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FOREIGN EXCHANGE BUREAUS IN THE ECONOMY OF GHANA

KOFIA. OSEI

AFRICAN ECONOMIC RESEARCH CONSORTIUM

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Foreign exchange bureaus in the economy of Ghana

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Abstract

From 1983, Ghana embarked on an economic recovery programme (ERP), an important feature which was trade and foreign exchange liberalization. This called for a legalization of the black market into foreign exchange (forex) bureaux.

This paper looks at the structure of this market, including the major players, the level of activity and availability of currency on the market. The paper also looks at the efficiency of the market. The intention here is to ascertain whether information is widely and cheaply available to market participants. Lastly, the paper looks at the tax generation capacity of the bureau after the legalization of the black market.

The main findings are that the market pivots around traders, and that small-scale users of foreign currency benefit enormously from this market. Since a higher percentage of the traders operate within the sub-region, intra-West African trade is substantially enhanced. The paper also found that the market is generally inefficient, evidenced by the number of arbitrage opportunities that exist. However, the benefits to Ghana from the introduction of the forex bureaux include an increased availability of foreign currency, tax revenue and employment. Forex bureau taxes bring the government more than 1% of company taxes, plus a license renewal fee of US\$1,000 per bureau per year. The bureaux have also removed the inconveniences which small-scale foreign currency purchasers experienced in the previous exchange control regime. The most important development has been that the forex bureaux have obviously increased the overall level of economic activity in the country.

I Introduction

The foreign exchange market is a market where currencies are bought and sold openly by individuals, businesses, government and others. Compared to the United States, Britain, Germany and other developed countries, developing countries such as Ghana on the other hand do not allow such free markets in foreign exchange. They usually maintain restrictions on foreign currency transactions, including, but not limited to, insufficient amounts of foreign currency that may be purchased and sometimes for specific purposes only, government licensing requirements and, in extreme situations, outright prohibitions of foreign currency use by private people.

As a result of these restrictions, illegal markets develop in response to demand for foreign currency. Until February 1988, when the foreign exchange bureaus (forex bureaus) came into existence in Ghana, dealings in foreign exchange had been the monopoly of the central bank and some commercial banks, who were designated as authorized dealers.

Over the past two decades the trade and foreign exchange policies followed by Ghana have been nothing but restrictive. In 1972, for instance, a system of import licensing was introduced by the then military government to control foreign exchange. In a further effort to conserve foreign exchange, a foreign exchange decree aimed at checking the illegal transfer of funds outside the country through under invoicing of exports and inflated import prices was promulgated.

The oil price hikes of the OPEC countries that began around 1973 brought more chaos into the foreign exchange market of Ghana. With almost 50% of the available foreign exchange spent on the importation of petroleum products, inadequate amounts of foreign exchange were left for the heavily import-dependent Ghanaian economy. The numerous foreign exchange controls that resulted led to the rapid development of a black market.

The introduction of the Special Unnumbered Licence (SUL) in the mid-1970s as a trade policy further accelerated the growth of the black market. Under the SUL system, importers with their own foreign exchange resources were allowed to bring in imports since such imports did not involve any transfer of foreign currency from the country. The SUL system boosted the development of the black market as cedis generated after selling goods brought in under SUL had to be reconverted into hard currency in order to repeat the cycle. Among other restrictions introduced to cut back foreign exchange use in the late 1970s were the 10% import license levy on the face value of the license and a mandatory cash margin requirement for letters of credit.

Because of the severity of the exchange controls, by the late 1970s, almost all the

major international currencies were readily available in unprecedented quantities on the black market. In Accra, for instance, the name 'Cow Lane' was a household word synonymous with 'unauthorized foreign exchange market'. Similar names were coined in other Ghanaian cities.

Until February 1988, when the forex bureau system started, it was illegal to transact business on the black market and many dealers have faced the law. Interestingly, the more the government intervened through arrests, raids, confiscations, prosecutions etc., the more divergent the prices on the two markets became. The black market simply flourished.

After a long and unsuccessful battle with black marketeers, the Government of Ghana decided in February 1988 to licence individuals, companies and financial institutions to open foreign exchange bureaus where the general public could buy and sell eight major currencies: the United States dollar, the pound sterling, the CFA franc, the Deutsche mark, the French franc, the Swiss franc, the Canadian dollar and the Japanese yen.

The introduction of the forex bureau concept therefore legalized a previously illegal market, giving rise to numerous advantages including the ability of the government to receive taxed revenue on transactions in the market, release of resources used to fight the illegal dealers, easy access to the foreign currency market by all users, and, more importantly, building confidence in the financial market in general, and the currency market in particular, for a faster economic development of Ghana.

The problem and the need for the research

Some studies (although not many) have been done on the foreign exchange market of Ghana. For example May (1985) focused on the exchange control and the parallel market of Ghana, and Dordunoo (1991) focused on the working of the auction market. However, there has not been any well organized research into the forex bureau since it started operating. This research is therefore an attempt to fill that gap. There is a real need for a high degree of knowledge for the proper policy direction of this market.

This particular research concerns itself with identifying the key participants and their roles. Since policy is directed at participants, such information will be vital. The performance of the bureau market *vis à vis* the interbank market is also looked into to see if the original expectation of convergence of exchange rates is on course. Other issues which this research looks at include the efficiency and tax generation capacity of the forex bureau market. On efficiency, the study assesses the ability of the market to transmit information on exchange rates over time. If the market transmits information very quickly, then government policy of intervention in the market (for example to halt a depreciating or appreciating cedi) can be carried out swiftly if the need arises, without creating profit making opportunities for market participants. Obviously, if the market is slow, the policy effect of such a decision would be minimal. It is hoped that the study will form a basis for future research to be conducted on the forex bureau market of Ghana.

Objectives of the study

The objectives of the study are:

1. To make a comprehensive study of the structure of the forex bureau market of Ghana;
2. To investigate the efficiency of the market by looking at arbitrage opportunities on the market.
3. To assess the tax generation capacity of the forex bureau market.

Phase II of the research will analyse the economic impact of the actors in the forex bureau market whilst Phase III will look at capital flight through the forex bureau system.

Methodology

Data collection and sources

The study used mainly primary data obtained by interviewing forex bureau operators in nine cities: Accra and Tema in the Greater Accra region, Kumasi in the Ashanti region, Takoradi in the Western region, Aflao in the Volta region, Bawku and Bolgatanga in the Upper East region, Tamale in the Northern region and Dormaa Ahenkro in the Brong Ahafo region. In all, 100 out of the 178 (as at the end of 1991) active bureaus were served with questionnaires. Out of this number, questionnaires from 42 bureaus were returned. Bureaus used for the survey were randomly selected. Of the 178 active bureaus, 163 were non-bank with the remaining 15 being bank bureaus. Twelve of the bank bureaus were located in Accra with the remaining three owned by three rural banks from Brong Ahafo, Central and the Volta regions. Seven of the Accra banks had 17 bureaus branches in the regions.

Data were selected once between July and September 1992. The distribution of bureaus interviewed is shown in Table 1.

Apart from the survey information, secondary data was obtained from various sources, including the Bank of Ghana, the Internal Revenue Service (IRS), the Ministry of Trade and Tourism, and the Statistical Service.

Method of analysis

The method of analysis is mainly descriptive. The study on structure of the forex bureaus in Section 1 used cross tabulations. For example, analysis of major currency buyers and

Table 1: Regional distribution of bureaus interviewed.

Region	No. of active bureaus in region (bank and non-bank)	No. of bank bureaus	Bureaus interviewed
Greater Accra	131	17	22
Ashanti	25	7	10
Northern	1	0	1
Upper East	3	0	2
Brong Ahafo	2	1	1
Volta	4	1	3
Western	8	4	3
Central	3	0	0
Eastern	1	0	0

Source: Bank of Ghana

Note: 1. Active bureau figures as at December 1991.

2. Only 3 out of the 22 bureaus from Greater Accra interviewed were bank bureaus.

sellers is done on percentages on both a regional and national basis. Other aspects of structure which are all analysed on a percentage basis include the volume of transactions, and currency availability on the market, etc. The efficiency in Section II is analysed by testing for locational arbitrage (see Section II for specification of condition and test). The analysis on efficiency is further supplemented with the statistical test of Analysis of Variance (ANOVA).

Limitations of the study

Questionnaires demanded that forex bureaus provided up to 664 price quotations from 1988-92. We realize that it was not an easy task supplying this information. Because of the busy schedule of the bureaus, we found the quality of information furnished on rate quotations by some was not as reliable as we wanted and therefore may affect the analysis.

Bureau rates do not necessarily stay the same throughout the day, and the rates returned by bureaus did not show this situation. The analysis on arbitrage would therefore be affected by this observation.

Data for this study covers the period 1988-92. Interpretations or analysis outside this period should reflect this fact.

Figures shown in tables 2, 3, 4 and 8 are based on bureaus operators judgement as no formal forms are completed by clients for such information. The accuracy of the information may therefore be limited. However, because of the familiarity of most bureau operators with many of their clients, the reliability of the figures is fairly reasonable and therefore useful.

Organization of the study

The research is organized into five sections. The introductory section, incorporates the problem statement, the need for the research, the objectives, the methodology of the research and the limitations of the study. Section II deals the structure of the forex bureau whilst Section III deals with the efficiency of the forex bureau market. Tax generation from the bureau is examined in Section IV. The conclusions and policy recommendations are drawn in Section V.

II Forex bureau market structure

Market structure refers to the number and size distribution of sellers and buyers and the extent of product differentiation (Brigham and Pappas, 1976). Seo (1991) indicates the five important determinants of market structure as; sellers' characteristics, buyers' characteristics, product characteristics, conditions of market entry and exit, and economies of scale.

Under the forex bureau market structure in this section, the buyers and sellers of currency as well as the volume of purchases and sales from the forex bureaus are determined. To assess how big transactions on this market could be, the largest possible orders handled by these bureaus are also looked into. Currency availability, pricing, and problems are also investigated under market structure.

Buyers and sellers of currency on the bureau market

Tables 2 and 3 show the number of buyers and sellers of currency to the bureaus. Table 2 shows that in all the regions, the dominant group buying foreign currency from the forex bureaus is traders¹. This is followed by Ghanaians purchasing currency for travel outside the country. Businesses also purchase currency from the forex bureau market but on a small scale. The zeros in Tables 2, 3, 4 may be interpreted as negligible.

It may be inferred from Table 2 that the forex bureaus have facilitated trade between Ghana and the rest of the world. Also, travelling is now easier, as before the establishment of the foreign exchange bureaus travellers had to go through a bureaucratic system and ended up with insufficient amounts of foreign exchange anyway. We may also infer from the level of participation of businesses in the bureau market that businesses supplement their foreign exchange requirements from the forex bureau, their main source being the official (now interbank) foreign exchange market.

Table 3 shows that the main suppliers of currency to the forex bureau market are first, Ghanaians who receive remittances regularly from their relatives overseas and, second, tourists. Looking at this emigration profile, the significance of remittances as a leading source of foreign exchange supply to the forex bureau market is expected. Ghana has seen mass emigration, especially of the youth, to other countries since the early 1980s, in search of better prospects. The role of the tourist as one of the leading suppliers of cur-

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Table 2: Major currency buyers from the forex bureaus (%)

Type of buyer	Nationwide	Greater Accra region	Western region	Volta region	Northern region	Ashanti region	Upper East region	Brong Ahafo region
Traders	55.8	46.6	70.0	68.3	55.0	60.7	72.5	80.0
Business/ companies	12.7	17.4	2.5	5.0	14.0	11.9	2.5	0.0
Government officials	1.1	1.2	0.0	1.7	5.0	0.0	2.5	0.0
Ghanaians buying to travel	16.8	18.9	12.5	15.6	7.0	17.1	10.0	15.0
Expatriates	7.0	9.1	7.5	3.7	16.0	1.7	10.0	1.0
Others	6.6	6.8	7.5	5.7	3.0	8.6	2.5	4.0

Source: Field survey.

Table 3: Major currency sellers to the forex bureaus (%)

Type of seller	Nationwide	Greater Accra region	Western region	Volta region	Northern region	Ashanti region	Upper East region	Brong Ahafo region
Foreign tourist	30.8	32.3	55.0	45.0	50.0	20.7	12.5	2.0
Ghanaians with relatives abroad	33.1	36.1	45.0	5.4	20.0	47.1	7.5	5.0
Traders	19.6	13.3	0.0	43.3	5.0	21.5	70.0	3.0
Companies	8.9	14.4	0.0	1.0	15.0	2.1	5.0	0.0
Others	7.6	3.9	0.0	5.3	10.0	8.6	5.0	90.0

Source: Field survey.

rency implies that tourism promotion policies may improve currency availability on the market considerably. It may be worth noting the dual role of traders as buyers and suppliers of foreign currency, although they tend to demand more than they supply.

Direction of trade

Having indicated that the dominant group buying currency is traders, it is of interest to know whether these traders trade mainly within the West African sub-region (intra-ECOWAS trade) or whether the trade is mainly outside the sub-region. Table 4 shows that a substantial part of the currency purchased is used for intra-ECOWAS trading, since a greater percentage of the traders trade within West Africa. It may be inferred, therefore, that the establishment of the forex bureaus is promoting trade within the sub-region.

Table 4: Distribution of traders between West African, European and other markets (%)

Market	Nationwide	Greater Accra region	Western region	Volta region	Northern region	Ashanti region	Upper East region	Brong Ahafo region
West Africa	62.0	48.2	75.0	88.5	88.0	59.3	85.0	100.0
Europe/ America/ Far East, etc.	38.0	51.8	25.0	11.5	12.0	40.7	15.0	0.0

Source: Field survey.

Volume of transactions

Tables 5 and 6 show that a greater percentage of the transactions on the forex bureau market are small in volume. In almost all the regions about 85 out of 100 people making a transaction on this market are likely to purchase or sell foreign currency valued at US\$1,000 or less. The zeros in Tables 5 and 6 may again be interpreted as negligible rather than zero since transactions of over \$10,000 have been recorded (see Table 7 for the largest orders) except that their frequency of occurrence is extremely low. Tables 5 and 6 also show transactions above \$10,000 are mostly found in the Greater Accra and Ashanti regions. This trend is to be expected because Accra and Kumasi are the first and second largest cities, respectively and, the commercial cities of Ghana.

The regional differences in the figures therefore seem to lie in the presence of major commercial centres in the region. Where there are such commercial centres with multi

Table 5: Categorization of buyers from the forex bureaus by volume of purchases (%)

Customers buying in the range (equiv) (US\$)	Nationwide	Greater Accra region	Western region	Volta region	Northern region	Ashanti region	Upper East region	Brong Ahafo region
1-100	31.1	20.0	25.0	75.0	80.0	26.3	80.0	70.0
101-500	23.5	21.5	52.5	10.0	15.0	27.1	20.0	10.0
501-1,000	19.7	22.6	22.5	7.5	3.0	22.6	0.0	10.0
1,001-5,000	17.3	23.8	0.0	5.0	2.0	16.4	0.0	10.0
5,001-10,000	5.7	8.1	0.0	2.5	0.0	5.0	0.0	0.0
over 10,000	2.7	4.0	0.0	0.0	0.0	2.6	0.0	0.0

Source: Field survey.

Table 6: Categorization of sellers to the forex bureaus by volume of sales (%)

Customers selling in the range (equiv) (US\$)	Nationwide	Greater Accra region	Western region	Volta region	Northern region	Ashanti region	Upper East region	Brong Ahafo region
1-100	38.5	31.2	32.5	85.0	80.0	25.0	57.5	90.0
101-500	30.5	27.0	57.5	10.0	12.0	43.8	40.0	5.0
501-1,000	16.6	20.7	10.0	5.0	5.0	15.8	2.5	4.0
1,001-5,000	9.8	14.3	0.0	0.0	3.0	8.7	0.0	1.0
5,001-10,000	3.0	4.4	0.0	0.0	0.0	5.0	0.0	0.0
over 10,000	1.6	2.4	0.0	0.0	0.0	1.7	0.0	0.0

Source: Field survey.

plicity of buyers and sellers, the likelihood of finding buyers and sellers of currency at all range levels especially the \$1-\$100, \$101-\$500 and \$501-\$1000 levels is high. Under such circumstances, the percentage buying smaller amounts are lower. This is especially true for Greater Accra and Ashanti and to a lesser extent the Western regions with

the largest three commercial cities.

In regions without much commercial activities, the demand and supply volumes are usually smaller and since the purchases are usually not for commercial purposes, most of the transactions are usually not for commercial purposes, most of the transactions are low in value hence the predominance of the \$1-\$100 level of transactions. This is especially true for the Volta, Northern, Upper East and the Brong Ahafo regions.

Table 7: Largest orders of selected bureaus

Bureau interviewed (number)	Region of bureau	Type of bureau	Largest orders	Portion executed (P=part) (A=all)
1	Greater Accra	Banking	US\$120,000	A
2	-do-	-do-	US\$245,000	A
3	-do-	-do-	US\$100,000	A
4	-do-	Non-Bank	US\$10,000	A
5	-do-	-do-	US\$40,000	P
6	-do-	-do-	US\$ 150,000	A
7	-do-	-do-	£ 50,000	A
8	-do-	-do-	US\$100,000	P
9	-do-	-do-	US\$100,000	A
10	-do-	-do-	CFA50 million	A
11	-do-	-do-	£7,000	P
12	-do-	-do-	US\$40,000	P
13	Ashanti	-do-	CFA10 million	A
14	-do-	-do-	CFA10 million	P
15	-do-	-do-	DM198,000	A
16	-do-	-do-	CFA2 million	A
17	Brong Ahafo	-do-	£30,000	P
18	Western	-do-	US\$4651	A
19	Northern	-do-	US\$10,000	P
20	Volta	-do-	CFA15 million	P
21	-do-	-do-	CFA5 million	A

Source: Survey.

Note: Assume CFA 30,000 = US\$100 = £60 = DM 170.

Largest orders

Table 7 shows some of the largest orders of foreign currency executed by the bureaus. One may expect the bank bureaus to have received and executed relatively larger orders but some of the non-bank bureaus have matched the bank bureaus as far as large orders are concerned. Over the five-year period of the existence of the forex bureaus, many of

the non-bank bureaus have been able to increase their capital base, hence their ability to transact equally large volumes as the banks. The fact that some of the non-bank bureaus are only able to execute portions of their large orders shows that some of them have limited capacity to execute large orders. Also, sometimes large orders are executed by a syndicate of both bank and non-bank bureaus. Large orders may also be executed over extended periods of one or two weeks. This is especially true with the non-bank bureaus.

Currency availability

Table 8 shows that on the average Deutsche marks are available at the bureaus 33% of the time. Similarly, the CFA Franc is on average available about 60% of the time. The availability of the other currencies are as shown. It must be cautioned that these are average figures and that some currencies are more active in certain parts of the country than others. For example, the CFA franc is very active at the border towns such as Aflao, Bawku, Dormaa Ahenkro etc where much of the trading activities are directly between the neighbouring countries of Ivory Coast, Togo and Burkina Faso.

Table 8: Average Currency Availability

Currency	Time available (%)
Deutsche mark	33
Pound sterling	43
US dollar	64
CFA franc	60
Japanese yen	1
Swiss franc	6
French franc	16
Canadian dollar	7

Source: Survey.

Size of the forex bureau market

The quantum size of the forex bureau market and its relative proportion to the import bill of Ghana is shown in Table 9. In 1988, when the bureau system was introduced, the bureaus provided about 8% of the import bill over the period April to December. In the subsequent years, the bureaus played an increasingly important role in the economy of Ghana by providing higher proportions of the import bill. Thus the government is relieved of some burden of having to provide foreign exchange for all imports. (This is rather an over simplified assumption that all foreign exchange from bureau sources are used for imports. A significant proportion is likely to be used to fund unrecorded transactions).

Table 9: Quantum and relative size of the forex bureau market (US\$ million).

	1988 Apr-Dec	1989	1990	1991	1992 Jan-Dec
Total purchases	51.477	123.269	221.278	306.291	307.112
Total sales	50.572	116.328	220.441	292.157	303.827
Total imports (f.o.b)	628.326	1200	1170.3	2080.58	
Total sales/ Total imports (%)	8.05	9.69	18.84	14.04	

Source: Purchases and sales figures from Research Department, Bank of Ghana. Import figures for 1988 and 1989 from International Financial Statistics, IMF, May 1992. Import figures for 1990 and 1991 from the Ministry of Trade and Tourism.

Forex bureau rates vs Bank of Ghana rates

Graphs 1-4 compare forex bureau rates *vis a vis* the central bank rates from July 1988 to August 1992 for the four major currencies, i.e., the British pound, the US dollar, the CFA franc and the Deutsche mark (see Appendix Table 5 for rates used for graphs). In all the four currencies, there were big premia between the bureau rates and the central bank rates when the bureau system was first introduced in early 1988. However, the premia have fallen gradually and steadily and currently the size of the premia seems quite insignificant. It is worth noting that, with the exception of the dollar, there have been situations where bureaus have sold currency at a discount compared with the central bank's rates (see graphs). The unique behaviour of the dollar shown in the graph may be explained by the excessive demand of that currency. The US dollar seems to be the most widely used currency for transactions, precautionary and speculative purposes.

The gradual reduction in the premia between the bureau rates and the official Bank of Ghana rates was due to two main forces. The bidding up of the forex rate at the government weekly auction and the increased supply of forex to the bureau market leading to a fall in the rate of increase in bureau rates (compared to the black market days).

When the bureaus first came into existence, the public was not sure whether the government's intention of liberalization of the forex market was genuine. This was obviously understandable because of many years of confiscations and prosecutions of foreign currency dealers on the black market. The public therefore kept away from the bureaus. It was after a few months later that the public began to realize that the liberalization of the forex market was real. After this realization, the supply of currency to the bureaus began to increase thus reducing the premium. Meanwhile, as bidders on the auction market bided higher to make sure that they got their allocation on the official auction market, the official rate gradually increased with the consequent reduction in the premium. This continued on the forex market until the premium was almost negligible. In some currencies, notably the pound sterling, the CFA and the Deutsche market, the

Figure 1: Comparison of official and bureau rates, July 1988-August 1992 - The pound sterling

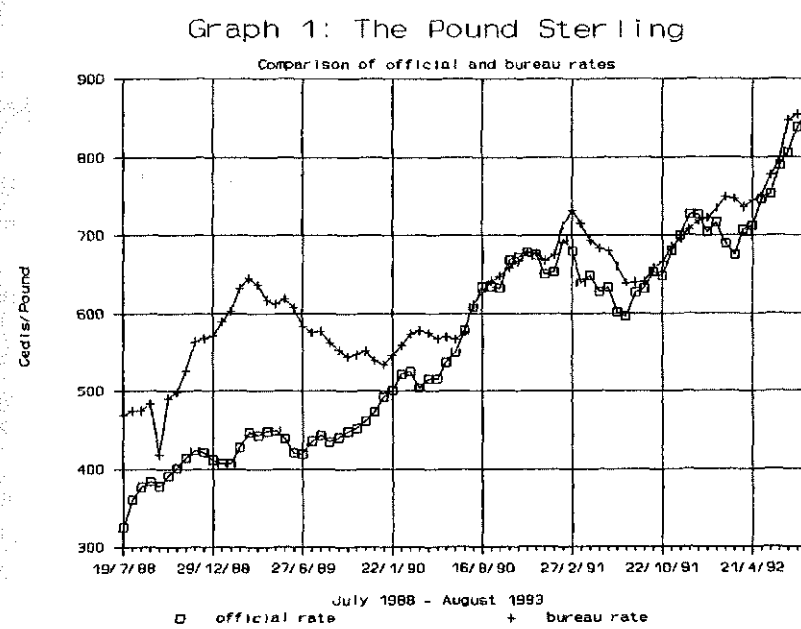


Figure 2: Comparison of official and bureau rates, July 1988 - August 1992 - The US dollar

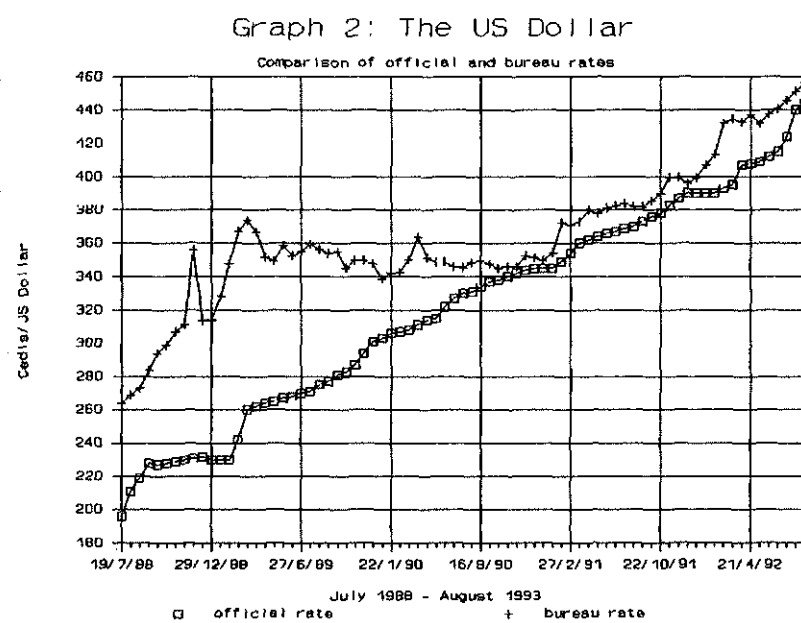


Figure 3: Comparison of official and bureau rates, July 1988 - August 1992 - The CFA franc

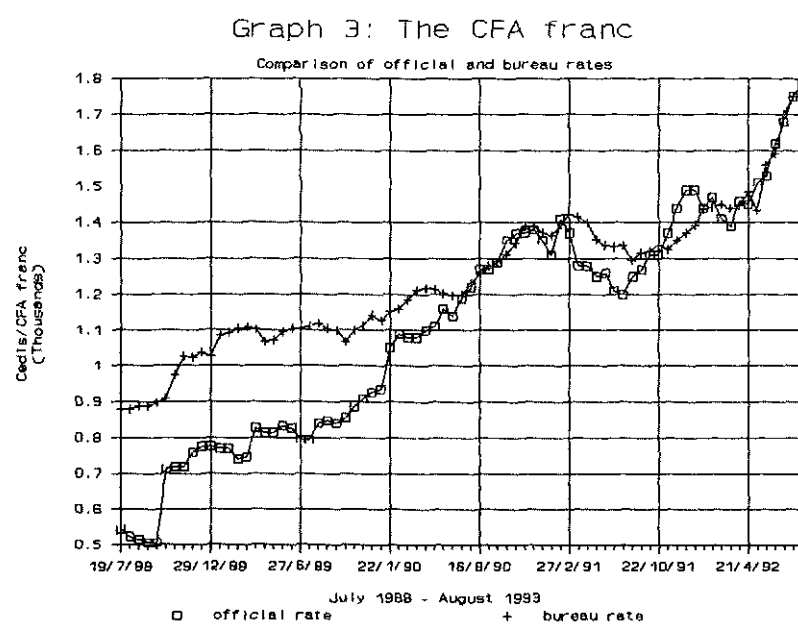
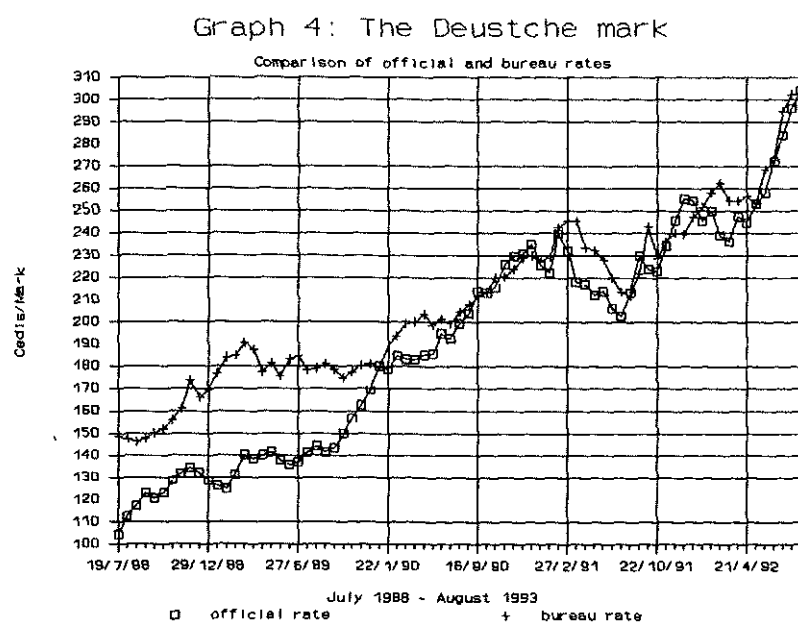


Figure 4: Comparison of official and bureau rates, July 1988 - August 1992 - The Deutsche mark



bureau rates occasionally fell below the official rate due to excess supply over demand.

Other characteristics of the bureau market

Employment

Survey analysis shows that employment by the bureaus ranged between 2-11 employees. The mode and the average were 4 and 5.6 employees respectively.

Tax generation from the forex bureaus³

One of the obvious benefits of the establishment of the forex bureaus is the tax revenue generated for government. Bureaus pay corporate tax for financial institutions which is currently 50% of net revenue. Table 10 shows the total tax payment by bureaus. In assessing whether the tax revenue paid by the bureaus is significant, Table 11 has been computed to show the forex bureau taxes as a percent of total company tax. In 1989 and 1990, the forex bureau taxes were about 1% of company tax. We may note that there is an additional tax in the form of renewal fees of US\$1,000 which is paid by each bureau every year. If this renewal fee of US\$1,000 per forex bureau is added to the bureau taxes, the revenue is significantly more than 1% of company tax. It seems obvious that the tax revenue generated by the bureaus cannot be ignored. It is a substantial source of government revenue.

Table 10: Tax payment by forex bureaus (cedis)

Year	Taxes charged	Taxes paid	Taxes Outstanding
1988	112,860,594	110,343,564	2,426,098
1989	255,870,794	275,369,782	(20,244,812)
1990	303,428,077	238,067,452	60,225,589
1991	372,039,165	102,352,574	278,192,365

Source: From the files of Internal Revenue, Accra.

Establishment of bureau rates

Responses to questionnaires on the determination of bureau rates showed that although bureaus determine their prices by demand and supply, other factors which are important in the determination of bureau prices (in order of importance) are:

1. Rates displayed by bureaus in vicinity	42%
2. Demand and supply	33%
3. Look at Bank of Ghana rates	12%
4. Market information from TV, radio, newspapers	11%
5. Look at rates of commercial banks	2%

Table 11: Forex bureau taxes as percent of total company tax (cedis)

Year	Bureau taxes (a)	Company tax (b) 000	a/b
1988	112,860,594	27,649,000	0.408%
1989	255,870,794	31,380,000	0.815394%
1990	303,428,077	36,800,000	0.82453%
1991	372,039,165	N/A	

Source: Internal Revenue Service and Statistical Service.

It is not unusual that bureaus are very sensitive to their competitors price. From economic theory this is fundamental. The price of competitors always affects the demand of a product. The Bank of Ghana rate seems important by virtue of the fact that it is the official rate serving as the bench mark for pricing in the market. Information from television, radio, etc is important because it gives the overall price trends around the country. Obviously this is a useful information for the bureaus. The importance attached to commercial banks rates may be due to their capacity to buy all available currency sold to them by clients. With such a capacity, the ability of the commercial banks to influence the forex market cannot be underestimated.

Accumulation of higher stocks of currency

The survey showed that to a large extent bureaus are not interested in holding on to high stocks of currency; the obvious reason being the high volatility of the currency market of Ghana. As much as 62% of the responses showed that whenever they found themselves with high stocks of currency without buyers, they were prepared to reduce the margin (if necessary very drastically) to attract buyers. The total responses are shown below:

1. Reduce margin (drastically if necessary) to attract buyers	61.8%
2. Sell to other bureaus	14.3%
3. Sell to known customers (on credit if necessary)	9.5%
4. Sell to bank of Ghana at their rate	4.8%

- | | |
|--|------|
| 5. Wait untill customers come | 4.8% |
| 6. Deposit money on our forex bank account | 4.8% |

Additional services rendered by bureaus

Survey analysis showed that 68% of the bureaus rendered no additional services apart from buying and selling currency. However, the remaining 32% rendered some services to their clients. The additional services include:

1. Buying travellers cheques;
2. Payment of documentary bill for collection;
3. Effecting transfer through the banks;
4. Issuing drafts;
5. Assisting customers to open letters of credit through banks;
6. Receiving remittances from overseas to dependants in Ghana; and
7. Purchasing personal cheques.

The above services are all important financial services usually performed by banks. This means that the bureaus are complementing the banks in the provision of these services. It is expected that the provision of such services will encourage the deepening of the forex market.

Customer patronage at the bureaus

Analysis on patronage at the bureaus showed that most bureaus received a maximum of 50 customers per day. The full analysis is summarised below:

<u>No. of Customers</u>	<u>Patronage (%)</u>
0-50	65.5
51-100	24
101-150	7
151-200	3.5

Problems

Analyses of questionnaires on problems faced by the bureau industry are ranked in order of frequency of mention (1 means most frequently mentioned etc.).

The major problems of the forex bureau industry of Ghana:

- | | |
|---|---|
| Competition from black market operators | 1 |
| Weak working capital base of bureaus | 2 |
| Taxes too high and too many | 3 |

Unavailability of foreign currency at all times	4
No check of receipts at the country's borders	5
Existence of fake currency	6
Banks inability to cope with foreign exchange withdrawals by bureaus	7
Funds management (including liquidity, keeping track of funds and transfers)	8

The analysis shows that black marketeering still poses a major problem to the bureau operators. The worry is understandable because of the large overheads including payment of rented premises, employees wages, utilities cost, taxes, license renewal fees, etc., incurred by bureaus. The black marketeers on the other hand virtually have no overheads and can afford to buy and sell at a discount and still survive in the market.

Many of the forex bureaus may be considered as "one-man" business. The capital base of such one-man business is usually very limited hence the poor working capital base of many of the bureaus. Perhaps one way of solving the weak working capital base is for the bureaus to arrange a line of credit with banks which may be drawn on any time more capital is required.

Bureaus are subjected to corporate tax as well as license renewal and may other taxes. The concern of the bureaus with respect to payment of high taxes therefore seems genuine.

Unavailability of foreign currency at all times is a reflection of lack of depth of the forex market. With the market still in its youthful stages, this is not unexpected (see text).

The concern of bureau operators that receipts of purchases be checked at the borders seems impracticable. Such a check would inconvenience most travellers and may be counter productive to the development of the bureau.

The existence of fake currencies should obviously concern the bureau operators and the public at large. It is, however, gratifying to note from the survey that almost all the bureaus have fake currency detectors. If the bureau operators could only be a bit more vigilant, this problem could be completely eliminated.

The banks inability to cope with foreign exchange withdrawals is due to the fact that such deposits are treated as any other forex deposits with the banks. The problem may be solved if the bureaus lodge such monies for safe keeping rather than deposit which will also mean making payments to the banks for the safe keeping services. A cost benefit analysis is necessary here.

The profitability of the bureau business depends much on the ability to manage funds especially proper scheduling of buying and selling for quicker turnover. Excessive buying without corresponding selling may lock up capital and reduce turnover thus reducing profitability drastically. Such funds management techniques will go a long way to make the bureau business more profitable.

III The efficiency of the forex bureau market

This section investigates the efficiency of the forex bureau market of Ghana. Efficiency shows whether information is widely and cheaply available to the market participants (Brealy and Myers, 1991). An efficient market means that it should not be possible for market participants to make instantaneous risk-free profits (Peirson, Bird, Brown and Howard 1990).

In this analysis, arbitrage is used as a measure of the efficiency of the forex bureau market. Riehl and Rodriquez (1983) define arbitrage as the process of taking advantage of the existence of different prices for the same product (or substitute) at the same time but in different markets (forex bureaus). The criteria used here is that if the forex bureau market is efficient, one should expect no (or only a few) cases of arbitrage. On the other hand, if the market is inefficient then there will be relatively large number of arbitrage cases occurring at short intervals.

In the arbitrage² analysis following, various dates (days) t_1, t_2, \dots, t_n were selected for 1988, 1989, 1990, 1991 and 1992 and on these dates the rates quoted by 18 bureaus drawn from around the country were obtained. The selection of the 18 bureaus was based on locational distribution around the country, reliability and adequacy of information. Dates were selected at two weekly intervals to get enough data points within each year. The four currencies of interest were again the sterling pound, the US dollar, the CFA franc, and the Deutsche mark (see appendix tables 1-4 for rate quotations of the 18 bureaus). The cities/towns from which the 18 bureaus were drawn to investigate this inter-spatial difference in rates are shown in table 10.

The cases of arbitrage (see condition for arbitrage below) are expressed as a percentage of the total number of possible comparisons of quotations between any two bureaus (see Tables 14-17).

See the distance matrix in Table 13 for distances separating cities in Table 12. Compare distances in Table 13 with distances between London, New York, Frankfurt, Tokyo, Singapore, Hong Kong etc, where most of the trading on the international foreign currency market is done. Even though the distances between Ghanaian cities are smaller, the digital communication of 'paper based' transactions on the international market cross more miles but leave less margin for price differentials.

Table 12: Distribution of bureaus used for arbitrage analysis

Bureau(s)	City of Bureau(s)
1-9	Accra
10	Tema
11-13	Kumasi
14	Dormaa Ahenkro
15	Bolga
16	Bawku
17	Takoradi
18	Tamale

Table 13: Distances separating cities used for arbitrage analysis (km)

	Accra	Tema	Kumasi	Takoradi	Bawku	Bolga	Tamale
Tema	29						
Kumasi	270	299					
Takoradi	227	256	304				
Bawku	893	922	622	918			
Bolga	810	838	539	843	83		
Tamale	650	678	379	746	243	160	
Dormaa-Ahenkro	485	514	214	518	837	670	510

Source:Geography Department, University of Ghana.

Arbitrage analysis

Condition for arbitrage

Let:

B_{itg} = the buying rate for bureau i in time t in city g
 S_{jtg} = the selling rate for bureau j in time t in city g

where

$$\begin{aligned} i &= 1 \dots r \\ t &= 1 \dots h \end{aligned}$$

$$g = 1 \dots m$$

(a) Intra-city arbitrage

$$B_{itg} > S_{jtg} \text{ or}$$

where for fixed values of t and g

$$i \neq j$$

(b) Inter-city arbitrage

$$B_{itg} > S_{itk} \text{ or}$$

$$B_{itg} - S_{itk} > 0$$

where for any fixed values of i and t

$$g \neq j$$

Calculation of arbitrage percentages

Let Y_{ij} = the total number of possible comparisons between bureaus i and j , then,

$$Y_{ij} = 2n_{ij} + x_{ij}$$

where

n_{ij} = the number of days for which both bureaus i and j have quotations for both buying and selling rates.

x_{ij} = the number of days for which one bureau has quotations for both buying and selling rates, but the other has quotations for only buying or selling rates.

Let W_{ij} = the number of cases the condition for arbitrage is satisfied i.e.,

$$B_i - S_j > 0 \text{ or } B_j - S_i > 0$$

Then, the required percentage is calculated as:

$$\frac{W_{ij}}{2n_{ij} + x_{ij}} \times 100$$

The range of values of x , n , and W are:

$$0 \leq x_{ij} \leq n_{ij}$$

$$0 \leq n_{ij} \leq h$$

$$0 \leq W_{ij} \leq 2n_{ij} + x_{ij}$$

Results

Tables⁴ 14, 15, 16, and 17 show the cases of arbitrage among the 18 bureaus in percentages for the four currencies. (Also see Appendix Tables A6-17, where Tables A6-9 show the total arbitrage cases between any two bureaus, i.e. $B_i - S_j > B_j - S_i > 0$, Appendix Tables A10-13 show $B_i - S_j > 0$ on one axis and $B_j - S_i > 0$ on the other axis, and Appendix Tables A14-17 show the total number of possible comparisons between any two bureaus i.e. $2n_{ij} + x_{ij}$).

The analysis of Tables 14-17 shows too frequent occurrences of both intra-city and inter-city arbitrage opportunities. The highest frequencies of arbitrage for all the currencies are very close to 40% with the mean percentages being about 17%, 10%, 9% and 12% for the pound, the dollar, the CFA franc and the German mark respectively. From tables 14, 15, 16, and 17, table 18 is created for detailed information on intra-city analysis for both Accra and Kumasi, intra bank analysis, inter bank and non-bank analysis and inter-city analysis between Accra and Kumasi.

With respect to the pound sterling, intra-Accra arbitrage cases among the bureaus is 10.7%. Intra-Kumasi arbitrage cases among the three bureaus from Kumasi city is 26.7%. Among the three banks from Accra, arbitrage occurrence is 8.3%. Arbitrage cases between the bank and non-bank bureaus from Accra is 13% whilst the inter-city arbitrage between the two major cities, Accra and Kumasi is 21.9% (see table 18).

From the figures on the pound sterling, pricing among the banks in Accra showed minimum arbitrage cases of 8.3%. This means that the banks prices do not deviate much from each other as far as bureaus in Accra are concerned. There appears to be a strong inter bank communication links of some sort. It is interesting to note that arbitrage cases between the bank and non-bank bureaus in Accra is higher i.e. 13% than the intra bank arbitrage cases. This indicates that there is a stronger communication links among the bank bureaus than between the bank and non-bank bureaus as far as the pound sterling is concerned. The high figure of 21.9% for the inter-city arbitrage between Accra and Kumasi is expected. With the large distance between the two cities, communication is expected to be more difficult and expensive hence the higher number of arbitrage cases. The exceptionally high intra-city arbitrage figure of 26.7% for Kumasi is unexpected. Kumasi is a relatively smaller city compared with Accra and it is expected that information will pass around quickly and cheaply than in Accra. The unusual arbitrage figure therefore seems to be due to poor data.

Interestingly the dollar, the CFA and the Deutsche mark show a similar picture as the

pound sterling. The intra bank figures are the lowest apparently for the same reasons mentioned before under the pound sterling analysis. The intra-Accra arbitrage figures are relatively lower showing how much information passes around in Accra. Again the arbitrage cases between the bank and non-bank bureaus in Accra is relatively lower showing a similar trend as the pound sterling. The intercity arbitrage cases between Accra and Kumasi is higher because of the long distance between the two cities. Again the intra-Kumasi figures are high for the dollar, the CFA, and the Deutsche mark for the same reason indicated under the pound sterling i.e. poor data.

The international foreign exchange market vs the local forex bureau market

The international foreign exchange market is highly developed. Buying and selling are done by telephone, telex, fax and other sophisticated communication facilities. Because of this, information is readily available to banks and other dealers globally. Price differentials among dealers are therefore almost non-existent. Should any price differential occur, because dealers are connected to computer terminals, the information is available almost immediately globally and the difference is removed almost instantaneously. Buying and selling may be done anywhere around the globe.

Transactions on the local forex bureau market is entirely different. All transactions are strictly on a cash basis. This implies that the market cannot react fast enough to correct any price differential existing amongst bureaus even within the same city. The Ghanaian forex bureau market is handicapped by poor communication facilities and lack of availability of currency when needed. The numerous cases of arbitrage occurring on the local market is therefore not unexpected.

Table 14: Arbitrage cases as percent of total number of possible comparisons between bureaus i and j $(W_{ij} \times 100)/(2n_{ij} + x_{ij})$ (currency: Pound)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
B1		9	4	9	15	21	7	19	14	13	24	31	31	23	7	23	18	14
B2			12	3	3	12	12	4	6	5	9	20	22	24	8	23	17	12
B3				10	16	26	7	20	16	18	21	25	30	30	6	26	11	16
B4					4	9	7	0	2	3	8	9	16	16	3	23	10	2
B5						6	15	0	9	9	10	21	29	26	13	27	18	16
B6							20	4	14	19	21	20	38	37	23	33	27	21
B7								22	15	18	18	16	15	9	1	16	0	4
B8									14	13	13	24	39	31	13	20	38	20
B9										4	18	28	35	34	7	28	20	12
B10											16	23	24	22	9	27	14	11
B11												22	34	34	18	71	23	23
B12													24	30	15	28	33	8
B13														32	16	35	17	14
B14															14	18	10	16
B15																22	5	5
B16																	14	14
B17																		6
B18																		

Source: Extracted from forex bureau quotations (see Appendix Table 1). Figures corrected to the nearest whole number.

Table 15: Arbitrage cases as percent of total number of possible comparisons between bureaus i and j $(W_{ij} \times 100)/(2n_{ij} + x_{ij})$ (currency: U.S. dollar)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
B1		9	0	3	19	22	2	17	13	8	24	34	21	1	4	12	4	27
B2			11	1	0	3	10	0	2	0	6	11	13	4	6	19	7	5
B3				1	16	23	2	13	13	4	15	32	13	0	3	12	1	0
B4					1	2	6	2	0	0	4	11	10	0	3	13	1	0
B5						1	15	0	4	0	5	10	14	5	11	22	6	3
B6							28	2	13	4	10	16	16	16	15	22	14	14
B7								17	16	14	26	37	22	2	0	6	0	8
B8									2	0	7	17	25	6	2	42	7	7
B9										5	16	16	17	5	9	19	10	7
B10											5	11	12	3	7	19	8	4
B11												15	24	11	9	23	9	9
B12													27	11	22	24	20	22
B13														16	18	19	9	10
B14															0	3	0	0
B15																10	1	0
B16																	7	13
B17																		4
B18																		

Source: Extracted from forex bureau quotations (see Appendix Table 2). Figures corrected to the nearest whole number.

Table 16: Arbitrage cases as percent of total number of possible comparisons between bureaus i and j $(W_{ij} \times 100)/(2n_{ij} + x_{ij})$ (currency: CFA franc)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
B1		7	4	5	11	17	3	13	6	6	19	25	21	9	6	7	7	4
B2			7	2	5	7	9	4	6	1	8	16	18	4	2	12	13	5
B3				4	9	12	0	15	9	4	13	19	9	7	5	12	4	2
B4					3	4	9	2	1	1	15	11	9	1	0	8	6	0
B5						0	11	2	3	2	5	3	15	6	8	18	22	9
B6							17	2	5	3	9	7	21	13	14	22	27	3
B7								13	2	4	5	18	21	2	1	5	0	2
B8									10	2	9	6	19	7	4	28	22	7
B9										0	11	8	6	0	3	11	5	4
B10											5	9	11	1	2	7	6	1
B11												15	24	14	13	28	30	20
B12													17	21	14	23	31	19
B13														16	10	22	30	22
B14															0	11	3	0
B15																13	3	0
B16																	6	6
B17																		3
B18																		

Source: Extracted from forex bureau quotations (see Appendix Table 3). Figures corrected to the nearest whole number.

Table 17: Arbitrage cases as percent of total number of possible comparisons between bureaus i and j $(W_{ij} \times 100)/(2n_{ij} + x_{ij})$ (currency: Deutsche Mark)

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
B1		5	13	6	9	13	3	9	7	7	20	21	12	25	15	24	8	7
B2			10	3	6	12	8	0	2	10	8	21	10	19	12	29	4	9
B3				4	13	24	0	9	11	11	24	24	11	4	3	9	2	2
B4					2	7	3	2	3	3	4	17	6	7	2	19	2	2
B5						10	9	6	3	9	11	11	11	16	11	21	10	7
B6							15	11	11	16	24	31	24	35	25	37	22	21
B7								13	6	6	13	15	7	17	6	21	0	4
B8									14	6	6	25	16	20	10	19	9	5
B9										4	24	18	3	14	7	21	9	5
B10											3	25	17	16	8	22	9	7
B11												23	18	28	16	33	10	9
B12													8	31	18	21	20	22
B13														20	17	32	10	11
B14															0	4	2	2
B15																17	0	2
B16																	0	2
B17																		0
B18																		

Source: Extracted from forex bureau quotations (see Appendix Table 4). Figures corrected to the nearest whole number.

Table 18: Intra and inter city arbitrage comparisons

	£	\$	CFA	DM
Intra Accra-city arbitrage	10.7	8.0	6.6	7.8
Intra Kumasi-city arbitrage	26.7	22.0	18.7	16.3
Intra bank bureaus - Accra	8.3	6.7	6.0	9.3
Inter bank and non-bank bureaus Accra	13	8.9	7.6	7.7
Inter-city, Accra and Kumasi	21.9	16.6	12.8	15.4

Source: Extracted from tables 14, 15, 16, and 17

Statistical comparisons

Having analysed arbitrage opportunities on the forex bureau market, this study probes further to see if there are differences in the rates quoted by the bureaus. Using analysis of variance the rates of 15 bureaus from around the country were compared. Using the same technique of analysis, eight bureaus from Accra were again compared for the four currencies; the pound, the dollar, the CFA and the Deutsche mark. Thus, we test the null hypothesis:

$$H_0: \bar{B}_{1g} = \bar{B}_{2g} = \bar{B}_{3g} = K\bar{B}_{4g}$$

$$\text{where } \bar{B}_{ig} = \left(\sum_{t=1}^h B_{itg} \right) / h$$

against the alternative:

H_1 : at least two of the mean buying rates are not equal.

Results

The results in Tables 19 and 20 show that the differences between the means of the buying and selling rates of bureaus around the country are significant. We may therefore infer that bureau pricing around the country is actually different, i.e, the alternative hypothesis H_1 is true at 5% level of significance.

The results for bureaus in Accra were mixed. On the buying side, the pound and the deutsche mark showed no significant differences in their pricing while the dollar and the CFA franc showed differences in pricing among the bureaus. On the selling side, with the exception of the CFA franc, there were no significant differences in the prices set by

Table 19: Anova results comparing 15 bureaus around the country

Currency	Degrees of freedom	F(0.05)	Decision
£ buy	14/585	2.5031	Reject H_0
\$ buy	14/585	3.1906	Reject H_0
CFA buy	14/585	2.3453	Reject H_0
DM buy	14/585	4.2883	Reject H_0
£ sell	14/585	1.2211	Accept H_0
\$ sell	14/585	2.0871	Reject H_0
CFA sell	14/585	4.4862	Reject H_0
DM sell	14/585	2.0947	Reject H_0

Table 20: Anova results for comparing 8 bureaus from Accra

Currency	Degrees of freedom	F(0.05)	Decision
£ buy	7/312	1.9191	Accept H_0
\$ buy	7/312	3.2051	Reject H_0
CFA buy	7/312	3.2125	Reject H_0
DM buy	7/312	1.9501	Accept H_0
£ sell	7/312	1.3412	Accept H_0
\$ sell	7/312	1.7935	Accept H_0
CFA sell	7/312	6.9560	Reject H_0
DM sell	7/312	0.4730	Accept H_0

bureaus in Accra.

The results for bureau pricing in Accra show some improvement over that of bureau pricing around the country. Information moves around Accra more quickly than it does around the country. The results in both cases are not unexpected and indicate that information is not widely and cheaply available on the forex bureau market, hence the inefficiency of the market.

V Conclusions

This study has shown that the major buyers of currency from the forex bureau market of Ghana are first, traders, second, Ghanaians who purchase currency for travel purposes, and third, companies. The role of traders is pivotal since more than 50% of the currency on this market is bought by them. The research has also established that the major sources of foreign currency to the forex bureaus are remittances sent in by Ghanaians resident outside the country, tourists and to a lesser extent traders. The dual role of traders as buyers and sellers on this market is worth noting.

The establishment of the forex bureaus has boosted external trade in general and intra-West African trade in particular. The study established that a higher proportion of the traders who purchase foreign currency actually use it within West Africa. This is obviously a positive development for the sub-region.

The forex bureau market has especially helped small-scale users of foreign currency, since about 85% of the number of transactions on the market are below US\$1,000. Big time users have also benefited, however large volume purchases are difficult to execute because of a constant lack of currency availability. This problem can be overcome by making enquiries from several bureaus, although this may be an arduous task.

Despite the legalization of the black market into the forex bureau system, some black market activities are still going on. However, the premium is so small that, looking at the risks involved, it may not be worth purchasing from the black market. The survey shows that this is still a worry to those bureau operators located in the city centres and the border towns where these black marketeers are prevalent.

In terms of efficiency, the many cases of arbitrage opportunities existing on the forex bureau market show that the market is inefficient. This situation is easily understood by looking at the communication facilities available in the country and the cost of information dissemination. More importantly, because the forex bureau market deals only in physical cash transactions, buying from low priced bureaus to sell to high priced bureaus is not easily achieved even if minimum distances separate bureaus (compared with mere paper transactions on the international foreign exchange market).

Apart from the fact that the forex bureau market has improved the availability of foreign currency of the country, there is additional benefit to government by way of tax revenue and employment. Forex bureau taxes are more than 1% of company taxes plus renewal fees of US\$1,000 per bureau per year. Another benefit obtained by introducing the bureaus is employment, which the study established to be about five employees per bureau.

Even though there are problems associated with the forex bureaus, most Ghanaians readily admit that the forex bureaus have removed inconveniences and bureaucracy, especially for small amounts of foreign currency. Whatever its short comings, the forex bureau system is a vast improvement on the exchange control system.

Policy recommendations

Bureaus have improved the foreign exchange sourcing of Ghana. One of the important sources of foreign currency on the forex bureau market is from tourists. A major limitation of the market is low currency availability. We can therefore improve on currency availability by encouraging tourism in the country. By putting in place the right policies which will promote tourism, we shall be improving currency availability on the market at the same time.

Despite the legalization of the forex bureaus, black marketing still exists. A good reason why they still exist may be due to the establishment requirements of going into the forex bureau business. Currently, the requirements⁵ to be fulfilled to establish and operate a bureau include 1. annual payment of tax at 50% of net revenue (tax rate of financial institutions); 2. license renewal fee⁶ of US\$1,000 per annum; 3. maintenance of a mandatory minimum balance of the equivalent of US\$5,000 at all times (see Appendix Table A6 for guidelines for the establishment of forex bureaus in Ghana).

While the tax requirement is normal, since all businesses pay tax, requirements 2 and 3 seem a bit superfluous and may pose a financial barrier to entry into the forex bureau business. The authorities need to take a second look at the entry and maintenance requirements of this industry, as the incidence of black marketing may be reduced substantially by lowering the entry requirements of the forex bureau business so that many black market operators can register their businesses. If this is not done, black markets may always coexist with the bureaus to the disadvantage of both the government (loss of tax) and the bureau operators (disadvantaged competition).

Traders are the major users of currency on the forex bureau market. It is also known that traders experience numerous problems at the country's borders. Since the traders bring various goods into the country, by taking steps to reduce the bureaucracy confronting them we can improve the availability of many goods brought in by these traders to the benefit of the economy.

It was apparent in the course of the survey that some bureaus were more or less black marketing, for example these bureaus did not issue receipts to customers if customers did not ask for them. All such instances will lead to under-reporting of foreign exchange purchases and sales. Occasional seminars by the Bank of Ghana to educate the bureau operators may reduce such practices. The formation of an active forex bureaus operators association⁷ as a watchdog may also help curb such practices.

Appendix A: Data tables

Table A1: Pound sterling quotations from 1988 to 1992 for 18 Bureaus from 8 cities

Date	Bureau 1		Bureau 2		Bureau 3		Bureau 4		Bureau 5		Bureau 6	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88							480	488				
10/05/88							480	490				
26/05/88							480	490				
14/06/88		485	495				480	490				
30/06/88			480	490							480	488
19/07/88	450	460	470	490							475	490
01/08/88	460	470	470	490							480	488
17/08/88	460	480	470	490							475	485
05/09/88	480	490	470	490							480	485
23/09/88	485	495	485	495							490	495
11/10/88	490	498	485	495							485	490
27/10/88	490	500	490	510							500	505
14/11/88	510	520	510	520							530	545
28/11/88	540	570	545	555							570	575
19/12/88	560	580	560	580							560	570
29/12/88	550	580	560	580							577	580
11/01/89	580	590	580	590							593	595
27/01/89	585	595	600	610							612	620
13/02/89	620	625	620	630							638	645
09/03/89	640	650	640	650							640	650
30/03/89	630	647	635	650							630	640
12/04/89	610	640	610	640							600	620
27/04/89	600	640	605	625							600	610
17/05/89	600	630	580	625					590	610	620	623
09/06/89	590	605	580	610					560	610	615	620
27/06/89	575	590	585	605					560	610	580	590
19/07/89	570	580	560	590			560	610	560	610	572	582
08/08/89	570	585	570	590			560	600	560	590	575	580
30/08/89	550	565	560	580			560	590	550	570	560	575
21/09/89	535	550	540	570			520	570	550	575	555	570
10/10/89	530	550	540	570			520	570	530	570	545	553
31/10/89	530	580	520	565			520	570	530	550	535	545
23/11/89	540	555	520	560			520	560	530	555	552	560
11/12/89	520	535	530	560			540	560	530	560	550	552
29/12/89	520	535	520	560			515	560	545	550	540	542

Table A1.....continued

22/01/90	530	545	520	555			530	560	545	560	552	560
08/02/90	540	555	540	560			550	570	555	570	567	575
26/02/90	545	560	570	580			575	575	580	595	590	600
19/03/90	550	565	580	590			585	610	590	605	595	602
09/04/90	560	575	570	585			570	610	580	596	575	590
26/04/90	560	575	570	585			560	610	560	585	565	570
17/05/90	555	570	565	580	560	570	550	600	560	575	570	585
12/06/90	555	568	565	580	560	570	530	590	560	580	570	574
02/07/90	569	575	565	580	570	595	530	590	575	590	576	585
25/07/90	605	610	600	610	605	615	580	610	600	620	610	620
16/08/90	622	630	615	630	620	640	600	625	610	625	625	635
04/09/90	620	640	630	640	630	650	610	635	640	655	650	655
27/09/90	635	650	645	650	635	655	645	655	645	655	650	655
18/10/90	650	665	640	645	650	660	640	655	645	660	655	665
09/11/90	660	670	650	660	650	660	650	670	655	670	665	673
27/11/90	670	680	670	680	675	685	660	685	675	683	680	685
10/12/90	670	680	670	680	670	680	660	685	675	687	676	680
24/12/90	645	680	650	680	670	680	640	680	640	680	666	680
15/01/91	660	670	670	680	670	680	650	675	675	685	684	685
11/02/91	690	700	700	715	700	710	690	725	725	740	727	735
27/02/91	695	710	755	770	700	730	740	775	755	770	760	763
19/03/91	695	710	700	755	700	730	710	745	720	740	725	730
10/04/91	680	700	670	740	700	710	660	725	680	690	695	698
03/05/91	680	690	680	700	690	710	670	720	670	695	680	684
28/05/91	675	690	670	690	680	690	640	680	670	680	675	680
20/06/91	630	665	670	685	660	680	650	680	670	684	670	675
10/07/91	605	640	600	670	630	670	600	670	635	670	640	670
05/08/91	625	640	620	660	630	650	600	665	640	645	645	650
30/08/91	630	645	620	660	630	650	600	665	637	655	642	645
25/09/91	650	660	645	655	630	650	640	665	657	661	660	664
22/10/91	650	670	665	675	650	665	660	675	665	675	670	675
14/11/91	675	689	675	680	670	685	665	685	681	690	688	689
09/12/91	690	705	690	700	700	710	660	700	682	690	694	695
23/12/91	705	720	690	700	685	700	660	700	693	698	700	705
06/01/92	710	730	708	710	710	720	680	705	705	710	613	720
22/01/92	700	715	740	745	710	720	725	745	730	744	735	740
10/02/92	710	735	740	750	700	725	720	740	742	750	745	748
27/02/92	705	730	775	780	720	740	750	780	775	778	776	785
13/03/92	705	735	770	780	720	740	750	780	770	780	768	780
31/03/92	705	735	750	770	710	730	740	775	750	770	750	755
20/04/92	-	-	735	760	720	740	730	750	735	755	743	746
13/05/92	740	750	735	760	730	750	740	760	750	756	753	757
04/06/92	-	-	770	778	750	765	770	760	775	780	775	780
30/06/92	786	792	792	797	760	785	785	795	795	800	799	805
21/07/92	825	840	842	850	800	810	840	860	845	855	859	864
06/08/92	850	860	850	862	840	850	840	860	850	865	852	855
14/08/92	850	860	845	858	845	855	840	860	850	863	850	855

Table A1....continued

Date	Bureau 7		Bureau 8		Bureau 9		Bureau 10		Bureau 11		Bureau 12	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
29/04/88												
13/04/88												
10/05/88												
26/05/88												
14/06/88					480	490						
30/06/88					480	490						
19/07/88					470	485	473	485				
01/08/88					470	490	470	480				
17/08/88					470	490	476	490				
05/09/88					470	-	475	490				
23/09/88					480	500	485	490				
11/10/88					485	-	490	500				
27/10/88					495	-	492	510				
14/11/88					510	530	510	520				
28/11/88					-	530	540					
19/12/88					560	-	550	580				
29/12/88					560	-	550	565				
11/01/89					575	-	575	580				
27/01/89					600	620	595	600				
13/02/89			-		-	620	625					
09/03/89					640	655	645	650				
30/03/89					630	-	630	640				
12/04/89					600	-	610	640			620	640
27/04/89					580	-	610	630			600	620
17/05/89					580	-	580	625			610	620
09/06/89			-		-	580	610		610		620	
27/06/89			-		-	580	595		600		610	
19/07/89					570	580	570	580			600	610
08/08/89					560	-	565	583			600	610
30/08/89					560	-	550	582			585	590
21/09/89					555	-	550	575			560	565
10/10/89					540	555	540	570			560	565
31/10/89					530	550	540	560			560	565
23/11/89					550	-	535	555			540	570
11/12/89	520	560				545	-	545	560		540	565
29/12/89	525	575				530	535	535	550		540	560
22/01/90	520	570			-	545	540	559			550	565
08/02/90	520	570			560	560	550	560			560	570
26/02/90	530	580			580	590	560	590			590	595
19/03/90	530	580			590	615	580	600			590	600
09/04/90	530	585			570	595	580	600			595	610
26/04/90	530	585			560	585	570	590			585	590
17/05/90	515	565			565	565	560	580			590	595
12/06/90	550	585			-	595	565	580	580	585	580	583
02/07/90	550	585			-	-	583	590	580	590	580	580
25/07/90	560	595			600	605	595	605	600	610	580	585

Date	Bureau 13 Buy Sell	Bureau 14 Buy Sell	Bureau 15 Buy Sell	Bureau 16 Buy Sell	Bureau 17 Buy Sell	Bureau 18 Buy Sell
13/04/88						
29/04/88						
10/05/88						
26/05/88						
14/06/88						
30/06/88						
19/07/88						

Table A1.....continued

01/08/88													
17/08/88													
05/09/88										470	490		
23/09/88										470	490		
11/10/88										460	495		
27/10/88										485	495		
14/11/88										490	500		
28/11/88										500	525		
19/12/88										510	540		
29/12/88										510	540		
11/01/89										520	540		
27/01/89										530	550		
13/02/89										600	610		
09/03/89										620	645		
30/03/89									630	645	590	620	
12/04/89	620	640							620	645	580		
27/04/89	620	635					580	620	600	620	590	610	
17/05/89	590	600					580	620	580	600	580	620	
09/06/89	590	600					580	600	580	600	580	620	
27/06/89	595	600					570	600	570	620	580	610	
19/07/89	580	590					570	600	540	580	550	600	
08/08/89	580	585					550	570	560	580	550	600	
30/08/89	565	570	540	580			550	590	-	-	540	600	
21/09/89	555	565	540	570			530	590	530	570	550	600	
10/10/89	555	565	500	540			530	560	520	570	550	600	
31/10/89	555	560	500	540			500	530	530	560	540	590	
23/11/89	555	565	500	540			530	550	510	560	540	550	
11/12/89	545	565	500	540			500	530	510	560	550	560	
29/12/89	545	550	500	540			500	530	500	560	550	590	
22/01/90	555	560	500	540	520	-	500	590	530	560			
08/02/90	565	570	540	580	540	-	500	540	530	560			
26/02/90	580	600	540	580	530	-	500	550	530	570			
19/03/90	595	600	540	580	540	580	500	550	570	590			
09/04/90	595	600	540	580	550	580	530	560	570	590			
26/04/90	595	600	540	580	540	-	530	540	570	590			
17/05/90	590	600	540	580	560	-	500	540	540	590			
12/06/90	575	580	540	580	500	580	500	550	550	590			
02/07/90	575	580	540	580	560	-	530	550	550	590			
25/07/90	595	600	540	580	585	600	530	550	580	600			
16/08/90	625	630	580	610	610	620	530	570	590	620			
04/09/90	620	630	580	610	610	640	530	570	620	640			
27/09/90	620	630	580	610	620	650	530	570	620	640			
18/10/90	635	635	600	640	630	660	530	570	640	650			
09/11/90	636	640	600	640	640	660	530	570	640	650			
27/11/90	637	645	600	640	660	-	550	580	640	655			
10/12/90	675	680	600	640	660	680	530	580	640	655			
24/12/90	675	680	600	640	650	690	550	580	620	660			
15/01/91	696	700	620	640	650	675	600	650	640	660	650	680	

Table A1....continued

11/02/91	700	710	620	640	670	720	600	650	650	690	700	740
27/02/91	700	710	650	680	690	720	600	660	710	730	710	740
19/03/91	700	710	680	720	680	740	650	670	690	730	680	740
10/04/91	695	700	580	620	670	690	650	670	690	710	650	700
03/05/91	690	700	600	640	620	710	650	670	650	690	640	700
28/05/91	690	690	620	650	640	700	650	690	650	690	640	675
20/06/91	645	650	630	655	640	700	650	690	650	680	640	650
10/07/91	640	645	630	650	630	700	650	690	650	680	600	650
05/08/91	625	630	600	640	620	630	650	690	650	680	600	670
30/08/91	620	625	600	640	610	630	650	690	600	660	600	620
25/09/91	625	632	630	660	630	670	640	690	600	660	600	620
22/10/91	635	640	610	660	640	670	640	700	620	660	650	670
14/11/91	645	650	640	660	650	680	650	700	650	690	650	675
09/12/91	665	670	650	660	660	685	660	700	670	690	650	700
23/12/91	675	680	650	660	675	685	660	700	-	690	660	680
06/01/92	745	750	670	700	680	700	700	750	680	700	660	700
22/01/92	745	750	670	700	700	740	700	740	690	710	705	730
10/02/92	745	750	700	750	690	720	700	740	690	720	725	740
27/02/92	765	770	720	775	720	778	700	740	710	735	740	760
13/03/92	745	750	755	775	730	760	700	735	730	735	740	765
31/03/92	740	745	760	770	730	770	700	735	730	750	740	765
20/04/92	695	700	730	740	710	740	720	750	730	750		
13/05/92	700	705	710	750	740	750	720	750	700	750		
04/06/92	706	710	760	765	745	770	720	750	710	750		
30/06/92	740	745	760	765	760	800	730	760	750	770		
21/07/92	786	790	800	830	820	820	730	760	760	800		
06/08/92	840	848	780	830	840	880	730	760	820	840		
14/08/92	840	848	780	830	840	860	730	760	820	840		

Table A2: Dollar from 1988 to 1992 for 18 bureaus from 8

Date	Bureau 1		Bureau 2		Bureau 3		Bureau 4		Bureau 5		Bureau 6	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88											260	268
10/05/88											258	265
26/05/88											260	263
14/06/88			255	265							250	265
30/06/88			260	270							262	270
19/07/88	260	270	260	270							255	270
01/08/88	265	275	265	275							265	270
17/08/88	270	280	270	280							272	270
05/09/88	280	290	280	290							275	290
23/09/88	290	305	285	295							285	295
11/10/88	295	305	290	305							295	300
27/10/88	300	310	300	310							308	310
14/11/88	310	320	315	325							305	310
28/11/88	340	370	345	350							353	360
19/12/88	280	350	300	330							295	330
29/12/88	270	350	300	330							315	320
11/01/89	290	345	320	340							332	345
27/01/89	340	350	350	360							340	360
13/02/89	360	370	360	370							360	378
09/03/89	375	385	375	385							360	375
30/03/89	350	377	365	380							360	380
12/04/89	310	378	340	370							350	370
27/04/89	320	370	350	365							350	357
17/05/89	350	370	340	365					350	360	354	360
09/06/89	345	360	355	370					360	365	350	355
27/06/89	350	360	365	380					360	365	-	-
19/07/89	350	360	360	375			350	375	360	365	362	365
08/08/89	345	360	350	370			350	375	340	375	355	365
30/08/89	340	355	350	365			350	375	350	370	355	365
21/09/89	340	355	355	365			340	365	350	365	360	365
10/10/89	335	350	350	360			340	365	345	365	352	360
31/10/89	335	350	350	365			340	365	350	365	352	362
23/11/89	335	350	345	360			340	365	350	365	352	360
11/12/89	330	345	345	360			340	365	-	360	355	360
29/12/89	320	335	330	360			340	365	350	360	345	355
22/01/90	320	335	320	355			330	365	345	360	354	360
08/02/90	325	340	340	360			335	360	345	360	350	355
26/02/90	335	350	340	360			340	360	350	360	355	360
19/03/90	340	355	340	360			345	365	340	360	355	360
09/04/90	340	355	350	360			350	365	350	365	350	360
26/04/90	340	355	345	360			350	365	345	360	345	355
17/05/90	335	350	345	360	345	355	345	360	350	360	353	358
12/06/90	332	348	345	355	345	355	340	355	345	355	348	356
02/07/90	335	349	345	355	345	335	340	355	350	355	345	352
25/07/90	335	350	345	355	345	355	340	360	345	365	350	358

Table A2....continued

16/08/90	335	350	340	350	340	350	330	355	340	350	342	350
04/09/90	335	350	340	350	340	350	330	355	335	345	340	345
27/09/90	340	345	340	350	340	350	340	355	345	345	345	350
18/10/90	338	348	340	350	340	350	340	355	345	355	347	352
09/11/90	340	348	340	355	340	350	340	355	345	350	345	350
27/11/90	348	355	345	355	345	355	340	355	350	356	350	357
10/12/90	345	355	340	355	345	355	335	355	342	360	350	355
24/12/90	342	355	330	355	345	355	330	355	345	360	347	355
15/01/91	345	355	350	360	345	350	340	360	350	360	357	360
11/02/91	360	370	370	375	355	370	365	380	375	385	377	382
27/02/91	354	370	385	390	370	375	370	390	380	390	373	387
19/03/91	360	370	375	385	360	375	365	385	380	388	375	388
10/04/91	365	375	375	385	365	375	370	390	385	395	387	392
03/05/91	365	375	380	395	350	380	375	390	380	390	383	388
28/05/91	370	380	380	390	350	380	375	390	385	390	385	390
20/06/91	370	380	385	390	375	385	380	395	388	396	385	395
10/07/91	370	380	385	395	375	385	380	395	385	395	391	394
05/08/91	370	380	380	395	370	390	380	400	385	394	386	392
30/08/91	373	380	380	390	370	390	370	395	384	395	386	388
25/09/91	376	385	382	395	375	380	375	395	386	392	388	393
22/10/91	378	388	387	395	370	390	385	395	388	397	395	398
14/11/91	384	398	405	410	385	395	395	410	403	410	406	410
09/12/91	387	398	400	405	385	395	380	405	400	410	405	408
23/12/91	390	400	370	402	360	400	375	400	390	400	395	398
06/01/92	390	400	405	410	390	400	380	405	400	408	402	405
22/01/92	392	405	410	416	400	410	400	415	410	418	413	418
10/02/92	395	410	424	427	400	420	410	420	422	432	422	427
27/02/92	405	420	452	458	410	425	440	455	448	456	450	454
13/03/92	412	435	440	452	430	440	430	450	435	450	444	448
31/03/92	412	430	440	448	430	440	440	450	442	450	442	447
20/04/92	-	-	430	440	430	440	425	450	430	445	434	440
13/05/92	420	435	430	440	430	440	430	440	434	442	435	438
04/06/92	-	-	435	440	430	440	430	440	435	445	436	439
30/06/92	425	445	444	448	430	440	435	445	440	450	444	448
21/07/92	430	448	448	453	430	445	445	455	450	454	450	454
06/08/92	445	455	447	456	440	450	430	450	450	458	450	454
14/08/92	447	480	447	455	445	455	440	450	450	457	457	460

Date	Bureau 7		Bureau 8		Bureau 9		Bureau 10		Bureau 11		Bureau 12	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88							255	265				
30/06/88							260	270				
19/07/88							250	270	265	270		

Table A2.....continued

01/08/88					265	275	265	275				
17/08/88					270	280	270	275				
05/09/88					280	290	278	290				
23/09/88					290	305	285	300				
11/10/88					285	305	285	305				
27/10/88					300	315	298	310				
14/11/88					320	330	315	330				
28/11/88					350	365	350	370				
19/12/88					290	-	300	340				
29/12/88					310	-	320	340				
11/01/89					330	350	330	350				
27/01/89					350	360	350	360				
13/02/89					365	375	360	380				
09/03/89					370	385	370	383				
30/03/89					350	380	370	383	360		365	
12/04/89					350	370	340	370	340		345	
27/04/89					350	360	340	370	340		345	
17/05/89					350	360	340	350	360		373	
09/06/89				-	-	360	370		365		375	
27/06/89				-	-	365	380		375		380	
19/07/89					360	370	360	375	375		390	
08/08/89					350	-	355	370	360		365	
30/08/89					350	365	345	366	350		360	
21/09/89					355	375	350	370	355		370	
10/10/89					345	355	350	365	360		365	
31/10/89					350	375	340	360	360		365	
23/11/89					350	370	350	360	355		365	
11/12/89	325	350			345	360	345	360	355		365	
29/12/89	320	350			340	345	335	350	340		360	
22/01/90	315	345			-	-	345	360	355		360	
08/02/90	315	345			345	355	340	353	360		363	
26/02/90	315	345			340	360	350	360	357		365	
19/03/90	315	345			340	360	350	362	357		365	
09/04/90	315	350			355	360	355	365	358		365	
26/04/90	315	350			345	365	350	365	355		360	
17/05/90	315	350			345	360	340	360	360		365	
12/06/90	325	350			-	365	335	346	350	360	360	365
02/07/90	325	350			-	-	345	355	355	360	355	360
25/07/90	325	350			350	365	345	356	355	360	356	360
16/08/90	325	350			340	355	342	353	340	348	350	354
04/09/90	325	350			335	355	340	355	335	345	335	340
27/09/90	330	347			340	345	336	350	345	355	342	350
18/10/90	330	347			340	360	345	353	345	350	342	350
09/11/90	330	347			345	360	345	347	345	350	345	358
27/11/90	330	347			345	365	350	358	355	360	360	365
10/12/90	335	350			345	360	342	355	345	355	350	360
24/12/90	335	350			340	-	343	355	348	356	340	370
15/01/91	335	350	350	360	355	-	350	360	350	360	355	360

Table A2....continued

11/02/91	335	355	360	380	365	-	368	380	370	385	380	388
27/02/91	345	365	375	392	375	377	373	390	390	397	380	395
19/03/91	355	375	375	390	-	390	375	387	340	345	385	395
10/04/91	355	375	370	390	385	395	380	390	385	400	395	398
03/05/91	365	385	375	390	380	382	380	395	387	405	394	398
28/05/91	365	385	375	395	382	390	378	390	360	370	394	398
20/06/91	365	385	380	395	385	395	380	393	388	397	395	398
10/07/91	365	385	380	395	385	395	380	390	390	400	392	394
05/08/91	360	385	380	395	370	390	380	400	392	402	397	398
30/08/91	360	385	380	390	382	384	380	390	386	395	385	390
25/09/91	360	385	382	392	385	395	380	390	388	390	393	398
22/10/91	365	390	390	395	390	-	390	400	393	400	392	395
14/11/91	365	390	404	409	402	410	402	410	393	400	410	415
09/12/91	375	400	390	410	395	410	390	408	400	412	415	420
23/12/91	375	400	385	405	390	410	385	410	390	400	415	425
06/01/92	375	400	400	408	395	410	390	410	370	400	402	410
22/01/92	375	400	411	414	410	415	410	420	410	418	400	418
10/02/92	385	410	422	424	418	430	415	424	422	427	425	430
27/02/92	385	410	452	460	450	465	440	460	420	440	460	465
13/03/92	395	420	435	445	450	455	430	450	440	445	465	470
31/03/92	400	435	440	450	440	450	440	450	440	450	443	445
20/04/92	400	435	-	-	-	-	425	440	432	450	440	443
13/05/92	400	435	433	440	430	450	425	440	435	440	440	445
04/06/92	400	435	-	-	-	-	425	440	432	439	440	445
30/06/92	400	435	442	450	440	450	440	450	442	448	450	458
21/07/92	410	450	450	455	452	460	442	450	415	460	450	460
06/08/92	425	455	446	455	447	465	442	455	440	452	450	460
14/08/92	425	455	447	455	450	-	445	455	445	455	452	458

Date	Bureau 13		Bureau 14		Bureau 15		Bureau 16		Bureau 17		Bureau 18	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88												
30/06/88												
19/07/88												
01/08/88												
17/08/88												
05/09/88									270	280		
23/09/88									270	280		
11/10/88									280	300		
27/10/88									290	300		
14/11/88									300	310		
28/11/88									310	325		
19/12/88									280	330		
29/12/88									270	290		

Table A2....continued

11/01/89										300	320	
27/01/89										310	330	
13/02/89										310	330	
09/03/89	375	385								365	380	300
30/03/89	375	385								350	370	310
12/04/89	350	365								350	370	340
27/04/89	350	365					320	350	330	350	360	370
17/05/89	350	360					320	350	330	350	330	360
09/06/89	365	370					320	350	330	350	350	380
27/06/89	370	375					320	350	340	370	350	370
19/07/89	365	375					320	350	340	370	340	370
08/08/89	360	366					320	350	350	370	340	360
30/08/89	360	365	320	370			340	360	-	-	340	370
21/09/89	360	365	320	370			340	360	340	370	340	380
10/10/89	360	365	320	370			330	370	340	370	340	370
31/10/89	355	360	320	350			320	370	340	370	340	370
23/11/89	355	360	320	350			320	370	320	360	340	360
11/12/89	345	355	320	350			320	370	320	360	340	360
29/12/89	345	355	320	350			320	370	320	360	350	370
22/01/90		355	360	320	350	330	335	320	370	330	360	
08/02/90		350	355	320	350	345	-	320	360	330	360	
26/02/90		350	360	320	350	330	-	320	360	330	360	
19/03/90		355	360	320	350	330	360	320	360	330	360	
09/04/90		355	365	320	350	330	360	330	360	330	360	
26/04/90		355	360	320	350	340	-	330	360	340	360	
17/05/90		355	360	320	350	340	360	330	360	340	360	
12/06/90		350	355	320	350	345	360	330	370	330	360	
02/07/90		350	355	330	350	340	-	330	370	340	360	
25/07/90	345	350	330	350	335	340	330	370	340	360		
16/08/90	340	345	320	350	335	360	300	350	320	340		
04/09/90	340	345	320	350	335	350	300	350	330	355		
27/09/90	345	350	320	350	335	350	300	350	330	355		
18/10/90	345	350	320	345	335	350	300	350	330	355		
09/11/90	348	350	320	345	340	355	300	350	330	355		
27/11/90	348	350	320	345	345	-	300	350	340	355		
10/12/90	348	350	325	355	345	350	300	350	340	340		
24/12/90	348	350	320	350	335	360	300	350	320	355		
15/01/91	378	380	325	350	340	350	300	340	340	355	340	355
11/02/91	370	380	340	370	355	380	300	340	355	370	365	375
27/02/91	370	375	350	380	355	385	-	-	360	385	370	385
19/03/91	375	382	350	380	360	380	320	360	360	375	365	385
10/04/91	370	375	350	380	360	382	340	360	360	385	360	390
03/05/91	-	-	360	390	365	390	340	360	355	385	360	390
28/05/91	-	-	360	390	370	395	340	360	370	385	370	390
20/06/91	360	365	360	390	370	390	340	360	365	390	360	400
10/07/91	345	351	360	390	370	395	350	370	375	390	360	390
05/08/91	-	-	370	395	375	400	350	370	375	390	370	390

Table A2....continued

30/08/91	335	342	360	390	370	395	350	370	375	390	375	395
25/09/91	348	352	370	390	375	390	370	380	375	390	380	390
22/10/91	375	380	370	390	380	395	370	380	380	390	385	400
14/11/91	385	390	390	410	385	405	370	380	390	400	385	395
09/12/91	395	400	380	410	380	405	370	380	380	410	380	400
23/12/91	395	400	370	410	390	405	370	380	370	400	388	405
06/01/92	395	400	380	410	390	410	410	430	370	400	385	405
22/01/92	395	400	390	440	380	420	410	430	390	410	400	410
10/02/92	440	445	440	415	400	425	410	430	400	415	400	415
27/02/92	445	450	420	450	405	430	415	430	400	425	420	455
13/03/92	435	450	430	450	405	450	415	425	415	450	425	450
31/03/92	438	400	420	450	415	440	420	440	430	455	425	450
20/04/92	415	420	430	450	415	440	420	440	430	455		
13/05/92	430	434	410	445	425	433	420	440	420	450		
04/06/92	435	438	425	445	425	455	420	440	420	450		
30/06/92	442	445	430	445	430	450	420	440	430	450		
21/07/92	440	444	435	460	440	450	430	440	430	450		
06/08/92	440	446	430	450	442	460	420	440	430	455		
14/08/92	445	450	430	450	445	460	420	440	430	455		

Table A3: CFA quotations from 1988 to 1992 for 18 bureaus from 8 cities

Date	Bureau 1		Bureau 2		Bureau 3		Bureau 4		Bureau 5		Bureau 6	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88											900	910
10/05/88											905	915
26/05/88											890	910
14/06/88			890	900							880	900
30/06/88			890	900							890	900
19/07/88	860	870	880	900							880	900
01/08/88	860	870	880	900							885	900
17/08/88	870	900	880	900							880	900
05/09/88	870	900	870	890							880	900
23/09/88	880	900	890	905							900	910
11/10/88	910	920	905	930							890	910
27/10/88	960	990	960	990							970	980
14/11/88	1000	1030	1000	1030							1030	1050
28/11/88	1010	1040	1100	1120							-	-
19/12/88	1000	1110	980	1100							980	1060
29/12/88	900	1110	900	1050							1030	1070
11/01/89	1000	1150	1050	1080							1080	1110
27/01/89	1050	1150	1090	1120							1070	1100
13/02/89	1080	1150	1060	1120							1080	1110
09/03/89	1080	1120	1090	1130							1100	1130
30/03/89	1080	1130	1100	1130							1070	1130
12/04/89	950	1130	1080	1125							1070	1120
27/04/89	1000	1130	1090	1125							1060	1100
17/05/89	1080	1130	1090	1125					1070	1130	1080	1090
09/06/89	1100	1130	1100	1130					1070	1130	1085	1100
27/06/89	1100	1110	1100	1130					1090	1150	-	-
19/07/89	1090	1120	1080	1130			1060	1135	1090	1150	1110	1130
08/08/89	1100	1130	1100	1130			1060	1140	1090	1140	1115	1130
30/08/89	1060	1120	1100	1140			1100	1140	1100	1140	1110	1130
21/09/89	1080	1120	1050	1130			1100	1140	1050	1130	1080	1120
10/10/89	1000	1120	1000	1120			1000	1120	1000	1100	1060	1090
31/10/89	1050	1120	1080	1100			1000	1120	1080	1120	1110	1120
23/11/89	1050	1120	1120	1140			1050	1155	1120	1160	1130	1155
11/12/89	1080	1120	1130	1150			1105	1160	1140	1180	1180	1190
29/12/89	1080	1120	1140	1160			1120	1170	1140	1200	1140	1170
22/01/90	1080	1120	1120	1160			1190	1190	1170	1210	1200	1210
08/02/90	1100	1140	1160	1190			1190	1220	1180	1220	1190	1210
26/02/90	1150	1190	1160	1190			1185	1220	1180	1220	1190	1210
19/03/90	1170	1210	1180	1200			1185	1220	1210	1220	1220	1250
09/04/90	1180	1220	1200	1220			1185	1250	1220	1260	1225	1250
26/04/90	1180	1220	1200	1220			1200	1260	1180	1240	1220	1240
17/05/90	1150	1200	1200	1220	1150	1225	1200	1260	1200	1240	1220	1240
12/06/90	1150	1200	1200	1220	1150	1225	1190	1250	1190	1230	1210	1230
02/07/90	1150	1200	1200	1200	1200	1230	1190	1250	1180	1250	1210	1235
25/07/90	1200	1240	1200	1220	1200	1240	1200	1250	1220	1250	1240	1250

Table A3....continued

16/08/90	1250	1270	1230	1250	1200	1240	1200	1250	1240	1260	1240	1270
04/09/90	1250	1290	1240	1260	1240	1280	1220	1260	1270	1300	1280	1300
27/09/90	1280	1300	1280	1300	1260	1300	1270	1310	1280	1320	1280	1310
18/10/90	1290	1340	1280	1300	1280	1320	1270	1310	1290	1320	1300	1320
09/11/90	1310	1350	1300	1320	1280	1320	1270	1310	1340	1360	1340	1370
27/11/90	1350	1390	1380	1400	1340	1380	1340	1400	1360	1420	1400	1410
10/12/90	1350	1395	1360	1400	1320	1375	1340	1400	1360	1400	1400	1410
24/12/90	1350	1375	1350	1400	1380	1400	1340	1400	1370	1400	1370	1390
15/01/91	1315	1365	1350	1400	1340	1410	1340	1400	1375	1400	1380	1400
11/02/91	1355	1400	1350	1400	1400	1410	1340	1410	1390	1440	1400	1420
27/02/91	1355	1420	1400	1420	1420	1440	1420	1470	1430	1460	1450	1465
19/03/91	1355	1420	1400	1450	1420	1440	1420	1470	1410	1460	1440	1445
10/04/91	1405	-	1380	1430	1380	1430	1350	1440	1350	1420	1370	1420
03/05/91	1380	-	900	1400	1320	1380	1250	1430	1300	1400	1300	1380
28/05/91	1380	-	1250	1340	1300	1380	1220	1360	1250	1330	1280	1350
20/06/91	1380	-	1280	1340	1300	1380	1220	1360	1280	1340	1290	1330
10/07/91	1380	-	1250	1340	1300	1380	1200	1340	1290	1350	1300	1330
05/08/91	1200	1350	1280	1340	1280	1350	1200	1340	1290	1350	1300	1330
30/08/91	1270	1350	1250	1320	1280	1350	1200	1340	1250	1330	1320	1325
25/09/91	1270	1350	1250	1290	1280	1350	1200	1340	1310	1340	1325	1340
22/10/91	1300	-	1330	1360	1280	1350	1320	1370	1330	1370	1350	1370
14/11/91	1180	1340	1360	1390	1290	1380	1330	1380	1380	1405	1380	1400
09/12/91	1200	1420	1420	1440	1360	1460	1370	1460	1390	1420	1380	1400
23/12/91	1200	1435	1400	1440	1360	1460	1350	1450	1420	1460	1420	1430
06/01/92	1250	1450	1440	1470	1360	1460	1350	1450	1420	1460	1430	1440
22/01/92	1250	1500	1480	1500	1360	1400	1400	1500	1490	1520	1490	1510
10/02/92	1250	1500	1500	1520	1360	1460	1440	1520	1500	1530	1500	1520
27/02/92	1200	1520	1520	1545	1360	1460	1470	1530	1530	1550	1530	1550
13/03/92	1200	1520	1520	1545	1360	1460	1500	1540	1520	1550	1510	1530
31/03/92	1200	1500	1500	1540	1460	1550	1480	1540	1500	1550	1540	1550
20/04/92	-	-	1480	1530	1460	1550	1470	1540	1480	1540	1480	1490
13/05/92	1200	1500	1460	1520	1460	1550	1470	1530	1570	1520	1510	1520
04/06/92	-	-	1540	1560	1460	1550	1530	1530	1550	1575	1550	1570
30/06/92	1550	1600	1600	1620	1500	1580	1570	1630	1600	1630	1600	1620
21/07/92	1680	1700	1690	1720	1580	1600	1650	1735	1700	1740	1700	1720
06/08/92	1740	1760	1720	1750	1680	1750	1680	1740	1730	1760	1740	1760
14/08/92	1740	1760	1720	1750	1680	1750	1680	1740	1730	1760	1740	1760
Date	Bureau 7		Bureau 8		Bureau 9		Bureau 10		Bureau 11		Bureau 12	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88							880	885				
30/06/88							880	890				
19/07/88							880	890	880	920		
01/08/88							870	900	880	905		

Table A3....continued

17/08/88				860	900	870	900						
05/09/88				850	900	870	900						
23/09/88				880	950	870	905						
11/10/88				900	925	900	920						
27/10/88				950	1000	960	990						
14/11/88				-	-	970	1010						
28/11/88				1100	1130	1050	1100						
19/12/88				980	1100	1000	1100						
29/12/88				-	-	1000	1050						
11/01/89				1050	1150	1040	1080						
17/01/89				1050	1150	1050	1100						
13/02/89				1050	1150	1080	1130						
09/03/89				1050	1150	1060	1120						
30/03/89				1050	1150	1100	1150		1080	1110			
12/04/89				1050	1150	1080	1130		1090	1120			
27/04/89				1050	1150	1080	1130		1090	1120			
17/05/89				1050	1150	1060	1120		1130	1140			
09/06/89				-	-	1080	1130		1100	1125			
27/06/89				-	-	1100	1130		1120	1130			
19/07/89				1050	1150	1080	1140		1110	1125			
08/08/89				1050	-	1080	1130		1130	1135			
30/08/89				-	1120	1070	1130		1125	1130			
21/09/89				1050	-	1080	1130		1110	1120			
10/10/89				-	-	1050	1110		1080	1090			
31/10/89				-	1150	1040	1130		1100	1110			
23/11/89				1120	1170	1100	1160		1140	1165			
11/12/89	1000	1100		-	-	1100	1160		1180	1210			
29/12/89	1100	1200		-	1190	1120	1180		1180	1195			
22/01/90	1100	1200		-	-	1140	1180		1200	1220			
08/02/90	1100	1200		-	-	1190	1200		1200	1215			
26/02/90	1100	1200		1180	1220	1150	1210		1200	1220			
19/03/90	1100	1200		1200	-	1180	1220		1245	1250			
09/04/90	1100	1200		-	1250	1190	1240		1240	1245			
26/04/90	1100	1200		-	1250	1200	1260		1235	1240			
17/05/90	1100	1200		-	-	1180	1250		-	1200			
12/06/90	1160	1260		-	1250	1180	1230	1310	1330	1230	1235		
02/07/90	1160	1260		-	-	1180	1230	1200	1230	1210	1220		
25/07/90	1160	1260		1200	-	1180	1240	1220	1240	1225	1245		
16/08/90	1200	1300		1200	1260	1190	1250	1230	1250	1245	1260		
04/09/90	1220	1300		1240	1300	1235	1290	1245	1260	1295	1310		
27/09/90	1250	1350		1250	1330	1260	1290	1285	1300	1295	1350		
18/10/90	1250	1350		1250	-	1290	1320	1300	1315	1280	1315		
09/11/90	1250	1350		1320	1370	1290	1350	1320	1340	1360	1400		
27/11/90	1250	1350		-	1450	1350	1420	1390	1410	1400	1415		
10/12/90	1300	1400		1350	1400	1350	1420	1365	1385	1395	1400		
24/12/90	1300	1400		1350	1400	1350	1400	1365	1385	1350	1370		
15/01/91	1300	1400	1360	1400	1350	1420	1340	1380	1380	1400	1380	1400	
11/02/91	1330	1400	1400	1440	1380	-	1360	1400	1380	1400	1420	1440	

Table A3....continued

27/02/91	1350	1430	1420	1460	1430	1470	1440	1460	1445	1460	1420	1470
19/03/91	1350	1430	1420	1460	-	1480	1400	1455	1370	1380	1420	1440
10/04/91	1350	1430	1400	1450	1350	1370	1350	1420	1370	1385	1390	1400
03/05/91	1300	1400	1320	1400	-	-	1300	1420	1320	1335	1300	1350
28/05/91	1300	1400	1320	1360	1250	1270	1250	1370	1280	1300	1300	1310
20/06/91	1200	1300	1280	1330	1250	1400	1250	1350	1290	1330	1320	1320
10/07/91	1200	1300	1300	1350	1250	1400	1250	1320	1290	1300	1300	1310
05/08/91	1200	1300	1300	1340	1250	1400	1250	1320	1300	1320	1310	1325
30/08/91	1200	1300	1250	1330	1200	1300	1250	1350	1310	1330	1260	1280
25/09/91	1200	1300	1300	1320	-	1400	1250	1350	1330	1370	1350	1360
22/10/91	1250	1350	1360	1375	1320	1400	1300	1370	1350	1380	1350	1370
14/11/91	1250	1350	1385	1410	1330	1400	1340	1380	1400	1410	1410	1415
09/12/91	1350	1440	1380	1450	1350	1400	1350	1450	1420	1440	1398	1400
23/12/91	1350	1440	1400	1470	1350	1450	1350	1450	1410	1420	1410	1420
06/01/92	1350	1440	1420	1470	1350	-	1350	1450	1440	1480	1425	1460
22/01/92	1350	1440	1420	1470	-	1520	1450	1485	1485	1510	1510	1515
10/02/92	1400	1500	1482	1520	1470	-	1450	1500	1502	1520	1500	1520
27/02/92	1400	1500	1530	1560	1500	-	1450	1550	1530	1540	1550	1560
13/03/92	1350	1500	1520	1560	1500	-	1500	1550	1520	1530	1550	1560
31/03/92	1400	1500	1510	1540	1450	1480	1450	1540	1500	1515	1500	1520
20/04/92	1400	1500	-	-	1450	-	1450	1550	1480	1520	1510	1520
13/05/92	1450	1550	1500	1540	1450	-	1470	1530	1500	1520	1500	1520
04/06/92	1450	1550	-	-	-	-	1530	1570	1540	1555	1500	1560
30/06/92	1450	1550	1600	1620	-	1570	1560	1590	1610	1620	1600	1620
21/07/92	1500	1600	1655	1700	-	1750	1700	1750	1700	1720	1700	1720
06/08/92	1650	1750	1710	1750	1700	1730	1700	1740	1690	1710	1710	1720
14/08/92	1650	1750	1720	1760	-	-	1700	1740	1720	1740	1747	1750

Date	Bureau13		Bureau 14		Bureau 15		Bureau16		Bureau 17		Bureau 18	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88												
30/06/88												
19/07/88												
01/08/88												
17/08/88												
05/09/88										850	890	
23/09/88										860	890	
11/10/88										870	895	
27/10/88										950	990	
14/11/88										950	990	
28/11/88										990	1030	
19/12/88										900	1060	
29/12/88										880	950	

Table A3....continued

11/01/89									1000	1070		
27/01/89									1020	1070		
13/02/89	1100	1110							1050	1100		
09/03/89	1100	1110						1050	1100	1050	1100	
30/03/89	1100	1110						1050	1100	1070	1120	
12/04/89	1100	1110						1050	1100	1050	1120	
27/04/89	1100	1105					1070	1120	1050	1100	1110	1120
17/05/89	1120	1130					1070	1120	1050	1100	1100	1120
09/06/89	1115	1120					1080	1120	1050	1100	1050	1120
27/06/89	1115	1120					1080	1120	1050	1100	1060	1120
19/07/89	1120	1125					1080	1120	1050	1100	1060	1120
08/08/89	1125	1130					1090	1130	1050	1100	1050	1120
30/08/89	1100	1130	1080	1120			1090	1130	-	-	1050	1120
21/09/89	-	-	1030	1090			1090	1130	1020	1120	1050	1120
10/10/89	1090	1100	1020	1070			1040	1110	1020	1100	1050	1120
31/10/89	1090	1100	1050	1100			1050	1110	1020	1100	1050	1120
23/11/89	1145	1150	1100	1160			1090	1120	1050	1120	1070	1120
11/12/89	1160	1160	1100	1160			-	-	1080	1140	1050	1120
29/12/89	1150	1160	1080	1160			1150	1200	1050	1140	1050	1120
22/01/90	1195	1200	1140	1200	1150	1190	1110	1190	1100	1140		
08/02/90	1200	1205	1150	1200	1180	1220	1150	1200	1100	1160		
26/02/90	1215	1220	1160	1210	1170	1200	1150	1200	1150	1180		
19/03/90	1225	1230	1180	1230	1170	1210	1150	1200	1150	1180		
09/04/90	1235	1240	1190	1240	1190	1240	1200	1250	1170	1200		
26/04/90	1230	1235	1200	1240	1200	1240	1200	1250	1180	1220		
17/05/90	1220	1225	1170	1220	1200	1230	1200	1250	1180	1220		
12/06/90	1215	1220	1170	1220	1200	1230	1150	1200	1180	1220		
02/07/90	1200	1210	1170	1220	1200	1240	1200	1240	1180	1220		
25/07/90	1200	1240	1200	1250	1200	-	1200	1240	1180	1220		
16/08/90	1235	1240	1200	1250	1200	1250	1200	1250	1180	1220		
04/09/90	1255	1260	1220	1270	1220	1260	1200	1250	1220	1250		
27/09/90	1260	1300	1240	1300	1260	1300	1250	1350	1250	1280		
18/10/90	1306	1310	1260	1310	1270	1320	1250	1300	1250	1280		
09/11/90	1315	1320	1290	1350	1280	1320	1250	1300	1200	1280		
27/11/90	1338	1350	1320	1380	1320	1400	1400	1450	1300	1350		
10/12/90	1396	1400	1320	1380	1320	1400	1300	1400	1300	1350		
24/12/90	1396	1400	1300	1350	1350	1400	1300	1350	1200	1350		
15/01/91	1406	1410	1340	1390	1350	1400	1320	1370	1300	1350	1350	1380
11/02/91	1408	1410	1350	1400	1360	1400	1320	1370	1350	1400	1380	1400
27/02/91	1418	1420	1400	1450	1370	1420	1350	1400	1350	1400	1380	1420
19/03/91	1398	1400	1420	1460	1400	1430	-	1400	1350	1450	1400	1420
10/04/91	1398	1400	1350	1400	1380	1440	1350	1400	1300	1450	1350	1420
03/05/91	-	-	1320	1380	1340	1400	1320	1400	1300	1400	1350	1400
28/05/91	-	-	1250	1320	1260	1420	1250	1380	1250	1400	1300	1330
20/06/91	1358	1360	1300	1340	1250	1300	1320	1380	1250	1300	1250	1330
10/07/91	1330	1335	1280	1340	1280	1330	1330	1380	1250	1300	1250	1350
05/08/91	1314	1318	1280	1330	1280	1330	1330	1370	1250	1300	1270	1300
30/08/91	1309	1310	1250	1300	1230	1320	1330	1370	1250	1300	1250	1340

Table A3....continued

25/09/91	1338	1330	1250	1300	1260	1320	1330	1370	1200	1300	1250	1320
22/10/91	1379	1380	1300	1350	1350	1390	1330	1360	1270	1350	1320	1350
14/11/91	1418	1400	1350	1400	1340	1400	1340	1360	1300	1350	1350	1380
09/12/91	1418	1420	1350	1400	1380	1430	1350	1370	1300	1400	1370	1440
23/12/91	1429	1430	1350	1400	1400	1450	1350	1370	1350	1400	1370	1400
06/01/92	1448	1450	1400	1440	1400	1450	1400	1450	1300	1350	1400	1430
22/01/92	1449	1450	1450	1490	1430	1480	1400	1450	1350	1450	1450	1470
10/02/92	1448	1550	1470	1500	1450	1500	1400	1450	1400	1500	1440	1510
27/02/92	1448	1550	1500	1530	1480	1520	1400	1450	1400	1500	1450	1520
13/03/92	1525	1530	1470	1530	1480	1530	1400	1450	1400	1500	1450	1520
31/03/92	-	-	1470	1500	1470	1520	1400	1450	1400	1500	1450	1520
20/04/92	1488	1490	1470	1510	1480	1520	1400	1450	1400	1500		
13/05/92	1500	1505	1460	1500	1490	1530	1400	1450	1400	1500		
04/06/92	1515	1520	1500	1550	1500	1550	1500	1550	1420	1520		
30/06/92	1545	1550	1550	1590	1520	1580	1500	1600	1530	1570		
21/07/92	1690	1695	1630	1670	1620	1680	1500	1650	1550	1620		
06/08/92	1680	1700	1660	1700	1680	1730	1500	1650	1650	1700		
14/08/92	1690	1700	1700	1740	1700	1750	1500	1650	1650	1700		

Table A4: Deutsche Mark quotation from 1988 to 1992 for 18 bureaus from 8 cities

Date	Bureau 1		Bureau 2		Bureau 3		Bureau 4		Bureau 5		Bureau 6	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88											150	155
10/05/88											150	155
26/05/88											150	155
14/06/88			150	155							150	155
30/06/88			150	155							145	152
19/07/88	140	150	140	150							150	155
01/08/88	140	150	140	150							145	155
17/08/88	140	150	140	150							145	150
05/09/88	140	150	140	150							150	152
23/09/88	140	150	140	155							148	153
11/10/88	150	160	150	155							148	150
27/10/88	150	160	150	160							155	158
14/11/88	150	160	155	165							165	170
28/11/88	160	180	155	165							175	180
19/12/88	170	190	160	165							150	155
29/12/88	150	190	160	170							168	170
11/01/89	160	185	160	170							177	185
27/01/89	170	185	170	180							186	195
13/02/89	170	185	180	190							190	195
09/03/89	180	195	190	200							190	198
30/03/89	170	195	190	200							190	195
12/04/89	160	190	180	195							170	190
27/04/89	180	195	180	195							170	180
17/05/89	160	195	175	195					190	195	172	175
09/06/89	180	190	180	195					170	195	180	183
27/06/89	180	190	180	190					170	195	-	-
19/07/89	170	180	170	190			170	195	170	195	180	184
08/08/89	170	180	170	190			170	195	170	195	180	186
30/08/89	170	180	170	190			170	190	170	195	185	190
21/09/89	170	180	180	190			170	195	170	195	180	185
10/10/89	165	180	170	190			170	195	170	185	175	180
31/10/89	165	180	175	185			170	195	170	185	180	185
23/11/89	165	180	175	185			170	195	170	195	185	192
11/12/89	170	185	180	190			170	195	170	195	183	187
29/12/89	170	185	180	185			170	195	180	185	180	185
22/01/90	180	195	175	185			170	195	180	195	190	195
08/02/90	185	200	190	195			180	200	170	200	193	197
26/02/90	185	210	185	195			185	200	195	210	200	202
19/03/90	185	200	185	195			190	210	195	210	205	210
09/04/90	190	205	190	200			195	210	175	215	205	215
26/04/90	190	200	195	205			195	210	195	215	200	205
17/05/90	190	200	195	205	190	200	195	210	195	206	205	210
12/06/90	185	205	195	210	190	200	195	210	198	206	200	206
02/07/90	200	210	195	210	190	200	195	210	175	215	202	207
25/07/90	202	210	200	210	190	200	195	210	200	215	208	212

Table A4....continued

16/08/90	210	215	200	210	190	200	195	210	200	212	209	213
04/09/90	202	220	200	210	200	225	200	220	180	220	215	217
27/09/90	215	222	210	215	190	220	200	220	220	225	218	225
18/10/90	215	225	210	215	200	225	210	225	220	218	217	225
09/11/90	220	230	215	225	200	225	210	225	200	220	222	224
27/11/90	228	235	220	230	200	225	210	225	220	225	228	230
10/12/90	228	235	220	230	210	230	210	225	220	226	227	230
24/12/90	225	235	220	230	210	230	210	225	220	228	225	228
15/01/91	222	232	215	230	215	230	210	230	220	225	230	233
11/02/91	235	245	225	235	200	235	225	240	200	245	242	248
27/02/91	238	245	240	250	220	235	240	260	200	260	248	251
19/03/91	238	245	240	250	220	235	240	260	240	255	249	250
10/04/91	225	245	230	245	230	235	210	250	225	245	230	234
03/05/91	225	245	200	245	220	240	210	250	200	228	227	232
28/05/91	220	240	230	260	220	235	210	240	200	230	225	227
20/06/91	205	225	230	260	220	235	210	235	220	226	224	227
10/07/91	205	225	230	260	220	235	190	225	200	212	210	215
05/08/91	210	225	230	260	210	230	190	225	190	200	205	207
30/08/91	215	245	200	220	210	230	180	220	205	225	212	215
25/09/91	250	275	210	220	200	220	210	215	215	223	223	225
22/10/91	220	235	225	230	210	225	215	235	215	230	229	232
14/11/91	230	240	230	235	220	240	220	240	190	200	235	240
09/12/91	235	249	230	240	220	240	220	240	220	235	237	239
23/12/91	235	250	230	240	220	240	215	240	190	200	235	238
06/01/92	245	260	240	245	230	250	215	240	195	250	241	243
22/01/92	240	255	245	250	230	250	240	260	245	265	255	257
10/02/92	245	260	260	265	240	260	240	260	255	263	263	265
27/02/92	240	255	275	280	240	260	260	275	275	285	275	280
13/03/92	240	255	240	274	240	260	240	270	265	275	260	263
31/03/92	240	255	260	270	240	260	240	265	260	275	260	263
20/04/92	-	-	255	265	240	260	235	265	230	275	256	257
13/05/92	250	255	255	265	240	260	240	260	260	263	253	255
04/06/92	-	-	265	270	240	260	250	260	260	268	267	270
30/06/92	268	272	270	275	240	260	265	280	270	275	274	278
21/07/92	290	295	284	290	260	280	280	300	286	295	296	298
06/08/92	295	305	295	305	265	285	285	300	297	304	304	305
14/08/92	302	305	295	305	265	285	285	300	298	304	300	305
Date	Bureau 7		Bureau 8		Bureau 9		Bureau 10		Bureau 11		Bureau 12	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88												
30/06/88							140	-				
19/07/88							140	-	145	146		

Table A4....continued

01/08/88					140	-	145	146				
17/08/88					-	-	140	147				
05/09/88					140	-	143	146				
23/09/88					-	-	148	150				
11/10/88					-	-	160	161				
27/10/88					-	-	158	160				
14/11/88					160	175	155	160				
28/11/88					165	-	166	170				
19/12/88					-	-	160	168				
29/12/88					160	-	160	168				
11/01/89					-	-	168	170				
27/01/89					-	-	168	170				
13/02/89					-	-	180	190				
09/03/89					-	-	185	202				
30/03/89					-	-	180	185		205	215	
12/04/89				170	-	180	185		180	194		
27/04/89				-	-	-	180	185	180	194		
17/05/89				-	-	-	180	190	180	193		
09/06/89				-	-	-	180	190	173	178		
27/06/89				-	-	-	180	188	174	179		
19/07/89				-	-	-	180	190	169	170		
08/08/89				170	-	175	190		169	170		
30/08/89				180	-	180	190		160	169		
21/09/89				175	-	185	193		160	168		
10/10/89				160	-	180	185		170	175		
31/10/89				170	180	180	190		160	169		
23/11/89				-	-	180	192		160	168		
11/12/89	165	185			160	-	180	190	180	185		
29/12/89	170	185			-	-	180	190	180	195		
22/01/90	185	200			-	-	182	190	180	195		
08/02/90	185	200			190	-	185	197	190	200		
26/02/90	185	200			-	-	185	207	190	195		
19/03/90	185	200			-	-	190	207	190	200		
09/04/90	185	205			160	205	205	210	190	200		
26/04/90	185	205			200	-	205	215	200	210		
17/05/90	185	200			205	205	195	210	205	210		
12/06/90	195	210			-	210	190	210	215	207	220	
02/07/90	195	210			-	-	200	210	215	200	210	
25/07/90	195	210			-	210	195	212	205	213	210	215
16/08/90	200	215			205	210	212	214	210	215	200	210
04/09/90	200	215			210	215	205	215	210	215	200	210
27/09/90	210	225			-	-	210	215	215	225	200	210
18/10/90	210	225			210	215	210	218	215	225	205	215
09/11/90	215	230			-	-	220	230	215	225	220	230
27/11/90	215	230			-	235	225	235	215	225	185	190
10/12/90	220	235			-	-	225	235	220	228	189	190
24/12/90	220	235			215	222	215	225	220	224	215	224
15/01/91	220	235	200	220	215	-	220	225	220	228	220	232

Table A4....continued

11/02/91	230	245	-	240	-	-	240	245	235	240	220	232
27/02/91	235	250	200	240	245	247	240	245	225	230	254	255
19/03/91	235	250	200	240	-	255	240	245	230	240	256	258
10/04/91	235	250	205	240	230	232	210	215	200	210	220	250
03/05/91	220	235	205	240	220	222	220	225	230	235	220	260
28/05/91	220	235	210	240	220	-	215	225	205	215	200	205
20/06/91	220	235	220	230	-	-	210	215	220	230	200	205
10/07/91	210	225	210	230	-	-	210	215	220	230	207	224
05/08/91	210	225	210	230	200	-	205	210	220	230	206	224
30/08/91	210	225	210	230	205	223	205	220	230	235	211	215
25/09/91	200	220	220	230	210	-	205	220	220	224	200	205
22/10/91	210	230	228	235	-	-	225	236	226	229	200	206
14/11/91	210	230	230	240	-	-	225	236	230	237	235	240
09/12/91	230	245	230	245	-	-	215	248	230	234	230	235
23/12/91	230	245	230	245	-	-	225	235	230	238	230	235
06/01/92	230	245	235	250	-	-	215	240	240	244	205	210
22/01/92	230	245	250	260	-	-	240	250	240	244	200	210
10/02/92	230	245	255	264	-	-	245	255	260	266	200	215
27/02/92	230	245	270	278	-	253	270	275	275	279	220	230
13/03/92	230	245	260	270	-	-	253	260	260	266	220	230
31/03/92	235	255	260	270	-	-	255	260	260	266	230	234
20/04/92	235	255	-	-	-	-	250	260	252	260	225	230
13/05/92	240	260	255	265	-	-	250	260	260	264	250	265
04/06/92	240	260	-	-	-	-	250	260	260	265	240	245
30/06/92	240	260	265	275	-	-	250	260	277	280	270	275
21/07/92	250	270	280	290	-	-	275	253	290	293	270	275
06/08/92	285	305	300	305	-	-	290	283	294	298	295	300
14/08/92	285	305	298	302	-	-	280	300	296	301	296	298

Date	Bureau 13		Bureau 14		Bureau 15		Bureau 16		Bureau 17		Bureau 18	
	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell	Buy	Sell
13/04/88												
29/04/88												
10/05/88												
26/05/88												
14/06/88												
30/06/88												
19/07/88												
01/08/88												
17/08/88												
05/09/88										140	150	
23/09/88										140	150	
11/10/88										140	150	
27/10/88										145	155	
14/11/88										150	160	
28/11/88										155	165	
19/12/88										150	168	
29/12/88										150	168	

Table A4....continued

11/01/89										155	168	
27/01/89										155	-	
13/02/89										170	180	
09/03/89	190	200								180	190	160
30/03/89	190	200								180	190	180
12/04/89	180	200								180	190	185
27/04/89	180	195					150	-		170	180	180
												190
17/05/89	180	190					160	-		170	180	170
09/06/89	180	185					160	-		170	180	160
27/06/89	180	185					150	-		170	180	160
19/07/89	182	185					150	-		170	190	160
08/08/89	180	190					150	-		170	185	160
30/08/89	182	185	160	185			150	-	-	-	170	185
21/09/89	175	180	160	185			150	-		170	185	160
10/10/89	175	182	160	185			150	-		170	185	160
31/10/89	175	185	160	185			150	-		170	185	180
23/11/89	185	190	160	185			150	-		170	185	170
11/12/89	185	190	160	185			150	-		170	185	165
29/12/89	180	185	160	185			150	-		160	185	140
												160
22/01/90	-	-	160	180	175	-	160	180	160	185		
08/02/90	195	200	160	180	185	-	150	190	160	185		
26/02/90	195	200	160	180	185	-	150	190	180	195		
19/03/90	195	200	160	180	185	-	150	190	170	185		
09/04/90	180	200	160	180	185	-	150	190	180	195		
26/04/90	180	210	160	180	185	205	150	190	185	195		
17/05/90	-	-	150	170	200	210	150	190	190	200		
12/06/90	205	210	170	200	200	205	150	190	190	200		
02/07/90	200	210	170	200	200	-	160	190	190	200		
25/07/90	200	205	170	200	200	205	160	190	190	200		
16/08/90	210	215	185	205	200	205	160	190	200	210		
04/09/90	208	210	185	205	200	210	160	190	200	215		
27/09/90	-	-	190	215	200	-	160	190	200	215		
18/10/90	213	215	190	215	205	208	160	190	205	215		
09/11/90	215	220	190	215	205	215	160	196	210	215		
27/11/90	216	225	200	220	210	-	160	196	210	220		
10/12/90	222	225	200	215	210	220	160	195	210	220		
24/12/90	222	225	200	215	210	230	180	186	200	220		
15/01/91	228	230	190	215	210	220	180	220	210	225	200	220
11/02/91	230	235	210	225	215	220	180	220	220	235	230	240
27/02/91	230	250	210	240	220	245	200	220	230	240	220	245
19/03/91	245	250	220	240	220	245	200	220	225	250	220	245
10/04/91	230	235	215	240	220	230	200	220	225	240	200	240
03/05/91	230	235	210	240	200	230	200	220	220	240	180	240
28/05/91	230	232	190	220	200	215	200	220	210	240	200	240
20/06/91	218	220	200	225	200	215	200	220	210	240	200	240
10/07/91	218	220	190	200	200	235	200	220	210	240	170	235
05/08/91	215	220	185	200	190	235	200	220	200	230	180	220
30/08/91	210	220	185	210	190	210	200	220	200	230	185	200

Table A4....continued

25/09/91	220	222	190	210	195	240	200	220	190	230	190	220
22/10/91	220	225	200	220	210	240	200	220	200	230	200	220
14/11/91	220	225	220	230	220	240	200	220	220	240	210	230
09/12/91	225	230	210	220	210	230	200	220	220	240	210	240
23/12/91	225	230	210	220	220	230	200	220	200	240	220	250
06/01/92	250	260	215	240	220	230	220	240	220	240	220	240
22/01/92	255	260	240	260	230	240	220	240	200	240	240	250
10/02/92	255	270	240	260	240	250	220	240	240	260	235	255
27/02/92	255	260	-	-	240	270	230	250	240	260	245	270
13/03/92	265	270	255	270	240	270	230	250	240	260	240	265
31/03/92	-	-	240	260	240	255	230	260	240	260	240	260
20/04/92	215	220	240	260	230	260	230	260	240	260		
13/05/92	236	240	250	255	245	255	230	260	240	260		
04/06/92	240	245	255	260	245	260	260	280	240	260		
30/06/92	250	255	255	260	260	280	260	280	240	260		
21/07/92	260	265	260	275	-	-	260	280	260	280		
06/08/92	296	300	280	290	285	306	260	280	280	295		
14/08/92	297	300	280	290	285	306	260	280	280	295		

Table A5: Bureau and official rates used for graphs

Date	Pound		Dollar		CFA		DM	
	Bur	OR	Bur	OR	Bur	OR	Bur	OR
19/07/88	469	326	264	196	878	543	149	104
01/08/88	475	361	269	211	879	524	148	113
17/08/88	475	377	273	219	888	515	146	117
05/09/88	484	385	284	228	888	508	148	123
23/09/88	491	378	294	227	898	508	150	121
11/10/88	491	392	299	228	908	714	152	123
27/10/88	499	402	307	229	975	719	156	129
14/11/88	526	415	311	230	1028	719	161	132
28/11/88	564	424	356	231	1025	758	174	134
19/12/88	568	422	314	232	1038	775	166	132
29/12/88	572	412	314	230	1028	775	170	129
11/01/89	590	408	328	230	1085	769	177	126
27/01/89	603	408	348	230	1093	769	184	125
13/02/89	632	428	367	242	1105	741	185	131
09/03/89	645	447	374	260	1108	746	191	140
30/03/89	637	443	367	262	1103	826	188	139
12/04/89	618	449	352	264	1068	813	178	140
27/04/89	613	450	349	265	1073	813	181	141
17/05/89	618	439	359	267	1095	833	176	138
09/06/89	608	422	353	268	1104	826	183	136
27/06/89	584	420	355	270	1105	794	185	137
19/07/89	576	437	359	271	1113	794	179	142
08/08/89	578	444	356	275	1119	840	179	144
30/08/89	563	435	354	277	1105	847	181	142
21/09/89	553	441	355	281	1100	840	179	144
10/10/89	545	449	349	283	1068	855	175	150
31/10/89	548	452	350	287	1100	885	178	157
23/11/89	552	462	350	294	1114	909	181	163
11/12/89	539	474	348	301	1143	926	181	170
29/12/89	534	493	339	303	1128	935	180	180
22/01/90	547	502	342	306	1153	1050	190	178
08/02/90	559	522	343	307	1160	1090	194	185
26/02/90	574	525	350	308	1185	1080	199	183
19/03/90	578	504	364	311	1213	1080	200	183
09/04/90	575	516	351	314	1219	1100	204	185
26/04/90	568	516	349	315	1215	1110	199	186
17/05/90	570	537	349	322	1203	1160	201	195
12/06/90	567	550	346	327	1198	1140	199	193
02/07/90	576	578	345	330	1199	1190	205	199
25/07/90	611	603	348	331	1233	1220	208	204
16/08/90	628	634	349	334	1258	1270	212	214
04/09/90	641	634	348	337	1280	1270	214	213
27/09/90	648	632	345	338	1293	1290	220	216
18/10/90	659	669	346	340	1313	1350	221	226
09/11/90	667	672	346	342	1343	1370	224	230

Table A5....continued

27/11/90 679	678	353	344	1388	1370	229	231
10/12/90 677	675	351	345	1389	1380	230	235
24/12/90 668	650	350	345	1371	1350	227	226
15/01/91 675	653	354	345	1365	1310	229	222
11/02/91 713	695	372	349	1394	1410	243	240
27/02/91 732	680	371	354	1423	1370	246	232
19/03/91 715	639	373	360	1416	1280	246	218
10/04/91 693	649	380	362	1398	1280	234	217
03/05/91 684	627	378	364	1353	1250	232	212
28/05/91 680	633	381	366	1337	1260	228	214
20/06/91 660	602	383	367	1333	1210	220	206
10/07/91 639	597	384	369	1337	1200	214	203
05/08/91 640	627	382	370	1295	1250	212	213
30/08/91 641	632	382	373	1316	1270	222	230
25/09/91 659	653	386	376	1321	1310	243	224
22/10/91 666	648	390	378	1340	1310	229	223
14/11/91 685	680	400	383	1325	1370	236	235
09/12/91 696	700	400	387	1350	1440	240	246
23/12/91 708	727	396	390	1371	1490	240	255
06/01/92 718	727	399	390	1393	1490	247	255
22/01/92 723	704	407	390	1438	1440	252	245
10/02/92 735	716	414	390	1443	1470	258	250
27/02/92 749	689	432	393	1450	1410	263	239
13/03/92 747	675	434	395	1440	1390	255	236
31/03/92 736	707	432	407	1448	1460	255	248
20/04/92 745	713	437	408	1485	1450	257	245
13/05/92 750	746	432	409	1433	1510	253	253
04/06/92 778	753	438	412	1560	1530	269	258
30/06/92 796	789	441	415	1593	1620	273	272
21/07/92 847	806	446	424	1700	1680	295	284
06/08/92 854	838	451	440	1750	1750	302	296
14/08/92 854	857	456	444	1750	1790	303	304

Source: Official Exchange Rates Obtained from the Operations Dept. - Bank of Ghana
 Bureau Rates are the Means of Buy and Sell Rates of two Accra Bureaus (one bank and one non-bank) located in the Business center.

Table A6 : Total Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0 + B_j - S_i > 0 = W_{ij}$
Currency: Pound Sterling

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1		14	3	10	17	31	7	10	16	19	18	36	36	24	6	27	21	10
B2			10	3	3	19	12	2	7	8	7	24	27	26	7	28	24	9
B3				8	13	21	6	11	10	15	17	20	25	25	5	21	9	7
B4					5	10	7	0	2	3	6	10	18	17	3	26	11	1
B5						7	15	0	8	11	8	24	34	28	11	32	21	10
B6							20	2	16	29	17	24	43	40	20	39	39	15
B7								12	12	18	14	15	15	9	1	16	0	2
B8									6	7	7	13	21	17	7	11	20	9
B9										5	11	25	31	29	5	25	21	6
											13	27	29	24	8	32	21	8
												17	27	27	14	27	18	10
													29	32	13	33	39	6
														35	14	42	20	10
															12	19	11	9
																19	4	2
																	16	10
																		4

Source: Extracted from appendix 1

Table A7 : Total Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0 + B_j - S_i > 0 = W_{ij}$
Currency: US Dollar

B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14					
B1	14	0	3	22	33	2	9	17	12	18	41	24	1	3	14	5	19	
B2		9	1	0	5	10	0	3	0	5	14	15	4	5	23	10	4	
B3			1	13	19	2	7	9	3	12	26	10	0	2	10	1	0	
B4				1	2	6	1	0	0	3	12	11	0	3	14	1	0	
B5					1	15	0	4	0	4	12	16	5	10	25	7	2	
B6						27	1	12	6	8	20	19	17	13	26	20	10	
B7							9	13	14	21	36	20	2	0	6	0	4	
B8								1	0	4	9	12	3	1	22	4	3	
B8									6	11	17	17	5	7	19	12	5	
B9										4	14	14	3	6	23	12	3	
											12	18	9	7	18	7	4	
												32	12	20	28	24	16	
													16	15	21	11	7	
														0	3	0	0	
															9	1	0	
																8	9	
																	3	

Source :Extracted from appendix 2

Table A8 : Total Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0 + B_j - S_i > 0 = W_{ij}$
Currency: CFA franc

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1		10	3	5	12	24	3	6	6	9	13	28	24	9	5	8	10	3
B2			6	2	6	11	9	2	6	2	6	20	21	4	2	14	19	4
B3				3	7	10	0	8	5	3	10	15	7	6	4	10	3	1
B4					3	5	9	1	1	1	12	12	9	1	0	9	7	0
B5						0	11	1	2	2	4	4	17	7	7	21	26	6
B6							17	1	5	5	7	9	25	14	13	25	39	2
B7								7	1	4	12	17	19	2	1	5	0	1
B8									4	1	5	3	9	4	2	15	12	3
B9										0	6	6	5	0	2	8	5	2
											4	11	13	1	2	8	9	1
												12	18	11	10	22	24	9
													19	22	13	27	38	14
														16	9	24	35	15
															0	12	3	0
																12	3	0
																	7	4
																		2

Source: Extracted from appendix 3

Table A9 : Total Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0 + B_j - S_i > 0 = W_{ij}$
Currency: Deutsche mark

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1		7	10	6	10	19	3	5	3	11	15	25	14	25	12	25	11	5
B2			8	3	7	19	8	0	1	16	6	26	12	20	10	31	6	7
B3				3	11	20	0	5	3	9	19	20	8	3	2	7	2	1
B4					2	8	3	1	1	3	3	19	6	7	2	20	2	1
B5						12	9	3	1	11	9	13	12	17	9	22	12	5
B6							15	6	5	25	19	38	28	37	21	39	31	15
B7								7	2	6	10	15	6	16	5	20	0	2
B8									2	3	3	13	8	10	5	10	5	2
B9										2	6	7	1	5	2	8	4	1
											2	31	20	17	7	24	13	5
												18	14	22	12	26	8	4
													9	33	15	22	25	16
														20	13	32	12	8
															0	4	2	1
																14	0	1
																	0	1
																		0

Source :Extracted from appendix 4

Table A10: Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0$ on one axis and $B_j - S_i > 0$ on the other axis; Currency : Pound Sterling¹

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14					
B1		12	0	8	16	31	0	10	13	14	15	25	20	2	0	3	3	5	
B2	2		1	0	3	19	0	1	2	2	6	10	7	0	0	0	0	0	
B3	3	9		7	11	18	0	10	8	9	15	9	9	2	1	0	0	1	
B4	2	3	1		5	10	0	0	2	1	5	4	5	0	0	0	0	0	
B5	1	0	2	0		6	0	0	1	1	4	7	8	0	0	1	1	0	
B6	0	0	3	0	1		0	0	1	2	6	6	14	1	0	1	0	1	
B7	7	12	6	7	15	20		11	12	8	13	13	12	1	1	0	0	2	
B8	0	1	1	0	0	2	1		0	1	3	1	4	0	0	0	5	0	
B9	3	5	2	0	7	15	0	6		3	8	11	12	1	0	0	0	1	
	5	6	6	2	10	27	0	6	2		10	13	9	0	1	0	0	0	
	3	1	2	1	4	11	1	4	3	3		3	5	1	1	1	1	0	
	11	14	11	6	17	18	2	12	14	14	14		9	3	5	2	3	1	
	16	20	16	13	26	29	3	17	19	20	22	20		7	6	7	5	1	
	22	26	23	17	28	39	8	17	28	24	26	29	28		12	4	8	8	
	6	7	4	3	11	20	0	7	5	7	13	8	8	0		2	1	1	
	24	28	21	26	31	38	16	11	25	32	26	31	35	15	17		16	8	
	18	24	9	11	20	39	0	15	21	21	17	16	15	3	3	0		3	
	5	9	6	1	10	14	0	9	5	8	10	5	9	1	1	2	1		

Source: appendix 1

Table A11: Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0$ on one axis and $B_j - S_i > 0$ on the other axis; Currency : US Dollar

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14					
B1			14	0	3	22	33	0	9	17	12	17	41	19	0	1	2	0	1
B2	0			0	0	0	4	0	0	0	0	0	13	2	0	0	0	0	0
B3	0		9		1	13	19	0	7	8	3	11	26	4	0	0	1	0	0
B4	0	1	0			1	2	0	1	0	0	1	12	2	0	0	1	0	0
B5	0	0	0	0	0			0	0	0	0	0	12	3	0	0	1	0	0
B6	0	1	0	0	0	1		0	0	2	2	2	18	3	0	0	1	0	1
B7	2	10	2	6	15	27			9	13	14	20	36	17	2	0	3	0	4
B8	0	0	0	0	0	0	1	0		1	0	0	9	2	0	0	1	0	0
B9	0	3	1	0	4	10	0	0	0		5	7	15	6	0	0	0	0	1
	0	0	0	0	0	4	0	0	0	1		1	13	4	0	0	0	0	0
	1	5	1	2	4	6	1	4	4	3			12	4	1	1	1	1	1
	0	1	0	0	0	2	0	0	2	1	0			5	0	0	0	0	0
	5	13	6	9	13	16	3	10	11	10	14	27		5	5	5	5	5	3
	1	4	0	0	5	17	0	3	5	3	8	32	11		0	1	0	0	0
	2	5	2	3	10	13	0	1	7	6	6	20	10	0		0	0	0	0
	12	23	9	13	24	25	3	21	19	23	17	28	16	2	9		7	8	
	5	10	1	1	7	20	0	4	12	12	6	24	6	0	1	1			1
	2	4	0	0	2	9	0	3	4	3	3	16	4	0	0	1	2		

Source: appendix 2

Table A12: Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0$ on one axis and $B_j - S_i > 0$ on the other axis; Currency : CFA franc

B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14						
B1		7	1	2	9	21	0	3	3	6	7	22	18	3	2	3	0	1	
B2	3		0	1	6	10	0	1	1	1	4	19	15	0	0	2	0	0	
B3	2	6		3	7	10	0	8	3	3	9	14	6	5	4	1	0	1	
B4	3	1	0		3	5	0	1	1	0	11	12	6	0	0	0	0	0	
B5	3	0	0	0		0	0	0	0	0	1	3	5	0	0	0	0	0	
B6	3	1	0	0	0	0		0	0	0	2	5	10	0	0	1	0	2	
B7	3	8	0	3	11	17		7	0	4	12	17	19	2	1	5	0	1	
B8	3	1	0	0	1	1	0		0	0	2	2	5	0	0	1	0	0	
B9	3	5	2	0	2	5	1	4		0	6	6	4	0	1	1	0	1	
	3	1	0	1	2	5	0	1	0		4	11	9	0	0	2	0	0	
	6	2	1	1	3	5	0	3	0	1		9	10	1	2	2	0	1	
	6	1	1	0	1	4	0	1	0	0	3		10	0	0	3	0	0	
	6	6	1	3	12	15	0	4	1	4	8	19		1	0	2	0	1	
	6	4	1	1	7	14	0	4	0	1	10	22	15		0	3	0	0	
	3	2	0	0	7	13	0	2	1	2	8	13	9	0		3	0	0	
	5	12	9	9	21	24	0	14	7	6	20	24	22	9	9		0	1	
	10	19	3	7	26	39	0	12	5	9	24	38	35	3	3	7		2	
	2	4	0	0	6	10	0	3	1	1	7	14	14	0	0	3	0		

Source: appendix 3

Table A13: Arbitrage Cases Between Bureaus i and j; $B_i - S_j > 0$ on one axis and $B_j - S_i > 0$ on the other axis; Currency : Deutsche mark

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14					
B1			5	0	1	4	15	0	3	1	3	6	5	4	0	0	0	0	0
B2	2			0	0	2	14	0	0	0	5	2	3	2	0	0	0	0	0
B3	10	8			3	7	18	0	5	3	6	10	8	7	0	0	0	0	0
B4	5	3	0			0	8	0	1	0	1	2	0	2	0	0	0	0	0
B5	6	5	4	2			9	3	3	0	3	7	5	5	2	2	0	1	2
B6	4	5	2	0	3			2	1	0	3	6	5	6	0	0	0	0	0
B7	3	8	0	3	6	13			7	1	3	7	5	5	1	0	0	0	0
B8	2	0	0	0	0	5	0		1	0	1	2	2	0	0	0	0	0	0
B9	2	1	0	1	1	5	1	1		1	3	2	1	1	0	0	0	0	0
	8	11	3	2	8	22	3	3	1		1	6	12	0	2	0	1	0	0
	9	4	9	1	2	13	3	2	3	1		0	5	1	1	0	1	0	0
	20	23	12	19	18	33	10	11	5	25	18		0	12	9	4	13	9	0
	10	10	1	4	7	22	1	6	0	8	9	9		0	3	3	1	0	0
	25	20	3	7	15	37	15	10	5	17	21	21	20		0	0	2	1	0
	12	10	2	2	7	21	5	5	2	5	11	6	10	0		0	0	1	0
	25	31	7	20	22	39	20	10	8	24	26	18	29	4	14		0	1	0
	11	6	2	2	11	31	0	5	4	12	7	12	11	0	0	0		0	0
	5	7	1	1	3	15	2	2	1	5	4	7	8	0	0	0	0		0

Source: appendix 4

Table A14: Total Number of Possible Comparisons Between two Bureaus($2n_{ij} + x_{ij}$);
Currency :Pound Sterling

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1	150	78	108	114	150	94	54	111	150	76	116	118	104	83	116	141	73	
B2		82	112	118	158	98	54	116	154	80	120	122	108	87	120	145	73	
B3			82	82	82	82	54	64	82	80	80	82	82	79	82	81	44	
B4				112	112	98	54	88	112	80	110	112	108	87	112	109	62	
B5					118	98	54	89	118	80	116	118	108	87	118	115	68	
B6						98	54	116	154	80	120	122	108	87	120	145	73	
B7							54	78	98	80	96	98	98	87	98	97	48	
B8								44	54	54	54	54	54	54	54	53	44	
B9									112	62	89	91	85	70	90	104	52	
										80	120	122	108	87	120	145	73	
											78	80	80	78	80	79	44	
													120	106	85	118	117	71
														108	87	120	119	71
															87	108	105	58
																87	86	44
																	117	70
																		70

Source: appendix 1

Table A15: Total Number of Possible Comparisons Between two Bureaus($2n_{ij} + x_{ij}$);
Currency :US Dollar

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1	150	78	108	113	148	94	54	132	150	76	120	116	104	85	114	142	76	
B2		82	112	117	156	98	54	136	154	80	124	120	108	89	118	146	76	
B3			82	82	82	82	54	69	82	80	82	76	82	80	81	82	44	
B4				111	112	98	54	96	112	80	112	106	108	89	110	110	62	
B5					115	98	54	97	117	80	117	111	107	89	115	115	67	
B6						98	54	96	152	80	122	118	108	89	116	144	74	
B7							54	83	98	80	98	92	98	89	96	98	48	
B8								49	54	54	54	48	54	54	52	54	44	
B9										132	67	104	100	93	75	98	124	
											80	124	120	108	89	118	146	
												80	74	80	78	78	80	
													118	108	89	118	122	
														102	83	112	118	
															89	106	106	
																87	89	
																	116	
																	68	
																	74	

Source : appendix 2

Table A16: Total Number of Possible Comparisons Between two Bureaus($2n_{ij} + x_{ij}$);
Currency : CFA franc

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14			
B1	144	72	102	108	140	88	48	98	144	70	113	112	98	83	107	136	70
B2		82	112	118	154	98	54	108	154	80	123	120	108	93	117	146	76
B3			82	82	82	82	54	56	82	80	81	76	82	81	81	82	44
B4				112	112	98	54	70	112	80	111	104	108	93	109	110	62
B5					116	98	54	72	118	80	117	110	108	93	115	116	68
B6						98	54	106	150	80	121	118	108	93	115	142	74
B7							54	62	98	80	97	92	98	93	95	98	48
B8								39	54	54	54	48	54	54	53	54	44
B9									104	56	78	77	67	61	74	97	53
										80	123	120	108	93	117	146	76
											80	74	80	79	79	80	44
												115	107	92	116	121	74
													100	87	109	118	68
														93	105	106	58
															92	93	43
																115	67
																	74

Source: appendix 3

Table A17: Total Number of Possible Comparisons Between two Bureaus($2n_{ij} + x_{ij}$);
Currency :Deutsche mark

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14				
B1	150	78	108	112	148	94	53	46	150	76	120	114	102	80	103	141	75	
B2		82	112	118	156	98	53	47	154	80	124	118	106	84	107	145	75	
B3			82	82	82	82	53	27	82	80	82	76	80	77	82	82	44	
B4				112	112	98	53	38	112	80	112	104	106	84	103	110	62	
B5					116	98	53	38	118	80	118	110	106	84	106	116	68	
B6						98	53	47	152	80	122	116	106	84	106	143	73	
B7							53	32	98	80	98	90	96	84	96	98	48	
B8								14	53	53	53	51	51	51	53	53	43	
B9									46	25	39	37	37	29	38	43	22	
										80	124	118	106	84	107	145	75	
											80	76	78	75	80	80	44	
												116	106	84	107	122	73	
													98	78	99	116	73	
														82	99	104	56	
															84	84	44	
																106	57	
																	73	

Source: appendix 4

Appendix B: Rules and regulations governing the operations of a forex (foreign exchange) bureau

A. Categories of foreign exchange dealers

1. For purposes of dealing in foreign exchange transactions, two main categories of dealers are recognised:
 - (a) Authorised Dealer Banks; and
 - (b) Other authorised Dealers.
2. Authorised Dealer Banks will continue to perform all foreign exchange transactions as they are currently permitted to do, including purchase and sale of foreign exchange.
3. Other authorised dealers shall be granted permission to deal in the purchase and sale of foreign currency as well as purchase of travellers cheques or the acceptance of such foreign currency and travellers' cheques as payment for services rendered.
4. A Forex Bureau shall constitute a sub-category of other authorised dealers which shall be engaged in the purchase of travellers' cheques.
5. For purposes of these guidelines, a Forex Bureau shall be established by a person, a commercial bank or any other institution duly licensed by the Bank of Ghana to undertake money changing transactions.
6. The activities of a Forex Bureau will be governed by the following rules and regulations.

B. Conditions governing the issue of licence and commencement of business

Persons; commercial banks and other institutions satisfying the undermentioned conditions may apply to the Bank of Ghana for a licence to operate a Forex Bureau.

1. An applicant shall be eligible to be considered for the issue of a licence to operate a Forex Bureau subject to the fulfillment of the following conditions:

- (i) the applicant must first register in Ghana with the Registrar-General's Department;
 - (ii) the applicant must have established an identifiable location for the bureau. The location must not only be accessible but also public;
 - (iii) the applicant must submit to the Bank of Ghana the name(s) and address(es) of his bankers in Ghana.
2. Without prejudice to the above conditions, the Bank of Ghana reserves the right to refuse to issue a licence to an applicant.
 3. Duly completed application forms may be submitted directly to the Bank of Ghana or through any of the Bank of Ghana's regional offices.
 4. Each applicant satisfying the requirements for the issue of a Forex Bureau licence shall pay a non-refundable registration fee of US\$1000.00 or its equivalent in any of the currencies listed in D(2).
 5. The registration fee shall be treated as an autonomous entity both for purposes of registration and operation.
 6. Each Forex Bureau shall be subject to periodic review.
 7. On receiving the licence from the Bank of Ghana, an applicant must first obtain a certificate to commence business from the Registrar-General's Department before operating the bureau.
- C. Officials of a forex bureau
1. A Forex Bureau must have identifiable official(s).
 2. Any change in the official(s) of a Forex Bureau must be communicated immediately to the Bank of Ghana.
 3. No person(s) other than the official(s) of a Forex Bureau shall be allowed to transact business in foreign exchange on behalf of a bureau.
- D. Currencies of transaction
1. A Forex Bureau shall freely purchase from and sell foreign exchange to the public. The public is also free to sell to or purchase foreign exchange from the bureau.
 2. A Forex Bureau shall, for the time being, conduct foreign exchange cash transactions in the following currencies only;

- (a) United States Dollar;
 - (b) Pound Sterling;
 - (c) Deutsche Mark;
 - (d) Swiss Franc;
 - (e) Canadian Dollar;
 - (f) French Franc;
 - (g) CFA Franc; and
 - (h) Japanese Yen.
- 3. A Forex Bureau shall only purchase traveller's cheques and in the following currencies only;
 - (a) United States Dollar; and
 - (b) Pound Sterling.
- E. Foreign exchange encashment/sale receipts
A Forex Bureau shall issue foreign exchange encashment receipts (FXER) or foreign exchange sale receipts (FXSR) obtainable from the Bank of Ghana.
- F. Confidentiality
 - 1. All transactions conducted by a Forex Bureau shall be done and maintained in the strictest confidence.
 - 2. No information or documents other than those required for the completion of the foreign exchange encashment or sale receipts shall be demanded by any Forex Bureau.
- G. Buying and selling rates
 - 1. Each Forex Bureau Shall be free to quote its foreign exchange buying and selling rates.
 - 2. Both the buying and selling rates for all currencies and travellers' cheques shall be prominently displayed.
- H. Opening of foreign exchange accounts
 - 1. A Forex Bureau shall be required to open a foreign exchange account with any of the authorised dealer banks.
 - 2. Such a foreign exchange account must at all times maintain a minimum balance of US\$5,000.00 or its equivalent in any of the currencies listed in D(2).

3. The minimum balance to be maintained on the foreign exchange account shall be subject to periodic review.
 4. The bureau's foreign exchange account shall be used solely for its day to day operations.
 5. All deposits in excess of the required minimum shall at all times be available to the Forex Bureau.
- I. Register of accounts
1. Each Forex Bureau shall maintain the following registers in respect of its transactions.
 - (a) Register of purchases of foreign currency;
 - (b) Register of purchases of travellers cheques and
 - (c) Register of sales of foreign currency.
 2. All registers and other records of a bureau shall be available for inspection by authorised Bank of Ghana officials.
- J. Submission of returns to the Bank of Ghana
1. For statistical purposes, each Forex Bureau shall submit to the Research Department, Bank of Ghana, the following monthly returns not later than five (5) working days after the month for which the report is being made:
 - (a) Statement of total purchases and total sales of foreign currencies; and
 - (b) Statement of purchases of travellers' cheques.
 2. Such statements shall be in accordance with formats prescribed by the Bank of Ghana.
- K. Use of temporary premises
- Any Forex Bureau wishing to undertake transactions outside its registered place of operation on a temporary basis or on special occasions shall first seek and obtain the approval of the Bank of Ghana.
- L. Renewal of a forex bureau licence
- A forex bureau licence shall be renewed annually at a fee to be determined by the Bank of Ghana.
- M. Revocation of the forex bureau licence

The Bank of Ghana reserves the right to revoke the licence of any Forex Bureau if in the Bank's opinion the conduct of the bureau is detrimental to the success of the Forex Bureau scheme.

N. Amendment to guidelines

The Bank of Ghana reserves the right to make amendments to the rules and regulations governing the operation of the Forex Bureau scheme.

O. Enquiries

All enquiries on these guidelines and requests for application forms may be directed to the Secretary, Bank of Ghana, Accra.

Source: Bank of Ghana

Appendix C: Questionnaire for forex bureau research

1. When did your forex bureau start operation?
2. How many employees do you have?
Kindly give their job titles in the space below (e.g. managing director, cashier, clerk, security, messenger, etc.)
(a)
(b)
(c)
(d)
(e)
(f)
3. How many of the above employees are part-timers?
4. Have you had any training programs of any kind for any of your employees since they wereemployed? Yes No If yes, what kind of training?
5. How are you able to establish your bureau rates (prices) for the various currencies?
6. Who are the buyers of currency from your bureau. Please indicate size by giving percentage each group buys from your bureau. You are also free to make your own list.
(Please note that the percentages must add up to 100%)
a. Traders %
b. Businesses/companies %
c. Government officials %
d. Ghanaians buying to travel abroad %
e. Other Africans %
f. Foreigners (whites) %
g. Others (indicate)
1 %
2 %
3 %
100%

7. Who sells foreign currency to your bureau. Indicate percentages. (Please this must add up to 100%)

a. Foreign tourist	%
b. Ghanaian with relatives abroad.	%
c. Traders	%
d. Companies	%
e. Others (indicate)	
1.	%
2.	%
3.	%

100%

8. What percentage of traders who purchase foreign currency from your bureau trade along the West African Coast compared with those going to Europe and beyond. (Please this must add up to 100%)

West African traders	%
Europe etc., bound traders	%

Total	100%
-------	------

9. For customers buying currency from your bureau, what percentage buy in the range below (or equivalent). (You may flip through your receipt books if you cannot remember very well). Figures here must add up to 100%

US\$(1-100)	%
US\$(101-500)	%
US\$(501-1000)	%
US\$(1001-5000)	%
Over US\$10,000	%

100%

10. For customers selling currency to your bureau, what percentage sell in the range below (or equivalent). (Please figures here must add up to 100%)

US\$(1-100)	%
US\$(101-500)	%
US\$(501-1000)	%
US\$(1001-5000)	%
OverUS\$(10,000)	%

100%

11. What is the largest order of foreign exchange (purchases or sales) that you have received at your bureau? Please quote in currency you received that order
Were you able to execute the whole order? Yes No If no why
12. How will you describe your currency position in these currencies? The pound sterling was available about % of the time:
0% 5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
- Attach similar availability percentages beside currencies below
The US dollar
The CFA
The deutsche mark
The French franc
The Canadian dollar
The Japanese yen
The Swiss franc
13. Do you have any level of stock in the currencies beyond which you will not buy any more of a currency unless current stocks have been reduced? Yes No
If yes, what is the level in these currencies.
The Pound sterling The dollar The CFA
The deutsche mark The French franc
The Canadian dollar The Japanese yen
The Swiss franc
14. If you found yourself with a big stock of currency without buyers what would you do?
15. Apart from buying and selling currency, what other services do you render to your customers?
16. On the average how many customers transact at your bureau in a day. Please circle one
a. 0-50
b. 51-100
c. 101-150
d. 151-200
e. 201-250
f. 251-300
g. Over 300
17. Do you trade with other bureaus? Yes No
18. Can you list two major problems peculiar to your forex bureau?
19. Can you list two major problems peculiar to the forex bureau industry of Ghana.

Notes

1. A Ghanaian trader is a merchant trading in all kinds of goods. Traders travel back and forth all around the globe to buy goods to be sold in Ghana. Their peculiar characteristic is that they do not use the banking system much for money transfers. They tend to carry much of the physical money for their transactions on them apparently to quicken the entire goods delivery process.
2. The main costs encountered in this arbitrage analysis are transport and telephone costs. For both intra-city and inter-city arbitrage analysis, the two costs are substantial especially with the inter-city analysis where long distances are involved. For simplicity, the two costs are assumed zero in this research.
3. Tax figures for Tema, Brong Ahafo and Western Regions could not be obtained.
4. Tables 14-17 and Appendix Tables A6-17 are all 18 x 18 matrix bureau tables.
5. Just as this report was being finalized, the Bank of Ghana announced new fees for the bureau industry. Licensing fees are increased to \$5,000 from \$1,000 (i.e. a 400% increase). Annual license renewal fees went up to \$3,000 from \$1,000 (i.e. a 200% increase). The mandatory minimum balance with banks is increased from \$5,000 to \$10,000 (i.e. a 100% increase).

The Bank of Ghana however could not implement these measures after a vehement protest from the bureau operators.
6. For comparison with other business, as at August 1993, maximum license renewal fees for retailing and wholesaling is \$140 per year. Maximum renewal fees for hotels and restaurants is less than \$80 dollars a year (see PNDC Law 156 of 1986).
7. During the period of this research, there was no active forex bureau operators association in place.

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