reflects a smaller premium or a higher degree of convergence between the official and the bureaux rates.

We define convergence as the equality of the two rates in principle. In practice, however, after allowing for capital controls, the cost of commission, paper work or form filling, and waiting, as well as uncertainty in the auction market *vis a vis* the instant/cash nature of, and the premium lost by buyers of foreign exchange from the bureau market, convergence used in this study is defined in line with Dordunoo (1993) as:

> "... a divergence of 6 per cent (or less) of auction rate from bureau exchange rate, and a fairly stable/predictable exchange rate. Thus, a divergence averaging between zero and 6 percent is acceptable as a condition for unification or an epsilon equilibrium (if it is greater than zero but less than or equal to 6 per cent) of the auction and the bureau exchange rate."

It is important to note that this definition is not inconsistent with the concept used in Aron and Elbadawi (1994), which states that:

> "The term unification in the Sub-Saharan African (SSA) context refers to eradication of the parallel market. However, since these countries are likely to maintain capital controls in the medium term, there would remain a small role for the parallel market in meeting portfolio demand. Our concept of unification in SSA is thus a substantial reduction of the parallel market so that it is no longer a major signal in the economy".

Figure 3 shows that, at a highly appreciated exchange rate below the marginal rate, there will be excess demand in the auction market. Similarly, in Figure 4 we observe excess demand in the bureau market at rates below the equilibrium rate. It is also clear that the lower the marginal rate (E_{MR}^*), the greater the excess demand in the bureau market at the marginal rate. As the marginal rate rises (i.e. as the cedi depreciates), the excess demand in the bureau market will narrow. It is, therefore, expected that excess demand in the bureau market will cause an increase in the exchange rate in that market; this will then exert further pressure on the selling bureau rate to rise. This, in turn,

should lead to a higher marginal rate in the auction market unless (i) the auction is not well enough designed to capture market forces, and/or (ii) the marginal rate is a managed float (or the auctioneer supplies more foreign exchange in subsequent auctions). These issues will be investigated in this study.

II Exchange policies prior to the auction regime

Exchange rate policy before 1983

During the initial phase of Ghana's ERP, a series of massive and discrete devaluations of the cedi had been implemented in order to realign the highly overvalued local currency and to reduce the acute shortage of foreign exchange, as well as the size of the parallel foreign exchange market.

Following the devaluation in 1967 (after the overthrow of the first president in 1966) from C0.71: $1.00 to C1.02: $1.00, the exchange rate was rigidly fixed at C1.02: $1.00. It was again devalued in 1971 (which partially led to the overthrow of the government of the second republic) to C1.82: $1.00 in 1972; thereafter, the exchange rate was pegged at C1.15: $1.00 for six years until another devaluation to C2.75: $1.00 in 1978. This rate lasted for five years up to 1982. The rate of inflation in Ghana, however, far exceeded the average inflation rates of its trading partners. Consequently, the real exchange rate appreciated by more than 500 per cent between 1970 and 1982.[3]

The yawning gap between the demand for and supply of foreign exchange in the official market resulted in a substantial differential between the official and the parallel market exchange rates. In 1967, the degree of divergence (reflecting a percentage premium) between the two rates was about 8 per cent, but it increased steadily to 4,264 per cent at the end of 1982. As a result, the informal black market dominated in the mobilization and allocation of foreign exchange. The existence of a substantial black market and the premium of the parallel market rate over the official exchange rate indicate the disequilibrium between the demand for and the supply of foreign money at the exchange rate. Some of the demand pressures emanated from capital flight[4] (which reflected the lack of confidence and of legal investment opportunities). The shortfall in supply of foreign currency resulted from four policy actions in the early 1980s which reduced confidence in the Ghanaian banking system, namely, (i) C50.00 notes were demonetized, (ii) bank deposits greater than C50,000.00 were frozen pending investigation for tax liability or fraud, (iii) bank loans to

finance trading inventories were recalled, and (iv) a requirement was imposed that business transactions exceeding C1,000.00 be conducted by cheque.

Table 3 Annual exchange rate and degree of divergence between official and parallel exchange rates (C:$)

	1965	1970	1975	1980	1981
Official	0.71	1.02	1.15	2.75	2.75
Parallel	0.80	1.15	1.92	11.11	50.00
Divergence (%)	12.00	12.70	67.00	304.00	1,718.20
	1982	**1983**	**1984**	**1985**	**1986***
Official	2.75	30.00	50.00	59.99	90.01
Parallel	120.00	97.00	120.00	170.00	181.70
Divergence (%)	4,264.00	223.30	140.00	183.40	101.90

Sources:
(a) International Financial Statistics (various issues of the Year Book).
(b) Pick's/World Currency Year Book, Pick, F (various issues).
* The exchange rates and the degree of divergence before September 1986.

Additionally, bank borrowing (or deposit) rates were ridiculously low while lending rates were exorbitantly high, reflecting a high interest rate risk in the money market. Thus while effective deposit rate averaged less than 8 per cent, the effective lending rate averaged more than 22 per cent per annum with a pread of about 14 per cent. Consequently, a drastic financial disintermediation occurred in the form of large cash holdings (despite the high risk). The degree of financial intermediation (measured by M2-GDP ratio) which was more than 29 per cent in 1976 declined steadily to as low as 11 per cent in 1983. Also, there was a strong preference for holding liquid assets abroad rather than transfering foreign exchange to Ghana.

The impact of this included a sharp reduction in production and exports of goods as incentives had been removed. Besides, imports of essential consumer goods and producer inputs fell sharply, resulting in low production in both industrial and agricultural sectors, which, in turn, exerted inflationary pressures. Furthermore, external financing sources dried up due to Ghana's inability to service its debt obligations. These became worse as a result of the unilateral declaration of moratorium/repudiation (Yentua) in 1972. Estimates

show that external debt servicing arrears were over $600 million at the beginning of ERP in 1983.[5]

Inception of a multiple exchange rate regime (April 1983 January 1986)

Prior to 1983, the monetary and fiscal authorities could not implement large exchange rate adjustments as these could worsen political instability. But in April 1983, the government adopted many realistic exchange rate policy measures by devaluing the cedi in stages from C2.75: $1.00 to C90.00: $1.00 by the third quarter of 1986. The scheme of bonuses on exchange receipts and surcharges on exchange payments was a transitional measure. The exchange device comprised a multiple exchange rate system of two official rates of C23.38: $1.00 and C30.00: $1.00 which were applied to specified receipts and payments.

This scheme continued until 10 October 1983 when exchange rates were unified at C30.00: $1.00. After this, a real exchange rate rule, in the framework of PPP, was adopted. This rule required a quarterly adjustment of the exchange rates in accordance with relative inflation rates in Ghana and its major trading partners for the period 1983 84. The quarterly adjustment mechanism was replaced in December 1984 by more episodic exchange rate devaluations because the real exchange rate was still considered overvalued. The last discrete exchange rate adjustment, before the establishment of an auction system, brought the exchange rate to C90.00: $1.00 at the end of September 1986.

During the same period, the black market premium remained high (about 180 per cent) indicating the rationing of foreign exchange from official sources for the import of goods. Imports remained controlled within the framework of an annual import programme. There was a scheme for producers to utilize special unnumbered licences (SULs) which were mainly a channel for remittances from Ghanaians abroad. The SULs were used to finance imports of goods which were then sold at a profit on the domestic market. Also, before October 1986, the import licensing system involved two different import licences, namely, the Specific Import Licence (SPIL) and the Special Import Licence (SIL). While the specific licence allowed the use of foreign exchange from the banking system, the SIL carried the condition that the importer used his own foreign exchange resources. In 1985 there was a further liberalization by increasing the number of goods that could be freely imported under SIL, resulting in a shorter negative list. In this new arrangement, quantitative

restrictions on importation of goods had been removed and only subjected to the importers' access to foreign exchange from official sources.

Despite the above policy measures, the cedi still remained overvalued, as reflected by the divergence between the parallel and official exchange rate, and deterioration in the balance of payments position. In order to accelerate the adjustment of the exchange rate and attain the objective of trade liberalization, the auction market was introduced on 16 September 1986.

III The dual retail auction and the Dutch auction systems

Dual exchange rate system in a retail auction market (September 1986 February 1987)

Between October 1983 and 16 September 1986, all foreign exchange transactions operated under only one window, Window 1. Before the abolition of Window 1 in February 1987, the government shifted to a floating mechanism which was considered the best way of depoliticizing the issue of exchange rate adjustment. Besides, by resorting to a floating scheme the authorities were continually able to determine the exchange rate in line with the fundamental forces of demand and supply rather than having to resort to discrete devaluations as under the previous pegged regime. Added benefits of the new arrangement were the minimizing of capital flight and the prevention of collusion between the commercial banks.

Under the new system, there was a dual exchange rate system comprising two windows. The Window 1 exchange rate was fixed at C90.00: $1.00, while the Window 2 exchange rate was determined by demand and supply in the new weekly auctions conducted by BOG. Window 1 was used for such transactions as debt service payments on official debt contracted before 1 January 1986, imports of crude oil, processed petroleum products, inputs for Ghana Italian Petroleum (GHAIP), and essential drugs. Corresponding to the duality of the exchange rates, the surrender of exchange earnings to BOG was effected at two different rates. Earnings from exports of cocoa and residual oil products were to be surrendered at Window 1 exchange rate. All other transactions (about 66 per cent of external payments and receipts) were conducted through Window 2.

Retail nature of the auction

The new dual exchange rate system empowered BOG to auction foreign exchange on a weekly basis to final users only; this underlines the retail nature of the auction system. Authorized dealer banks had a very limited intermediary role to play in the new system. Their main functions were to centralize the bids for auction funds from their clients and then channel these bids to BOG.

Import licence under the dual exchange rate system

With the establishment of the dual exchange rate system, a new import licensing arrangement was introduced from 6 October 1986. There were three types of licence, namely, "A", "S" and "G". The "A" licence permitted the holder to bid for foreign exchange through the auction system and initially it was issued for drugs and producer inputs such as raw materials, semi-finished products, spare or repair parts, and machinery. Holders of an "S" licence could use their own foreign exchange resources to import goods with the provision that such imports were undertaken under the existing SIL regulations. The "G" licences were allocated to Government organizations for the importation of essential commodities. The foreign exchange for "G" licence holders was directly allocated outside the auction system.

The main characteristic of the new licensing system was the inclusion of all non-consumer goods under "A" licences, giving access to foreign exchange from the auction. In the previous arrangement, elegibility for the auction had been limited to very few goods and only importers who had acquired a specific import licence. Additionally, there were no restrictions on the number of "A" licences. This led to the elimination of monopoly rents that could be reaped in the previous scheme because of limitations imposed on the number of specific import licences.

Holders of a valid import licence, and persons or institutions who received the approval of the exchange control authorities to undertake service payments or make an outward transfer, were eligible to bid in the auction market. But other traders were to import goods using their own foreign exchange as long as such imports were allowed under the existing SIL regulations.

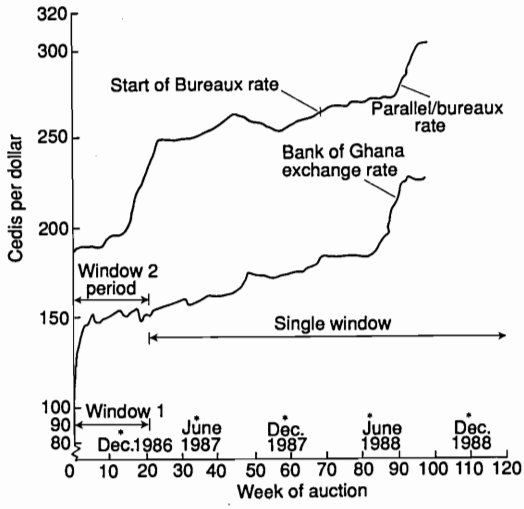
Supply and retention of foreign exchange

During the period under consideration, partial surrender requirements continued to be enforced. Exporters were generally allowed to retain up to 35 per cent of their export proceeds in accounts abroad for financing essential imports. The retention ratio was 45 per cent for Ashanti Gold Mining Company, 20 per cent for log exporters, and 5 per cent for the Cocoa Board. The retention did not apply to exports of residual oil and electricity, and receipts from electricity exports were not surrendered to BOG but kept in the Volta River Authority's accounts abroad.

Apart from these, all foreign exchange earnings were to be repatriated and sold to the BOG (directly or through commercial banks). After foreign exchange allocation to the Government and certain other public institutions, BOG decided the amount of foreign exchange to auction. The extra-auction exchange transactions were affected through the marginal rate of Window 2.

The primary objective of the auction is to narrow the spread between the parallel and official exchange rates. The official or marginal rate depreciated from C128.00: $1.00 at the first auction on 19 September 1986 to C152.00: $1.00 at the 14th auction on 19 December 1986. In the event, the spread/premium of the parallel exchange rate over the marginal rate declined from 41 per cent at the first auction to 20 per cent at the 14th auction (at the end of December 1986). See Figure 5.

Figure 5 Time series graph of exchange rates, 19 September 1986 14 October 1988



The switch from marginal pricing to the Dutch auction system

The first auction was based on MPAS in the determination of the exchange rate, in which case all the successful bidders pay the marginal price. But as from the second auction DAS was adopted. Under DAS successful bidders paid the bid price.

Bidders submitted their bids to BOG in sealed envelopes by the end of Thursday each week. Auctions were conducted every Friday. Bidders used a standard bid form and enclosed specified supporting documents, such as import licence, letters of credit, pro forma invoice, etc. Bids could be for US dollars, British pounds, German marks, French francs and Japanese yen. A bidder was required to state the currency, the amount being bid for, and the bid price he was willing to pay. There was no restriction on the bid price.

The adoption of DAS led to a multiple currency practice. But the auction was conducted in US dollars. Consequently, the dollar equivalent of bids in currencies other than the dollar was determined using the most recent cross rates[6] between the dollar and other currencies in the international currency markets.[7] A bidder was obliged to submit an authorization from his commercial bank that allowed BOG to debit the Bank's account with 100 per cent of the cedi equivalent of a successful bid. Additionally, the bid must be above $500.

The clearing of the auction was supervised by a foreign exchange auction committee that included representatives from BOG and several ministries. The bids were verified against the elegibility criteria mentioned above.

After that, the committee determined the marginal exchange rate as the rate where the foreign exchange supply made by BOG was exhausted by the demand. The demand at the most depreciated exchange rates was satisfied first. There were cases where the total demand at the marginal rate exceeded the supply at that rate. In that case, the bidders whose bid prices were equal to the marginal rate received a pro-rated amount of the foreign exchange.

The marginal exchange rate declared on the auction day (until a new rate was announced) applied to all extra-auction transactions such as (i) all foreign exchange bought by BOG, (ii) foreign exchange outside the auction, and (iii) foreign exchange sold to the commercial banks to replenish their working balances.

Apart from the switch from MPAS to DAS, there were several modifications of the Ghanaian auction market even though its retail nature had remained intact. The two windows that coexisted from September 1986 were unified on 19 February 1987.[8] Thus, from the 21st auction week to the 176th

auction week (27 April 1990) all transactions through the banking system were settled according to the marginal rate determined in the weekly retail auction.

Following the abolition of Window 1, BOG widened access to the auction market in order to expand the coverage of the exchange arrangement. This arrangement more closely represented market conditions during the period 1987-89. As of 20 March 1987, several categories of imports subject to the SIL scheme (which was more than a third of the value of all goods previously excluded from the "A" licensing scheme) were now included in the "A" list of goods eligible for foreign exchange from the auction. From 14 September 1987, additional SIL goods about one half of the value of all SIL goods were moved onto the "A" list of goods. On 5 February 1988, all remaining goods under the SIL scheme were moved onto the "A" list of goods, with the exception of beer and stout, cigarettes, cement pipes, asbestos and fibre roofing sheets and those goods prohibited for non-trade reasons.

The removal of all foreign exchange restrictions on the demand side meant that existing administrative arrangements for import licensing became redundant. Therefore, the import licensing system together with the Import Programming and Monitoring Committee (IPMC) (comprising the Secretaries of Finance and Economic Planning, Industries, Agriculture, Trade, and Health, and the Governor of the Bank of Ghana) were abolished on 14 January 1989. After this, importers were requested simply to file an import declaration form at their commercial banks.

Demand for the dollar on the auction, emanating from payments for invisibles, also underwent changes in the 1987-89 period. From 13 March 1987, services and transfer payments approved by the exchange control authorities became eligible for funding on the auction. Also, from 29 February 1988, all bona fide requests for business travel (up to a maximum of $3,000 per trip) became eligible for funding through the auction, as did transfers of profits and dividends from 1 February 1989. But transfer of profits by companies that had been financed with locally raised capital was not permitted.

Supply of the dollar on the auction through export proceeds and the retention scheme were also modified. The aim was to increase the supply of foreign exchange to the auction and to reduce foreign exchange being held in retention accounts. First, the Cocoa Board's foreign exchange retention ratio was reduced from 5 to 2 per cent on 20 March 1987. Second, from 28 April 1989, foreign exchange retention entitlements were to be credited to the exporters' foreign exchange accounts with banks located in Ghana within 60 days of shipment. Third, cocoa exports under bilateral payment agreements that did not yield convertible foreign exchange receipts were gradually reduced to 10,000 tons (less than 5 per cent of Ghana's total cocoa exports).

Objectives of the modifications in the auction market

There were four major objectives behind the introduction of the new auction system and modifications implemented between 1987 and 1989, namely, to achieve an increased supply of foreign exchange to match increased demand, a reduction in the erratic behaviour of the exchange rate, a decrease in the spread between the highest and lowest bid (or marginal exchange rates), and finally, narrowing of the degree of divergence between the auction and the parallel rates.

The Bank of Ghana was able to increase the supply to match the upsurge in demand for foreign exchange due to the further liberalization of international trade and finance. At the first auction, the total supply was $2.5 million. The average weekly supply was $2.952 million in 1986 (after September) *vis à vis* a mean weekly demand of $4.804 million; the excess demand was $2.196 million over and above the supply of foreign exchange on the auction market. As can be seen from Table 4, the mean weekly supply increased steadily to $7.743 million in 1990 *vis à vis* a demand of $9.010 million. It is important to note that excess demand (supply minus demand), in absolute terms, decreased slowly but steadily from $2.196 million in 1986 to $0.267 million in 1990.

Table 4 Weekly mean[a] supply of and demand for foreign exchange at auction market, 1986-90 (million dollars)

		1986	1987	1988	1989	1990
Supply		2.608	4.584	5.127	6.951	7.743
Demand		4.804	5.884	6.240	7.960	8.010
Excess demand[b]	-2.196	-1.300	-1.113	-1.009	-0.267	

[a] Weekly mean supply (WMS) and weekly mean demand (WDM) were calculated for year *j* using the formula:

$$WMS_j = \frac{1}{N}\sum_{i=1}^{N} S_{ij}$$

where $i = 1,2,3,\ldots,N$, N = number of weeks of auction in a year, j = 1986, 1987, ..., 1990 = jth year. The demand analogue is:

$$WMD_j = \frac{1}{N}\sum_{i=1}^{N} D_{ij}$$

[b] (-) means that demand exceeded supply of foreign exchange; excess demand = supply minus demand.

In addition, the mean weekly variation in the marginal rate declined. In terms of weekly percentage changes, the marginal rate variability, estimated to be 2.01 per cent in 1986, fell gradually to a little less than 0.23 per cent in 1990. In the second week of auction, the change was 6.25 per cent but from then on declined steadily. The next highest weekly percentage change was 3.90 per cent in 1987 in the nineteenth auction week. This figure went down to less than 2.00 per cent but then, in the 89th week in 1988, an extremely high weekly change of 4.98 per cent was recorded. Since then, however, the weekly variation has averaged less than 1.50 per cent.[9] The mean weekly spread between the highest and the lowest bid rates in the auction market also declined from C24.07 in 1986 to C6.58 in 1987. Thereafter, it increased to C7.35 in 1988 and C9.55 in 1989, and fell to C2.72 in 1990.

The picture is not significantly different when we consider the spread between the mean buying and selling parallel/black market rates. As shown in Table 5, the spread was C20.66 in 1986; it increased to C32.16 in 1987, and went up again by 12.4 per cent to C36.25 in 1988. It started to decline in 1989, falling to C28.20, and again to C13.39 in 1990 (see Figures 6-9). The widening of the spread from 1986 to 1988 implies an increase in foreign exchange risk on the market and points to improper functioning of the auction for the period under consideration.

A similar trend can be seen with regard to the degree of divergence between the bureaux buying rate and the marginal rate as a percentage of the latter. In 1986, the divergence was 24.25 per cent; it increased to 32.13 per cent in 1987, reflecting erratic behaviour in the auction market.

Table 5 Weekly mean spread between highest and lowest bid, buying and selling rates and degree of divergence between marginal and parallel bureau rates, 1986-90

	1986[a]	1987	1988	1989	1990
Highest auction bid rate (HR)	158.40	171.37	218.40	285.88	333.32
Lowest auction bid rate (LR)	134.40	164.79	211.05	276.34	330.60
Spread (HR-LR)[b]	24.00	6.58	7.35	9.55	2.72
Marginal rate (MR)	146.00	166.50	212.10	277.34	331.15
Bureau buying rate (BR)	181.70	219.99	263.63	335.92	342.14
Bureau selling rate (SR)	202.36	252.15	299.78	364.12	355.53
Spread (SR-BR)	20.66	32.15	36.15	28.20	13.39
Divergence (%)[c]	24.25	32.13	24.30	21.12	3.32

[a] With effect from September 1986.

[b] The weekly mean spread between the highest and lowest rates (WMSHL) is the difference between the weekly mean highest bid rate (HR) and the weekly mean lowest bid rate (LR). Each of the rates is a simle arithmetic mean. Alternatively, the WMSHL can be obtained directly from the weekly raw data by the formula

$$WMSHL_j = \frac{1}{N} \sum_{i=1}^{N} \left(HR_{ij} - LR_{ij}\right)$$

where $i = 1, 2, 3, ..., N$, N = number of weeks of auction in a year; j = 1986, 1987, ..., 1990 = jth year; HR_{ij} = highest bid rate in week i and in year j; and LR_{ij} = lowest bid rate.

[c] The weekly mean degree of divergence (*WMDD*) is obtained by the formula

$$WMDD_j = \left[\left(BR_j \,/\, MR_j\right) - 1\right] * 100\%$$

After 1988, however, the divergence went down to 3.32 per cent which represented a near unification of the two rates.[10] It is important to note that the above "near-merger position of the official and the parallel exchange rates" has been attained after 210 auctions spanning 3.25 years of auctioning and 7 years of exchange rate and trade stabilization. This period seems rather long. Indeed, it is a "gradualist" approach to realignment of the exchange rate market.[11] In the author's view, the fact that it took a very long time for the parallel and official markets to converge, and the behaviour of the market exchange rates to become erratic may be ascribed to the design and/or operation of the market system.

Figure 6 Foreign exchange graph: marginal and buying bureaux

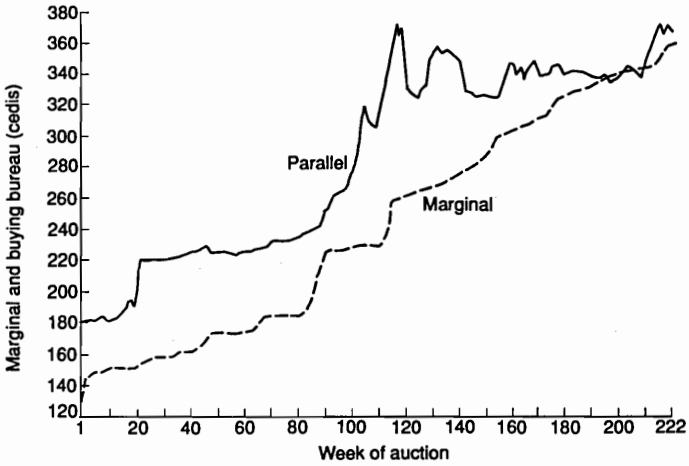


Figure 7 Parallel buying/marginal rate ratio

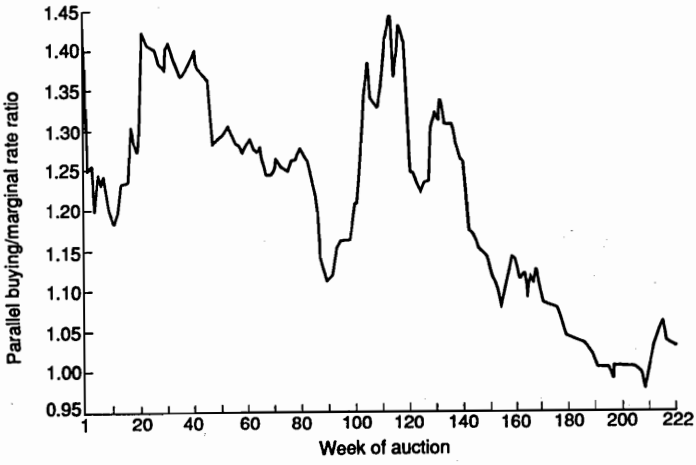


Figure 8 Parallel selling/marginal rate ratio and buying/marginal rate ratio

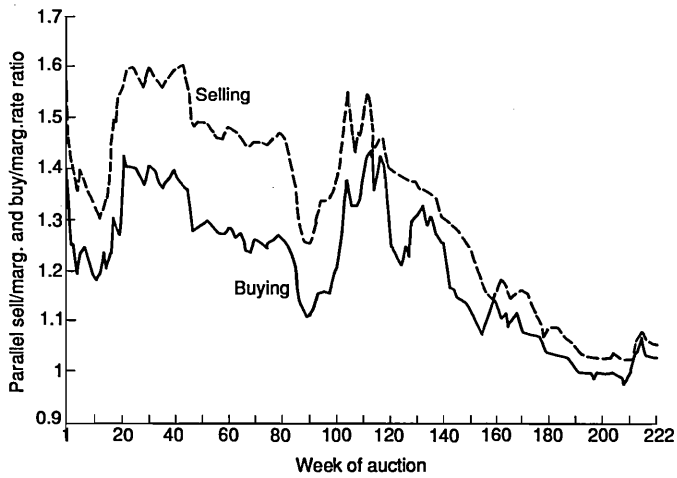
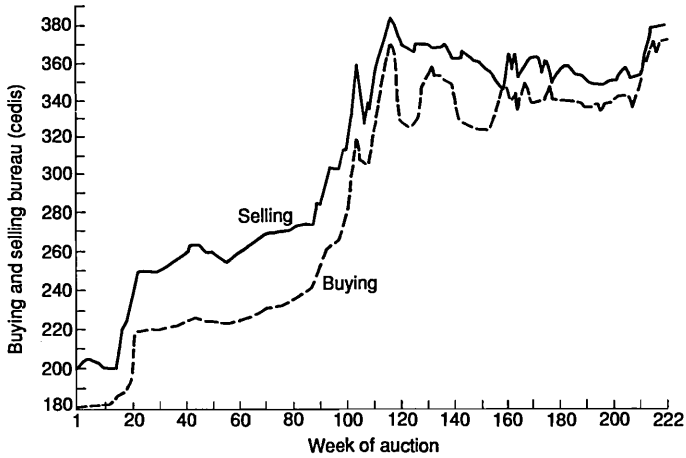


Figure 9 Foreign exchange graph (buying and selling bureau rates)



As outlined above, the auction market in Ghana has performed erratically given the supportive institutional arrangements and foreign exchange assistance from which it has benefitted. It has also taken a long time for the objectives to be realized. Despite this, however, many positive developments took place, albeit rather late. For example, the premium that the parallel rate had over the official exchange rate fell (as evidenced by the degree of divergence between the official and the parallel exchange rate) from 24.25 per cent in 1986 to 3.32 per cent in 1990 (having risen to 32.13 per cent in 1987, and then fallen to 24.3 per cent in 1988 and 21.12 per cent in 1989).

The key objectives in the attempt to liberalize and stabilize the exchange rate and trade regime of Ghana were finally accomplished by the legalization of the parallel market.

IV The foreign exchange bureaux

Establishment of foreign exchange *Bureaux de Change*

In order to absorb the parallel/black market into the legal foreign exchange system in Ghana, foreign exchange bureaux were allowed to operate as from 1 February 1988.

The co-existence of a parallel market, especially when there is a substantial divergence between the parallel and official exchange rate, is indicative of a basic disequilibrium in the foreign exchange market and trade regime. In the view of Quirk *et al.* (1987), an auction arrangement based on DAS inhibits entry to the auction market by participants who fear having to pay a price significantly higher than the clearing price for exchange if their bid is successful, leading to the continued existence of a black market and collusion before auctions. But it is essential to note than in addition to the inhibition imposed on bidders in the DAS, the rejection of bids from participants and, more importantly, an excessively overvalued exchange rate in the official market, have the effect of encouraging the co-existence of a black market.

Thus, despite the modifications in, and institutional arrangements for, the implementation of the foreign exchange auction, divergence between the marginal rates and parallel rates widened from 24.25 per cent in 1986 to 32.12 per cent in 1987. This compelled the authorities to legalize the parallel market by the introduction of foreign exchange bureaux. The first foreign exchange Bureau, became operative on 8 April 1988; by the end of June 1988 119 bureaux had come into full operation, and by early 1990 over 180 bureaux were fully licensed. The foreign exchange bureaux were owned and operated as separate entities by individuals, groups of individuals, banks or institutions, provided they had been licensed.

Rules and regulations

Commercial bank bureaux were to function independently of, and separate from, normal banking operations. Other rules and regulations authorized the

bureaux to buy and sell foreign exchange at freely negotiated rates and to be free to quote buying (or bid) and selling (or offer) prices, and specified that neither the bureaux nor their customers/sellers were under any obligation to indicate or identify the sources of their foreign exchange. The bureaux were (until the establishment of wholesale and interbank auctions in April 1990) required to report their monthly transactions in terms of volume of purchases and sales by type of currency to BOG.

Bureaux could purchase traveller's cheques only in US dollars and British pounds, and were to purchase and sell currency notes only in Canadian dollars, Deutsche marks, French and CFA francs, and US dollars. However, in practice, traveller's cheques in other foreign currencies and other currency notes were, and still are, transacted in the bureaux market. Also, all legal imports and services were, and still are, allowed to be funded through the bureaux.

Supply of, and demand for, foreign exchange in the bureau market

The main sources of supply of foreign exchange are exporters' retention accounts, receipts from unofficial (particularly non-traditional) exports, private remittances, and from the general public. The key demand sources include all those engaged in legal import and service payments, and capital transactions. The latter is illegal in some cases because "all outgoing capital movements must be approved by BOG; application for such transfers must be supported by documentary evidence and are considered on their merits".[12]

Remittances by non-Ghanaian employees and self-employed persons were, and still are, allowed through the bureaux but were usually limited to 40 per cent of new annual earnings, up to a maximum of $2,600 per annum, plus leave allowance.[13]

Developments in the foreign exchange bureau market

With the establishment of the bureaux, Ghana's exchange arrangements were characterized by the co-existence of two spot foreign exchange markets where spot rates were quoted.[14] The auction and the bureaux markets were effectively segmented between 8 April 1988 and 29 December 1989. Foreign exchange bureaux were not allowed to bid for foreign exchange in the weekly retail auction.[15] The absence of seepage between the two markets (in view of the existing regulatory framework at the time) resulted in imbalances between the supply of and the demand for foreign exchange. This partially explained the

divergence between the exchange rates in the bureau and the auction markets, as outlined above.

The exchange rate differential between the two markets, which was 24.25 per cent in 1986, widened sharply to 32.13 per cent in 1987 and continued to be fairly high in the first half of 1989. This was, among other factors, due to the termination of contraband activities involving the sale of cocoa by Ghanaian farmers and traders to neighbouring countries (firstly, because of difficulties experienced by those countries in marketing their cocoa and, secondly, because of the increase in the producer price of cocoa being offered to the farmer in Ghana).[16] An end to these illegal cross-border activities reduced the supply of foreign exchange to the bureaux.

Despite the fairly wide premium that existed between the auction and the bureau exchange rates, the latter got closer to the parallel rate. The results of the surveys conducted in this study reveal that the gap, which was C10.00 in 1988 after the legalization of the bureaux, narrowed to C2.00 in 1990, indicating a virtual absorption of the parallel sub-market by the bureau market. The latter "cow-lane" may be thought of as the Wall Street of Ghana.

Following the legalization of the bureaux in Ghana, the volume of transactions through the bureau foreign exchange market showed tremendous progress. The monthly transactions were about $0.534 million in purchases and $0.660 million in sales in April 1988. The purchases and sales proceeded to rise quickly and steadily to $7.800 million and $8.500 million respectively in August 1988. As can be seen from Table 6, the volume of monthly transactions remained fairly stable at about $10 million after the first quarter of 1989.

Merger of the auction and bureau foreign exchange markets

The key objectives behind the institutionalization of the bureaux were to eliminate the parallel market, to capture the main market forces directly behind the determination of the cedi-dollar rate, and to absorb the bureau/parallel market into a single foreign exchange market. The principal consideration and the historical rationale behind these objectives can be discerned in the Government's intention to minimize and eventually eliminate the use of any administrative mechanism in the allocation of foreign exchange, and then replace it with the forces of demand and supply to bring foreign exchange outside the banking system into the legal auction/bureau market, and finally to attain full trade liberalization.

Table 6 Monthly mean foreign exchange bureau transactions, 1986-90 (million dollars per month)[a]

	April 1988[b]	August 1988	Q3 1988	Oct. 1988[b]	Q4 1988
Purchases	0.534	7.800	7.350	6.900	7.632
Sales	0.606	8.500	7.550	6.600	7.531
Difference	-0.126	-0.700	-0.200	0.300	0.101
No. of bureau in operation[c]	10	70	NA	NA	119
	Q1 1989	**Q2 1989**	**Q3 1989**	**Q4 1989**	**Q1 1990**
Purchases	10.812	10.632	9.901	10.001	13.210
Sales	9.735	9.644	9.795	10.000	13.402
Difference	1.077	0.988	0.106	0.001	-0.192
No. of bureau in operation[c]	140	180	NA	NA	NA

[a]Preliminary estimates calculated from a sampled of 61 out of 180 bureaux. 29 bureaux, from a sample of 60, did not respond to the questionnaire. Some bureaux at Elubo (near the Côte d'Ivoire border), Takoradi, Aflao (near the Togo border), Cape Coast, and a few from Kumasi did not reply. Over 51 per cent of the bureaux that did respond were in Accra. Because of the use of averages, the figures may be biased.
[b] Source: World Bank (1989).
[c]Source: Bank of Ghana.

The attainment of these objectives required the exchange rates to be equal on the two markets. In particular, the marginal rate in the auction market must equal the buying bureau rates. As can be seen in Figure 6, there have been two big steps/jumps in the marginal rate, first from C211.00 to C215.00 (an increase of 4.98 per cent on the 90th over the 89th auction) and, second, from C242.00 to C258.00 (an increase of 6.61 per cent on the 117th over the 116th auction). Before and after these jumps the marginal rate levelled off, even though there were (i) periods of larger divergences between the marginal rates and the bureau buying rates, and (ii) excess demand in the auction market. These developments seem to suggest that either the auction has been a managed float or the auction design has not been effective in capturing the forces of demand and supply of foreign exchange, or both.

The degree of divergence by the 160th auction week on 22 December 1989 was 12.6 per cent (as noted in Table 5). The continued existence of the spread or premium led to the introduction of the wholesale auction system. The wholesale auction, which replaced the retail system, became operative with effect from 23 March 1990. Under the wholesale auction, a composite

exchange rate system was operated, namely, an interbank and a wholesale system.

In December 1989, guidelines were provided to enable the participation of dealer banks and eligible foreign exchange bureaux who would purchase foreign exchange from BOG to meet their own import requirements and on behalf of their end-user customers. The eligibility criteria for the bureaux were that (i) the bureau must have been in operation for at least a year, (ii) it must have had a monthly turnover averaging $250,000 or more during the previous six months, and (iii) it must arrange to use the facilities of authorized dealer banks for disbursement of auction funds.

The customers (or end-users) were to submit applications for foreign exchange to authorized dealer banks and eligible bureaux indicating the bid rate, the amount, and the currency required. The consolidated exchange requirement at each bid rate computed by each bureau was submitted to the auction through authorized dealer banks. The dealer banks then submitted the aggregated bids of their end-user customers to BOG together with their own bids and those received through eligible foreign exchange bureaux. The eligibility of bids was no longer decided by BOG but by the 11 participating commercial banks, as well as eligible foreign exchange bureaux.

DAS was retained. Thus, the successful bidders were required to pay for their foreign exchange allocation at their respective bid rates plus a margin determined by each authorized foreign exchange bureau and the dealer bank.

The immediate effects of the above institutional modification were (i) an increase in the number of bidders/participants in the auction, (ii) a narrowing of the spread between auction and bureau rates, and (iii) an increase in the number of authorized dealers, thereby laying a solid foundation for the merger of the bureaux and the official foreign exchange markets.

Developments between the end of December 1989 and the end of April 1990

The expansion of the transactions in the auction market reduced the excess demand that hitherto was not satisfied on the official auction market and which usually spilled over to the foreign exchange bureaux.

Also, the operations of the bureaux were broadened; consequently, as participants gained more confidence in the market, speculative pressures subsided leading to a further narrowing of the degree of divergence between the auction and the bureau exchange rates. The degree of divergence between the marginal and the bureau buying rates narrowed steadily from 12.6 per cent

at the end of December 1989 to 7.6 per cent at the end of April 1990 (as can be seen from Figures 6-9).

The exchange rates quoted in the bureau market exhibited erratic behaviour initially and later remained fairly stable, while the spread between the buying and selling rates narrowed. For the same period, the spread between the selling and buying bureau rates, which averaged C31.26 per week, narrowed to C16.50 by the end of April 1990.

V Wholesale and interbank systems for 7 April 1990 and beyond

With effect from 23 March 1990, the wholesale auction became operative. As from 27 April 1990, the authorized dealer banks and the eligible foreign exchange bureaux were allowed to purchase foreign exchange from BOG for sale to their end-user customers and to meet their own foreign exchange needs. In the pre-end-April 1990 arrangement, the authorized dealers were not allowed to be on their own account and, with the exception of the bids covering their own import needs, dealers' bids were to be entirely backed by firm bids by end-users of foreign exchange. In effect, the dealer banks and bureaux were not allowed to bid for themselves for the purposes of reselling; now they may.

The authorized dealers, therefore, were now allowed to determine freely the structure of their own bids at the wholesale auction. They could now sell the foreign exchange obtained in the auction to their customers plus a margin determined by each authorized dealer. The wholesale auction continued to be based on DAS.

Interbank auction system

Under the interbank market, authorized dealers may trade in foreign exchange among themselves or with their end-user customers. The main provisions are that the foreign exchange traded in the interbank auction should not be subject to surrender requirements; BOG may also participate as a buyer or seller in the interbank market; authorized dealer banks' working balances should not exceed a given maximum, and balances in excess of that after 14 days may be kept with BOG; banks are to provide weekly reports on their gross holding, showing the banks' own balances and total balances in customers' accounts.[17]

In order to increase the supply of foreign exchange to the interbank market, the surrender requirements have remained almost the same as under the retail auction and the wholesale auction systems. Under the new requirements, however, all proceeds from exports of non-traditional products must be lodged

in a commercial bank in Ghana upon receipt. Other export earnings, apart from those from electricity, are to be surrendered to BOG.

On the demand side, the remaining restrictions on payment for current international transactions involving invisible payments were lifted. This was a step toward full liberalization of the exchange system; it marked significant progress toward the attainment of convertibility of the cedi.[18]

Effects of the wholesale and interbank auction systems

Between 27 April 1990 and 8 June 1990 the authorized dealer banks were very cautious in bidding at the wholesale auctions on their own account. Therefore, transactions in the interbank arrangement were limited. But as from 8 June 1990, business on the interbank market became brisk as the dealer banks tried to buy foreign exchange over and above the actual bid requirements of their end-user customers and to then sell the excess to the public at small margins. Since 8 June 1990 (which was the twelfth wholesale auction) the number of authorized participating financial institutions has remained at 11 commercial banks.

The major impact of the wholesale auction and the interbank arrangements relates to the narrowing of excess demand on the auction market, reduction in the difference between the highest and lowest bid rates in the auction market, and the convergence of the marginal auction and the bureau exchange rates. The weekly mean excess demand in the auction market, which was, in absolute terms, $0.349 million for the second quarter in 1990, fell to a weekly mean of $0.166 million in the last quarter of 1990. A worrying development, however, was the widening of the excess demand gap in the first quarter of 1991 to a weekly mean average of $0.191 million.

The difference between the highest bid rates in the auction market also fell from a weekly mean of C3.63 in the second quarter to C2.20 in the last quarter of 1990 and continued to be fairly low (C2.60) in the first quarter of 1991.

The degree of divergence, which was 7.6 per cent at the end of April 1990, was completely eliminated in the last quarter of 1990, as can be seen from Figures 6-9. The most disturbing development, however, was that the convergence attained in the auction and bureau markets after 9 November 1990 started to widen again in the first quarter of 1991.

VI Conclusion and research agenda

The major inference from this study is that important lessons can be learnt on the basis of the Ghanaian experience. In particular, it demonstrated that foreign exchange rate reform involves a tremendous amount of institutional and foreign exchange support, sound fiscal and monetary policies and judicious trade and price regimes. All this must, of necessity, be implemented within an enabling macroeconomic environment.

It is worth to note that prior to April 1983 before the ERP was launched the Ghanaian cedi was heavily overvalued; the monetary and fiscal authorities could not implement large exchange rate adjustments as these could worsen political instability. As part of the reform process, the cedi was devalued in phases from C2.75:$1.00 to C90.00:$1.00 by September 1986. Additionally, the Government utilized the scheme of bonuses on exchange receipts and surcharges on exchange payments as a transitional measure. In the process, the exchange device adopted comprised a multiple exchange rate system of two official rates applied to specified receipts and payments respectively. Besides, a scheme was introduced for producers to utilize special unnumbered licences (SULs) which were mainly a channel for remittances from Ghanaians abroad. The SULs were used to finance imports of goods which were then sold at a profit on the domestic market.

After September 1986, a dual retail auction based on Dutch auction system and a special arrangement involving two windows were introduced. Window 2 starting with C128.00:$1.00 exchange rate operated side by side with Window 1. While the exchange rate of Window 1 was fixed at C90.00:$1.00, that of Window 2 was determined by demand and supply in line with the weekly auctions. In February 1987, Window 1 was abolished and access to the auction market widened. With virtually all foreign exchange restrictions removed, the existing administrative arrangements for import licensing became redundant. Consequently, the import licensing system together with the Import Programming and Monitoring Committee were abolished in January 1989.

Side by side with the removal of the restrictions on the foreign exchange transactions was the establishment of foreign exchange *bureaux de change* aimed at absorbing the parallel market into the legal foreign exchange system

in Ghana. Between April 1988 and early 1990, over 180 bureaux were fully licensed. The introduction of the bureaux led to the narrowing of the spread between the official and the parallel rates. As the operations of bureaux were broadened, participants gained more confidence in the market and the speculative pressures subsided.

The last stages of the foreign exchange reform (towards unification of the parallel and official rates) were achieved with the introduction of wholesale and interbank auctions that became operative in March 1990. The foreign exchange bureaux which were hitherto prohibited, were now allowed to purchase foreign exchange from the BOG through authorised financial institutions.

Two basic methods of reform lend themselves for consideration, namely, overnight reform and gradualist transformation. The latter has been adopted in Ghana, and seemed to be much more suitable for a country with a highly overvalued local currency and an economy where exchange rate devaluation results in political instability. The most important consideration, however, is the design of a workable foreign exchange auction framework that takes into account the peculiarities of the economy. There are three broad auction designs, namely, DAS, MPAS, and RPA arrangements, each of which has many variants. The nature of the auction design has implications for developments in the foreign exchange market.

Indeed with the adoption of the DAS, official exchange rate gyrations abated, excess demand in the auction market contracted, the difference between the highest and lowest bid rates narrowed and convergence/unification of the (official) marginal and bureau exchange rates was attained. Despite these positive developments, variability in the exchange rate has started to increase while the unification that had been achieved has begun to open again, even though monetary and fiscal policies remain sound.

The question to be raised is this:

> "After all this institutional and foreign exchange support in a sound fiscal and monetary policy environment, why is it that the foreign exchange market in Ghana behaved erratically and continued to co-exist with a bureau sub-market?"

As we have already noted, an auction arrangement based on DAS inhibits entry to the auction market by participants who fear having to pay a price significantly higher than the clearing price for exchange if their bid is successful, and this results in the continued existence of a black market and collusion before auctions.

Also, the existence of excess demand in the market points to the need for BOG's buying exchange rate to rise in order to increase the incentive for exporters to surrender their earning to increase further the supply of foreign exchange. But this was not possible under DAS. DAS, therefore, raises questions as to which exchange rate will be relevant to the after-auction market transactions during the auction interval of one to two weeks, or more particularly, when the supply of foreign exchange falls short of demand. The gap between the marginal rate (used for outside-auction transactions and for the purchase of foreign exchange by BOG) and the parallel rate closed only after a very long period, and it has started to diverge again. This may be due to the nature of DAS.

A much more basic criticism of DAS is that it involves price discrimination and fails to capture the main forces of demand and supply that operate in the determination of exchange rate. Thus, very often, when excess demand widened, the marginal rate hardly responded. How do we overcome these weaknesses and attain a sustainable convergence within a reasonable space of time? In order to speed up the process and pace of unification of the parallel and official exchange rates, reduce excess demand, and narrow the gyrations in the exchange rates, another mechanism for exchange rate determination had been suggested in another study (Dordunoo, 1994). The system has been designated as the modified Dutch auction system (MDAS), and had been considered in a game theoretic prisoner's dilemma framework in the study. A suggested auction design that will minimize volatility of exchange rates for a given macroeconomic environment will be considered at a later stage. Of equal relevance for future study is the issue of *sustainability* of unification of the official and the parallel rates especially when the BOP supports from the IMF, the World Bank and other donor agencies cease.

Footnotes

1. It is crucial to note that in the context of Ghana, there were (and still are) two broad sources of foreign exchange to support the auction, namely, (i) own-generated foreign exchange through exports and inflows of unrequited transfers, and (ii) borrowing from external sources. The export-import or trade gap is what is financed by external multilateral and bilateral agencies; in other words, the locally generated funds are supplemented by external inflows. But the latter is influenced by Ghana's continued servicing of the foreign loan.

2. Under MPAS, a single rate, the most appreciated bid price at which the available foreign exchange is exhausted, is applied to all successful bidders. Bidders who have offered rates more depreciated than the market-clearing rate receive all the foreign exchange they bid for at the marginal price; those whose bid rates are more appreciated will not receive foreign exchange; and those whose bid price is equal to the market-clearing rate will receive only part of what they bid for on the basis of an allocative rule. RPA hinges on the use of a reserve price for foreign exchange which is the most appreciated exchange rate at which the central bank will undertake to supply foreign exchange.

   A classification based on Smith (1982) advances two major types of auction systems for the purchase or sale of a single item, of which foreign exchange is an example. They are continuous auction systems (CAS) and sealed-bid auction systems (SBAS). Of the former category, there are two designs, namely English auction system (EAS) and the Dutch auction system (DAS); the latter category also has two arrangements, namely, first-price auction system (FPAS) and the second-price auction system (SPAS). In the context of the Ghanaian auction, it is the DAS which has been adopted.

   A much more detailed exposition on the various exchange rate arrangements can be found in Quirk (1987). A more recent work is Killick (1990).

3. The real exchange rate (RER) is calculated using the formula

$$RER = (NER * P_F)/(\$ * P_D) = NER * (P_F/P_D)$$

Where NER = nominal exchange rate in cedis per dollar, P_F = foreign price, P_D = domestic price. The dollar is the numeraire equated to unity.

4. Capital flight takes place when domestic investments are expected to be unsafe or to yield low returns relative to returns available abroad. Outflow of capital can increase balance of payments disequilibrium and thereby exert further pressure for the depreciation of a currency. In principle, the main causes of capital flight are exchange rate overvaluation and expected devaluation, political instabilities and social unrest, high and volatile inflation, low domestic deposit rates because of interest rate controls, rapid monetary expansion, and large fiscal deficits, or other domestic policies that are perceived to be unsustainable. Capital flight occurs through different channels. Domestic importers, for example, attempt to obtain foreign exchange (and hoard it) before the domestic currency depreciates; exporters, on the other hand, postpone surrender of foreign exchange earnings to the central bank. These leads and lags in international financial transactions can reduce short-run exchange inflows. Illegal channels include smuggling, and over-invoicing of imports and under-invoicing of exports.

Human capital flight takes the form of outflow of able-bodied skilled labour to overseas labour markets instead of rendering services within the economy to boost growth in the GDP. All these phenomena befell the economy of Ghana prior to 1983. For details about the principle of capital flight see Collins (1990). For other aspects of international payments and finance refer to Furness (1983).

5. See World Bank (1985), and the World Bank's *Debtor Reporting System* and *World Debt Tables* (various issues) for details.

6. The exchange rate between two given currencies can be obtained from the exchange rates of those two currencies in terms of a third currency. For example, given C/$ rate and $/DM rate, we can obtain C/DM by using the formula C/DM = C/$ × $/DM. The C/DM is then a cross rate.

7. The other currencies are the Australian dollar, Austrian shilling, Belgian franc, Canadian dollar, CFA franc, Danish croner, French franc, Deutschemark, Italian lire, Japanese yen, Dutch guilder, New Zealand dollar, Norwegian kroner, British pound, Spanish peseta, Swedish kroner, and Swiss franc.

8. During the same period interest rates were decontrolled and prices of consumer goods were market-determined rather than set at government-mandated prices. For a detailed account of the price decontrolling, fiscal, and monetary policies refer to Dordunoo (1990a), pp. 256-97, and Alderman (1990). For an earlier work that addressed the decontrolling policies between 1983 and 1986, refer to Ewusi (1987).

9. The mean weekly variation (or percentage change) of the marginal rate (WMVMR) is calculated using the formula:

$$WMVMR = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{MR_{t,i} - MR_{t-1,i}}{MR_{t-1,i}}\right]$$

where WMVMR is the mean weekly variation in marginal rate, t is time period, t-1 is previous time period, i = 1, 2, ..., N is the ith week in a year.

10. In some of the analytical work by the World Bank and the IMF in 1989 the marginal rate was compared with the selling bureau rate. This is inaccurate in the sense that the marginal rate is the exchange rate for extra-auction financial transactions covering the purchase of foreign exchange by the BOG. Therefore, the appropriate rate to compare with the marginal rate is the buying rate of the bureaux for the premium and/or divergence analysis. In any case, the use of the selling rate will exaggerate the spread and, therefore, indicate a higher level of foreign exchange risk. The risk takes three forms: first, potential exporters may be unwilling to surrender their earnings for fear of having to pay higher prices when they next come to need foreign exchange; second, importers may buy foreign exchange now and hoard it in the fear that the rate may depreciate in the future; third, there will be a strong temptation for seepage between the two markets to take place.

11. For details on the overnight versus gradual reform approach to exchange markets see Pinto (1989 and 1990).

12. For details about foreign exchange regulations in Ghana, refer to Caires and Fletter (1989) pp.180-82.

13. The rules governing payment for invisibles in Ghana, among other countries, are detailed in the IMF *Annual Survey of Exchange Arrangements and Exchange Restrictions*, Annual Report, IMF Washington DC (various issues).

14. *Spot rate* is technically defined as foreign exchange rate for currency delivered within a maximum of two days. This must be contrasted with *forward rate* which is the exchange rate for currency to be delivered at a future date. When the forward exchange is expressed in terms of premiums or discounts from the spot rate then we have *swap rate* (see Rodriguez and Carter (1984)).

15. Effective 29 December 1989, a "wholesale" auction system was introduced under which bureaux were allowed to purchase foreign exchange from BOG.

16. The producer price to the cocoa farmer was C56,600 per ton in 1985/86, C85,000 in 1986/87, C140,000 in 1987/88 but increased again to C165,000 in 1988/89 and C174,400 in 1989/90 (source Ghana Cocoa Board).

17. Various types of foreign exchange account are available to both Ghanaian and overseas residents. Some of the accounts are (i) foreign exchange external accounts for customers who are to meet certain obligations in foreign exchange for the purchase of machinery and equipment, (ii) foreign accounts for overseas residents, (iii) foreign exchange accounts for local residents with foreign exchange obtained locally, and (iv) cedi-denominated foreign exchange accounts for diplomatic missions and similar organizations.

18. The traditional definition of currency convertibility is "the unrestricted exchange of paper money into gold at a predetermined rate". In modern times it is "the unrestricted use of a country's currency for international transactions, allowing it to be freely exchanged for foreign currencies". This is the sense in which the concept is used here. Strictly speaking,

we are referring to current-account convertibility and not full convertibility since capital transfers are still subject to government controls. For details refer to Dordunoo (1990b).

References

Alderman, H. (1990) *Downturn and Economic Recovery in Ghana: Impacts on the Poor*, Washington DC: USAID, Africa Bureau, Cornell University, Food and Nutrition Policy Programme.

Aron, J. and I. Elbadawi (1994) "Foreign exchange auction markets in Sub-Saharan Africa, Part I: A typology of auctions", World Bank, Washington DC (mimeo).

Caires, B. de and D. Fletter (eds)(1989) *The Guide to Investing in Emerging Securities Markets*, London: Euromoney Books, pp. 180-82.

Collins, S.M. (1990) "Multiple exchange rates, capital controls, and commercial policy" in R. Dornbusch and F.L.C.H. Helmers (eds), *The Open Economy: Tools for Policy Makers in Developing Countries*, EDI Series in Economic Development for the World Bank, Washington DC: Oxford University Press.

Dordunoo, C.K. (1990a) *Introductory Economics*, Accra, Ghana: Ghana Universities Press.

_____ (1990b) "The convertibility of the cedi" (draft concept paper), Policy Analysis Division, Ministry of Finance and Economic Planning, Accra, Ghana.

_____ (1993) "An application of the prisoner's dillema model to the foreign exchange market in Ghana: a modified Dutch option", an unpublished AERC Research Paper, African Economic Research Consortium, Nairobi, Kenya.

_____ (1994) "Operationalization of the game theoretic prisoner's dillema model in the foreign exchange market in Ghana", *African Journal of Economic Policy*, vol. 1, no. 1 (June) pp. 75-100.

Ewusi, K. (1987) *Structural Adjustment and Stabilization Policies in Developing Countries: A Case Study of Ghana's Experience in 1983-86*, Ghana: Ghana Publishing Corporation, Tema Press.

Furness, E.L. (1983) *Money and Credit in Developing Africa*. London: Heinemann Education Books Ltd.

Gilman, M.G. (1990) "Heading for currency convertibility", *Finance and Development* (September), IMF, Washington DC.

Gold, J. (1981) "The multilateral system of payments: Keynes, convertibility, and IMF's Articles of Agreement", IMF, Washington DC (August).

Grilli, V. and G. Kaminsky (1991), "Nominal exchange rate regimes and real exchange rate: Evidence from the US and Great Britain 1985-1986", *Journal of Monetary Economics*, April pp. 191-121.

Killick, T. (1990) "Exchange rates and structural adaptation", Working Paper 33, ODI, London (January).

Pinto, B. (1986) "Fiscal deficits, inflation and parallel exchange markets in Ghana: Monetarism in the tropics?", World Bank (mimeo).

_____ (1989) "Black market premia, exchange rate unification and inflation in sub-Saharan Africa", *World Bank Economic Review* (forthcoming).

_____ (1991) "Black markets for foreign exchange, real exchange rates and inflation: overnight vs gradual reform in sub-Saharan Africa", *Journal of International Economics*, 30, 121-35.

Quirk, P.J. (1987) "Floating exchange rates in developing countries: experience with auctions and interbank markets", IMF Occasional Paper 53, IMF, Washington DC (May).

Rodriguez, R.M. and E.E. Carter (1984) *International Financial Management,* 3rd edn, India: Prentice-Hall.

Smith, V.L. (1982) "Microeconomic systems as an experimental science", *American Economic Review*, 72 (5).

World Bank (1985) *Ghana Towards Structural Adjustment*, Vol. II, Statistical Appendix, Washington DC: World Bank.

_____ (1989) *Ghana: Structural Adjustment for Growth*, Washington DC: World Bank.

Appendix

Table A1 The foreign exchange market in Ghana

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
19.09.86	1	128.00		180.00	200.00	20.00
26.09.86	2	136.00	6.250	181.00	201.00	20.00
03.10.86	3	145.00	6.618	181.00	203.00	22.00
10.10.86	4	145.00	0.000	182.00	204.00	22.00
17.10.86	5	151.00	4.138	181.00	205.00	24.00
24.10.86	6	147.00	-2.649	181.00	205.00	23.50
31.10.86	7	146.00	-0.680	181.00	203.00	22.00
07.11.86	8	148.00	1.370	184.00	203.00	19.00
14.11.86	9	149.00	0.676	184.00	203.00	19.00
21.11.86	10	150.00	0.671	182.00	203.00	21.00
28.11.86	11	151.00	0.667	181.00	202.00	21.00
05.12.86	12	152.00	0.662	180.00	201.00	21.00
12.12.86	13	154.00	1.316	183.00	200.00	17.00
19.12.86	14	152.00	-1.299	182.00	200.00	18.00
09.01.87	15	150.00	1.316	185.00	200.00	15.00
16.01.87	16	152.00	1.333	184.00	201.00	17.00
23.01.87	17	153.00	0.658	189.00	208.00	19.00
30.01.87	18	154.00	0.654	190.00	219.00	29.00
06.02.87	19	148.00	-3.896	193.00	222.00	29.00
13.02.87	20	152.00	2.703	195.00	226.00	31.00
20.02.87	21	150.00	-1.316	191.00	232.00	41.00
27.02.87	22	153.00	2.000	199.00	238.00	39.00
13.03.87	23	155.00	1.307	221.00	242.00	21.00
20.03.87	24	156.00	0.645	219.00	248.00	29.00
27.03.87	25	156.00	0.000	220.00	250.00	30.00
03.04.87	26	156.00	0.000	219.00	250.00	31.00
10.04.87	27	157.00	0.641	220.00	250.00	30.00
24.04.87	28	158.00	0.637	221.00	250.00	29.00
08.05.87	29	159.00	0.633	220.00	250.00	30.00
15.05.87	30	159.00	0.000	220.00	250.00	30.00
22.05.87	31	160.00	0.629	220.00	250.00	30.00
29.05.87	32	157.00	-1.875	220.00	250.00	30.00

Table A1 cont ...

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
05.06.87	33	157.00	0.000	221.00	251.00	30.00
12.06.87	34	159.00	1.274	222.00	251.00	29.00
19.06.87	35	159.00	0.000	221.00	252.00	31.00
26.06.87	36	161.00	1.258	221.00	253.00	32.00
03.07.87	37	162.00	0.621	222.00	254.00	32.00
10.07.87	38	163.00	0.617	223.00	255.00	32.00
17.07.87	39	162.00	-0.613	223.00	256.00	33.00
24.07.87	40	162.00	0.000	224.00	257.00	33.00
31.07.87	41	162.00	0.000	224.00	258.00	34.00
07.08.87	42	162.00	0.000	227.00	260.00	33.00
14.08.87	43	163.00	0.617	224.00	261.00	36.50
21.08.87	44	164.00	0.613	226.00	263.00	37.00
28.08.87	45	165.00	0.610	226.00	265.00	39.00
04.09.87	46	166.00	0.606	227.00	264.00	37.00
11.09.87	47	168.00	0.205	229.00	264.00	35.00
18.09.87	48	171.00	1.768	229.00	264.00	35.00
25.09.87	49	176.00	2.924	225.60	262.00	36.40
02.10.87	50	175.00	-0.568	225.00	260.00	35.00
09.10.87	51	174.00	-0.571	225.00	260.00	35.00
16.10.87	52	174.00	0.000	225.00	260.00	35.00
23.10.87	53	174.00	0.000	225.00	260.00	35.00
30.10.87	54	174.00	0.000	226.00	259.00	33.00
06.11.87	55	173.00	-0.575	226.00	258.00	32.00
13.11.87	56	173.00	0.000	224.00	257.00	33.00
20.11.87	57	174.00	0.578	224.00	256.00	32.00
27.11.87	58	174.00	0.000	223.00	255.00	32.00
04.12.87	59	175.00	0.575	224.00	256.00	32.00
11.12.87	60	176.00	0.571	224.00	257.00	33.00
18.12.87	61	176.00	0.000	226.00	258.00	32.00
08.01.88	62	176.00	0.000	225.00	260.00	35.00
15.01.88	63	176.00	0.000	227.00	261.00	34.00
22.01.88	64	176.00	0.000	226.00	262.00	36.00
29.01.88	65	178.00	1.136	226.00	262.00	36.00
05.02.88	66	179.00	0.562	227.00	263.00	36.00
12.02.88	67	179.00	0.000	229.00	264.00	35.00
19.02.88	68	181.00	1.117	228.00	265.00	37.00
26.02.88	69	183.00	1.105	228.00	266.00	38.00
04.03.88	70	185.00	1.093	230.00	267.00	37.00
11.03.88	71	185.00	0.000	230.00	268.00	38.00
18.03.88	72	185.00	0.000	233.00	269.00	36.00
25.03.88	73	185.00	0.000	234.00	270.00	36.00
08.04.88	74	185.00	0.000	232.50	270.00	37.50
15.04.88	75	185.00	0.000	232.00	270.00	37.50
22.04.88	76	186.00	0.541	233.00	270.00	37.00
29.04.88	77	186.00	0.000	232.00	270.00	38.00

Table A1 cont ...

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
06.05.88	78	186.00	0.000	234.00	271.00	37.00
13.05.88	79	185.00	-0.538	234.00	271.00	37.00
20.05.88	80	185.00	0.000	234.00	271.00	37.00
27.05.88	81	184.00	-0.541	235.00	272.00	37.00
03.06.88	82	185.00	0.543	236.00	272.00	36.00
10.06.88	83	186.00	0.541	236.00	273.00	37.00
17.06.88	84	188.00	1.075	238.00	274.00	36.00
24.06.88	85	190.00	1.064	238.00	274.00	36.00
08.07.88	86	193.00	1.579	239.00	274.00	35.00
15.07.88	87	196.00	1.554	240.00	275.00	36.00
22.07.88	88	201.00	2.551	241.00	275.00	34.00
29.07.88	89	211.00	4.975	241.50	274.00	32.50
05.08.88	90	215.00	1.896	243.00	275.00	32.00
12.08.88	91	219.00	1.860	245.00	277.00	32.00
19.08.88	92	226.00	3.196	252.00	285.00	33.00
26.08.88	93	226.00	0.000	253.00	285.00	32.00
02.09.88	94	228.00	0.885	258.00	290.00	32.00
09.09.88	95	228.00	0.000	263.00	295.00	32.00
16.09.88	96	227.00	-0.439	263.50	300.00	36.50
23.09.88	97	227.00	0.000	264.00	305.00	41.00
30.09.88	98	227.00	0.000	265.00	305.00	40.00
07.10.88	99	228.00	0.441	266.00	305.00	39.00
14.10.88	100	229.00	0.439	266.00	305.00	39.00
21.10.88	101	229.00	0.000	271.00	310.00	39.00
29.10.88	102	229.00	0.000	277.00	315.00	38.00
04.11.88	103	230.00	0.437	278.00	315.00	37.00
11.11.88	104	230.00	0.000	286.00	323.00	37.00
18.11.88	105	231.00	0.435	296.00	333.00	37.00
25.11.88	106	231.00	0.000	319.00	360.00	40.10
09.12.88	108	231.00	0.000	310.00	350.00	40.00
16.12.88	109	232.00	0.433	309.00	340.00	31.00
23.12.88	110	230.00	-0.862	308.00	330.00	22.00
06.01.89	111	230.00	0.000	308.00	330.00	34.00
13.01.89	112	230.00	0.000	311.00	337.50	26.50
20.01.89	113	230.00	0.000	318.00	347.00	29.00
27.01.89	114	232.00	0.870	328.50	357.50	29.00
03.02.89	115	235.00	1.293	338.00	365.00	27.00
10.02.89	116	242.00	2.979	349.50	369.25	19.75
17.02.89	118	258.00	6.612	352.50	373.50	21.00
24.02.89	118	260.00	0.775	362.25	377.50	15.25
03.03.89	119	260.00	0.000	372.00	383.50	11.50
10.03.89	120	262.00	0.769	367.50	383.50	16.00
17.03.89	121	262.00	0.000	370.00	382.00	12.50
31.03.89	122	264.00	0.763	349.50	377.50	28.00

Table A1 cont ...

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
07.04.89	123	264.00	0.000	330.00	372.00	42.50
14.04.89	124	264.00	0.000	330.00	372.50	42.50
21.04.89	125	265.00	0.379	327.50	370.00	42.50
28.04.89	126	265.00	0.000	327.50	370.00	42.50
05.05.89	127	266.00	0.377	326.00	370.00	44.00
12.05.89	128	267.00	0.376	326.00	367.50	41.50
19.05.89	129	267.00	0.000	334.00	370.00	36.00
26.05.89	130	267.00	0.000	330.00	372.50	42.50
02.06.89	131	268.00	0.375	350.00	370.00	20.00
09.06.89	132	268.00	0.000	351.00	370.00	19.00
16.06.89	133	268.00	0.000	355.00	372.50	17.50
23.06.89	134	270.00	0.746	355.00	370.00	15.00
30.06.89	135	270.00	0.000	361.00	370.00	9.00
07.07.89	136	271.00	0.370	355.00	370.00	15.00
14.07.89	137	271.00	0.000	355.00	370.00	15.00
21.07.89	138	272.00	0.369	356.00	370.00	14.00
28.07.89	139	273.00	0.368	356.00	370.00	14.00
04.08.89	140	275.00	0.733	352.50	372.50	20.00
11.08.89	141	275.00	0.000	352.50	367.50	15.00
18.08.89	142	277.00	0.727	350.00	364.50	14.50
25.08.89	143	277.00	0.000	350.00	365.00	15.00
01.09.89	144	278.00	0.361	337.50	365.00	27.50
08.09.89	145	280.00	0.719	329.00	365.00	36.00
15.09.89	146	281.00	0.357	330.00	365.00	35.00
22.09.89	147	282.00	0.356	330.00	367.50	37.50
29.09.89	148	283.00	0.355	328.00	365.00	37.00
06.10.89	149	283.00	0.000	326.00	365.00	39.00
13.10.89	150	284.00	0.353	326.50	362.50	36.00
20.10.89	151	286.00	0.704	327.50	362.50	35.00
27.10.89	152	287.00	0.350	328.00	362.50	34.50
03.11.89	153	289.00	0.697	325.00	362.50	37.50
10.11.89	154	291.00	0.692	325.00	360.00	35.00
17.11.89	155	294.00	1.031	327.50	357.50	30.00
24.11.89	156	298.00	1.361	327.50	357.50	30.00
01.12.89	157	301.00	1.007	325.00	357.50	32.50
08.12.89	158	301.00	0.000	330.00	355.00	25.00
15.12.89	159	303.00	0.664	335.00	352.50	17.50
22.12.89	160	303.00	0.000	341.30	352.50	11.20
05.01.90	161	304.00	0.330	347.50	350.00	2.50
12.01.90	162	304.00	0.000	347.50	347.50	0.00
19.01.90	163	306.00	0.658	347.50	360.00	12.50
26.01.90	164	306.00	0.000	342.50	366.00	23.50
02.02.90	165	307.00	0.327	342.50	360.00	17.50
09.02.90	166	307.00	0.000	345.00	366.00	21.00
15.02.90	167	308.00	0.326	336.00	355.00	19.00
23.02.90	168	308.00	0.000	345.00	360.00	15.00

Table A1 cont ...

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
02.03.90	169	309.00	0.325	342.50	357.50	15.00
09.03.90	170	310.00	0.324	350.00	357.50	7.50
16.03.90	171	311.00	0.323	347.50	362.50	15.00
23.03.90	172	312.00	0.322	342.50	365.00	22.50
30.03.90	173	313.00	0.321	340.00	365.00	25.00
06.04.90	174	314.00	0.319	340.00	365.00	25.00
20.04.90	175	315.00	0.318	341.00	365.00	24.00
27.04.90	176	317.00	0.635	341.00	357.50	16.50
04.05.90	177	320.00	0.946	345.00	362.00	17.00
11.05.90	178	322.00	0.625	347.50	360.00	12.60
18.05.90	179	325.00	0.932	347.50	360.00	12.50
25.05.90	180	326.00	0.308	344.80	350.00	5.20
01.06.90	181	327.00	0.307	342.00	356.50	14.50
08.06.90	182	327.00	0.000	341.00	356.50	15.50
15.06.90	183	328.00	0.306	342.50	358.50	16.00
22.06.90	184	329.00	0.305	342.50	360.00	17.50
29.06.90	185	330.00	0.304	342.50	360.00	17.50
06.07.90	186	330.00	0.000	343.50	360.00	16.50
13.07.90	187	331.00	0.303	342.50	359.50	17.00
20.07.90	188	331.00	0.000	343.50	355.00	11.50
27.07.90	189	332.00	0.302	341.50	355.00	13.50
03.08.90	190	332.00	0.000	340.00	355.00	15.00
10.08.90	191	334.00	0.602	340.00	355.00	15.00
17.08.90	192	335.00	0.299	337.50	352.50	15.00
24.08.90	193	336.00	0.299	337.50	352.50	15.00
31.08.90	194	337.00	0.298	338.00	351.25	13.25
07.09.90	195	337.00	0.000	339.00	350.00	11.00
14.09.90	196	338.00	0.297	340.00	350.00	10.00
21.09.90	197	338.00	0.000	340.00	350.00	10.00
29.09.90	198	339.00	0.296	336.50	350.00	13.50
05.10.90	199	339.00	0.000	336.00	350.00	14.00
12.10.90	200	339.00	0.000	341.00	350.00	9.00
19.12.90	201	340.00	0.295	341.50	352.50	11.00
26.10.90	202	342.00	0.588	341.50	351.50	10.00
02.11.90	203	342.00	0.000	343.50	351.50	8.00
09.11.90	204	343.00	0.292	343.00	354.00	11.00
16.11.90	205	343.00	0.000	346.00	358.50	12.50
23.11.90	206	344.00	0.292	345.00	355.00	10.00
30.11.90	207	344.00	0.000	344.00	357.50	13.50
07.12.90	208	345.00	0.291	345.00	357.50	12.50
14.12.90	209	345.00	0.000	342.50	352.50	10.00
21.12.90	210	345.00	0.000	337.50	356.00	18.50
04.01.91	211	345.00	0.000	344.00	355.00	11.00
11.01.91	212	345.00	0.000	348.00	355.00	7.00
18.01.91	213	346.00	0.290	355.50	357.50	2.00
25.01.91	214	346.00	0.000	358.00	369.00	11.00

Table A1 cont ...

Date	Week of auction	Exchange rate C:$ (marginal)	Exchange rate C:$ (marginal) % change	Average parallel/ bureau (buying)	Average parallel/ bureau (selling)	Difference between SR and BR rates
01.02.91	215	347.00	0.289	362.50	370.00	7.50
08.02.91	216	349.00	0.576	368.50	376.50	8.50
15.02.91	217	351.00	0.573	373.00	381.50	8.50
22.02.91	218	354.00	0.855	368.50	380.00	11.50
01.03.91	219	357.00	0.847	368.50	380.00	11.50
08.03.91	220	359.00	0.560	373.00	381.00	8.00
15.03.91	221	360.00	0.279	371.00	380.00	9.00
22.03.91	222	361.00	0.278	373.00	382.50	9.50

Table A2 The foreign exchange auction in Ghana II

Date	Week of auction	Buying bureau/ marginal ratio	Selling bureau/ marginal ratio	Lowest bid rate (LR) (auction)	Highest bid rate (HR) (auction)	Difference between HR and LR rates
19.09.86	1	1.41	1.56	90.00	152.00	62.00
26.09.86	2	1.33	1.48	92.00	160.00	68.00
03.10.86	3	1.25	1.40	100.00	155.00	55.00
10.10.86	4	1.26	1.41	141.00	160.00	19.00
17.10.86	5	1.20	1.36	142.00	163.00	21.00
24.10.86	6	1.23	1.39	142.00	163.00	21.00
31.10.86	7	1.24	1.39	143.00	157.00	14.00
07.11.86	8	1.24	1.37	146.00	158.00	12.00
14.11.86	9	1.23	1.36	146.00	155.00	9.00
21.11.86	10	1.21	1.35	146.00	160.00	14.00
28.11.86	11	1.20	1.34	146.00	158.00	12.00
05.12.86	12	1.18	1.32	145.00	157.00	12.00
12.12.86	13	1.19	1.30	150.00	160.00	10.00
19.12.86	14	1.20	1.32	152.00	160.00	8.00
09.01.87	15	1.23	1.33	150.00	158.00	8.00
16.01.87	16	1.21	1.32	150.00	158.00	8.00
23.01.87	17	1.24	1.36	152.00	155.00	3.00
30.01.87	18	1.23	1.42	152.00	157.00	5.00
06.02.87	19	1.30	1.50	148.00	157.00	9.00
13.02.87	20	1.28	1.49	148.00	158.00	10.00
20.02.87	21	1.27	1.55	149.00	157.00	8.00
27.02.87	22	1.30	1.56	151.00	156.00	5.00
13.03.87	23	1.43	1.56	150.00	158.00	8.00
20.03.87	24	1.40	1.59	152.00	158.00	6.00
27.03.87	25	1.41	1.60	152.00	160.00	8.00
03.04.87	26	1.40	1.60	152.00	160.00	8.00
10.04.87	27	1.40	1.59	152.00	160.00	8.00
24.04.87	28	1.40	1.58	156.00	160.00	4.00
08.05.87	29	1.38	1.57	156.00	162.00	6.00
15.05.87	30	1.38	1.57	159.00	165.00	6.00
22.05.87	31	1.38	1.56	159.00	163.00	4.00
29.05.87	32	1.40	1.59	157.00	165.00	8.00
05.06.87	33	1.41	1.60	157.00	162.00	5.00
12.06.87	34	1.40	1.58	157.00	162.00	5.00
19.06.87	35	1.39	1.58	158.00	164.00	6.00
26.06.87	36	1.37	1.57	159.00	164.00	5.00
03.07.87	37	1.37	1.57	159.00	164.00	5.00
10.07.87	38	1.37	1.56	162.00	165.00	3.00
17.07.87	39	1.38	1.58	162.00	170.00	8.00
24.07.87	40	1.38	1.59	162.00	166.00	4.00
31.07.87	41	1.38	1.59	162.00	165.00	3.00
07.08.87	42	1.40	1.60	162.00	165.00	3.00
14.08.87	43	1.38	1.60	163.00	165.00	2.00
21.08.87	44	1.38	1.60	163.00	165.00	2.00
28.08.87	45	1.37	1.61	163.00	167.00	4.00

Table A2 cont ...

Date	Week of auction	Buying bureau/ marginal ratio	Selling bureau/ marginal ratio	Lowest bid rate (LR) (auction)	Highest bid rate (HR) (auction)	Difference between HR and LR rates
04.09.87	46	1.37	1.59	163.00	168.00	5.00
11.09.87	47	1.36	1.57	164.00	169.00	5.00
18.09.87	48	1.34	1.54	168.00	172.00	4.00
25.09.87	49	1.28	1.49	170.60	179.00	9.40
02.10.87	50	1.29	1.49	175.00	191.00	16.00
09.10.87	51	1.29	1.49	172.00	183.00	11.00
16.10.87	52	1.29	1.49	172.00	182.00	10.00
23.10.87	53	1.29	1.49	174.00	180.00	6.00
30.10.87	54	1.30	1.49	174.00	182.00	8.00
06.11.87	55	1.31	1.49	173.00	180.00	7.00
13.11.87	56	1.29	1.49	170.00	179.00	9.00
20.11.87	57	1.29	1.47	172.00	181.00	9.00
27.11.87	58	1.28	1.47	170.00	170.00	0.00
04.12.87	59	1.28	1.46	174.00	180.00	6.00
11.12.87	60	1.27	1.46	175.00	178.00	3.00
18.12.87	61	1.28	1.47	176.00	180.00	4.00
08.01.88	62	1.28	1.48	176.00	180.00	4.00
15.01.88	63	1.29	1.48	176.00	180.00	4.00
22.01.88	64	1.28	1.49	176.00	180.00	4.00
09.01.88	65	1.27	1.47	176.00	180.00	4.00
05.02.88	66	1.27	1.47	177.00	181.00	4.00
12.02.88	67	1.28	1.47	179.00	182.00	3.00
19.02.88	68	1.26	1.46	179.00	182.00	3.00
26.02.88	69	1.25	1.45	180.00	185.00	5.00
04.03.88	70	1.24	1.44	183.00	186.00	3.00
11.03.88	71	1.24	1.45	185.00	190.00	5.00
18.03.88	72	1.26	1.45	185.00	188.00	3.00
25.03.88	73	1.26	1.46	185.00	189.00	4.00
08.04.88	74	1.26	1.46	185.00	189.00	4.00
15.04.88	75	1.26	1.46	185.00	188.00	3.00
22.04.88	76	1.25	1.45	185.00	190.00	5.00
29.04.88	77	1.25	1.45	186.00	189.00	3.00
06.05.88	78	1.26	1.46	186.00	189.00	3.00
13.05.88	79	1.26	1.46	185.00	190.00	5.00
20.05.88	80	1.26	1.46	185.00	190.00	5.00
27.05.88	81	1.28	1.48	184.00	190.00	6.00
03.06.88	82	1.28	1.47	184.00	188.00	4.00
10.06.88	83	1.27	1.47	185.00	189.00	4.00
17.06.88	84	1.27	1.46	185.00	190.00	5.00
24.06.88	85	1.25	1.44	187.00	191.00	4.00
08.07.88	86	1.24	1.42	189.00	195.00	6.00
15.07.88	87	1.22	1.40	193.00	198.00	5.00
22.07.88	88	1.20	1.37	196.00	202.00	6.00
29.07.88	89	1.14	1.30	201.00	218.00	17.00
05.08.88	90	1.13	1.28	211.00	240.00	29.00
12.08.88	91	1.12	1.26	219.00	241.00	22.00
19.08.88	92	1.12	1.26	219.00	240.00	21.00
26.08.88	93	1.12	1.26	226.00	252.00	26.00

Table A2 cont ...

Date	Week of auction	Buying bureau/ marginal ratio	Selling bureau/ marginal ratio	Lowest bid rate (LR) (auction)	Highest bid rate (HR) (auction)	Difference between HR and LR rates
02.09.88	94	1.13	1.27	220.00	220.00	0.00
09.09.88	95	1.15	1.29	228.00	240.00	12.00
16.09.88	96	1.16	1.32	227.00	240.00	13.00
23.09.88	97	1.16	1.34	227.00	242.00	15.00
30.09.88	98	1.17	1.34	227.00	240.00	13.00
07.10.88	99	1.17	1.34	227.00	240.00	13.00
14.10.88	100	1.16	1.33	229.00	235.00	6.00
21.10.88	101	1.18	1.35	229.00	235.00	6.00
29.10.88	102	1.21	1.38	229.00	235.00	6.00
04.11.88	103	1.21	1.37	230.00	238.00	8.00
11.11.88	104	1.24	1.40	230.00	235.00	5.00
18.11.88	105	1.28	1.44	230.00	240.00	10.00
25.11.88	106	1.35	1.51	231.00	235.00	4.00
02.12.88	107	1.38	1.56	231.00	236.00	5.00
09.12.88	108	1.34	1.52	229.00	237.00	8.00
16.12.88	109	1.33	1.47	231.00	235.00	4.00
23.12.88	110	1.34	1.43	230.00	236.00	6.00
06.01.89	111	1.33	1.48	230.00	235.00	5.00
13.01.89	112	1.35	1.47	230.00	235.00	5.00
20.01.89	113	1.38	1.51	230.00	236.00	6.00
27.01.89	114	1.42	1.54	230.00	235.00	5.00
03.02.89	115	1.44	1.55	232.00	240.00	8.00
10.02.89	116	1.44	1.53	235.00	246.00	11.00
17.02.89	118	1.37	1.45	243.00	263.00	20.00
24.02.89	118	1.39	1.45	255.00	311.00	56.00
03.03.89	119	1.43	1.48	254.00	305.00	51.00
10.03.89	120	1.40	1.46	262.00	300.00	38.00
17.03.89	121	1.41	1.46	262.00	298.00	36.00
31.03.89	122	1.32	1.43	264.00	298.00	34.00
07.04.89	123	1.25	1.41	264.00	298.00	34.00
14.04.89	124	1.25	1.41	264.00	295.00	31.00
21.04.89	125	1.24	1.40	265.00	290.00	25.00
28.04.89	126	1.24	1.40	265.00	290.00	25.00
05.05.89	127	1.23	1.39	265.00	275.00	10.00
12.05.89	128	1.22	1.38	267.00	275.00	8.00
19.05.89	129	1.25	1.39	267.00	275.00	8.00
26.05.89	130	1.24	1.40	267.00	280.00	13.00
02.06.89	131	1.31	1.38	268.00	272.00	4.00
09.06.89	132	1.31	1.38	268.00	272.00	4.00
16.06.89	133	1.32	1.39	268.00	275.00	7.00
23.06.89	134	1.31	1.37	269.00	275.00	6.00
30.06.89	135	1.34	1.37	270.00	276.00	6.00
07.07.89	136	1.31	1.37	270.00	275.00	5.00
14.07.89	137	1.31	1.37	271.00	275.00	4.00
21.07.89	138	1.31	1.36	271.00	281.00	10.00
28.07.89	139	1.30	1.36	272.00	276.00	4.00

Table A2 cont ...

Date	Week of auction	Buying bureau/ marginal ratio	Selling bureau/ marginal ratio	Lowest bid rate (LR) (auction)	Highest bid rate (HR) (auction)	Difference between HR and LR rates
04.08.89	140	1.28	1.35	273.00	278.00	5.00
11.08.89	141	1.28	1.34	275.00	281.00	6.00
18.08.89	142	1.26	1.32	276.00	281.00	5.00
25.08.89	143	1.26	1.32	277.00	282.00	5.00
01.09.89	144	1.21	1.31	277.00	282.00	5.00
08.09.89	145	1.18	1.30	278.00	284.00	6.00
15.09.89	146	1.17	1.30	281.00	285.00	4.00
22.09.89	147	1.17	1.30	281.00	284.00	3.00
29.09.89	148	1.16	1.29	282.00	286.00	4.00
06.10.89	149	1.15	1.29	283.00	286.00	3.00
13.10.89	150	1.15	1.28	284.00	287.00	3.00
20.10.89	151	1.15	1.27	285.00	288.00	3.00
27.10.89	152	1.14	1.26	286.00	290.00	4.00
03.11.89	153	1.12	1.25	288.00	292.00	4.00
10.11.89	154	1.12	1.24	290.00	295.00	5.00
17.11.89	155	1.11	1.22	292.00	296.00	4.00
24.11.89	156	1.10	1.20	298.00	302.00	4.00
01.12.89	157	1.08	1.19	300.00	308.00	8.00
08.12.89	158	1.10	1.18	301.00	310.00	9.00
15.12.89	159	1.11	1.16	303.00	310.00	7.00
22.12.89	160	1.13	1.16	303.00	309.00	6.00
05.01.90	161	1.14	1.15	304.00	310.00	6.00
12.01.90	162	1.14	1.14	304.00	310.00	6.00
19.01.90	163	1.14	1.18	304.00	308.00	4.00
26.01.90	164	1.12	1.20	306.00	310.00	4.00
02.02.90	165	1.12	1.17	307.00	310.00	3.00
09.02.90	166	1.12	1.19	307.00	311.00	4.00
15.02.90	167	1.09	1.15	308.00	311.00	3.00
23.02.90	168	1.12	1.17	308.00	312.00	4.00
02.03.90	169	1.11	1.16	308.00	311.00	3.00
09.03.90	170	1.13	1.15	308.00	311.00	3.00
16.03.90	171	1.12	1.17	310.00	315.00	5.00
23.03.90	172	1.10	1.17	311.00	315.00	4.00
30.03.90	173	1.09	1.17	312.00	315.00	3.00
06.04.90	174	1.08	1.16	314.00	316.00	2.00
20.04.90	175	1.08	1.16	314.00	318.00	4.00
27.04.90	176	1.08	1.13	317.00	318.00	1.00
04.05.90	177	1.08	1.13	317.00	320.00	3.00
11.05.90	178	1.08	1.12	322.00	324.00	2.00
18.05.90	179	1.07	1.11	323.00	325.00	2.00
25.05.90	180	1.06	1.07	325.80	330.00	5.20
01.06.90	181	1.05	1.09	326.00	330.00	4.00
08.06.90	182	1.04	1.09	327.00	330.00	3.00
15.06.90	183	1.04	1.09	328.00	330.00	2.00
22.06.90	184	1.04	1.09	329.00	331.00	2.00
29.06.90	185	1.04	1.09	329.00	332.00	3.00

Table A2 cont ...

Date	Week of auction	Buying bureau/ marginal ratio	Selling bureau/ marginal ratio	Lowest bid rate (LR) (auction)	Highest bid rate (HR) (auction)	Difference between HR and LR rates
06.07.90	186	1.04	1.09	330.00	333.00	3.00
13.07.90	187	1.03	1.09	331.00	335.00	4.00
20.07.90	188	1.04	1.07	331.00	334.00	3.00
27.07.90	189	1.03	1.07	331.00	333.00	2.00
03.08.90	190	1.02	1.07	332.00	335.00	3.00
10.08.90	191	1.02	1.06	332.00	335.00	4.00
17.08.90	192	1.01	1.05	334.00	336.00	2.00
24.08.90	193	1.00	1.05	334.00	337.00	3.00
31.08.90	194	1.00	1.04	336.00	338.00	2.00
07.09.90	195	1.01	1.04	337.00	339.00	2.00
14.09.90	196	1.01	1.04	337.00	340.00	3.00
21.09.90	197	1.01	1.04	338.00	340.00	2.00
29.09.90	198	0.99	1.03	338.00	340.00	2.00
05.10.90	199	0.99	1.03	339.00	341.00	2.00
12.10.90	200	1.01	1.03	339.00	341.00	2.00
19.12.90	201	1.00	1.04	340.00	342.00	2.00
26.10.90	202	1.00	1.03	340.00	342.00	2.00
02.11.90	203	1.00	1.03	342.00	344.00	2.00
09.11.90	204	1.00	1.03	342.00	344.00	2.00
16.11.90	205	1.01	1.05	343.00	346.00	3.00
23.11.90	206	1.00	1.03	343.00	346.00	3.00
30.11.90	207	1.00	1.04	344.00	346.00	2.00
07.12.90	208	1.00	1.04	345.00	346.00	1.00
14.12.90	209	0.99	1.02	345.00	347.00	2.00
21.12.90	210	0.98	1.03	345.00	348.00	3.00
04.01.91	211	1.00	1.03	345.00	348.00	3.00
11.01.91	212	1.01	1.03	345.00	348.00	3.00
18.01.91	213	1.03	1.03	345.00	347.00	2.00
25.01.91	214	1.03	1.07	345.00	348.00	3.00
01.02.91	215	1.04	1.07	346.00	348.00	2.00
08.02.91	216	1.06	1.08	349.00	350.00	1.00
15.02.91	217	1.06	1.09	351.00	351.00	0.00
22.02.91	218	1.04	1.07	351.00	375.00	24.00
01.03.91	219	1.03	1.06	355.00	375.00	20.00
08.03.91	220	1.04	1.06	359.00	375.00	16.00
15.03.91	221	1.03	1.06	360.00	365.00	5.00
22.03.91	222	1.03	1.06	360.00	365.00	5.00

Table A3 The foreign exchange auction in Ghana III

Date	Week of auction	Supply of dollars (millions) (auction)	Demand for dollars (millions) (auction)	Excess demand (auction)	Weekly mean SP read b/n HR and LR	Weekly mean of supply (million)
19.09.86	1	2.500	7.830	-5.33		
26.09.86	2	4.000	11.952	-7.95		
03.10.86	3	6.000	12.970	-6.97		
10.10.86	4	2.360	2.460	-0.10		
17.10.86	5	2.600	4.850	-2.25		
24.10.86	6	2.500	3.100	-0.60		
31.10.86	7	1.300	2.032	-0.73		
07.11.86	8	2.636	2.886	-0.25		
14.11.86	9	1.015	1.299	-0.28		
21.11.86	10	1.720	2.080	-0.36		
28.11.86	11	1.640	3.130	-1.49		
05.12.86	12	3.660	5.830	-2.17		
12.12.86	13	1.948	4.200	-2.25		
19.12.86	14	2.630	2.630	0.00	24.07	2.61
09.01.87	15	1.370	1.370	0.00		
16.01.87	16	2.539	3.318	-0.78		
23.01.87	17	2.245	3.055	-0.81		
30.01.87	18	2.800	3.150	-0.35		
06.02.87	19	2.457	2.457	0.00		
13.02.87	20	2.633	6.255	-3.62		
20.02.87	21	3.260	6.836	-3.58		
27.02.87	22	2.840	4.540	-1.70		
13.03.87	23	4.460	7.260	-2.80		
20.03.87	24	4.627	5.857	-1.23		
27.03.87	25	4.300	6.200	-1.90		
03.04.87	26	2.715	2.766	-0.05		
10.04.87	27	3.641	6.036	-2.39		
24.04.87	28	2.830	4.890	-2.06		
08.05.87	29	7.090	7.890	-0.80		
15.05.87	30	5.670	5.670	0.00		
22.05.87	31	3.940	4.070	-0.13		
29.05.87	32	2.530	2.530	0.00		
05.06.87	33	2.860	2.860	0.00		
12.06.87	34	3.800	5.200	-1.40		
19.06.87	35	4.140	5.070	-0.93		
26.06.87	36	2.787	6.650	-3.86		
03.07.87	37	2.960	6.020	-3.06		
10.07.87	38	5.180	7.430	-2.25		
17.07.87	39	7.198	7.198	0.00		
24.07.87	40	7.310	7.560	-0.25		
31.07.87	41	4.209	4.209	0.00		
07.08.87	42	3.660	3.660	0.00		
14.08.87	43	5.070	5.070	0.00		
21.08.87	44	3.610	4.630	-1.02		
28.08.87	45	4.710	7.470	-2.80		

Table A3 cont ...

Date	Week of auction	Supply of dollars (millions) (auction)	Demand for dollars (millions) (auction)	Excess demand (auction)	Weekly mean SP read b/n HR and LR	Weekly mean of supply (million)
04.09.87	46	6.806	9.607	-2.80		
11.09.87	47	3.000	6.880	-3.88		
18.09.87	48	2.700	14.639	-11.94	5.62	3.88
25.09.87	49	8.750	17.770	-9.02		
02.10.87	50	6.842	7.436	-0.59		
09.10.87	51	4.957	5.102	-0.15		
16.10.87	52	4.339	4.339	0.00		
23.10.87	53	3.895	3.895	0.00		
30.10.87	54	3.696	3.696	0.00		
06.11.87	55	4.675	4.675	0.00		
13.11.87	56	3.843	4.255	-0.41		
20.11.87	57	4.130	4.740	-0.61		
27.11.87	58	5.499	5.808	-0.31		
04.12.87	59	6.440	6.640	-0.20		
11.12.87	60	5.057	6.021	-0.96		
18.12.87	61	6.600	6.600	0.00	7.54	5.29
08.01.88	62	6.157	6.157	0.00		
15.01.88	63	4.900	4.900	0.00		
22.01.88	64	5.369	5.369	0.00		
29.01.88	65	4.121	9.132	-5.01		
05.02.88	66	4.650	6.820	-2.17		
12.02.88	67	7.230	7.230	0.00		
19.02.88	68	6.895	10.330	-3.44		
26.02.88	69	5.030	10.670	-5.64		
04.03.88	70	6.600	11.100	-4.50		
11.03.88	71	6.330	6.330	0.00		
18.03.88	72	7.428	7.428	0.00		
25.03.88	73	6.720	6.720	0.00		
08.04.88	74	5.200	7.200	-2.00		
15.04.88	75	3.394	3.394	0.00		
22.04.88	76	4.037	4.144	-0.11		
29.04.88	77	4.547	4.547	0.00		
06.05.88	78	5.560	5.560	0.00		
13.05.88	79	4.415	4.415	0.00		
20.05.88	80	4.800	4.800	0.00		
27.05.88	81	4.163	4.163	0.00		
03.06.88	82	4.146	4.386	-0.24		
10.06.88	83	4.146	5.078	-0.66		
17.06.88	84	4.400	8.908	-4.51		
24.06.88	85	5.600	10.800	-5.20		
08.07.88	86	5.350	13.190	-7.84		
15.07.88	87	6.700	12.100	-5.40		
22.07.88	88	4.056	10.540	-6.48		
29.07.88	89	4.510	15.170	-10.66		

Table A3 cont ...

Date	Week of auction	Supply of dollars (millions) (auction)	Demand for dollars (millions) (auction)	Excess demand (auction)	Weekly mean SP read b/n HR and LR	Weekly mean of supply (million)
05.08.88	90	6.210	11.300	-5.09		
12.08.88	91	6.650	6.650	0.00		
19.08.88	92	6.300	11.200	-4.90		
26.08.88	93	5.506	5.506	0.00		
02.09.88	94	6.200	9.100	-2.90		
09.09.88	95	4.990	4.990	0.00		
16.09.88	96	4.560	4.560	0.00		
23.09.88	97	4.200	4.200	0.00	7.47	5.31
30.09.88	98	4.516	4.516	0.00		
07.10.88	99	5.308	5.314	-0.01		
14.10.88	100	4.765	4.765	0.00		
21.10.88	101	4.160	4.160	0.00		
29.10.88	102	3.865	3.865	0.00		
04.11.88	103	5.195	5.195	0.00		
11.11.88	104	3.899	3.899	0.00		
18.11.88	105	7.100	7.198	-0.10		
25.11.88	106	4.995	4.995	0.00		
02.12.88	107	5.050	5.050	0.00		
09.12.88	108	4.501	4.609	-0.11		
16.12.88	109	5.520	6.530	-1.01		
23.12.88	110	5.315	5.315	0.00	7.23	4.94
06.01.89	111	3.348	3.348	0.00		
13.01.89	112	4.700	4.700	0.00		
20.01.89	113	1.320	3.320	0.00		
27.01.89	114	7.300	7.900	-0.60		
03.02.89	115	5.000	10.900	-5.90		
10.02.89	116	4.904	15.190	-10.29		
17.02.89	118	5.990	17.910	-11.92		
24.02.89	118	7.000	7.066	-0.07		
03.03.89	119	3.270	3.310	-0.04		
10.03.89	120	12.375	12.375	0.00		
17.03.89	121	7.567	7.567	0.00		
31.03.89	122	10.468	10.468	0.00		
07.04.89	123	5.939	5.939	0.00		
14.04.89	124	10.216	10.216	0.00		
21.04.89	125	8.816	8.816	0.00		
28.04.89	126	7.139	7.139	0.00		
05.05.89	127	6.745	6.745	0.00		
12.05.89	128	9.513	9.513	0.00		
19.05.89	129	6.063	6.063	0.00		
26.05.89	130	4.270	4.270	0.00		
02.06.89	131	6.170	6.170	0.00		
09.06.89	132	4.298	4.298	0.00		
16.06.89	133	5.120	5.120	0.00		
23.06.89	134	4.573	4.573	0.00		
30.06.89	135	8.184	8.184	0.00		

Table A3 cont ...

Date	Week of auction	Supply of dollars (millions) (auction)	Demand for dollars (millions) (auction)	Excess demand (auction)	Weekly mean SP read b/n HR and LR	Weekly mean of supply (million)
07.07.89	136	8.440	9.440	-1.00		
14.07.89	137	6.017	6.017	0.00		
21.07.89	138	9.580	9.618	-0.04		
28.07.89	139	9.039	9.569	-0.53		
04.08.89	140	11.485	13.502	-2.02		
11.08.89	141	9.430	9.430	0.00		
18.08.89	142	9.430	10.590	-1.16		
25.08.89	143	6.573	6.573	0.00		
01.09.89	144	6.270	7.785	-1.52		
08.09.89	145	5.900	7.500	-1.60		
15.09.89	146	6.020	6.020	0.00	14.31	6.96
22.09.89	147	6.840	8.048	-1.21		
29.09.89	148	5.230	6.810	-1.58		
06.10.89	149	6.099	6.099	0.00		
13.10.89	150	5.340	5.340	0.00		
20.10.89	151	6.224	7.627	-1.40		
27.10.89	152	7.200	7.206	-0.01		
03.11.89	153	5.400	5.600	-0.20		
10.11.89	154	5.399	7.599	-2.20		
17.11.89	155	7.200	10.053	-2.85		
24.11.89	156	8.041	11.882	-3.84		
01.12.89	157	10.830	11.540	-0.71		
08.12.89	158	6.965	6.965	0.00		
15.12.89	159	8.690	8.690	0.00		
22.12.89	160	7.756	7.756	0.00	4.79	6.94
05.01.90	161	5.030	5.030	0.00		
12.01.90	162	6.185	6.185	0.00		
19.01.90	163	8.259	9.194	-0.94		
26.01.90	164	10.165	10.165	0.00		
02.02.90	165	6.540	6.540	0.00		
09.02.90	166	7.864	7.864	0.00		
15.02.90	167	7.963	7.963	0.00		
23.02.90	168	9.251	9.251	0.00.		
02.03.90	169	9.070	9.780	-0.71		
09.03.90	170	6.420	9.220	-2.80		
16.03.90	171	8.520	8.520	-0.01		
23.03.90	172	9.730	9.730	-0.06		
30.03.90	173	7.640	7.760	-0.12		
06.04.90	174	7.770	7.770	0.00		
20.04.90	175	17.812	17.837	-0.02		
27.04.90	176	8.784	8.784	0.00		
04.05.90	177	6.590	6.590	0.00		
11.05.90	178	7.630	7.630	0.00		
18.05.90	179	6.420	10.890	-4.47		
25.05.90	180	17.520	.17.880	-0.36		

Table A3 cont ...

Date	Week of auction	Supply of dollars (millions) (auction)	Demand for dollars (millions) (auction)	Excess demand (auction)	Weekly mean SP read b/n HR and LR	Weekly mean of supply (million)
01.06.90	181	8.300	8.400	-0.10		
08.06.90	182	5.230	5.230	0.00		
15.06.90	183	6.530	6.530	0.00		
22.06.90	184	10.140	10.140	0.00		
29.06.90	185	7.880	8.090	-0.21		
06.07.90	186	3.970	3.970	0.00		
13.07.90	187	6.440	6.440	0.00		
20.07.90	188	6.810	6.810	0.00		
27.07.90	189	6.100	6.590	-0.49		
03.08.90	190	8.510	8.510	0.00		
10.08.90	191	8.880	8.900	-0.02		
17.08.90	192	5.590	5.980	-0.39		
24.08.90	193	4.630	6.410	-1.78		
31.08.90	194	9.600	10.030	-0.43		
07.09.90	195	9.590	9.590	0.00	3.23	8.10
14.09.90	196	7.930	7.980	-0.05		
21.09.90	197	6.210	6.210	0.00		
29.09.90	198	6.700	7.400	-0.70		
05.10.90	199	7.460	7.460	0.00		
12.10.90	200	6.700	7.400	-0.70		
19.12.90	201	7.510	7.510	0.00		
26.10.90	202	8.790	9.140	-0.35		
02.11.90	203	6.590	6.590	0.00		
09.11.90	204	6.210	6.490	-0.28		
16.11.90	205	6.600	6.600	0.00		
23.11.90	206	7.250	7.660	-0.41		
30.11.90	207	9.400	9.400	0.00		
07.12.90	208	7.150	7.150	0.00		
14.12.90	209	8.560	8.560	0.00		
21.12.90	210	7.780	7.780	0.00	2.20	7.39
04.01.91	211	7.790	7.790	0.00		
11.01.91	212	10.900	10.900	0.00		
18.01.91	213	8.370	8.370	0.00		
25.01.91	214	11.820	11.820	0.00		
01.02.91	215	9.490	11.970	-2.48		
08.02.91	216	10.420	10.420	0.00		
15.02.91	217	8.300	8.300	0.00		
22.02.91	218	10.660	10.660	0.00		
01.03.91	219	10.850	10.850	0.00		
08.03.91	220	12.450	12.450	0.00		
15.03.91	221	9.075	9.075	0.00		
22.03.91	222	8.200	8.370	-0.17	16.80	9.10

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