Treasury-Federal Reserve Study of
the U. S. Government Securities Market

GOVERNMENT SECURITIES MARKET PERFORMANCE IN THE WAKE OF OFFICIAL OPERATIONS IN COUPON ISSUES
DAY-TO-DAY PERFORMANCE

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A. Introduction and Summary

The objective of this study has been to analyze the impact of official operations in coupon issues on the daily performance of the Government securities market. The first section below selects statistical indicators of daily market performance, mainly on the basis of a review of criteria of market performance proposed in the past and the dealers' criticisms of official operations in coupon securities. The second section studies the relationship between these market indicators and dealer sales to official accounts on days when there were no Treasury financings, during the period from August 22, 1962 through December 31, 1963. As a supplement, the final section considers the relationship between dealer sales to official accounts and retail sales and purchases (two of the more important market indicators) during Treasury rights financings from March 1961 through July 1964.

The major findings of the study are summarized below:

(1) Dealer sales to official accounts were not significantly related to dealer sales to private customers on days when Treasury financings were not in progress. During financings, however, purchases by official accounts apparently encouraged a higher level of sales to retail customers of securities maturing in 5-10 years and after 10 years. Thus, there was little or no evidence in the daily data to confirm the dealers' contention that private buyers were discouraged by official operations.

(2) Dealer sales to official accounts were positively correlated with dealer purchases from private customers of securities in the 5-10 and over-10 year maturity classes, both during financings and on other days.

These results were consistent with the dealers' argument that buying by official accounts led other customers to take the opportunity of dumping securities. They could also be explained, however, by the practice of official accounts of buying securities when they were available--availability presumably being increased by large dealer purchases from private customers.

(3) Dealer sales to Treasury accounts on the current day were negatively related to the average change in prices of coupon securities on the same day in all three maturity classes studied ($>1 \leq 5$, $>5 \leq 10$, >10 years) on days without financings. Doubtless this reflected the Treasury's practice of concentrating investment orders in weak markets. This relationship appeared to have been temporary and slight. The possibility that purchases by official accounts led to price increases should be tested for periods longer than two days and with lags of more than one day.

(4) Dealer sales to official accounts were negatively associated with the change in the dealers' gross long positions and net positions in all three maturity classes on days without financings. This relationship, however, was probably mainly an immediate technical reaction and so would not necessarily reflect a lessened dealer willingness to take positions over a slightly longer period.

(5) Dealer sales to official accounts on the current day were also associated with a rise in offerings of securities in all three maturity classes to the Trading Desk at the New York Federal Reserve Bank, on days when there were no Treasury financings.

These findings are subject to a number of qualifications. First, the analysis was confined to the market's daily response to official operations in the period after the Federal Reserve System began to buy coupon securities.

In most cases a complete appraisal of the arguments about official operations in coupon securities also requires analyses of weekly or monthly data and comparison with market behavior in the period before 1961 when there was no possibility of System intervention. Second, the frequency of days with large official operations was not great. The findings might have been different if operations had been larger or more frequent. In addition, the statistical reliability of the results, particularly during financings, would have been greater if operations had been more frequent. Third, even in the cases where official operations were significantly related to market indicators, such operations usually did not explain much of the variation in the indicator. Finally, it would seem preferable to approach the problem of the impact of official operations in coupon securities on market performance indirectly, by the construction of a statistical model of the Government securities market that would explain positions, trading, prices and official operations at the same time.

B. Statistical Indicators of Daily Market Performance

The first step in this study was to select statistical indicators of the daily performance of the U. S. Government securities market. The indicators selected should facilitate an appraisal of the dealers' statements about the impact of official operations in coupon securities on market performance, and they should also measure the technical criteria used to judge market performance. Therefore, the first two sections below briefly review the criteria of market performance proposed in the past and summarize the dealers' criticisms of official operations in coupon securities. The third section describes the statistical indicators selected and the hypotheses that can be tested through a study of these indicators.

1. Review of Criteria of Market Performance

In general terms it is usually agreed that an adequately functioning Government securities market would have the capacity to accommodate Treasury financings, Federal Reserve open market operations, and private investment transactions. Such a market would be characterized by continuity in trading at prices which reflect demand and supply and would not exhibit the sustained sharp price movements that might reflect investor or dealer unwillingness to maintain an active, functioning market. More technical criteria implicit in this definition have been developed along two lines, one defining ideal markets and the other defining disorderly markets.

The Ad Hoc Subcommittee on the Government Securities Market in 1952 characterized an efficiently functioning market as one possessing "depth, breadth, and resiliency." These characteristics were defined in terms of the orders on the dealers' books. The market "possesses depth when there are orders, either actual orders or orders that can be readily uncovered, both above and below the market. The market has breadth when these orders are in volume and come from widely divergent investor groups. It is resilient when new orders pour promptly into the market to take advantage of sharp and unexpected fluctuations in prices."[1] Adopting a somewhat different approach, Chairman Martin, in his 1959 reply to a questionnaire of the Joint Economic Committee, stated that the Government securities market should be characterized by a relatively large volume of continuous trading and moderate day-to-day price changes.[2]

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[1] U. S. Congress, Joint Committee on the Econimic Report, Subcommittee on Economic Stabilization (Flanders Committee), United States Monetary Policy: Recent Thinking and Experience, Hearings, 83d Cong., 2d Sess., 1954, p. 265.

[2] U. S. Congress, Joint Economic Committee, Employment, Growth, and Price Levels, Hearings, Part 6C, 86th Cong., 1st Sess., 1959, p. 1801.

The Ad Hoc Subcommittee defined a declining market as disorderly "when selling feeds on itself so rapidly and menacingly that it discourages both short covering and the placement of offsetting new orders by investors who ordinarily would seek to profit from purchases made in weak markets."[1] A similar definition of disorderly conditions was applied to rising markets.

Most of these characteristics, particularly those referring to orders on the dealers' books, cannot be measured directly. Nevertheless, several statistical series have been suggested or used to measure "depth, breadth and resiliency." For example, Mr. Sproul in the Flanders Committee Hearings in December 1954 suggested that "depth, breadth, and resiliency" might be measured by dealers' positions, volume of trading, or erratic price movements. The Fact Finding Staff Committee, which studied the performance of the market from 1950-57, used data on trading volume, dealers' positions, and spreads between the dealers' quoted bid and asked prices. Economists outside the Federal Reserve System, who have not had access to data on positions and trading until recently, have studied ownership distribution of the Treasury debt, price movements and spreads between bid and asked prices in order to appraise market performance.

2. The Dealers' Criticisms of Official Operations in Coupon Securities

This section summarizes only the opinions of those dealers who have criticized purchases of coupon securities by official accounts and does not necessarily reflect the attitudes of all the dealers or even of the majority.[2] The criticisms can be divided into two groups, one pertaining to the role of what the market has dubbed "operation nudge" in

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[1] Flanders Committee, Hearings, p. 268.

[2] The summary was based on the weekly letters of Aubrey G. Lanston & Co., Inc., Robert Van Cleave's article "Operation Nudge" (Banking, April 1962), and a column by Paul Hefferman, "Stability in Government Bond Market," (reprinted in American Banker, July 7, 1964).

achieving the objectives of the Federal Reserve and the Treasury and the other pertaining to the impact of "operation nudge" on market performance.

a. Achievement of the Objectives of "Operation Nudge." The dealers admitted to some uncertainty about the actual objectives of official accounts in buying coupon securities. They thought, however, that any recognized objectives of "operation nudge" that were achieved could also have been accomplished without such purchases. In addition, "operation nudge" contributed to a shortening of the publicly held debt during 1961--a development which might complicate future attempts to combat inflation.

One publicized objective of "operation nudge," namely to supply reserves with a minimum of downward pressure on bill rates, was achieved. Treasury bill rates did not fall to as low levels in the 1960-61 recession as in earlier recessions, but according to the dealers this was not a result of "operation nudge." They thought that the decline in bill rates was relatively small because the Treasury sold a large volume of short-term securities and because the discount rate was held at higher levels than in previous recessions. In a recession banks tend to invest surplus reserves in Treasury bills thus driving down rates, but this bank demand for bills is in part determined by rates on other short-term assets. Thus since in 1960-61 the discount rate was relatively high and the Federal funds rate was frequently near the discount rate, banks hesitated to buy bills at rates much lower than those on Federal funds. "Operation nudge," on the other hand, produced little reduction in net buying pressure on bill rates. If a decrease in official purchases of bills led to relatively high bill rates, they would be largely offset by an increase in private purchases or a decrease in private sales.

Very few of the investors who sold intermediate and long-term securities to the Federal Reserve reinvested the funds in the private long-term credit markets. The large flow of funds into these markets reflected a high level of savings, and so this second assumed objective of "operation nudge" would probably also have been accomplished anyway. Similarly, the reduction in the spread between long-term and short-term yields could have occurred without the help of "operation nudge," as happened in 1959.

b. Market Performance. The dealers also claimed that official operations in coupon securities impaired the functioning of the market for intermediate and long-term Government securities. This impairment resulted from the possibility of official operations as well as from the actual operations themselves, but the detrimental effects on the market were said to be most pronounced in periods when operations were largest.

These dealers alleged first that price levels were artificially high, since they reflected actual and potential purchases by official accounts rather than supply and demand from private investors. The impact of actual purchases by official accounts on prices was larger than was warranted by their size. Moreover, even in periods when official accounts were not in the market, prices were artificially high because the possibility of official buying was always in the background. The resultant artificiality of price levels made it extremely difficult for the Treasury to plan financings, first because substantial price concessions were necessary to market new Treasury securities and second because price quotations provided poor guidance to the size of necessary concessions or even to maturity areas where demand existed. Private borrowers were also sometimes misled about the strength of market demand for securities

by artificial market prices and offered excessive amounts of new issues, thus causing congestion. In addition, private investors found it difficult to sell large blocks of Government securities because price quotations were not firm on the bid side.

Second, retail trading was said to have been smaller because of official transactions in coupon securities.[1] Potential buyers hesitated to buy because they thought price levels were too high or because they were uncertain about the Federal Reserve's goals and their future purchases. Sellers sometimes rushed in to take advantage of the chance to sell to official accounts at high prices, but at other times they postponed sales in the expectation that official buying would push prices still higher in the near future. This decline in retail activity may not have been evident in the data, according to the dealers, because of an increase in trading among dealers and brokers that also stemmed from official purchases, since several dealers or brokers may handle securities ultimately sold to the Federal Reserve.

Third, it was claimed that the dealers were less willing to take positions in intermediate and long-term Government securities, especially short positions, because of uncertainty about future official purchases.

3. Statistical Indicators Selected

The statistical indicators selected for analysis of the market's day-to-day response to official operations were the following:

(1) Dealer sales to private customers by maturity (retail sales).

(2) Dealer purchases from private customers by maturity (retail purchases).

(3) Average daily price changes of securities in each maturity class.

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[1] Advance refundings were also given some credit by the dealers for the decline in trading.

(4) Dealer offerings to the Trading Desk by maturity.

(5) Daily change in dealers gross long positions, gross short positions and net positions by maturity.

The maturity categories selected for all indicators in all series were securities maturing after one year through five years, those maturing after five years through ten years, and those maturing after ten years.

a. Description of the Indicators. Dealer sales to private customers (also referred to as retail sales) were defined as dealer sales to all customers except U. S. Government securities brokers and dealers, other brokers and dealers, and official accounts (i.e., System and Treasury). Similarly, dealer purchases from private customers (also referred to as retail purchases) were defined as dealer purchases from all customers except U. S. Government securities brokers and dealers, other brokers and dealers, and official accounts. The source of these statistics was the daily reports submitted by the dealers reporting to the Market Statistics Division of the Federal Reserve Bank of New York. Repurchase agreements were not included in private trading or in official transactions.

The series on average daily price changes were calculated especially for this study, in order to obtain daily data for price changes in each desired maturity class. The basic source of the data was the daily closing bid prices of U. S. Government securities as published by the Federal Reserve Bank of New York. Every Government security maturing after one year (except the 1 1/2's) was classified daily in the appropriate maturity class ($>1 \leq 5, > 5 \leq 10, > 10$).[1] The day's price change for each issue in the given maturity class was calculated, and then a simple arithmetic average was obtained. The resulting averages were expressed in points and decimal fractions, rather than in 32nds.

[1] Issues moving from one maturity class to another were arbitrarily shifted on the 10th trading day of the appropriate month, in order to simplify programming.

Data on daily dealer offerings to the Trading Desk were calculated by the Securities Department of the Federal Reserve Bank of New York from the daily tabulations of all unsolicited offerings.[1] Again, offerings were classified into three desired maturity classes.

Daily changes in gross long positions, gross short positions, and net positions of dealers came from the daily reports submitted by the dealers to the Market Statistics Division of the Federal Reserve Bank of New York. Positions were on a commitment basis, and securities placed with customers under repurchase agreements were included in gross long positions and net positions.

b. Use of the Indicators. These series were selected because they were measures of market performance, because they could be used to test the dealers' allegations about the market performance, and because they were available on a daily basis. If these indicators responded to official purchases in the ways suggested by the dealers, official purchases of coupon securities generally should have led to a low level of dealer sales to private customers, a high level of dealer purchases from private customers (unless prices were expected to rise further, when purchases should also have been low), a rise in security prices, a rise in dealers' short positions or a decline in long positions, and a decline in net positions. In addition, official buying should have caused dealers to offer still more securities to the Trading Desk.

Unfortunately, however, official purchases were also partly a response to the market indicators. This might lead one to expect different relationships between official operations and market indicators and complicate the interpretation of the relationships. For example, any negative relationship between official purchases and dealer sales to private customers

[1] Offerings made in response to System requests are not included. If a dealer changes his price (or quantity) revisions are made in the original offering, so double counting does not occur.

and any positive relationship between official purchases and dealer purchases from private customers might also have reflected the tendency for official accounts to buy when securities were available. To take another example, Treasury accounts tended to buy when prices were falling--a fact which should have caused a negative relationship between price changes and dealer sales to official accounts rather than the positive relationship suggested earlier. These hypotheses are discussed further when the tests are presented and interpreted.

This study was confined to the impact of official operations on the market indicators on the day when these accounts were in the market and, in some cases, on the following day. Effects attributable simply to the possibility of official transactions during the entire period would have to be assessed by comparisons with pre-1961 statisitcs.

C. Relationship Between Dealer Sales to Official Accounts and Market Indicators on Days When There Were No Financings, 8/22/62-12/31/63

Preliminary examination of the data showed that the behavior of most market indicators was much different during Treasury financings than at other times, even when there were no official transactions. For example, trading was, of course, much higher during financings than at other times. Therefore, this section of the study analyzes the response of market indicators to official transactions on days when Treasury financings were not in progress. (Section D considers the response of selected market indicators during financings.) Moreover, because of the time-consuming nature of the task of keypunching daily data, this study of days without financings covered only August 22, 19622 through December 31, 1963,

not the entire period for which data were available.[1] Official operations in coupon securities were relatively heavy in this period, however; so that the sample provided a good basis for analysis.

Financing periods were selected independently for each of the three maturity classes ($>1 \leq 5$, $>5 \leq 10$, >10), so that the number of days without financings in the samples differed for each maturity class. For example, if a financing involved only issues maturing in 1-5 and 5-10 years, days during this financing were included in the sample of days with financings for the 1-5 and 5-10 year maturity classes and in the sample of days without financings for bonds maturing after 10 years. A financing was defined as extending from the day after the announcement day through the payment date if the securities in the maturity class included new issues. If the issues in the given maturity class that were involved in the financing included only rights, the financing was defined as covering the day after the announcement through the day the books closed. The samples of days without financings, of course, excluded all days falling within financing periods so defined.[2]

After a description of the frequency and size of official operations, the remainder of this section discusses the results of statistical tests of the day-to-day response of each market indicator to dealer sales of coupon securities to official accounts. The first

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[1] This period was selected arbitrarily because official operations were relatively frequent. August 22, 1962 was the starting day because it was the beginning of a period of operations.

[2] The days when reinvestment of the proceeds of municipal advance refundings took place were also excluded (i.e., 2/14/63 and 10/16/63 for 1-5 year issues and 7/13/63 for 5-10 year issues). Days of competitive bond auctions were not excluded.

type of test, the chi-square test, utilized frequency distributions of the days in the sample classified according to dealer sales to official accounts and also according to each of the market indicators. For example, the frequencies of days with high and low dealer sales to private customers when official accounts were in the market and when they were out of the market were compared to the frequency distributions expected on the basis of the distribution of such sales on all days in the sample. This test should indicate whether there was a relationship between sales to official accounts and the given market indicator. (An example of how the test was applied is given below.)

Chi-square tests were applied to the relationship between each market indicator and each of the following measures of official transactions on the current day: 1) the existence or non-existence of sales to the System and Treasury accounts, 2) the existence or non-existence of sales to the System, 3) the existence or non-existence of sales to Treasury accounts, 4) large and small sales to the System and Treasury accounts, 5) large and small sales to the System and 6) large and small sales to Treasury accounts. The tests were also applied to the relationship between market indicators and the same measures of sales to official accounts on the previous day, in order to test for the existence of a lagged relationship. In all tests the frequency distributions were compressed to four cells to increase the number of frequencies in each cell. Even so, not all the tests could be calculated for all three maturities because there were not enough theoretical frequencies in some cells.[1]

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[1] The original data from the computer showed more classes for the market indicators and also the mean and standard deviation of the market indicators for each frequency distribution.

The chi-square test does not indicate the form or magnitude of the relationships between sales to official accounts and the market indicators. Thus, as a second test, multiple regressions were also calculated to see how much of the variations in the market indicators could be "explained" by official operations. In each regression five measures of official operations were used as independent variables, namely, dealer sales to Treasury accounts on the current day (S^T_t), sales to the System on the current day (S^S_t), sales to the Treasury on the previous day (S^T_{t-1}), sales to the System on the previous day (S^S_{t-1}), and a measure of the duration of sales to official accounts (D) which was the number of days out of the most recent five days on which dealers made sales to either Treasury accounts or the System. These measures permitted analysis of the current response of the market indicators to System and Treasury operations separately, as well as analysis of the lagged response and of the response to the duration of operations. Obviously, the market indicators also responded to each other and to other factors (in ways discussed below); and so, where reasonable, market indicators were also included as independent variables in the multiple regressions.

1. Dealer Sales of Coupon Issues to Official Accounts

Tables I through III describe the frequency and size of the dealers' daily sales to official accounts of coupon securities in each of the three maturity classes, when financings were not taking place. In each of the three maturity classes sales to either the System or the Treasury or both occurred on slightly over one-fourth of the days--63 days out of 242 days for 1-5 year issues, 71 days out of 265 days for 5-10, and 91 days out of 311 days for over-10 year issues. Relatively large operations were much less frequent. For example, sales of over $20 million

Table I

Frequency Distribution of Trading Days Without Financings Classified According to Level of Dealer Sales to Official Accounts of Securities Maturing in >1 ≤5 Years

(August 22, 1962-December 31, 1963)

Volume of Sales to Official Accounts (in millions of dollars)	Type of Official Account		
	Treasury	SOMA	Total
	(number of days)		
	212	207	179
Subtotal: Greater than 0	(30)	(35)	(63)
Greater than 0 but less than or equal to 1	11	0	11
Greater than 1 but less than or equal to 20	12	11	22
Subtotal: Greater than 20	(7)	(24)	(30)
Greater than 20 but less than or equal to 40	4	10	12
Greater than 40 but less than or equal to 60	1	10	12
Greater than 60	2	4	6
Total:	242	242	242
	(in millions of dollars)		
Highest Daily Sales	73.5	78.7	78.7
Average Daily Sales*	1.7	4.9	6.6

* Based on entire number of days in the sample.

Table II

Frequency Distribution of Trading Days Without Financings Classified According to Level of Dealer Sales to Official Accounts of Securities Maturing in $>5 \leq 10$ Years

(August 22, 1962-December 31, 1963)

Volume of Sales to Official Accounts (in millions of dollars)	Type of Official Account		
	Treasury	SOMA	Total
	(number of days)		
	222	229	194
Subtotal: Greater than 0	(43)	(36)	(71)
Greater than 0 but less than or equal to 1	17	0	11
Greater than 1 but less than or equal to 10	11	7	17
Subtotal: Greater than 10	(15)	(29)	(43)
Greater than 10 but less than or equal to 20	8	10	17
Greater than 20 but less than or equal to 30	3	14	15
Greater than 30 but less than or equal to 40	3	3	8
Greater than 40	1	2	3
Total:	265	265	265
	(in millions of dollars)		
Highest Daily Sales	47.5	45.7	47.5
Average Daily Sales*	1.6	2.7	4.3

* Based on entire number of days in the sample.

Table III

Frequency Distribution of Trading Days
Without Financings Classified According to Level of
Dealer Sales to Official Accounts of Securities Maturing After 10 Years
(August 22, 1962-December 31, 1963)

Volume of Sales to Official Accounts (in millions of dollars)	Type of Official Account		
	Treasury	SOMA	Total
	(number of days)		
	234	288	220
Subtotal: Greater than 0	(77)	(23)	(91)
Greater than 0 but less than or equal to 1	21	1	18
Greater than 1 but less than or equal to 5	27	17	40
Subtotal: Greater than 5	(29)	(5)	(33)
Greater than 5 but less than or equal to 10	11	5	14
Greater than 10 but less than or equal to 15	7	0	8
Greater than 15 but less than or equal to 20	5	0	4
Greater than 20	6	0	7
Total:	311	311	311
	(in millions of dollars)		
Highest Daily Sales	61.3	10.0	61.3
Average Daily Sales*	2.0	0.3	2.3

* Based on entire number of days in the sample.

occurred on 30 days in 1-5 year issues. Sales exceeding $10 million were executed on 43 days in the 5-10 year class; and sales of more than $5 million were made on 33 days for securities maturing after 10 years.

In addition, sales to official accounts were not divided equally between the Treasury and the System. The Treasury accounted for most of the activity in the longest maturity class, while the System was more important in the two shorter maturity classes. Thus, sales to Treasury accounts of securities maturing after 10 years were made on 77 days while sales to the System were made on only 23 days. Similarly, sales to the Treasury of this maturity exceeded $5 million on 29 days, whereas sales to the System exceeded $5 million on only 5 days. The opposite was true in the 1-5 year class. Large sales--over $20 million--were made on only 7 days to the Treasury and on 24 days to the System. A somewhat more balanced situation occurred in the 5-10 year class, although more large daily sales were made to the System (over $10 million) than to the Treasury--29 days compared to 15 days.

The contrast in the relative importance of System and Treasury accounts was also evident in the daily average volume of dealer sales to these accounts. In the over-10 year class, sales to the Treasury averaged $2.0 million a day in this period, while sales to the System averaged only $.3 million. In contrast sales of 1-5 year and 5-10 year securities to the Treasury averaged $1.7 million and $1.6 million a day respectively, against $4.9 million and $2.7 million to the System.

The largest concentration of sales to official accounts during this period (excluding financings, of course) occurred in the Fall of 1962, May 1963, and late June and early July 1963. Relatively heavy daily sales were also scattered through the rest of the period.

2. Sales to Official Accounts and Sales to Private Customers

a. Chi-square Tests. The comments of the dealers would lead one to expect a lower level of dealer sales to private customers when dealers were also selling to official accounts. Analysis of the frequency distributions of daily sales to private customers for August 22, 1962 through December 31, 1963 revealed no such relationship either with sales to official accounts on the current day or on the previous day in any of the three maturity classes. This analysis was based on the chi-square test of the significance (or lack of significance) of the relationship between two principles of classification, in this case two characteristics of the Government securities market.

This test is described in detail for retail sales of securities maturing after 10 years and large sales (over $5 million) of such securities to official accounts. The first row of Table IV shows the actual frequency distribution of daily dealer sales to private customers. In other words, each of the 311 days is classified according to the level of retail sales. Thus, on 207 days retail sales were less than or equal to $10 million, while on 104 days retail sales were greater than $10 million. The second row shows the percentage of the total days falling in each class--i.e., on 66.6 per cent of the 311 days, sales were $10 million or less. The third and fourth rows show the same absolute frequency distributions for days when dealer sales to official accounts were less than or equal to $5 million (278) and days when such sales exceeded $5 million (33).

The question to be answered by the chi-square test is whether the frequency distributions in rows three and four are what would be expected, if there had been no relationship between large sales to official accounts and retail sales. If there had been no relationship,

Table IV

Example of Calculation of Chi-Square
Relating Retail Sales to Large Dealer Sales to
Official Accounts of Securities Maturing After 10 Years

(Dollar amounts in millions)

Sales to Official Accounts	Dealer Sales to Private Customers ≤10	≥10	Total
All Days Without Financings			
(1) Number	207	104	311
(2) Per cent	66.6	33.4	100
Days When Volume of Sales to SOMA + Treasury were			
	Actual Distribution		
(3) ≤ 5	189	89	278
(4) > 5	18	15	33
	Theoretical Distribution		
(5) ≤ 5	185	93	278
(6) > 5	22	11	33

$$\text{Chi-square} = \frac{16}{185} + \frac{16}{22} + \frac{16}{93} + \frac{16}{11} = 2.4401$$

66.6 per cent of the 278 days with small sales to official accounts and 66.6 per cent of the 33 days with large sales to official accounts would have had retail sales of $10 million or less, since 66.6 per cent of all days in the sample had retail sales of $10 million or less (row two). The so-called "theoretical" frequency distributions in rows five and six were calculated on the basis of this assumption of the same percentage distribution for the two sub-groups as existed for the total sample. In fact, the actual and theoretical distributions were not exactly the same, but these differences may have been due to chance.

The chi-square statistic is calculated from these theoretical and actual frequency distributions by a formula[1] which gives a chi-square of zero if the distributions are exactly the same and increasingly large chi-squares as the difference between the distributions increases. Then prepared tables are consulted to see if the resulting value of chi-square is significantly different from zero--in other words, if the differences between the actual and theoretical frequency distributions were too great to be due to chance, under the hypothesis that large sales to official accounts and retail sales were really unrelated.

In this case, chi-square equaled 2.4401 and was not significantly different from zero at the 5 per cent confidence level. In other words, a value this large could occur more often than 5 times in 100 if the true value were zero. Thus, the data were consistent with the hypothesis of no relationship between retail sales and large sales to official accounts.

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[1] Chi-square equals the sum of the squared differences between the numbers in corresponding cells of the theoretical (f) and actual frequency (f_o) distributions divided by the theoretical frequency.

$$\text{Chi-square} = \sum \left| \frac{(f_o - f)^2}{f} \right|$$

If chi-square had been 3.841 or greater in this example, the hypothesis of no relationship would have been rejected, since such a large value of chi-square would occur by chance only 5 times in 100 if there were in fact no relationship. In fact, none of the chi-squares relating retail sales and sales to official accounts were significant at the 5 per cent level.

Where there were enough observations, the same chi-square tests were also calculated for days when prices declined (the average price decline exceeded 1/32), when prices were unchanged (the average change was between + and - 1/32) and when prices rose (the average price increase was greater than 1/32), on the possibility that a reaction between retail sales and prices had obscured a relationship between retail sales and official transactions. Again there were no significant chi-squares. Thus, the tests were consistent with the hypothesis that there was no relationship on a day-to-day basis between dealer sales to private customers and dealer sales to official accounts.

b. Multiple Regressions. As a further test for a relationship between dealer sales to private customers (S^P_t) and sales to official accounts, mulitiple regressions were calculated. The independent variables included the five measures of official operations mentioned earlier, dealer sales to Treasury accounts on the current day (S^T_t), dealer sales to the System on the current day (S^S_t), dealer sales to Treasury accounts on the previous day (S^T_{t-1}), dealer sales to the System on the previous day (S^S_{t-1}), and the number of days out of the last five on which either dealers made sales to the System or Treasury accounts (D). In addition, the dealers' net position on the previous day (NP_{t-1}), the average change in prices on the current day (ΔP_t), and the average change in prices on the previous day (ΔP_{t-1}) were used as independent variables.

Even with the addition of these other variables, however, the equations were far from expressing the complex interrelationships in the Government securities market. Obviously, a number of factors on both the supply and demand sides of the market, other than official activity, may influence dealer sales to private customers. The supply of securities available for sale depends partly on the dealers' inventories, partly on the dealers' willingness to sell their inventories, and partly on what the dealers expect to be able to buy in the market. The dealers' willingness to sell their inventories would, in turn, depend on expected price changes and, on the cost of financing the securities relative to the coupon. The dealers' net position on the previous day was included in the regressions; and the actual change in prices on the past two days may have reflected the dealers' expectations; but there undoubtedly were a number of influences on the supply side that were left out. On the demand side the omitted variables were even more numerous. Presumably, private customers' demand for Governments would depend on relative or absolute yields, their own cash flows, and expected price changes.

The implication of this brief discussion is that the regressions calculated would probably not explain much of the variation in retail sales on days without financing. Furthermore, it raises the possibility that the true relationship between retail sales and official operations may not be uncovered. One possible solution, a detailed model of the Government securities market, is beyond the scope of this study.

The final equations[1] were as follows:

(1-5 yrs.) $$S^P_t = 25.737 - .349\ S^T_t + .148\ S^S_t + .613\ S^T_{t-1} + .218\ S^S_{t-1}$$
$$(.342) \quad (.148) \quad (.336) \quad (.147)$$

[1] In each equation all variables referred only to the given maturity class. In these equations and those in the following sections, dollar variables were in millions and changes in prices were in points. Price changes less than 1 point were expressed as decimals, not 32nds. See Appendix Table XIV for other results.

$$- 2.777\ D + \underline{.085}\ NP_{t-1} + 108.115\ \Delta P_t + 18.475\ \Delta P_{t-1}$$
$$(1.764)\quad (.017)\qquad (55.525)\qquad (55.307)$$

(5-10 yrs.) $$S^P_t = 34.649 - .094\ S^T_t + .128\ S^S_t - .126\ S^T_{t-1} + .113\ S^S_{t-1}$$
$$(.231)\quad (.158)\quad (.233)\quad (.162)$$

$$- \underline{2.641}\ D + \underline{.033}\ NP_{t-1} + 6.629\ \Delta P_t - 8.785\ \Delta P_{t-1}$$
$$(1.073)\quad (.009)\qquad (16.867)\qquad (16.858)$$

(>10 yrs.) $$S^P_t = 8.280 + .112\ S^T_t - .452\ S^S_t - .118\ S^T_{t-1} + \underline{.191}\ S^S_{t-1}$$
$$(.058)\quad (.274)\quad (.068)\quad (.092)$$

$$+ .176\ D + \underline{.016}\ NP_{t-1} + .231\ \Delta P_t + .501\ \Delta P_{t-1}$$
$$(.287)\quad (.005)\qquad (4.802)\qquad (4.843)$$

The numbers in parenthesis are the standard errors of the regression coefficients. The underlined regression coefficients are those that are significantly different from zero at the 5 per cent level or better--i.e., a coefficient that large could occur less than 5 times in 100 if the true coefficient were zero.

As can be seen from the equations, no significant relationship was found between the measures of official activity in most maturity classes, when all the variables were included. One exception was sales to the System on the previous day in the over-10 year maturity class. which was positively related to retail sales.[1] Another exception occurred in the 5-10 year maturity class, where there was a significant negative relationship between retail sales and the duration of sales to official accounts. (An increase of one day in the number of days out of the previous five on which official accounts bought 5-10 year Governments led to a decrease of $2.6 million in retail sales, when the other variables were

[1] As Appendix Table XIV shows, the simple correlation coefficient between retail sales and sales to the Treasury on the current day was positive and significant at the 1 per cent level, but it was not significant in multiple regressions because of multicollinearity with net position.

held constant.) Even the regression coefficients for these two variables, however, were on the borderline of significance: they were significant at the 5 per cent level but not the 1 per cent level. Moreover, the implications of the two coefficients are contradictory. In the 5-10 year class official activity led to lower retail sales, as the dealers suggested; but in the over-10 year class, it led to higher retail sales.

Of the three other variables, only net positions on the previous day was significant in all three maturity classes. Sales to private customers were somewhat higher when positions were large. Moreover, the total variation in retail sales explained by all the variables was very small indeed--12 per cent in the 1-5 year maturity class, 7 per cent in the 5-10 year maturity class, and 6 per cent in the over-10 year class.

As was the case with the chi-square tests, the multiple regressions provided almost no confirmation of the dealers' contention that buying by official accounts led other buyers to withdraw from the market on days without Treasury financings in late 1962 and 1963. Of course, these results might not hold if the magnitude or frequency of official purchases were greater than in this period. Moreover, as was explained above an integrated and more complete model of the market might reveal some more pronounced relationships.

3. Sales to Official Accounts and Purchases from Private Customers

a. Chi-square Tests. Chi-square tests were calculated on the relationship between dealer purchases from private customers and the various measures of dealer sales to official accounts. In all three maturity classes, some of the chi-squares based on the current day's measures of official activity were significant at the 5 per cent level, suggesting that there was a relationship between retail purchases and sales to official accounts

on the current day. Evidence of a lagged relationship also existed in the over-10 year maturity class, but not in the other two maturity classes. Examination of the frequency distributions showed that these relationships were in the direction suggested by the most frequent dealer criticisms. Retail purchases were higher on days when the dealers were also selling to official accounts.

In the 1-5 year maturity class, a significant chi-square of 4.0745 was found between the size of retail purchases and the existence or non-existence of dealer sales to official accounts. (See Appendix, Table I.) None of the other chi-squares were significant in this maturity class. In the 5-10 year class, more of the chi-squares were significant, as Appendix, Table II shows. Significant relationships were found between retail purchases and the two measures of sales to the System and the two measures of sales to the System and Treasury accounts together. No significant relationship was evident between retail purchases and sales to Treasury accounts.

In contrast, for the longest maturity class, there were no significant relationships between retail purchases and sales to the System, but there were significant relationships between the size of retail purchases and large sales to Treasury accounts on the current day and between retail purchases and large sales to Treasury accounts and the System, taken together. (See Appendix, Table III). Classification of the current day's sales to official accounts on a zero and greater than zero basis did not result in a significant chi-square. Probably this was because there were so many days when sales to Treasury accounts, although greater than zero, were very small (less than $1 million). On the other hand, there were significant chi-squares between existence or non-existence of sales

to Treasury accounts on the previous day and the current day's retail purchases (7.4200) and also between the existence or non-existence of sales to Treasury accounts and the System together on the previous day and retail purchases (4.1077). Possibly the dealers were aware of such small sales only with a lag and so also reacted to them by increasing purchases from private customers with a one day lag.

b. Multiple Regressions. The multiple regressions calculated to explain dealer purchases from private customers (P^P_t) used the same eight independent variables as the equations explaining retail sales, namely, S^T_t, S^S_t, S^T_{t-1}, S^S_{t-1}, D, NP_{t-1}, ΔP_t, and ΔP_{t-1}. As was the case with retail sales, retail purchases were undoubtedly influenced by many other variables not included in the regressions, such as investors cash needs, relative yields, price changes expected by the dealers and by customers, the cost of financing positions, and volume of sales to private customers expected by the dealers.

The final equations[1] were:

(1-5 yrs.) $$P^P_t = 39.906 - .144\ S^T_t + .159\ S^S_t + .193\ S^T_{t-1} + .170\ S^S_{t-1}$$
$$(.396) \quad (.171) \quad (.390) \quad (.170)$$
$$- 2.268\ D + \underline{.052}\ NP_{t-1} + 62.446\ \Delta P_t + \underline{129.553}\ \Delta P_{t-1}$$
$$(2.045) \quad (.019) \quad (64.356) \quad (64.104)$$

(5-10 yrs.) $$P^P_t = 31.656 + .361\ S^T_t + \underline{.510}\ S^S_t + .077\ S^T_{t-1} + .020\ S^S_{t-1}$$
$$(.238) \quad (.163) \quad (.241) \quad (.168)$$
$$- 1.402\ D + .001\ NP_{t-1} + \underline{46.162}\ \Delta P_t + \underline{44.662}\ \Delta P_{t-1}$$
$$(1.106) \quad (.009) \quad (17.400) \quad (17.391)$$

[1] See Appendix Table XV for other results.

$$(>10 \text{ yrs.}) \quad {}^{P}P_t = 8.448 + \underset{(.060)}{.204}\, {}^{T}S_t - \underset{(.284)}{.118}\, {}^{S}S_t + \underset{(.070)}{.109}\, {}^{T}S_{t-1} - \underset{(.095)}{.006}\, {}^{S}S_{t-1}$$

$$- \underset{(.297)}{.047}\, D - \underset{(.005)}{.001}\, NP_{t-1} + \underset{(4.971)}{17.548}\, \Delta P_t + \underset{(5.013)}{11.646}\, \Delta P_{t-1}$$

These variables, however, explained only a very small part of the variation in retail purchases--4 per cent in 1-5 year issues, 8 per cent in 5-10 year issues, and 10 per cent in issues maturing after 10 years.

In the equations for the 5-10 and over-10 year maturity classes, dealer sales to official accounts on the current day were positively correlated with retail purchases. Reflecting differences in activity discussed earlier, sales to Treasury accounts was the significant variable in the over-10 year class, while sales to the System was significant in the 5-10 year class. In the latter case retail purchases rose $510 thousand for every $1 million increase in sales to the System, assuming the other variables were constant. In the over-10 year maturity class retail purchases rose $204 thousand for a $1 million increase in sales to Treasury accounts. Both of these regression coefficients were significant at the 1 per cent level.

The other measures of official activity were not significant in the 5-10 and over-10 year class, while in the 1-5 year class none of the measures of official activity were significant.

As the equations above indicated, price changes were positively related to retail purchases in all maturity classes. In the two longest maturity classes, the regression coefficients for both the current day's change in prices and the previous day's change in prices were significant at the 5 per cent level or better, while in the 1-5 year class the only significant coefficient was that for price changes on the previous day.

For example, an increase of 1 point in the average price of securities maturing after 10 years on the current day was associated with an increase of $17.5 million in dealer purchases from retail customers, when there was no change in other variables.

In conclusion, the multiple regressions and the chi-square tests suggested that sales to official accounts have been associated with higher dealer purchases from private customers on a day-to-day basis, particularly in the case of longer-term securities. These results were consistent with the dealers' assertion that buying by official accounts led other customers to sell while good prices could be obtained. On the surface they also seemed consistent with the contention that official accounts bought when securities were available and that large dealer purchases implied greater availability.

4. Sales to Official Accounts and Changes in Prices

a. Chi-square Tests. The dealers' comments that purchases by official accounts in the coupon market result in artificially high prices would lead one to expect the average daily change in prices of Government securities to have been positively related to dealer sales of coupon securities to official accounts. On the other hand, the fact that the Treasury tended to buy in a weak market suggested that there might have been a negative relationship between sales to Treasury accounts and the daily change in prices.

Chi-square tests provided no evidence of any relationship between sales to Treasury accounts and the price change on the current day or between sales to Treasury accounts and the two-day price change (the current day and the next day). In the shortest maturity class, 1-5 years,

the chi-square test was significant when sales to the System were subdivided into zero and non-zero groups. For price changes on the current day chi-square was 7.5214; and for the two-day price change it was 3.9603. The smaller figure for the two-day price change implies that any price effect was quickly dissipated. As suggested by the hypothesis, price increases were more frequent than normal on days when dealers made sales to the System. No other significant relationships were revealed.

b. Multiple Regressions. The interrelationships between the change in prices and other market variables were also complex. While changes in prices over several months may have been mainly a reaction to actual supply and demand, on a daily basis price changes often did not reflect customer activity but were a technical reaction to some news item or development that might affect demand and supply in the future. In addition, while changes in retail sales or retail purchases sometimes may have caused price changes, price changes may also have reacted on retail sales and purchases. Thus it seems futile to try to explain daily price changes with the data available. Nevertheless multiple regressions with the change in prices (ΔP_t) as the dependent variable were calculated, using net positions on the previous day (NP_{t-1}), as well as the five measures of official transactions (S^T_t, S^S_t, S^T_{t-1}, S^S_{t-1}, D), as independent variables.

In all three maturity classes, sales to the Treasury on the current day was the variable entered first, which means it produced the greatest reduction in unexplained variation in the change in prices. In all three cases this reduction in variation was significantly different from zero at the 5 per cent level. As was expected the correlation was negative, indicating that the Treasury bought when prices were falling.

After the other variables were added, however, the regression coefficient for sales to the Treasury on the current day was no longer significant in the two longest maturity classes, because of multicollinearity with the other variables.

This negative price relationship, however, appears to have been relatively short-lived. For example, there was no significant simple correlation between the change in prices on the current day and Treasury (or System) operations on the previous day. On the other hand there was still no evidence that System or Treasury operations had a stimulating impact on (or positive correlation) with the change in prices. As a further test of the possibility that the negative correlation between the change in prices and sales to Treasury accounts was soon offset by the stimulating impact of sales to Treasury accounts, the two-day price change $[t + (t - 1)]$ was also used as the dependent variable. The two-day price change was also negatively correlated with sales to the Treasury on the current day. These simple correlation coefficients were about the same as those between the current day's price change and sales to the Treasury. The two-day change in prices, however, was negatively correlated with sales to the Treasury on the previous day in the two shorter maturity classes, but not in the longest maturity class where Treasury activity was heaviest. Moreover, in the shortest maturity class there was a positive simple correlation between the two-day price change and sales to the System on the previous day (.123). These results seem to suggest that the negative relationship between sales to the Treasury and the change in prices was temporary. They also raise the possibility that studies based on longer time periods or lags might turn up a positive relationship between official operations and prices.

None of the other independent variables were significant at the 5 per cent level. Moreover, the explained variation in the change in prices was exceptionally small--in the 1-5 year class 3 per cent, in the 5-10 year class 1/2 of 1 per cent, and in the over-10 year class actually negative.[1] In view of the fact that almost no regression coefficients were significant the equations are not given here, but are shown in Appendix, Table XVI.

5. Sales to Official Accounts and Changes in Dealer Positions

a. Chi-square Tests. Comparing frequency distributions through the chi-square test showed that the daily change in gross long positions and net positions were related to some measure of sales to official accounts in all maturity classes. As was expected, increases in long and net positions were less frequent on days when dealers were selling to official accounts. In the over-10 year maturity class there was also a significant relationship between sales to official accounts and the change in short positions--with a rise in short positions being more frequent when official accounts were buying. Appendix Tables IV through X show the actual and theoretical frequencies used to calculate the values of chi-square.

b. Multiple Regressions. Multiple regressions were also calculated to explain the daily change in the dealers' gross long position, gross short position, and net position, although it did not seem that daily data were the most suitable for testing the dealers' allegations that official operations had caused dealers to carry lower positions. Even if the dealers' willingness to carry positions over a longer period of time were not affected by official operations, some of any day's sales to official accounts would normally come out of positions. In the next week or so, however, positions could be rebuilt.

[1] It can be negative because R^2 is adjusted for the degrees of freedom by a subtractive adjustment.

The results for the regressions explaining the change in gross long position and net position were similar.[1] The proportion of the variation explained by all eight variables was about 33 per cent in the 1-5 year class, about 25 per cent in the 5-10 year class, and 41 per cent in the over-10 year class. As expected, dealer sales to both the System and the Treasury on the current day were negatively correlated with the changes in both long and net positions in all maturity classes. In the over-10 year class, however, sales to the Treasury on the previous day was positively related to the change in long and net positions. This implies that the dealers had already started to rebuild positions on the day after official operations--a fact not indicative of a reduced willingness to hold positions over the longer run.

The dealers' net position on the previous day was negatively related to the change in long and net positions in some maturity classes, while the change in prices on the current and previous day was positively related to the change in positions.

The results of the regressions on short positions showed much smaller R^2s and lower correlations (if any) between the change in positions and official activity. Only 7-9 per cent of the variation in the change in short positions was explained by the eight variables. (See Appendix, Table XVIII). In the 1-5 year class, both sales to the System on the current day and sales to the Treasury on the previous day were positively related to the change in short positions, when all variables were included. In the over-10 year class, the duration of official sales was positively correlated with the change in short positions. Multicollinearity prevented sales to the Treasury on the current day from being significant in this

[1] See Appendix, Tables XVII and XIX.

regression when all variables were added, although the simple correlation coefficient was significant. No other measures of official activity were significant; but the change in prices had significant negative coefficients in several cases.

The fact that the few significant correlation coefficients between the change in short positions and the measures of official activity were positive implied that dealers sometimes went short in order to sell to official accounts. These results were thus contrary to dealer criticisms, which suggested that dealers were less willing to carry short positions when official accounts were buying, because of fear that prices would rise and make it expensive to cover short positions. This would appear to be further evidence that correlations of daily data measured mainly immediate technical reactions and did not really reflect changes in dealers' willingness to carry positions even for the short-run, such as a week.

6. Sales to Official Accounts and Dealer Offerings to the Trading Desk

a. Chi-square Tests. Chi-square tests also showed significant relationships between daily offerings to the Trading Desk and some measures of dealer sales to official accounts in all three maturity classes. (See Appendix, Tables XI-XIII.) In the two shorter maturity classes, there was not a significant relationship between offerings and sales to Treasury accounts alone, while in the longest class there was not a significant relationship with sales to the System. This appears to have been another example of the actual division of labor between the System and the Treasury, with the Treasury concentrating on long maturities and the System concentrating on short maturities.

b. Multiple Regressions. In contrast to the other multiple regressions, a relatively high proportion of the variation in offerings

to the Trading Desk (O_t) was explained by the eight independent variables included, which were S^T_t, S^S_t, S^T_{t-1}, S^S_{t-1}, D, NP_{t-1}, ΔP_t and ΔP_{t-1}. In the 1-5 year maturity class 35 per cent of the variation in offerings was explained; in the 5-10 year class, 59 per cent; and in the over-10 year class 64 per cent. This probably reflected a less complex relationship and the inclusion of more of the determinants. Presumably, offerings should vary with the availability of securities to the dealers, their willingness to sell these securities, and the strength of their expectations of being able to sell to official accounts. Of the variables included in the regression net position$_{t-1}$ reflects availability, ΔP_t and ΔP_{t-1} influence the willingness to sell, and the measures of official operations influence their expectations of being able to sell to official accounts. Other variables not included--such as financing costs--may still have played a role, of course. There is still the problem, however, that offerings may also have influenced official purchases.

The equations[1] were:

(1-5 yrs.) $$O_t = 42.630 + .684\ S^T_t + \underset{(.409)}{1.059}\ S^S_t + .116\ S^T_{t-1} + \underset{(.403)}{.380}\ S^S_{t-1}$$
$$\underset{(.177)}{\qquad\qquad}\qquad\qquad\qquad\qquad\underset{(.176)}{\qquad\qquad}$$
$$- .216\ D + \underset{(2.111)}{.107}\ NP_{t-1} - \underset{(66.444)}{363.259}\ \Delta P_t - \underset{(66.183)}{60.729}\ \Delta P_{t-1}$$
$$\underset{(.020)}{\qquad}\qquad\qquad\qquad\qquad\qquad$$

(5-10 yrs.) $$O_t = 35.678 + \underset{(.258)}{.907}\ S^T_t + \underset{(.177)}{.931}\ S^S_t + .121\ S^T_{t-1} + \underset{(.182)}{.262}\ S^S_{t-1}$$
$$\underset{(.261)}{\qquad\qquad}\qquad\qquad\qquad\qquad\underset{(.182)}{\qquad\qquad}$$
$$+ .610\ D + \underset{(1.200)}{.134}\ NP_{t-1} - \underset{(18.869)}{169.136}\ \Delta P_t - \underset{(18.859)}{51.632}\ \Delta P_{t-1}$$
$$\underset{(.010)}{\qquad}\qquad\qquad\qquad\qquad\qquad$$

[1] See Appendix, Table XX for other results.

$$(>10 \text{ yrs.}) \quad O_t = 11.384 + \underset{(.090)}{.655}\, S^T_t + \underset{(.427)}{.896}\, S^S_t - \underset{(.106)}{.102}\, S^T_{t-1} + \underset{(.143)}{.132}\, S^S_{t-1}$$

$$+ \underset{(.447)}{1.462}\, D + \underset{(.008)}{.114}\, NP_{t-1} - \underset{(7.467)}{46.622}\, \Delta P_t - \underset{(7.531)}{4.398}\, \Delta P_{t-1}$$

As was suggested by the chi-square test, sales to official accounts on the current day were definitely significant in explaining offerings to the Trading Desk. In the shortest maturity class, sales to the System were more important, while in the longest class sales to Treasury accounts were the more important variable. In the 5-10 year class, sales to both accounts were significant at the 1 per cent level, although the partial correlation coefficient for sales to the System (.313) was somewhat higher than that for sales to Treasury accounts (.215).

In the 1-5 year class sales to the System on the previous day were also significant at the 5 per cent level; and in the over-10 year class the duration of sales to official accounts was significant at the 1 per cent level, when all eight independent variables were included. No other measures of official activity were significant in the multiple regressions because of multicollinearity. However, simple correlation coefficients between offerings and almost all measures of official activity were significant and positive.

Another indication of the importance of official operations was that the five variables reflecting official operations together explained 18 per cent of the variation in offerings in the 1-5 year class, 12 per cent in the 5-10 year class, and 33 per cent in the over-10 year class.

The net position on the previous day was significant at the 1 per cent level in all three regressions. In fact, net positions alone explained 33 per cent of the variation in offerings in the 5-10 year class

and 46 per cent in the over-10 year class. The change in prices on the current day was significant at the 1 per cent level in all three maturity classes, while the change in prices on the previous day was significant in the 5-10 year class.

Clearly both tests show that official purchases of coupon securities led to higher offerings to the Trading Desk.

7. Conclusions

This section has presented the results of a statistical analysis of the relationship between dealer sales of coupon securities to official accounts and selected indicators of market performance on days when there were no Treasury financings from August 22, 1962 through December 31, 1963. Relationships in each of three maturity classes ($>1 \leq 5$, $>5 \leq 10$, and >10 years) were studied separately, with all variables in each study applying only to the given maturity class. In this analysis several measures of dealer sales to official accounts were studied, namely, the size of sales on the current day, the size of sales on the preceding day, the official account involved (i.e., Treasury or System), and the duration of the official activity. Unless otherwise noted, the relationships summarized below were based on multiple regressions that included all five measures of official activity and some other variables. The conclusions were:

(1) There were almost no significant relationships between dealer sales to official accounts and dealer sales to private customers. The two exceptions--a positive correlation between dealer sales of securities maturing after 10 years to private customers and sales to the System on the previous day and a negative relationship between dealer sales to private customers of securities maturing in 5-10 years and the duration of dealer sales to official accounts--were borderline cases, that were significant at the 5 per cent level but not at the 1 per cent level.

(2) Dealer sales to Treasury accounts on the current day were positively related to dealer purchases from private customers in the over-10 year maturity class, while sales to the System were positively related to purchases from private customers in the 5-10 year maturity class. The difference in the relative importance of System and Treasury accounts in the two maturity classes undoubtedly reflected the fact that Treasury activity was concentrated in longer-term issues and System activity in the shorter- and intermediate-term issues.

The lagged value of sales to official accounts and the duration of sales to official accounts had no significant relationship to retail purchases in these two maturity classes, when the above variables were included. Suggestions in the chi-square tests of a positive relationship between sales to official accounts and retail purchases in the 1-5 year maturity class were not confirmed by the multiple regressions.

This positive relationship between dealer sales to official accounts and dealer purchases from private customers could mean that official activity stimulated private investors to sell their securities, possibly because they thought that prices were artificially high. It could also mean that official accounts bought securities when dealers were buying them from other customers, since securities were more available at such times.

(3) The daily average change in prices on the current day was negatively related to dealer sales to Treasury accounts on that day in all three maturity classes, when no other variables were included. When other variables were included, this relationship was no longer significant in the 5-10 and over-10 year maturity classes. Moreover, the current day's price change was not significantly related to the previous day's sales to the Treasury. These results probably imply that Treasury accounts

tended to buy Governments on days when prices were weak. Some of the data did suggest, however, that a positive impact between official operations and prices might show up if longer time periods or lags were used.

(4) Both the change in gross long positions and net positions were negatively related to dealer sales to Treasury accounts and also to sales to System accounts on the current day in all maturity classes. In the two shorter maturity classes sales to the System were more important than sales to the Treasury, but in the longest maturity class the opposite was true.

In the 1-5 year maturity, the change in dealers' gross short position was positively related to sales to the System on the current day and to sales to the Treasury on the previous day, at the 5 per cent significance level. In the over-10 year maturity class, the change in short positions was significantly related to the duration of sales to official accounts, rising as the frequency of official activity in recent days increased. In fact, this relationship, in a sense, overpowered the positive correlation between the size of sales to the Treasury and the change in short positions when both variables were included. No correlation between changes in short positions and any measure of official activity was found in the 5-10 year class.

It seems likely that these relationships between dealer positions and dealer sales to official accounts were mainly short-run and technical, since on the actual day of the sale at least part of the securities sold would normally have come from positions. Thus, the results do not necessarily imply that the dealers were less willing to hold positions over a longer period of time. This view gained some confirmation from the positive correlation with the change in short positions, since if dealers were less willing to take positions they should have reduced short positions too.

(5) Sales to official accounts also were associated with a rise in offerings to the Trading Desk in all maturity classes on the same day. Again sales to the System appeared to be more important in the two shorter maturity classes, with sales to Treasury accounts assuming the dominant role in the over-10 year class. There also appeared to be a significant lagged reaction to sales to the System in the 1-5 year class.

In appraising these conclusions, several qualifications should be kept in mind. First, the conclusions were based on official operations of the frequency and magnitude in the sample period. The impact might be different if operations were larger or more frequent (or smaller and less frequent) or if other economic conditions changed. One possible test of this would be to run similar tests for 1961-62 or 1964. Secondly, no attempt was made to develop a complete model of the Government securities market. Further work along the lines of developing a model that would simultaneously explain positions, prices, trading, and perhaps official operations, might also result in different conclusions about the impact of official operations.

D. Relationship Between Sales to Official Accounts and Retail Trading During Treasury Rights Financings

This section supplements the analysis of the previous section by studying the day-to-day relationships between sales of coupon securities to official accounts and retail trading during rights financings (i.e., exchanges and advance refundings) from March 1961 through July 1964. The study concentrated on retail purchases and sales and excluded other market indicators because the criticisms or hypotheses about the impact of official operations on retail trading seemed more testable than the hypotheses concerning other indicators. Moreover, the allegations that official purchases

led private buyers to withdraw from the market and private sellers to dump securities on the market would represent serious departures from an ideal market performance.

Only advance refundings and rights exchanges were covered in this study, because the pattern of trading was different during cash financings. In other words, in cash offerings no trading in new issues could take place until the books closed, whereas in rights financings the heaviest trading occurred before the books closed. Cash financings were not analyzed separately because the samples would have been too small. (See footnote 1, p. 44.) Even in the samples on rights financings, the results would have been more conclusive if there had been a greater number of days with large official transactions.

Both a long definition and a short definition of financing periods were used in this section. Under the long definition (also the one used in the previous section) the financing period extended from the day after the announcement through the payment day when the issues in the given maturity class included new issues. If the issues included only rights, the financing period ended the day the books closed. Under the short definition, the financing period extended from the day after the announcement through the day the books closed, regardless of whether the issues involved in the financing were rights or new issues.

This section first provides background information on the size and frequency of sales of coupon securities to official accounts and the average volume of retail trading. Then the hypotheses to be tested are reviewed; and finally the results of the simple and multiple correlations are presented and interpreted.

1. Dealer Sales of Coupon Issues to Official Accounts

Table V classifies all days during Treasury rights financings according to the size of the dealers' sales to official accounts on that day. During long rights financings, dealers made sales of securities maturing after 10 years to official accounts (the System and Treasury together) on 32 days out of 92. On about half of these days, however, sales did not exceed $5 million. In short financings dealers made sales of long-term Governments on 14 days, and on 11 of these days such sales exceeded $10 million. Almost all sales of long-term Governments were to Treasury accounts: the System bought on only 4 days in long financings and did not buy at all in short financings.

In the intermediate-term maturity class, $>5 \leq 10$ years, sales to official accounts were made on 60 days in long financings and 29 days in short financings. These sales exceeded $5 million on 33 days in long financings and 15 days in short financings. In short financings all such sales were to Treasury accounts, but in long financings relatively large sales were made to System accounts almost as often as to Treasury accounts.

Sales of short securities ($>1 \leq 5$) to official accounts were made on 53 days in long financings but only on 16 days in short financings. In long financings, such sales exceeded $5 million on 32 days, but in short financings sales of this size occurred on only 6 days.

The table indicates the tentative nature of conclusions based on the following analysis. Although the total number of days in each sample seems adequate, the number of days on which there were large sales to official accounts was not as large as would be desired. The number of such days was particularly small for securities maturing in $>1 \leq 5$ years in short financings. Sales to the System and Treasury accounts were not

Table V

Days During Treasury Financings,* Classified According to the Size of Sales to Official Accounts

Maturity class	Total days	Sales to Official Accounts (in millions of dollars)						
		0	>0≤5	>5≤10	>10≤20	>20≤40	>40≤60	>60
		(number of days)						
Long Financing Periods								
All Accounts								
>1 ≤5	166	113	21	6	10	8	5	3
>5 ≤10	158	98	27	8	16	8	1	0
>10	92	60	17	3	3	3	3	3
SOMA								
>1 ≤5	166	141	4	2	7	5	4	3
>5 ≤10	158	142	2	5	5	4	0	0
>10	92	88	3	1	0	0	0	0
Treasury								
>1 ≤5	166	138	17	4	3	3	1	0
>5 ≤10	158	107	30	7	10	3	1	0
>10	92	64	14	2	3	3	3	3
Short Financing Periods								
All Accounts								
>1 ≤5	78	62	10	0	4	1	1	0
>5 ≤10	67	38	14	5	6	3	1	0
>10	39	25	3	0	2	3	3	3

* Includes rights exchanges and advance refundings from March 1961 through July 1964.

considered separately in the following analysis, because this would have further reduced the number of days with large official transactions.[1]

2. Relative Magnitudes of Sales to Official Accounts and Retail Trading

Table VI provides some indication of the magnitude of dealer transactions with retail customers compared to dealer sales to official accounts during rights financings from March 1961 through July 1964. Dealer sales to retail customers of bonds maturing after 10 years averaged $28 million a day during long financing periods while retail purchases were $15 million. The actual daily highs, of course, were much larger, $108 million for sales and $81 million for purchases. In the 5-10 year maturity range retail sales averaged $57 million and purchases averaged $38 million, with daily peaks of $196 million and $145 million, respectively. Trading in 1-5 year issues was still heavier, with both retail sales and purchases averaging slightly over $90 million a day in long financings and with the record highs in such periods reaching $334 million and $445 million, respectively. Daily average retail sales and purchases were, of course, much larger in all maturity classes in the short financing periods, although the actual daily highs were unchanged.

Average dealer sales to official accounts were not large during long financing periods, equaling $6 million for securities maturing after 10 years, $4 million for securities maturing in 5-10 years, and $6 million for 1-5 year issues. Even in short financing periods, average daily sales to official accounts were moderate. These averages, however, were pulled down by the many days on which there were no sales to official accounts (see Table V). On certain days such sales were substantial.

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[1] This problem was even greater in the case of cash financings. There were 43 days that fell in cash financings for $>1 \leq 5$ year issues from March 1961-June 1963, and sales to official accounts were made on 15 days. In the 5-10 year class, there were 4 such days out of 42; in the over-10 year class, only 2 out of 14.

Table VI

Daily Average, High and Low Levels of Dealer Trading with Retail Customers and Dealer Sales to Official Accounts During Treasury Rights Financings*

(In millions of dollars)

Daily Trading	Securities Maturing in >1 ≤5 yrs.	>5 ≤10 yrs.	>10 yrs.
I. Long Financing Period (From Day After Announcement Through Payment Date)			
Average			
Dealer Sales to Official Accounts	5.9	4.0	6.0
Dealer Sales to Retail Customers	92.0	57.0	27.5
Dealer Purchases from Retail Customers	91.2	38.3	15.4
High			
Dealer Sales to Official Accounts	95.6	40.2	75.0
Dealer Sales to Retail Customers	334.4	196.1	108.1
Dealer Purchases from Retail Customers	445.3	145.4	81.4
Low			
Dealer Sales to Official Accounts	0.0	0.0	0.0
Dealer Sales to Retail Customers	19.7	5.4	2.4
Dealer Purchases from Retail Customers	14.3	3.7	1.6
II. Short Financing Period (From Day After Announcement Through Day Books Closed)			
Average			
Dealer Sales to Official Accounts	2.1	4.5	12.5
Dealer Sales to Retail Customers	119.4	79.5	45.4
Dealer Purchases from Retail Customers	124.2	49.3	23.0
High			
Dealer Sales to Official Accounts	58.0	40.2	75.0
Dealer Sales to Retail Customers	334.4	196.1	108.1
Dealer Purchases from Retail Customers	445.3	145.4	81.4
Low			
Dealer Sales to Official Accounts	0.0	0.0	0.0
Dealer Sales to Retail Customers	35.3	5.6	11.6
Dealer Purchases from Retail Customers	32.1	4.5	1.6

* Includes advance refundings and rights exchanges for March 1961 through July 1964.

For example, the record high in long financings was $75 million for securities maturing after 10 years, $40 million for 5-10 year issues and $96 million for 1-5 year securities.

As Table VI makes clear, average dealer sales to official accounts and the highest dealer sales to official accounts were much larger relative to retail sales and purchases in the longest maturity class than in the other two classes. For example, average sales to official accounts of securities maturing after 10 years were 22 per cent of average daily sales to retail customers and 39 per cent of retail purchases in long financings. In the 5-10 year maturity class sales to official accounts represented only 7 per cent of retail sales and 11 per cent of retail purchases, while in the 1-5 year class sales to official accounts averaged just over 6 per cent of both retail sales and retail purchases. Results for short financings were similar. The relative frequency of heavy sales to official accounts was also much greater for longer-term securities, as Table I showed. These comparisons raise the possibility that an impact of official transactions in trading would be more likely to be found in the longest maturity class.

3. Hypotheses

As was discussed earlier, the major hypotheses about the impact of sales of coupon issues to official accounts on retail trading were derived from the dealers' criticisms. According to these criticisms, dealer sales to retail customers were lower than otherwise when official accounts were buying because price levels were artificially high. At such times, dealer purchases from retail customers were higher than otherwise, particularly if prices were expected to fall in the future, since purchases by official accounts offered investors a chance to sell at relatively high prices.

The dealers, however, did not apply their criticisms specifically to sales to official accounts during Treasury financings, and it seems probable that the impact of official purchases on retail sales may have been different at such times. Purchases by official accounts during financings probably made the Treasury's offerings look more attractive and thus may have led to larger dealer sales to retail customers. The potential market at such times probably consisted of a larger number of less sophisticated investors who would not be aware of official purchases and would be favorably impressed by strong prices. Even if investors were aware of official buying, they might be encouraged to buy themselves by the thought that the Treasury was going to keep prices from falling.

It may also be argued that the causal mechanism underlying any relationships between retail trading and official operations ran from retail trading to official operations as well as from official operations to retail trading. In this case, there should have been negative correlation between retail sales and sales to official accounts and a positive correlation between retail purchases and sales to official accounts. In other words, official accounts bought when the dealers' purchases from retail customers were high or sales to retail customers were low, because at such times securities were available. An even more important reason for such relationships during financings was that high retail purchases or low retail sales may have led to price weakness which the Treasury especially wanted to avoid at such times.

Thus, the hypotheses to be tested were as follows:

(1) Daily retail purchases during Treasury financings were higher when official accounts were buying, because retail customers took advantage of these opportunities to sell securities at relatively attractive

prices and/or because official accounts were buying securities purchased by the dealers from retail customers in order to maintain a favorable atmosphere for the financing.

(2) Daily retail sales were lower when official accounts were buying, because retail customers were discouraged from buying by artificially high prices or because official accounts were buying securities which dealers could not sell in order to maintain a favorable atmosphere.

(3) Daily retail sales were higher when official accounts were buying because retail customers were encouraged to purchase securities by the strong price performance and the implied attractiveness of the financing.

These hypotheses were tested by simple correlations and multiple regressions. In both cases three variables were included as measures of official transactions. They were dealer sales to official accounts of securities in the given maturity class on the current day (DS^O_t), dealer sales to official accounts on the previous day (DS^O_{t-1}), and the cumulative volume of dealer sales to official accounts from the first day during the financing to the current day (ΣDS^O_t). The latter two variables were included on the possibility that the influence of official accounts was felt with a lag. In addition, if the lagged variables prove to be significant, it suggests that the line of causation ran from sales to official accounts to retail trading rather than in the other direction, since official transactions cannot be influenced by retail trading on days in the future.

4. Simple Correlation

Table VII shows the simple correlation coefficients between retail trading and dealer sales to official accounts. For securities

Table VII

Simple Correlation Coefficients between Retail Trading and Official Purchases of Coupon Issues During Treasury Rights Financings

(March 1961-July 1964)

Retail Trading on Current Day	Dealer Sales to Official Accounts: Current day	Previous day	Cumulated for financing to date
I. Long Financing Period			
Dealer Purchases from Retail Customers of Securities Maturing in			
$>1 \leq 5$ years	- .041	- .086	- .183*
$>5 \leq 10$ years	.121	.018	- .027
>10 years	.470**	.324**	.192
Dealer Sales to Retail Customers of Securities Maturing in			
$>1 \leq 5$ years	- .049	- .025	- .145
$>5 \leq 10$ years	.199*	.080	- .020
>10 years	.336**	.296**	.064
II. Short Financing Period			
Dealer Purchases from Retail Customers of Securities Maturing in			
$>1 \leq 5$ years	.018	.024	.026
$>5 \leq 10$ years	.324**	.256*	.287*
>10 years	.403*	.364*	.466**
Dealer Sales to Retail Customers of Securities Maturing in			
$>1 \leq 5$ years	.091	.178	.183
$>5 \leq 10$ years	.335**	.245*	.370**
>10 years	.168	.282	.310

* Significant at 5 per cent level.
** Significant at 1 per cent level.

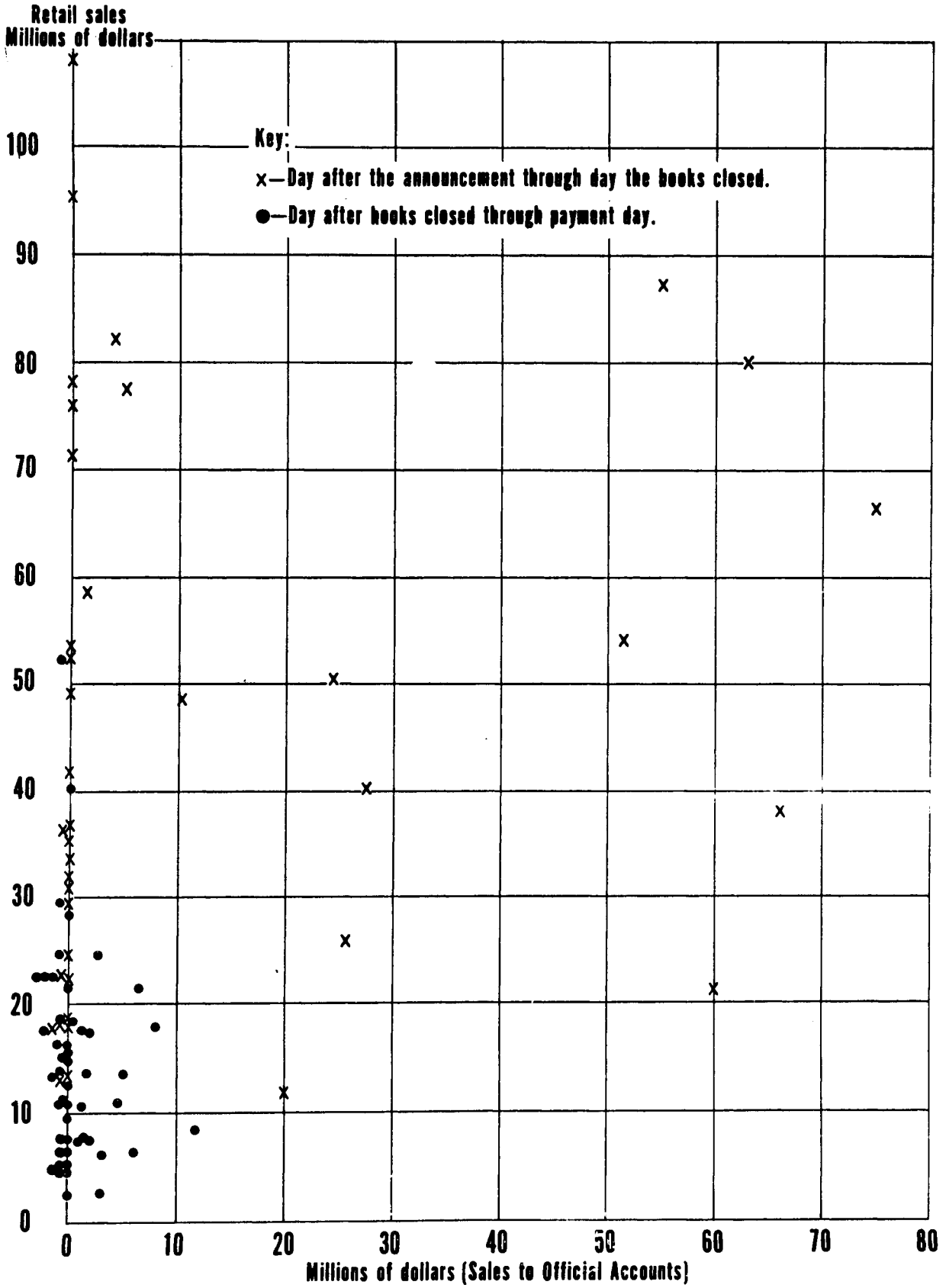
maturing after 10 years there was significant positive correlation between dealer sales to official accounts on the current day and dealer purchases from retail customers in both long and short financing periods. In long financing periods there was also significant positive correlation in this maturity class between sales to official accounts and sales to retail customers.

These relationships are illustrated in Charts I and II. Chart I is a scatter diagram relating daily retail sales to daily sales to official accounts of securities maturing after 10 years. Plottings for the day after the announcement day through the day the books closed are stars; plottings for days after the books closed through the payment day are dots. Chart II is a scatter diagram relating daily retail purchases to daily sales to official accounts. When all the plottings are considered (i.e., in long financings) there seems to have been some tendency for both retail sales and retail purchases to be higher on days when official accounts were large buyers. The simple correlation coefficients of .336 between retail sales and official sales and of .470 between retail purchases and official sales for long financings confirmed this impression. When only the stars (short financings) were studied, however, this relationship vanished in the case of retail sales.

In contrast to longer term securities, the positive correlation between official purchases of 5-10 year securities on the current day and retail trading was more consistent in short financings. In the latter financings both retail purchases and retail sales showed significant positive correlation with sales to official accounts on the current day. In long financings positive correlation showed up only with retail sales.

Chart I

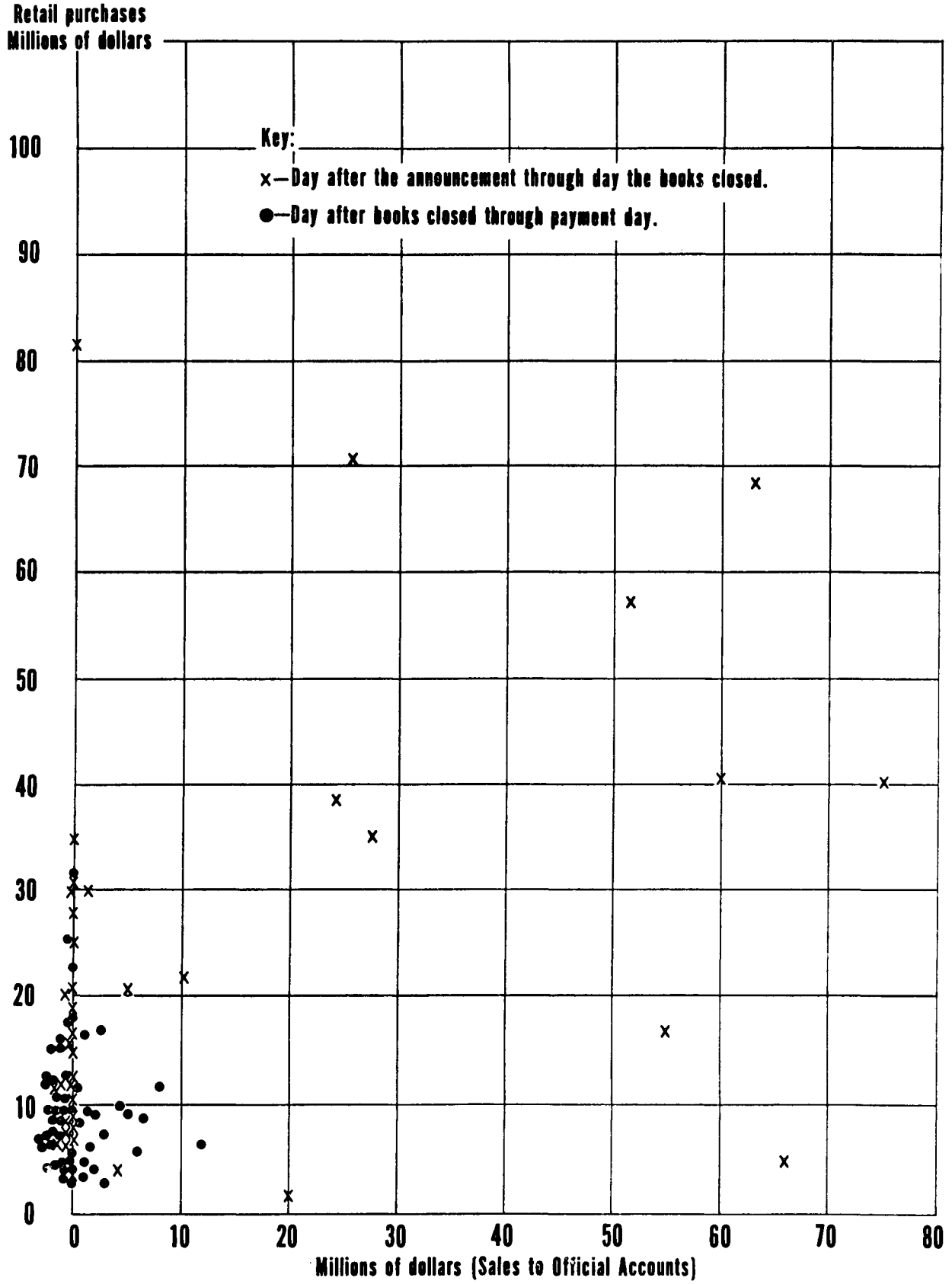
SCATTER DIAGRAM, RETAIL SALES AND SALES TO OFFICIAL ACCOUNTS OF GOVERNMENT SECURITIES MATURING AFTER TEN YEARS DURING FINANCINGS



Note: Based on daily data for Treasury rights financings from March 1961-July 1964.
Some zero values of retail sales were plotted to the left of the zero line because of lack of space.

Chart II

SCATTER DIAGRAM, RETAIL PURCHASES AND SALES TO OFFICIAL ACCOUNTS OF GOVERNMENT SECURITIES MATURING AFTER TEN YEARS DURING FINANCINGS



Note: Based on daily data for Treasury rights financings from March 1961-July 1964.
Some zero values of retail purchases were plotted to the left of the zero line because of lack of space.

In most cases in the 5-10 year and over-10 year maturity classes where sales to official accounts on the current day were positively correlated with retail trading, sales to official accounts on the following day were also positively correlated with retail trading. In short financings positive correlation also showed up between cumulated sales to official accounts and retail trading. In fact, the correlation coefficient for cumulated sales to official accounts was usually the highest of the three for each maturity class.

Table VII also indicates that there was no significant correlation between sales to official accounts on the current or previous day and retail trading in 1-5 year securities. It is possible, however, that some relationship was obscured by large variations in trading caused by technical factors, such as the size of issues in the financing or whether the books were open. On the other hand, the simple correlations indicated in Table VII for longer securities may really have reflected these technical factors. In order to hold such technical factors constant, multiple regressions were calculated.

5. Multiple Regressions

a. Variables Included. The dependent variables in the multiple regressions were dealer sales to retail customers of securities maturing in over one through five years, over five through ten years, and over ten years. Dealer purchases from retail customers of securities in the same three maturity classes were also used as dependent variables.

When the financing period was defined as lasting through the payment date, nine independent variables were included to take account of certain technical differences among days within financings and between financings.

For example, trading during rights financings was usually higher when the books were open. Therefore, one variable (A) was a dummy variable equal to +1 on the days the books were open and zero otherwise. Alternatively, another dummy variable (B), which equaled +1 from the day after the announcement day through the day the books closed and zero otherwise, was included. A second technical consideration which might have influenced the volume of trading is whether the financing was an advance refunding or a rights exchange, so variable C was equal to +1 in advance refundings and zero otherwise. Another set of variables took account of the size and type of issues in the given maturity class that were involved in the financings. Thus, variable D measured the size of rights in the maturity class held by the public and was the same for each day during the financings; and variable E equaled the size of the allotments to the public of new issues in the maturity class and was also the same value throughout each financing. Variable F was +1 on the payment date, and variable G was +1 on the day before the payment date, on the assumption that dealer sales and purchases might have been higher on these days as customers prepared to make payment. Variable H was zero from the announcement day through the day the books closed and thereafter increased by one on each day, reflecting a tendency for trading to fall gradually to normal levels after the books close. Variable I was constant throughout each financing and equaled the number of days from the day after the announcement day through the day the books closed, since daily trading might have been lower if investors had a longer time to act before the books closed.

When regressions were calculated for the short financing period (i.e., from the day after the announcement date through the day the books closed) five of the above independent structural variables were included, namely A, C, D, E, and I.

The independent variables included in these regressions were not necessarily the only determinants of the daily volume of retail trading. For example, the expectational element was omitted, except to the extent that it was reflected in the size of public allotments of the new issues. Dealers' positions and price behavior were also not considered, although they probably had an influence on trading.

b. Results for Long Financing Periods. When technical factors, as well as sales to official accounts were taken into account, a "significant" positive relationship showed up between some measure of sales to official accounts and retail sales and between sales to official accounts and retail purchases in both the 5-10 year and over-10 year maturity classes during rights financings. There was still no significant relationship, however, between official purchases and retail trading in the 1-5 year maturities. Table VIII shows the net regression coefficient and the corresponding values of Student's t for each of the independent variables for the long financing periods.

In the regression explaining dealer purchases from retail customers of securities maturing in more than 10 years, dealer sales to official accounts on the current day (DS^{O}_{t}) was the significant measure of official activity. An increase in dealer sales to official accounts of $1 million of bonds maturing after 10 years was associated with an increase of $211 thousand in dealer purchases from retail customers, when the other variables were held constant. This independent variable was the first one added to the equation[1] and by itself explained 21 per cent of the variation in retail purchases. The other measures of activity by official accounts

[1] In the program used, the variable reducing variance the most was added to the equation first.

Table VIII

Results of Multiple Regressions for Long Financing Periods

Independent variables	Dependent Variables: Dealer Purchases from Retail Customers of Securities Maturing in > 1 ≤ 5 yrs. b	t	> 5 ≤ 10 yrs. b	t	> 10 yrs. b	t	Dealer Sales to Retail Customers of Securities Maturing in > 1 ≤ 5 yrs. b	t	> 5 ≤ 10 yrs. b	t	> 10 yrs. b	t
DS^o_t	.172	.583	.112	.446	.211*	2.072	- .078	.293	.395	1.112	.034	.261
DS^o_{t-1}	.015	.046	- .268	1.004	.071	.703	.241	.826	- .228	.604	.271*	2.119
ΣDS^o_t	.024	.261	.188*	2.347	.032	1.343	- .068	.815	.352*	3.103	- .003	.092
A	14.620	1.281	.605	.098	4.544	.975	26.839*	2.606	- 1.864	.214	- 8.021	1.353
B	38.168*	2.536	20.002*	2.737	7.112	1.340	46.189*	3.400	46.941*	4.545	32.969*	4.885
C	-10.743	.708	-12.666*	2.613	15.452	1.636	- .525	.038	-20.825*	3.039	61.567*	5.126
D	.005*	4.036	- .001	.739	.000	.125	.001	1.074	- .008*	2.767	- .005*	3.937
E	.010*	3.088	.002*	2.014	- .004	1.544	.013*	4.558	.007*	4.487	- .009*	3.156
F	22.088	1.246	- 8.912	1.043	3.501	.609	7.955	.497	-12.881	1.066	8.658	1.184
G	31.025	1.850	- 5.644	.709	1.184	.217	20.306	1.342	- 2.928	.260	4.233	.611
H	- 3.645	1.494	- .301	.247	- .588	.828	- .848	.385	- .469	.273	- 1.243	1.375
I	.736	.111	4.655*	1.979	- 3.132	1.195	- 6.980	1.171	6.812*	2.049	-15.210*	4.562
R^2 adj. for DOF	.382		.197		.325		.402		.436		.571	
DOF	153		145		79		153		145		79	

Note: All dollar variables were measured in millions of dollars.

* Significantly different from zero at 5 per cent level.

were not significant, in part because of multicollinearity with sales to official accounts on the current day. Dealer sales to retail customers of securities maturing after 10 years were significantly related to dealer sales to official accounts on the previous day. A rise of $1 million in sales to official accounts on the previous day was accompanied by a rise of $271 thousand in retail sales on the current day.

In the 5-10 year maturity category, the measure of official activity which was significantly related to retail sales and purchases was the volume of sales to official accounts cumulated from the beginning of the financing through the given day. Holding the other variables constant, dealer sales to retail customers were $352 thousand higher for every $1 million increase in sales to official accounts, while dealer purchases from retail customers were $188 thousand higher. As is clear from comparing simple correlation coefficients in Table VII with Table VIII, this positive relationship between ΣDS^{O} and retail trading depends on taking account of technical factors, particularly the fact that average trading at the beginning of the financing period is much higher than at the end, which in itself would lead to a negative relationship between cumulated sales to official accounts and retail sales or purchases. When this was allowed for (through variable B), dealer sales and purchases with retail customers rose as the cumulated volume of official purchases increased.

These results are consistent with the hypothesis that retail purchases were higher when official accounts were buying. Moreover, the fact that retail purchases were positively correlated with the cumulated values of sales to official accounts, as well as with the current day's sales, suggests that large sales to official accounts caused the high level of retail purchases. The results are also consistent with the hypothesis

that retail sales were higher when sales to official accounts were high because investors were favorably impressed by price performance. They are not consistent with the hypothesis suggesting negative correlation between retail sales and sales to official accounts.

Although this study was mainly concerned with the relationship between official transactions and retail trading, a few comments on the relationships between the technical variables and retail trading follow. Variable B, a dummy variable which was +1 for days from the day after the announcement day through the day the books closed was positively related to retail purchases and retail sales at the 5 per cent significance level in five out of the six regressions. Such a relationship is evident just from inspection of the daily figures, since trading was generally higher before the books closed than afterwards.

The signs of other technical variables that were significant differed among maturity classes. Of particular interest, the coefficient for C, the dummy variable that was +1 in advance refundings and zero in rights exchanges, was negative for the 5-10 year maturity range. In other words, daily retail sales of securities maturing in 5-10 years were $21 million lower in advance refundings than in rights exchanges, and daily retail purchases were $13 million lower, when other variables (in particular the size of the new issues in the maturity class) were held constant. In this maturity range, the size of the new issues alloted to the public were positively correlated with retail trading. This result suggests that advance refundings led to less, rather than more, daily activity in the retail market in 5-10 year securities than when an equivalent amount of new securities was sold through an exchange offering.[1]

[1] In contrast, the coefficient for C, the advance refunding dummy, was positive in the case of retail sales of securities maturing after 10 years, but there was only one of the financings in this maturity class which was an exchange in the sample so that this result is not very convincing.

Possibly this reflected the fact that there was usually also a longer new issue in which to trade in advance refundings but in exchanges the 5-10 year issue was the longest option.

In the regression for securities maturing after 10 years, the negative coefficient for E, which measures the size of the new issues sold to the public, was unexpected. Possibly it can be explained by the fact that the smaller public allotments of new long-term bonds occurred in those advance refundings and exchanges where the rights were very short-term. Presumably these holders of rights sold them in the secondary market, and the dealers then sold new issues to other investors, thus leading to greater activity in the secondary market when public allotment of new issues were small.

c. Results for Short Financing Periods. Table IX shows the regression coefficients and the associated values of Student's t for those variables that were significant at the 5 per cent level in the multiple regressions for the short financing periods. Although the other variables mentioned on page 52 were tried in the regressions, the results in the table are for equations including only the variables listed in each column. This procedure was adopted because of the small size of the samples and because adding other variables frequently resulted in insignificant regression coefficients for all variables.

In the short financing period, retail sales of securities maturing in 5-10 years and after 10 years were positively related to the cumulated volume of sales to official accounts at the accepted significance level. Retail sales in the 1-5 year and over-10 year maturity classes, however, were also negatively related to the volume of sales to official accounts on the current day, when the seven other independent variables were taken into consideration.

Table IX

Results of Multiple Regressions for Short Financing Periods

Independent variables	Dependent Variables: Dealer Purchases from Retail Customers of Securities Maturing in						Dealer Sales to Retail Customers of Securities Maturing in					
	$>1 \leq 5$ yrs.		$>5 \leq 10$ yrs.		>10 yrs.		$>1 \leq 5$ yrs.		$>5 \leq 10$ yrs.		>10 yrs.	
	b	t	b	t	b	t	b	t	b	t	b	t
DS^o_t			1.030*	2.759			- 4.842*	2.072			- .717*	2.702
DS^o_{t-1}							- 2.548	1.161			- .309	1.129
$\sum DS^o_t$					.169*	3.587	2.239	1.617	1.066*	4.173	.463*	3.136
A							22.545	1.823			- 9.351	1.291
C							53.385*	2.086	-24.731*	2.238	111.750*	5.302
D	.007*	5.377			.003*	2.215	.001	.397			- .011*	4.607
E	.017*	3.895					.019*	4.390	.014*	6.177	- .018*	3.222
I							-13.409	1.681			-31.407*	5.131
R^2 adj. for DOF	.259		.091		.273		.364		.437		.468	
DOF	75		65		36		69		63		30	

Note: All dollar variables were measured in millions of dollars.

* Significantly different from zero at 5 per cent level.

Retail purchases of securities maturing after 10 years were positively correlated with the cumulated volume of sales to official accounts, while retail purchases in the 5-10 year class were positively correlated with the current day's sales to official accounts. No significant correlation between sales to official accounts and retail purchases existed in the 1-5 year maturity class.

The relationships (or lack of relationship) between retail sales of 1-5 year securities (or retail purchases) and sales to official accounts are questionable and should not be accepted without further confirmation, because there were only 6 days out of 78 when sales to official accounts exceeded $10 million. Even in the other maturity classes it would have been desirable to have more days with sizable sales to official accounts. In the 5-10 year maturity class there were 10 days out of 67 when sales to official accounts were greater than $10 million, and in the over-10 year class there were 11 such days out of 39. (See Table V.)

It should also be pointed out that the variables included in these regressions did not explain much of the variation in trading either in short financing periods or long financing periods. For example, only 57 per cent and 47 per cent of the variation in daily retail sales of securities maturing after 10 years in long financings and short financings, respectively, was explained. In all other cases the explained variance was lower.

Chart III illustrates this point by plotting the actual level of daily retail sales of securities maturing after 10 years against the level calculated by the regression equation for short financing periods. If there were no sales to official accounts during a financing, the calculated level of retail sales would drop when the books opened and be constant thereafter, as in the September 1961 and July 1964 advance refundings.

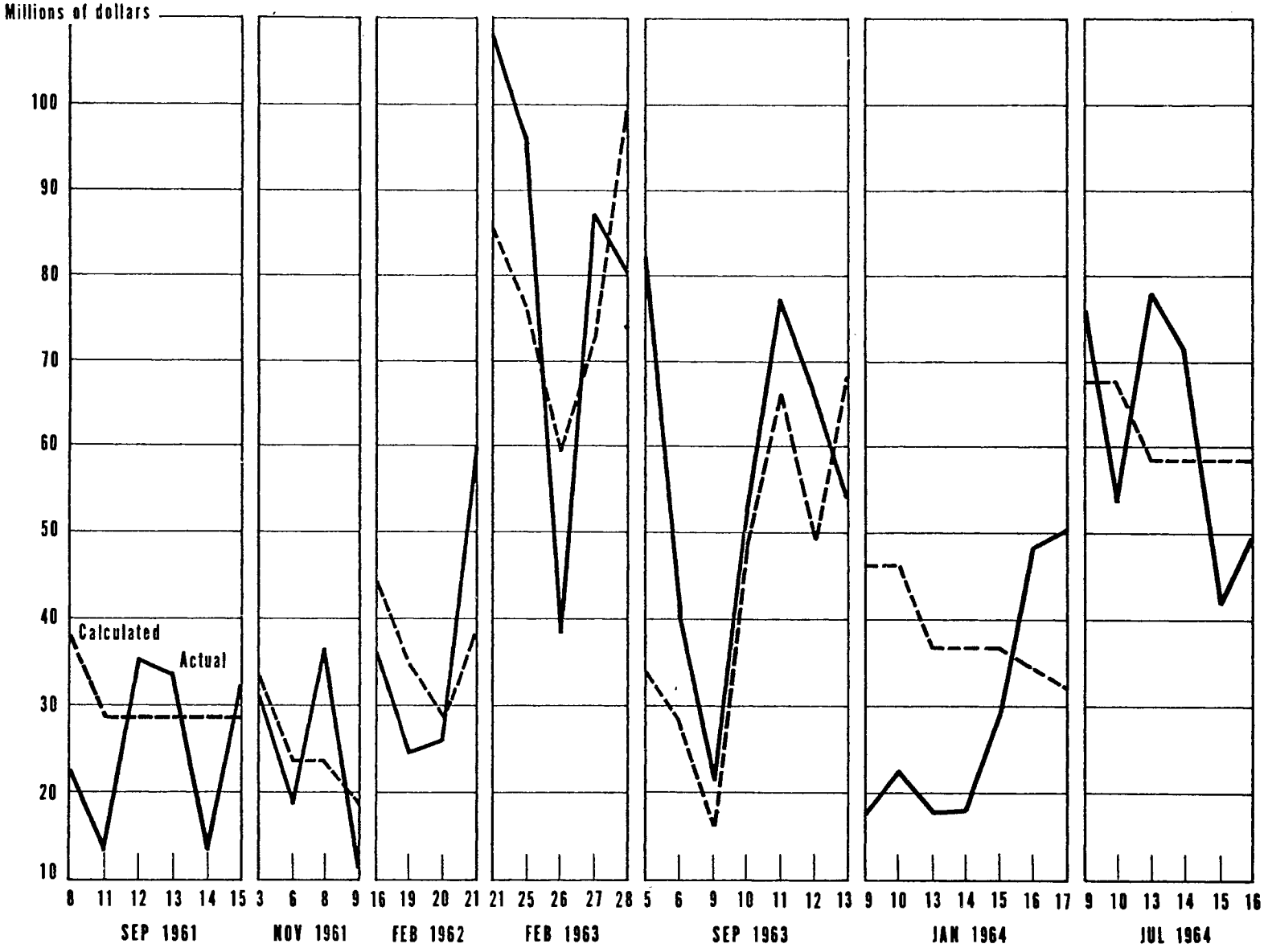
Any other day-to-day movement in the calculated level of retail sales during a given financing was a result of sales to official accounts. The average level of calculated retail sales during any financing (which depended largely on the size of public allotments of new issues and the advance refunding dummy) was generally close to the actual. In addition, the actual day-to-day variation in retail sales was similar to the variation in calculated retail sales in some of the financings--see, for example, the financings in February 1962, February 1963 and September 1963. Of course, there was also considerable day-to-day movement in retail sales during financings that was not explained.

6. Conclusions

(1) The results of the multiple regressions for 5-10 year and over-10 year Government securities were consistent with the hypothesis that the dealers' daily purchases from retail customers during Treasury financings were larger than otherwise when official accounts were buying such issues. Both the current day's sales to official accounts and the cumulated volume of sales to official accounts for the financing to date were positively related to retail purchases, although because of multicollinearity only one of these variables was significant in any multiple regression. This correlation may be explained both by the behavior of customers and by the behavior of official accounts: customers took advantage of the opportunity to sell at artificially high prices created by official operations, and official accounts bought because the dealers had taken on a large volume of securities from retail customers which would depress the market if not purchased. The fact that the positive correlation was between retail purchases and both the current day's sales to official accounts and the cumulated volume of sales to official accounts

Chart III

ACTUAL AND CALCULATED RETAIL SALES OF GOVERNMENT SECURITIES MATURING AFTER 10 YEARS DURING SHORT FINANCING PERIODS



suggests that the former interpretation may have been the dominant one, since retail activity on the current day could not have affected sales to official accounts on earlier days in any financing. (Obviously the cumulated volume of sales to official accounts is heavily weighted by sales on earlier days.)

(2) In contrast, there was no significant correlation between retail purchases of 1-5 year Governments and dealer sales to official accounts. Perhaps this reflected the relatively low level of sales to official accounts of 1-5 year securities.

(3) Daily sales to retail customers of Governments maturing in 5-10 years were positively related to the cumulated (for the financing to date) volume of sales to official accounts in both long and short financing periods, when certain other variables were held constant.

(4) The dealers' daily sales to retail customers of Governments maturing after 10 years were positively related to sales to official accounts on the previous day in long financing periods and to the cumulated volume (for the financing to date) of sales to official accounts in short financing periods, when other variables were held constant. In short financing periods retail sales were also negatively related to the current day's sales to official accounts, again holding constant the other independent variables. The positive correlation of retail sales of long bonds with the cumulated volume of sales to official accounts during short financing periods suggests that official buying did stimulate greater retail sales probably by maintaining a favorable atmosphere and by preventing or reducing price declines while the books were open. In view of this positive correlation between retail sales and cumulated sales to official accounts, the negative correlation between retail sales and the

current day's sales to official accounts should probably be interpreted as an indication that official accounts bought when retail sales were low in order to prevent an unfavorable atmosphere from developing rather than as an indication that sales to official accounts discouraged sales to retail customers.

(5) Retail sales of Governments maturing in 1-5 years were also negatively correlated with the current day's sales to official accounts, when other variables were held constant. These results were somewhat dubious, however, because of the small number of days when official accounts were buying.

While these statistical results did suggest that official purchases of coupon securities (particularly longer-term securities) had an influence on retail trading, a number of precautionary comments are in order. First, although according to the t test, the regression coefficients discussed above were significantly different from zero at the 5 per cent level, the t values were not especially high. Second, official sales accounted for only a small part of the variation in retail trading. Third, more financings, particularly financing with heavy official operations, would be desirable in order to test the relationships further.

Appendix, Table I

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Retail Purchases of Securities Maturing in 1-5 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Retail Purchases (in millions of dollars) ≤50.0	>50.0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	134	108	242	
Per cent	55.4	44.6	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	99	80	179	
>0 Numbers	35	28	63	
0 Actual	100	79	179	
>0 Numbers	34	29	63	
≤20 Theoretical	117	95	212	
>20 Numbers	17	13	30	
≤20 Actual	120	92	212	
>20 Numbers	14	16	30	
Days When Sales to SOMA Were				
0 Theoretical	115	92	207	
>0 Numbers	19	16	35	
0 Actual	121	86	207	4.0745
>0 Numbers	13	22	35	
≤20 Theoretical	121	97	218	
>20 Numbers	13	11	24	
≤20 Actual	126	92	218	
>20 Numbers	8	16	24	
Days When Sales to Treasury Were				
0 Theoretical	117	95	212	
>0 Numbers	17	13	30	
0 Actual	113	99	212	
>0 Numbers	21	9	30	

Note: Treasury ≤20, >20 not calculated because of insufficient frequencies of >20.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table II

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Retail Purchases of Securities Maturing in 5-10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Retail Purchases (in millions of dollars) 0-30.0	>30.0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	141	124	265	
Per cent	53.2	46.8	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	103	91	194	
>0 Numbers	38	33	71	
				8.5241
0 Actual	114	80	194	
>0 Numbers	27	44	71	
≤10 Theoretical	118	104	222	
>10 Numbers	23	20	43	
				17.4326
≤10 Actual	131	91	222	
>10 Numbers	10	33	43	
Days When Sales to SOMA Were				
0 Theoretical	122	107	229	
>0 Numbers	19	17	36	
				11.6421
0 Actual	132	97	229	
>0 Numbers	9	27	36	
≤10 Theoretical	126	110	236	
>10 Numbers	15	14	29	
				13.9999
≤10 Actual	136	100	236	
>10 Numbers	5	24	29	
Days When Sales to Treasury Were				
0 Theoretical	118	104	222	
>0 Numbers	23	20	43	
0 Actual	121	101	222	
>0 Numbers	20	23	43	

Note: Treasury ≤10, >10 not calculated because of insufficient frequencies of >10.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table III

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Retail Purchases of Securities Maturing After 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Retail Purchases (in millions of dollars) ≤10	>10	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	217	94	311	
Per cent	69.8	30.2	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	154	66	220	
>0 Numbers	63	28	91	
≤0 Actual	155	65	220	
>0 Numbers	62	29	91	
≤5 Theoretical	194	84	278	
>5 Numbers	23	10	33	
				4.8562
≤5 Actual	200	78	278	
>5 Numbers	17	16	33	
Days When Sales to SOMA Were				
0 Theoretical	201	87	288	
>0 Numbers	16	7	23	
≤0 Actual	198	90	288	
>0 Numbers	19	4	23	
Days When Sales to Treasury Were				
≤0 Theoretical	163	71	234	
>0 Numbers	54	23	77	
≤0 Actual	168	66	234	
>0 Numbers	49	28	77	
≤5 Theoretical	197	85	282	
>5 Numbers	20	9	29	
				5.3831
≤5 Actual	203	79	282	
>5 Numbers	14	15	29	

Note: SOMA ≤5, >5 not calculated because of insufficient frequencies for >5.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table IV

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Gross Long Positions for Securities Maturing in 1-5 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Long Position (in millions of dollars) ≦0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	137	105	242	
Per cent	56.6	43.4	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	101	78	179	
>0 Numbers	36	27	63	
				11.5766
0 Actual	89	90	179	
>0 Numbers	48	15	63	
≦20 Theoretical	120	92	212	
>20 Numbers	17	13	30	
				17.0833
≦20 Actual	109	103	212	
>20 Numbers	28	2	30	
Days When Sales to SOMA Were				
0 Theoretical	117	90	207	
>0 Numbers	20	15	35	
				15.0298
0 Actual	106	101	207	
>0 Numbers	31	4	35	
≦20 Theoretical	123	95	218	
>20 Numbers	14	10	24	
				10.6923
≦20 Actual	115	103	218	
>20 Numbers	22	2	24	
Days When Sales to Treasury Were				
0 Theoretical	120	92	212	
>0 Numbers	17	13	30	
0 Actual	118	94	212	
>0 Numbers	19	11	30	

Note: Treasury ≦20, >20 not calculated because of insufficient frequencies of >20.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table V

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Net Position for Securities Maturing in 1-5 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Net Position (in millions of dollars) ≦0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	137	105	242	
Per cent	56.6	43.4	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	101	78	179	
>0 Numbers	36	27	63	
				11.5766
0 Actual	89	90	179	
>0 Numbers	48	15	63	
≦20 Theoretical	120	92	212	
>20 Numbers	17	13	30	
				17.0833
≦20 Actual	109	103	212	
>20 Numbers	28	2	30	
Days When Sales to SOMA Were				
0 Theoretical	117	90	207	
>0 Numbers	20	15	35	
				15.0298
0 Actual	106	101	207	
>0 Numbers	31	4	35	
≦20 Theoretical	123	95	218	
>20 Numbers	14	10	24	
				10.6923
≦20 Actual	115	103	218	
>20 Numbers	22	2	24	
Days When Sales to Treasury Were				
0 Theoretical	120	92	212	
>0 Numbers	17	13	30	
0 Actual	118	94	212	
>0 Numbers	19	11	30	

Note: Treasury ≦20, >20 not calculated because of insufficient frequencies of >20.

*If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table VI

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Gross Long Position for Securities Maturing in 5 - 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Long Position (in millions of dollars) ≤0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	177	88	265	
Per cent	66.8	33.2	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	130	64	194	
>0 Numbers	47	24	71	
0 Actual	123	71	194	
>0 Numbers	54	17	71	
<10 Theoretical	148	74	222	
>10 Numbers	29	14	43	
<10 Actual	142	80	222	
>10 Numbers	35	8	43	
Days When Sales to SOMA Were				
0 Theoretical	153	76	229	
>0 Numbers	24	12	36	4.3769
0 Actual	147	82	229	
>0 Numbers	30	6	36	
≤10 Theoretical	158	78	236	
>10 Numbers	19	10	29	5.1964
≤10 Actual	152	84	236	
>10 Numbers	25	4	29	
Days When Sales to Treasury Were				
0 Theoretical	148	74	222	
>0 Numbers	29	14	43	
0 Actual	147	75	222	
>0 Numbers	30	13	43	

Note: Treasury ≤10, >10 not calculated because of insufficient frequencies of >10.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table VII

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Net Position for Securities Maturing in 5-10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Net Position (in millions of dollars) ≤0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	172	93	265	
Per cent	64.9	35.1	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	126	68	194	
>0 Numbers	46	25	71	
0 Actual	119	75	194	
>0 Numbers	53	18	71	
≤10 Theoretical	144	78	222	
>10 Numbers	28	15	43	
≤10 Actual	138	84	222	
>10 Numbers	34	9	43	
Days When Sales to SOMA Were				
0 Theoretical	149	80	229	
>0 Numbers	23	13	36	
0 Actual	143	86	229	4.2232
>0 Numbers	29	7	36	
≤10 Theoretical	153	83	236	
>10 Numbers	19	10	29	
≤10 Actual	148	88	236	
>10 Numbers	24	5	29	
Days When Sales to Treasury Were				
0 Theoretical	144	78	222	
>0 Numbers	28	15	43	
0 Actual	142	80	222	
>0 Numbers	30	13	43	

Note: Treasury ≤10, >10 not calculated because of insufficient frequencies of >10.

* Not significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table VIII

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Gross Long Position for Securities Maturing After 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Long Position (in millions of dollars) ≦0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	193	118	311	
Per cent	62.1	37.9	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	137	83	220	
>0 Numbers	56	35	91	8.6989
0 Actual	125	95	220	
>0 Numbers	68	23	91	
≦5 Theoretical	173	105	278	
>5 Numbers	20	13	33	8.0002
≦5 Actual	165	113	278	
>5 Numbers	28	5	33	
Days When Sales to SOMA Were				
0 Theoretical	179	109	288	
>0 Numbers	14	9	23	4.9953
0 Actual	174	114	288	
>0 Numbers	19	4	23	
Days When Sales to Treasury Were				
0 Theoretical	145	89	234	
>0 Numbers	48	29	77	4.1315
0 Actual	137	97	234	
>0 Numbers	56	21	77	
≦5 Theoretical	175	107	282	
>5 Numbers	18	11	29	6.8244
≦5 Actual	168	114	282	
>5 Numbers	25	4	29	

Note: SOMA ≦5, >5 not calculated because of insufficient frequencies of >5.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table IX

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Gross Short Position for Securities Maturing After 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Short Position (in millions of dollars) ≦0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	150	161	311	
Per cent	48.2	51.8	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	106	114	220	
>0 Numbers	44	47	91	
				9.7203
0 Actual	119	101	220	
>0 Numbers	31	60	91	
≦5 Theoretical	134	144	278	
>5 Numbers	16	17	33	
≦5 Actual	139	139	278	
>5 Numbers	11	22	33	
Days When Sales to SOMA Were				
0 Theoretical	139	149	288	
>0 Numbers	11	12	23	
0 Actual	141	147	288	
>0 Numbers	9	14	23	
Days When Sales to Treasury Were				
0 Theoretical	113	121	234	
>0 Numbers	37	40	77	
				7.6229
0 Actual	124	110	234	
>0 Numbers	26	51	77	
≦5 Theoretical	136	146	282	
>5 Numbers	14	15	29	
≦5 Actual	140	142	282	
>5 Numbers	10	19	29	

Note: SOMA ≦5, >5 not calculated because of insufficient frequencies of >5.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table X

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Change in Net Position for Securities Maturing After 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Change in Net Position (in millions of dollars) ≤0	>0	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	191	120	311	
Per cent	61.4	38.6	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	135	85	220	
>0 Numbers	56	35	91	
				20.0902
0 Actual	117	103	220	
>0 Numbers	74	17	91	
≤5 Theoretical	171	107	278	
>5 Numbers	20	13	33	
				12.8261
≤5 Actual	161	117	278	
>5 Numbers	30	3	33	
Days When Sales to SOMA Were				
0 Theoretical	177	111	288	
>0 Numbers	14	9	23	
				5.9652
0 Actual	171	117	288	
>0 Numbers	20	3	23	
Days When Sales to Treasury Were				
0 Theoretical	144	90	234	
>0 Numbers	47	30	77	
				1.5224
0 Actual	129	105	234	
>0 Numbers	62	15	77	
≤5 Theoretical	173	109	282	
>5 Numbers	18	11	29	
				11.6625
≤5 Actual	164	118	282	
>5 Numbers	27	2	29	

Note: SOMA ≤5, >5 not calculated because of insufficient frequencies of >5.

Appendix, Table XI

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Offerings to the Trading Desk of Securities Maturing in 1 - 5 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Offerings (in millions of dollars) $0 \leqq 75$	> 75	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	101	141	242	
Per Cent	41.7	58.3	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	75	104	179	
>0 Numbers	26	37	63	
0 Actual	82	97	179	
>0 Numbers	19	44	63	
$\leqq 20$ Theoretical	88	124	212	
>20 Numbers	13	17	30	
				17.1080
$\leqq 20$ Actual	99	113	212	
>20 Numbers	2	28	30	
Days When Sales to SOMA Were				
0 Theoretical	86	121	207	
>0 Numbers	15	20	35	
				7.6815
0 Actual	94	113	207	
>0 Numbers	7	28	35	
$\leqq 20$ Theoretical	91	127	218	
>20 Numbers	10	14	24	
				13.7486
$\leqq 20$ Actual	100	118	218	
>20 Numbers	1	23	24	
Days When Sales to Treasury Were				
0 Theoretical	88	124	212	
>0 Numbers	13	17	30	
0 Actual	89	123	212	
>0 Numbers	13	17	30	

Note: Treasury $\leqq 20$, >20 not calculated because of insufficient frequencies of >20.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table XII

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Offerings to the Trading Desk of Securities Maturing in 5-10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Offerings (in millions of dollars) ≤50	>50	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	143	122	265	
Per Cent	54.0	46.0	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	105	89	194	
>0 Numbers	38	33	71	
				5.5906
0 Actual	114	80	194	
>0 Numbers	29	42	71	
≤10 Theoretical	120	102	222	
>10 Numbers	23	20	43	
				26.8157
≤10 Actual	136	86	222	
>10 Numbers	7	36	43	
Days When Sales to SOMA Were				
0 Theoretical	124	105	229	
>0 Numbers	19	17	36	
				11.6461
0 Actual	134	95	229	
>0 Numbers	9	27	36	
≤10 Theoretical	127	109	236	
>10 Numbers	16	13	29	
				20.6933
≤10 Actual	139	97	236	
>10 Numbers	4	25	29	
Days When Sales to Treasury Were				
0 Theoretical	120	102	222	
>0 Numbers	23	20	43	
0 Actual	120	102	222	
>0 Numbers	23	20	43	

Note: Treasury ≤10, >10 not calculated because of insufficient frequencies of >10.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table XIII

Comparison of Actual and Theoretical Frequencies, Days Classified According to the Current Day's Sales to Official Accounts and Offerings to the Trading Desk of Securities Maturing After 10 Years

(August 22, 1962-December 31, 1963)

Sales to Official Accounts (in millions of dollars)	Offerings (in millions of dollars) ≤25	>25	Total	Chi-Square*
	(in number of days)			
All Days Without Financings				
Number	225	86	311	
Per cent	72.3	27.7	100	
Days When Sales to SOMA + Treasury Were				
0 Theoretical	159	61	220	
>0 Numbers	66	25	91	
				10.2936
0 Actual	171	49	220	
>0 Numbers	54	37	91	
<5 Theoretical	201	77	278	
>5 Numbers	24	9	33	
				31.1174
<5 Actual	215	63	278	
>5 Numbers	10	23	33	
Days When Sales to SOMA Were				
0 Theoretical	208	80	288	
>0 Numbers	17	6	23	
0 Actual	208	80	288	
>0 Numbers	17	6	23	
Days When Sales to Treasury Were				
0 Theoretical	169	65	234	
>0 Numbers	56	21	77	
				13.5591
0 Actual	182	52	234	
>0 Numbers	43	34	77	
≤5 Theoretical	204	78	282	
>5 Numbers	21	8	29	
				29.7409
≤5 Actual	217	65	282	
>5 Numbers	8	21	29	

Note: SOMA ≤ 5, > 5 not calculated because of insufficient frequencies of >5.

* If significant at 5 per cent level. Calculated using Yates' correction.

Appendix, Table XIV

Results of Multiple Regressions Explaining Dealer Sales to Private Customers on Days Without Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$	Δ Prices$_t$	Δ Prices$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$				
Simple r								
1-5	- .009	.081	.061	.062	- .060	.323**	.137*	.036
5-10	- .109	.033	- .115	.008	- .170**	.228**	.042	.006
>10	.159**	- .061	.001	.121*	.017	.214**	- .020	.000
Order Added								
1-5	6	7	5	3	4	1	2	8
5-10	6	3	4	5	2	1	8	7
>10	3	5	4	2	6	1	8	7
F Level, When Added								
1-5	1.315	1.007	1.673	1.291	1.258	28.027**	6.310*	0.112
5-10	.196	1.274	.772	.512	9.045**	14.386**	.154	.192
>10	2.810	2.481	2.584	3.622	.383	14.802**	.002	.016
R^2, Adjusted for Degrees of Freedom, When Added								
1-5	.126	.126	.125	.121	.122	.101	.120	.123
5-10	.072	.077	.077	.075	.077	.048	.066	.069
>10	.056	.066	.061	.051	.064	.043	.058	.061
Net Regression Coefficient at Final Stage								
1-5	- .349	.148	.613	.218	-2.777	.085**	108.115	18.475
5-10	- .094	.128	- .126	.113	-2.641*	.033**	6.629	-8.785
>10	.112	- .452	- .118	.191*	.176	.016**	.231	.501
Standard Error of Regression Coefficient at Final Stage								
1-5	.342	.148	.336	.147	1.764	.017	55.525	55.307
5-10	.231	.158	.233	.162	1.073	.009	16.867	16.858
>10	.058	.274	.068	.092	.287	.005	4.802	4.843
Partial Correlation Coefficient at Final Stage								
1-5	- .067	.065	.119	.097	- .103	.318	.127	.022
5-10	- .026	.051	- .034	.044	- .152	.236	.025	- .033
>10	.111	- .094	- .099	.119	.035	.178	.003	.006

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	25.737	.123
5-10	256	34.649	.066
>10	302	8.280	.058

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XV

Results of Multiple Regressions Explaining Dealer Purchases from Private Customers on Days Without Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$	Δ Prices$_t$	Δ Prices$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$				
Simple r								
1-5	- .042	.078	- .031	.061	- .048	.176**	.109	.151*
5-10	.041	.181**	.005	.043	- .015	.025	.210**	.197**
>10	.203**	- .001	.138*	- .005	.079	.092	.218**	.170**
Order Added								
1-5	8	6	7	4	5	1	3	2
5-10	4	2	6	7	5	8	1	3
>10	2	5	4	8	6	7	1	3
F Level When Added								
1-5	.132	.882	.124	.669	1.036	7.639**	1.568	6.224*
5-10	1.941	7.870**	.097	.014	1.628	.008	12.095**	6.696**
>10	18.521**	.204	2.912	.004	.037	.010	15.385**	4.545*
R^2 Adjusted for Degrees of Freedom, When Added								
1-5	.041	.048	.045	.048	.049	.027	.050	.048
5-10	.088	.065	.087	.083	.090	.080	.040	.085
>10	.096	.109	.111	.100	.106	.103	.044	.106
Net Regression Coefficient at Final Stage								
1-5	- .144	.159	.193	.170	-2.268	.052**	62.446	129.553*
5-10	.361	.510**	.077	.020	-1.402	.001	46.162**	44.662*
>10	.204**	- .118	.109	- .006	- .047	.001	17.548**	11.646*
Standard Error of Regression Coefficient at Final Stage								
1-5	.396	.171	.390	.170	2.045	.019	64.356	64.104
5-10	.238	.163	.241	.168	1.106	.009	17.400	17.391
>10	.060	.284	.070	.095	.297	.005	4.971	5.013
Partial Correlation Coefficient at Final Stage								
1-5	- .024	.061	.032	.065	- .072	.175	.063	.131
5-10	.094	.192	.020	.007	- .079	.006	.164	.158
>10	.193	- .024	.089	- .004	- .009	.006	.199	.133

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	39.906	.041
5-10	256	31.656	.080
>10	302	8.448	.100

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XVI

Results of Multiple Regressions Explaining Change in Prices on Days Without Financings, August 22, 1962-December 31, 1963

	Independent Variables					
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$		
Simple r						
1-5	- .188**	.090	- .083	.098	- .010	- .046
5-10	- .132*	.067	- .102	.054	- .077	- .009
>10	- .128*	.010	- .028	.028	- .009	- .074
Order Added						
1-5	1	4	3	2	6	5
5-10	1	2	5	4	3	6
>10	1	5	6	4	2	3
F Level When Added						
1-5	8.780**	.909	.995	1.967	.003	.029
5-10	4.639*	1.006	.200	.823	.777	.027
>10	5.185*	.108	.042	.199	.265	.192
R^2 Adjusted for Degrees of Freedom, When Added						
1-5	.0313	.0348	.0351	.0352	.0267	.0308
5-10	.0136	.0136	.0091	.0121	.0128	.0053
>10	.0133	.0029	- .0003	.0058	.0110	.0084
Net Regression Coefficient at Final Stage						
1-5	- .0011**	.0002	.0004	.0002	.0001	.0000
5-10	- .0010	.0006	- .0004	.0005	- .0038	.0000
>10	- .0014	.0012	.0002	.0005	.0009	.0000
Standard Error of Regression Coefficient at Final Stage						
1-5	.0004	.0002	.0004	.0002	.0021	.0000
5-10	.0009	.0006	.0009	.0006	.0041	.0000
>10	.0007	.0035	.0009	.0012	.0036	.0001
Partial Correlation Coefficient at Final Stage						
1-5	- .168	.057	.061	.066	.004	- .010
5-10	- .074	.067	- .028	.051	- .058	- .010
>10	- .110	.020	.012	.025	.014	- .030

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	235	- .0047	.0267
5-10	258	.0030	.0053
>10	304	- .0028	- .0003

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XVII

Multiple Regressions Explaining Change in Dealers' Gross Long Position on Days When There Were No Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$	Δ Prices$_t$	Δ Prices$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$				
Simple r								
1-5	- .269**	- .469**	- .219**	- .060	- .253**	- .224**	- .043	.076
5-10	- .112	- .289**	- .033	- .102	- .082	- .354**	.119	.181**
>10	- .610**	- .152**	- .069	.012	- .117*	- .301**	.206**	.108
Order Added								
1-5	2	1	7	6	8	3	5	4
5-10	4	2	6	8	7	1	5	3
>10	1	5	3	8	7	4	2	6
F Level When Added								
1-5	28.889**	67.796**	.214	.453	.009	7.149**	2.294	2.307
5-10	3.445	22.409**	1.673	1.177	.737	37.752**	2.029	12.113**
10	182.697**	4.158*	8.188**	.000	.011	5.914*	8.316**	.509
R^2 Adjusted for Degrees of Freedom, When Added								
1-5	.299	.217	.320	.322	.317	.316	.324	.320
5-10	.229	.188	.234	.233	.233	.122	.232	.221
>10	.370	.414	.398	.409	.411	.408	.384	.413
Net Regression Coefficient at Final Stage								
1-5	- .756**	- .842**	- .111	.060	.116	- .030*	-57.778	65.234
5-10	- .329*	- .476**	.122	- .109	.781	- .033**	15.859	32.229**
>10	- .717**	- .588*	.219**	.000	.032	- .013*	12.658*	3.655
Standard Error of Regression Coefficient at Final Stage								
1-5	.240	.104	.236	.103	1.238	.012	38.966	38.813
5-10	.143	.098	.144	.100	.664	.005	10.438	10.433
>10	.061	.292	.072	.098	.306	.005	5.118	5.161
Partial Correlation Coefficient at Final Stage								
1-5	- .202	- .470	- .031	.038	.006	- .165	- .097	.109
5-10	- .143	- .291	.053	- .068	.073	- .361	.095	.190
>10	- .558	- .115	.172	.000	.006	- .133	.141	.041

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	12.775	.317
5-10	256	-1.678	.233
>10	302	- .121	.409

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XVIII

Multiple Regressions Explaining Change in Dealers' Gross Short Position on Days When There Were No Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$	Δ Prices$_t$	Δ Prices$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$				
Simple r								
1-5	.154*	.109	.222**	.082	.073	.096	- .102	- .216**
5-10	.052	.038	- .007	- .022	- .015	- .001	- .256**	- .243**
>10	.141*	.071	.004	.066	.171**	.015	- .205**	- .137*
Order Added								
1-5	8	3	1	4	5	7	6	2
5-10	6	4	3	7	5	8	1	2
>10	4	7	3	6	2	8	1	5
F Level When Added								
1-5	.076	4.346*	12.450**	1.657	2.061	.675	.931	8.269**
5-10	.950	.806	.839	.007	.595	.000	18.462**	9.780**
>10	2.673	.311	1.926	1.439	9.459**	.013	13.493**	1.900
R^2 Adjusted for Degrees of Freedom, When Added								
1-5	.088	.086	.045	.089	.093	.091	.093	.073
5-10	.090	.091	.092	.086	.090	.082	.062	.092
>10	.072	.074	.067	.076	.064	.071	.039	.075
Net Regression Coefficient at Final Stage								
1-5	.035	.112*	.311*	.099	- .905	.005	-17.880	-55.462**
5-10	.098	.080	- .088	.006	- .442	.000	-25.425**	-23.511**
>10	.056	.096	- .074	.067	.491**	.000	- 8.704**	- 4.052
Standard Error of Regression Coefficient at Final Stage								
1-5	.128	.055	.126	.055	.659	.006	20.743	20.661
5-10	.101	.069	.102	.071	.468	.004	7.365	7.361
>10	.036	.172	.043	.058	.180	.003	3.005	3.030
Partial Correlation Coefficient at Final Stage								
1-5	.018	.132	.160	.118	- .090	.049	- .056	- .173
5-10	.061	.073	- .054	.005	- .059	- .001	- .211	- .196
>10	.090	.032	- .100	.067	.155	- .007	- .164	- .077

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	-1.939	.088
5-10	256	.845	.082
>10	302	- .779	.071

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XIX

Multiple Regressions Explaining Change in Dealers' Net Position on Days When There Were No Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to				Duration of sales to SOMA + Treasury	Net position$_{t-1}$	Δ Prices$_t$	Δ Prices$_{t-1}$
	Treasury$_t$	SOMA$_t$	Treasury$_{t-1}$	SOMA$_{t-1}$				
Simple r								
1-5	- .294**	- .450**	- .278**	- .084	- .248**	- .232**	.004	.152*
5-10	- .125*	- .269**	- .021	- .075	- .062	- .303**	.244**	.290**
>10	- .594**	- .164**	- .063	- .017	- .175**	- .263**	.267**	.154**
Order Added								
1-5	2	1	5	8	7	4	6	3
5-10	5	3	6	8	7	1	4	2
>10	1	4	3	8	7	5	2	6
F Level When Added								
1-5	33.718**	60.804**	2.364	.109	.420	7.554**	.843	8.536**
5-10	2.651	20.266**	3.554	1.021	1.869	26.634**	12.621**	28.706**
>10	168.675**	5.653*	8.244**	.400	1.860	2.433	18.637**	1.788
R^2 Adjusted for Degrees of Freedom, When Added								
1-5	.295	.199	.339	.334	.337	.335	.338	.316
5-10	.269	.232	.276	.279	.279	.089	.265	.175
>10	.351	.409	.400	.414	.415	.412	.386	.413
Net Regression Coefficient at Final Stage								
1-5	- .791**	- .955**	- .422	- .039	1.021	- .035**	-39.897	120.697**
5-10	- .428**	- .556**	.211	- .115	1.223	- .033**	41.284**	55.740**
>10	- .779**	- .691*	.289**	- .070	- .456	- .011	21.586**	7.938
Standard Error of Regression Coefficient at Final Stage								
1-5	.274	.118	.269	.118	1.413	.013	44.466	44.291
5-10	.161	.110	.163	.114	.751	.006	11.805	11.798
>10	.070	.332	.082	.111	.347	.006	5.805	5.855
Partial Correlation Coefficient at Final Stage								
1-5	- .186	- .467	- .102	- .022	.047	- .167	- .059	.176
5-10	- .163	- .300	.080	- .063	.101	- .323	.214	.283
>10	- .541	- .119	.198	- .036	- .075	- .103	.209	.078

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	14.713	.334
5-10	256	-2.523	.279
>10	302	.657	.414

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.

Appendix, Table XX

Results of Multiple Regressions Explaining Offerings to the Trading Desk on Days Without Financings, August 22, 1962-December 31, 1963

	Independent Variables							
	Dealer Sales to							
	$Treasury_t$	$SOMA_t$	$Treasury_{t-1}$	$SOMA_{t-1}$	Duration of sales to SOMA + Treasury	Net $position_{t-1}$	$\Delta Prices_t$	$\Delta Prices_{t-1}$
Simple r								
1-5	.233**	.357**	.160*	.150*	.204**	.345**	- .310**	- .119
5-10	.244**	.257**	.184**	.110	.229**	.576**	- .410**	- .206**
>10	.560**	.143*	.280**	.069	.202**	.681**	- .312**	- .151**
Order Added								
1-5	4	1	7	5	8	3	2	6
5-10	4	3	8	6	7	1	2	5
>10	2	5	7	6	4	1	3	8
F Level When Added								
1-5	6.702*	35.151**	.074	4.976*	.010	33.612**	37.380**	.988
5-10	21.299**	33.999**	.217	2.854	.461	130.505**	85.151**	7.494**
>10	79.630**	5.044*	.807	.893	12.724**	267.477**	42.596**	.341
R^2 Adjusted for Degrees of Freedom, When Added								
1-5	.346	.124	.355	.357	.352	.331	.239	.357
5-10	.581	.549	.592	.594	.593	.329	.492	.591
>10	.571	.641	.641	.641	.636	.462	.622	.640
Net Regression Coefficient at Final Stage								
1-5	.684	1.059**	.116	.380*	- .216	.107**	-363.259**	-60.729
5-10	.907**	.931**	.121	.262	.610	.134**	-169.136**	-51.632**
>10	.655**	.896*	- .102	.132	1.462**	.114**	- 46.622**	- 4.398
Standard Error of Regression Coefficient at Final Stage								
1-5	.409	.177	.403	.176	2.111	.020	66.444	66.183
5-10	.258	.177	.261	.182	1.200	.010	18.869	18.859
>10	.090	.427	.106	.143	.447	.008	7.467	7.531
Partial Correlation Coefficient at Final Stage								
1-5	.109	.365	.019	.140	- .007	.330	- .337	- .060
5-10	.215	.313	.029	.090	.032	.657	- .489	- .169
>10	.388	.120	- .056	.053	.185	.644	- .338	- .034

At Final Stage:	Degrees of freedom	Constant	R^2 adjusted
1-5	233	42.630	.352
5-10	256	35.678	.592
>10	302	11.384	.640

Note: Dollar variables in millions; price changes in points.

* Significant at 5 per cent level.

** Significant at 1 per cent level.