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Determinants of debt and liquidity in a firm

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DETERMINANTS OF DEBT AND LIQUIDITY IN A FIRM

by

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INTRODUCTION

The purpose of this study is to test a theory of financial decision-making for the individual firm. The theory is based upon the concepts of safe debt and necessary liquidity when compared with actual debt and actual liquidity. Though it is not possible to specify exact values of safe debt and necessary liquidity, it is possible to specify the determinants of each. If the firm responds to the levels of safe debt and necessary liquidity, it must also be responding to the determinants of each. Thus, it is possible to test the theory by measuring the firm's response to changes in actual debt and liquidity and to changes in the determinants of safe debt and liquidity.

The firm used in this study will not be named. It is a small to medium-sized lumber and building materials wholesale firm located in Des Moines, Iowa. The data in this study came from the firm's annual and monthly financial records and has not been changed in any manner such as deseasonalizing, etc.

The following chapter will be a fund-flow analysis of the firm over the period 1947-1964. After some insight into the firm has been gained, the theory of financial decision-making will be presented. Following that, the theory will be tested and the results discussed.

FUND-FLOW ANALYSIS OF A FIRM

Introduction

It is generally accepted that as a firm enters into and passes through an upswing in economic activity, it will call upon outside sources for additional amounts of money. This is because it tries to have its earning assets as large as possible when the probability of making increased profits is large.

The purpose of this chapter is to develop a mechanism to describe and analyze these flows. Also, it will endeavor to give some explanation of these flows as they have appeared in the years 1947-1964 for a particular firm. Most studies of these flows have been of firms whose flows and sales behaved cyclically (17). The firm analyzed here differs from the firms used in similar studies in that it has had, with the exception of one year, ever increasing sales over the period 1947-1964. It is also atypical in that it has experienced difficulty in borrowing long-term funds.

The Financial Statements in Mathematical Notation

In most accounting books one of the first things a student learns is the idea of double entry. This merely means that for every debit there is an equal and opposite credit or credits. In the balance sheet this is reflected by

equality between total assets on the one side and total liabilities plus the capital accounts on the other. The income statement equates net sales and other income with costs and expenses, plus retained earnings.

A simplified balance sheet can be written as

$$(2\text{-}1) \quad C_t + G_t + OCA_t + NFA_t + OA_t = D_{s_t} + OCL_t + D_{L_t} + IPS_t + ES_t$$

where:

C_t = cash at the end of t,

G_t = government securities at the end of t,

OCA_t = current assets excluding cash and government securities at the end of t,

NFA_t = net fixed assets at the end of t,

OA_t = other assets at the end of t,

D_{s_t} = short-term debt at the end of t,

OCL_t = other current liabilities at the end of t,

D_{L_t} = long-term debt at the end of t,

IPS_t = issued and paid-in surplus at the end of t, and

ES_t = earned surplus at the end of t.[1]

The simplified income statement can be written as,

(2-2) $NSOI_t = C\&E_t + Dep_t + RED_t$

where:

$NSOI_t$ = net sales and other income during period t,

Dep_t = depreciation during t,

$C\&E_t$ = costs and expenses during t, and

RED_t = retained earnings during t.

Equation 2-1 is an equation of stock variables and Equation 2-2 is an equation of flow variables. Equation 2-1 could have been written for the end of the previous period (or the beginning of period t) by inserting t-1 for t. Then Equation 2-1 for period t minus Equation 2-1 for period t-1 will be a difference equation,

(2-3) $(C_t - C_{t-1}) + (G_t - G_{t-1}) + (OCA_t - OCA_{t-1}) +$
$(NFA_t - NFA_{t-1}) + (OA_t - OA_{t-1}) = (D_{s_t} - D_{s_{t-1}}) +$
$(OCL_t - OCL_{t-1}) + (D_{L_t} - D_{L_{t-1}}) + (IPS_t - IPS_{t-1}) +$
$(ES_t - ES_{t-1})$.

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[1] In developing the fund-flow analysis and the theory of financial decisions many different symbols are used. A glossary of symbols used is contained in Appendix A for a central place to refer to if it is forgotten what one symbol represents.

Equation 2-3 like Equation 2-2 is composed of flow variables. The term $(C_t - C_{t-1})$ may be written as ΔC_t, the change in cash during period t. The other components in parenthesis of Equation 2-3 can be written similarily.

Equation 2-3, rewritten using "Δ" signs, can be added to Equation 2-2 to obtain,

$$(2\text{-}4) \quad C\&E_t + Dep_t + RED_t + \Delta C_t + \Delta G_t + \Delta OCA_t + \Delta NFA_t + \Delta OA_t = NSOI_t + \Delta D_{S_t} + \Delta OCL_t + \Delta D_{L_t} + \Delta IPS_t + \Delta ES_t.$$

Hence,

$$(2\text{-}5) \quad \Delta C_t = NSOI_t - C\&E_t - \Delta OCA_t + \Delta OCL_t - RED_t - \Delta NFA_t - \Delta OA_t - Dep_t + \Delta D_{S_t} + \Delta D_{L_t} + \Delta IPS_t + \Delta ES_t - \Delta G_t.$$

The right-hand side of Equation 2-5 is a statement of the cash transactions of the firm for period t with their resultant impact on the cash balance. The rest of the chapter will rely heavily on Equation 2-5 as a convenient mechanism for determining and analyzing the cash flows of the firm.

Cash Transactions of the Firm

The right-hand side of Equation 2-5 can be divided into two parts, business transactions and money market transactions. The purpose of dividing transactions into these two major areas is to point up the company's general need for funds from outside sources. Business transactions, denoted

by BT_t, are receipts and payments for goods and services rendered to and by the firm during period t. Furthermore,

(2-6) $BT_t = NSOI_t - C\&E_t - \Delta OCA_t + \Delta OCL_t - \Delta NFA_t - \Delta OA_t - Dep_t$.

Money market transactions are those in which money principal is received or returned.[2] This can be written as

(2-7) $MM_t = \Delta D_{S_t} + \Delta D_{L_t} + \Delta IPS_t - \Delta C_t$

where:

MM_t = money market transactions, and

$\Delta C_t = BT_t + MM_t$.

These two types of transactions account for all but two components of Equation 2-5. The two components are ΔES_t and $- RED_t$ which always sum to zero. ΔES_t is the change in earned surplus during t and RED_t is the earnings transferred into ES during t.

The business transactions can be further divided in two areas, the operating budget and the capital budget. The purpose of dividing business transactions into two areas is to point out more specifically the firm's needs for funds. Also, it can show the firm's ability to return money to the

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[2]This money market should not be confused with organized money markets, e.g. the commercial paper market, the capital market, etc.

money market.

The operating budget permits us to show cash receipts from customers plus all cash transactions having to do with the acquisition of goods and services on current account---payments to factors of production for services rendered (i.e. rent, wages, interest, dividends) and payments to vendors for services or materials destined for delivery to customers. All these payments, excluding income taxes and dividends, can be called production payments.

The second type of business transaction is the capital budget. This includes expenditures for noncurrent assets; investments and advances to subsidiaries or other companies; land, plant, and equipment; and other permanent or semi-permanent assets.

Table 1 is designed to illustrate the above discussion for two years, 1952 and 1953. In 1952 business receipts were $7,692,832 while business payments were $7,675,478, making an excess of business receipts over payments of $17,354. The firm could either have returned this latter amount to the money market or added it to its cash balances. It chose to do the latter plus borrowing another $16,200. This resulted in the cash balances increasing by $33,554.

In 1953 receipts from customers declined. At the same time operating payments dropped, causing an excess of receipts over payments in the operating budget. On the other

Table 1. Transactions affecting cash, 1952 and 1953

	1952	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		7688352
Production payments	7447153	
Income tax payments	123753	
Dividends		
Other current assets		
Subtotal	7570905	7688352
Subtotal difference		117446
Capital budget		
Investments & advances		4313
Expenditures on fixed assets	104573	
Expenditures on other assets		116
Subtotals	1045732	4480
Subtotal difference	100093	
Total business transactions	7675478	7692831
Difference		17353
Money-market transactions		
Government securities		
Notes payable-banks	45000	
Notes payable-other		612000
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	45000	612000
Difference		16200
Total payments and receipts	7720478	7754031
Effect on cash	33553	

Table 1 (Continued)

	1953	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		7583943
Production payments	7241748	
Income tax payments	102568	
Dividends		
Other current assets		
Subtotal	7524316	7583943
Subtotal difference		59627
Capital budget		
Investments & advances		25257
Expenditures on fixed assets	95079	
Expenditures on other assets	5	
Subtotals	95084	25257
Subtotal difference	69827	
Total business transactions	7619401	7609201
Difference	10200	
Money-market transactions		
Government securities		
Notes payable-banks	12640	
Notes payable-other		28550
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	12640	28550
Difference		15909
Total payments and receipts	7632041	7637751
Effect on cash	5710	

hand, payments exceeded receipts in the capital budget. These two components of business transactions resulted in business payments exceeding business receipts by $10,200. This excess was offset by an increase in short-term borrowing from non-bank or other sources. This borrowing slightly increased the total amount of cash held at the end of 1953.

Summary

In this section the cash transactions were divided into three general areas. They were the operating budget, the capital budget, and the money market transactions. This can be written as

(2-8) $C_t = OB_t + CB_t + MM_t$

where:

OB_t = the operating budget = $NSOI_t - C\&E_t - \Delta OCA_t + \Delta OCL_t$,

CB_t = the capital budget = $- \Delta NFA_t - \Delta OA_t - Dep_t$,

MM_t = the money market transactions = $\Delta D_{S_t} + \Delta D_{L_t} + \Delta IPS_t - \Delta G_t$, and

$BT_t = OB_t + CB_t$.

Digression on Cash Balances

Cash balances of the firm are generally considered to be a transactions balance. A transactions balance is the cash held to bridge the interval between the time of the incurrence of business costs and that of the receipts of sales' proceeds (11, p. 195).

It is quite difficult to say whether the cash balances of a firm will increase, decrease, or remain constant as transactions increase. At first glance it would appear that cash balances should increase. This is because a larger "interval" will have to be bridged as transactions increase. As the cash balance increases due to this interval, it should increase at a rate less than the rate of increase of transactions. This is due to economies of scale and spreading of risk (2).

However, other factors may enter which could reduce cash balances. As time goes by, the management of a firm may learn more about the operations of the firm, the nature of the demand for its product, and about newer and better techniques for determining the risk involved in the "interval". There have been significant developments in statistics and economics in recent years which deal with these problems---for example, statistical decision theory, linear programming, and heuristic programming. It must be

assumed that these techniques would have had some impact on cash balances of a firm. An older firm living in today's world would likely have gleaned some information over the years which would have an impact on its cash balance.

This accumulation of knowledge means that a firm can possibly change the framework within which it must make a decision from a zero-sum game against nature, with no idea of the probabilities of the strategies of nature, into a game where it does know the probabilities of the states of nature. If this is the case, it could very well alter its choice of a strategy in a given situation. It might choose a strategy which minimizes the expected loss over all strategies rather than choosing one which minimizes the worst possible loss nature can bestow the firm.

Another factor altering cash balances is an actual reduction of risk. The firm holds cash balances because it believes the opportunity cost is less than the cost of having to liquidate other assets at short notice in order to pay bills. In liquidating assets to raise cash the firm may have to reduce the price of the goods to be sold. Banks today extend "lines of credit" to firms by setting up a certain amount of funds that the firm may borrow at any time.

This is quite important to the firm. If it can get the amount of cash it needs by simply lifting the phone and dialing the bank it is possible to lower the cash on hand

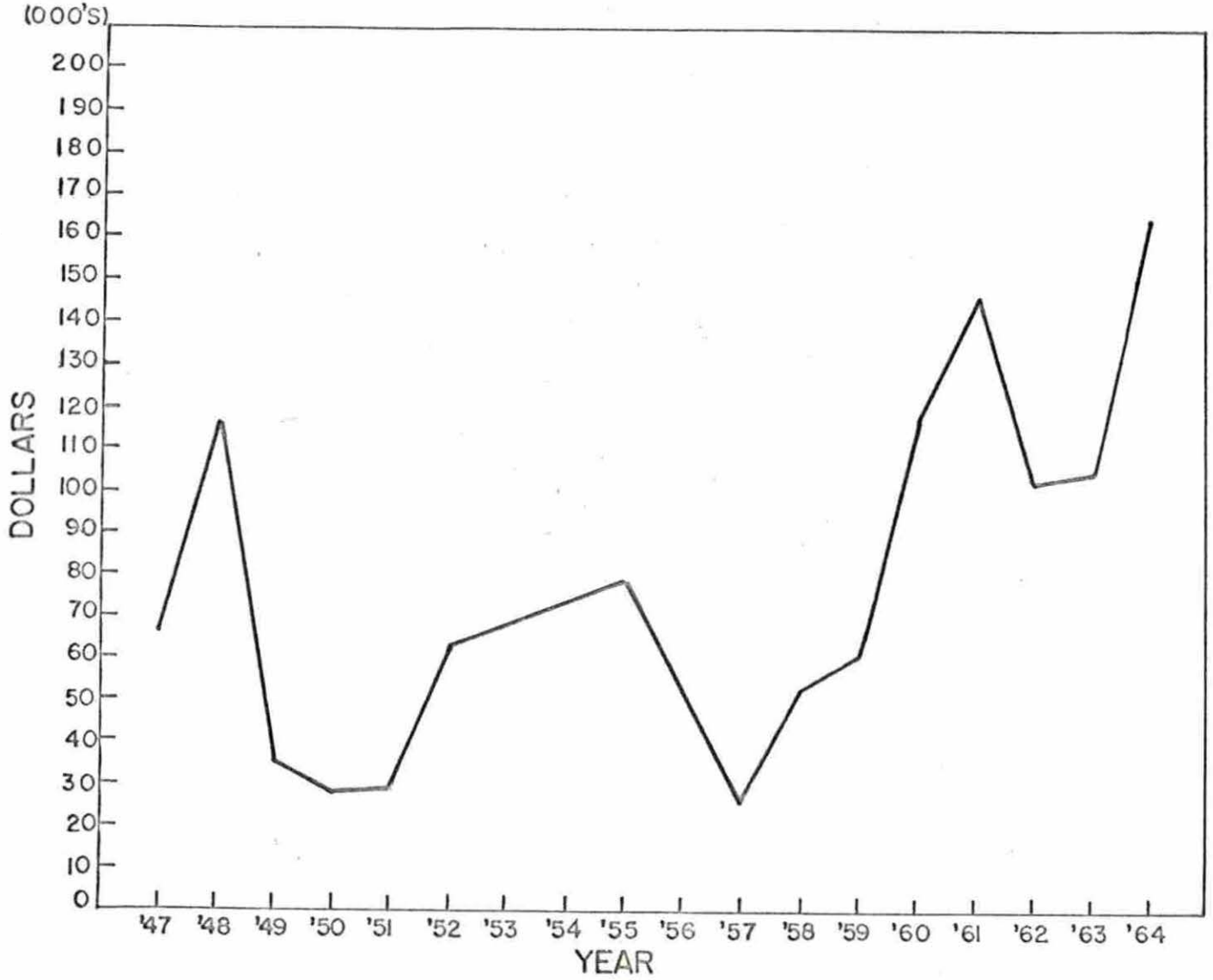

Figure 1. Cash balances

absolutely. Moreover, it may lead to the firm actually trying to minimize the amount of cash on hand at a given moment. It may also free management from trying to calculate expected payments and receipts, only becoming concerned if they approach too closely the maximum line of credit. Thus, the cash balance may actually become a relatively unimportant decision except to keep it near some very low level.

Figure 1 shows the end-of-the-year's cash balances for the years 1947 to 1964. Although there is no consistent trend upwards or downwards, there has been considerable variation in these balances. During the same period, sales have trebled, and consequently we cannot assert that cash balances have increased as sales, a measure of transactions, have increased. There is, however, some question about the validity of Figure 1 because the cash balance for each year has been taken from a population of 250. There is also the question of whether or not there is "window dressing" at the end of the year in order to make the annual reports look better. In any event, it would be difficult to prove that the cash balances have actually increased as transactions have increased.

Cash Flows between the Firm and the Money Market

Figure 2 shows the growth of cash payments and receipts with respect to business transaction over time. Cash payments and receipts have risen from slightly over four million dollars in 1946 to more than twelve million dollars in recent years. Payments and receipts may differ from each other substantially. In 1959, e.g., payments exceeded business receipts by $500,000. Other large excesses of payments over receipts can be noted.

According to Equation 2-8 a deficit due to business transactions has to be made up by going to the money market or by a reduction in cash balances. In this firm most of the effect is in the money market. In Figure 1, the highest amount of cash balances was about $166,000. This would not be large enough to cover an excess of business payments over business receipts of $500,000.

Figure 3 displays the excess of business receipts over business payments, and the excess of money market receipts over money market payments. Both vary considerably. The interesting thing is the symmetry of the two lines. The years 1949 and 1952 are the only years in which the excess occurred on the same side of the 0 deficit mark. In 1949 the two combined to decrease the cash balance by $81,000,

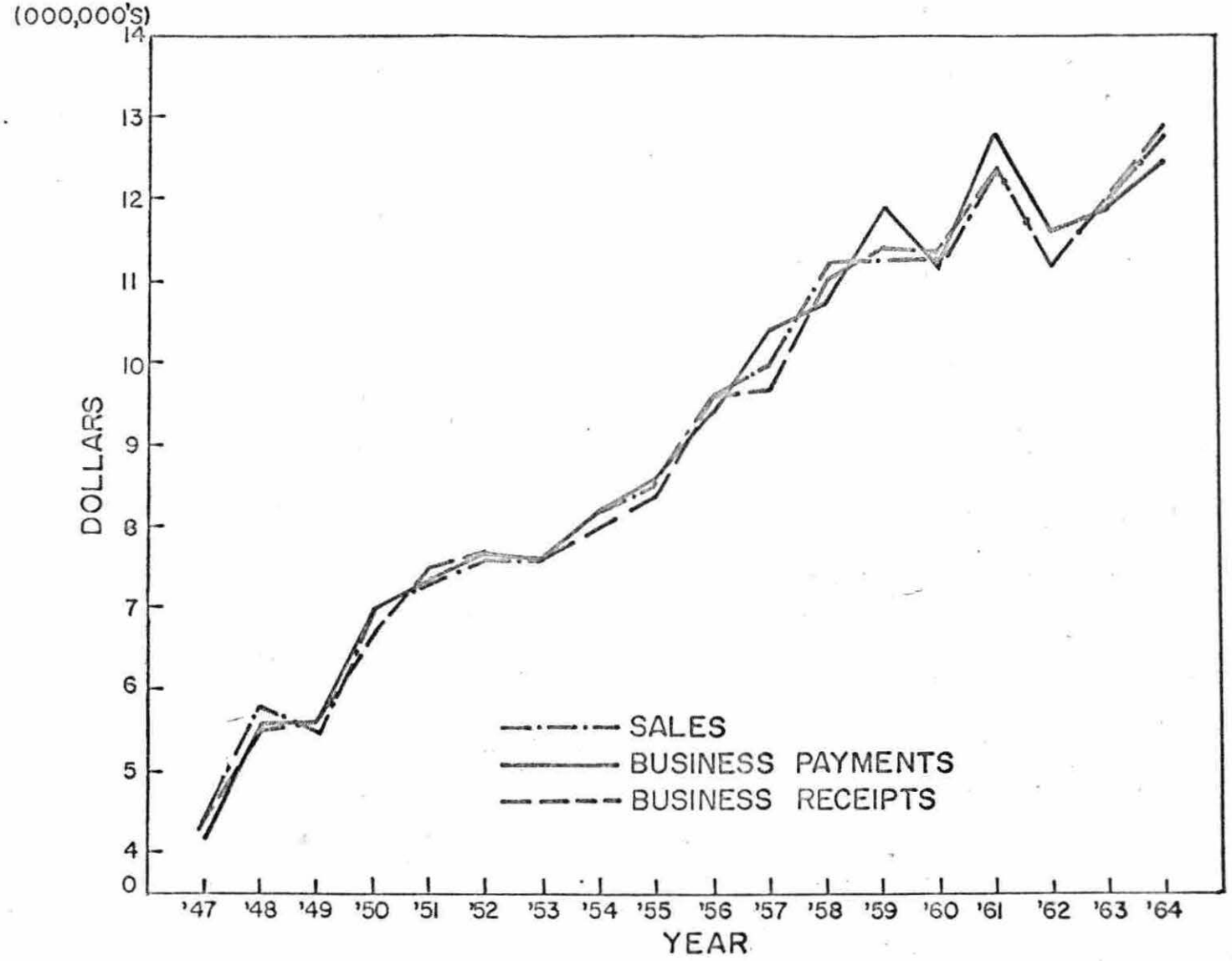

Figure 2. Business transactions and sales

and in 1952 they combined to increase the cash balance by $33,000.

Other than these two years money market transactions offset the excess of business payments over business receipts. The excess of money market receipts over money market payments is sometimes modified by decreases or increases in the cash balance, but then the changes in cash balances are not large. Figure 1 shows the largest change in cash balances came in 1949 when money market and business transactions both ran a deficit.

In Equation 2-8 $BT_t = OB_t + CB_t$. We would expect the capital budget to show a fairly stable excess of payments over receipts, because of replacement of worn-out fixed assets. Those variations in the capital budget which do exist can be traced by use of Equation 2-8.

Figure 4 shows the excess of capital budget expenditures over capital budget receipts. From 1947 to 1954 the excess is constant. After 1954 the excess gets larger and larger, reaching a maximum of $580,000 in 1957. In 1953 the excess was only $70,000. In order to explain this increase Equation 2-8 will be used.

As it stands CB_t has three components; ΔNFA_t, ΔOA_t, and Dep_t. The change in other assets during t, ΔOA_t, contains a component called the change in investments and advances dur-

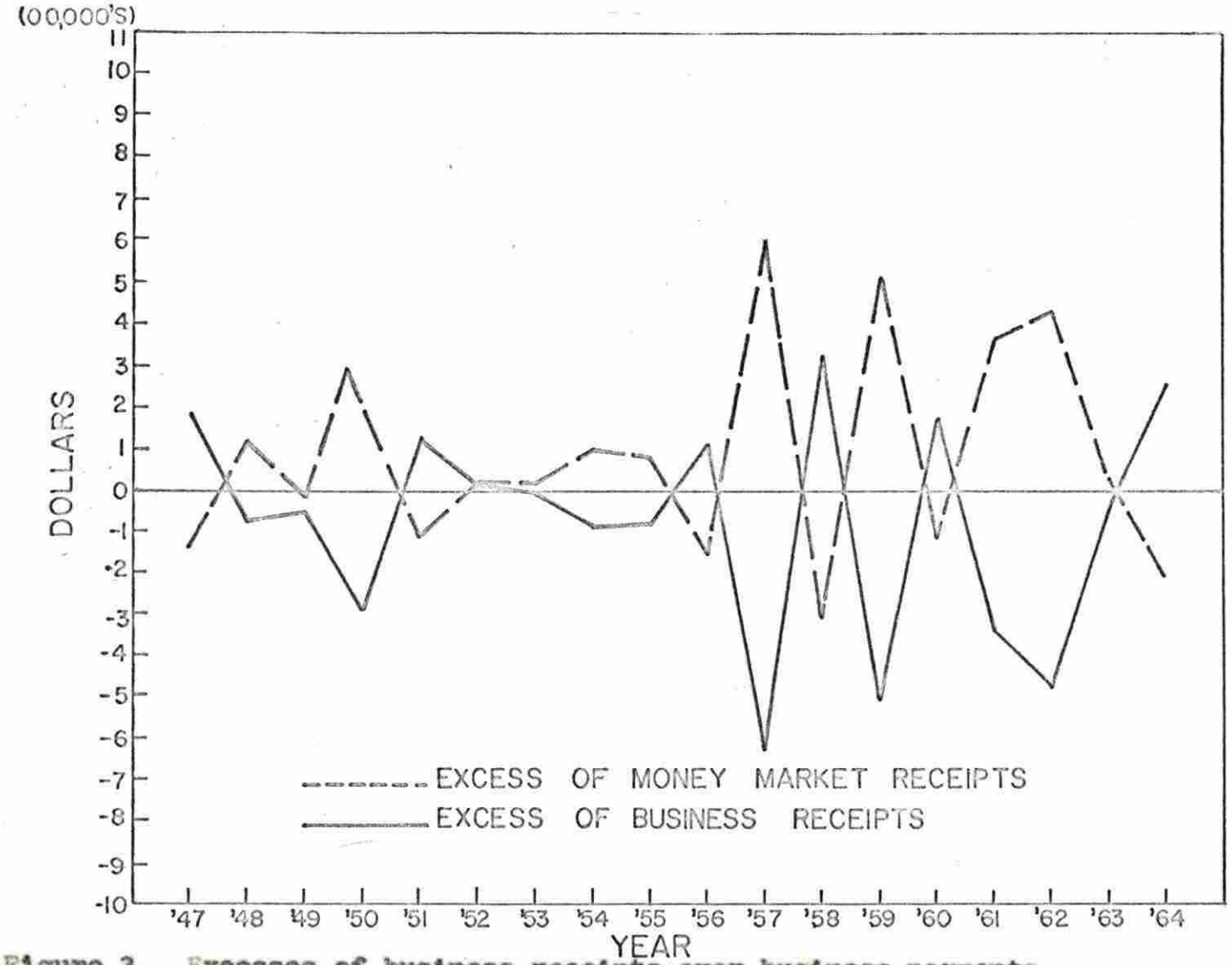

Figure 3. Excesses of business receipts over business payments

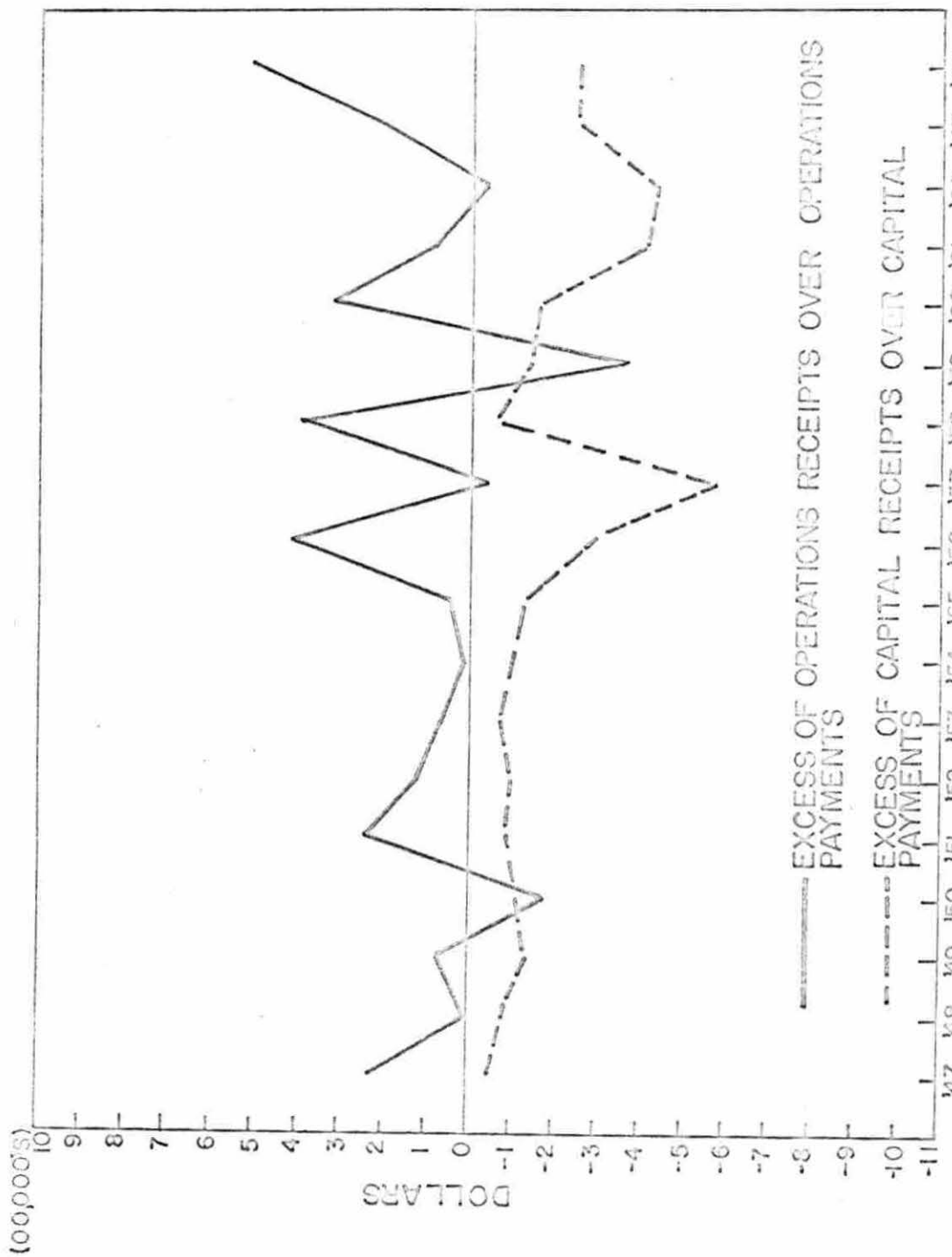

Figure 4. Excesses within business transactions

ing t, $\Delta I\&A_t$. What is left of ΔOA_t will be denoted by ΔOA^*_t. This gives us

(2-9) $CB_t = - Dep_t - \Delta NFA_t - \Delta I\&A_t - \Delta OA^*_t$.

$(- Dep_t - \Delta NFA_t)$ is sometimes called gross investment or gross expenditures on fixed assets. Gross expenditures on fixed assets and the change in investments and advances are the two main components of the capital budget.[3]

In only two years has gross investment deviated markedly from its mean value---1956 and 1961, in which it was over $230,000. For the most part gross investment in year t falls within a range bounded by gross investment in year t-1 plus or minus 10%. During the period 1954-1957 gross investment was quite stable.

The secret to the extreme increase in the capital budget deficit lies in $\Delta I\&A_t$. $\Delta I\&A_t$ is composed of loans and advances to subsidiaries and of purchases of subsidiaries. In 1953 this account gave an excess of receipts over expenditures of $25,000. In 1954 and 1955 it changed to a small excess of payments over receipts. This excess of payments over receipts carries over into 1957 where it reached a maximum of $476,000. The gross expenditures on fixed assets of the firm were small relative to $\Delta I\&A_t$.

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[3]A listing of cash transactions for the period 1947-1964 is enclosed in Appendix B.

In a sense the expenditures in $\Delta I\&A_t$ are gross investment for the firm, though not as concretely so as direct acquisition of fixed assets. The substantial excess of payments over receipts in 1961 and 1962 are different from the usual excess. Again these are due to $\Delta I\&A_t$. In 1960 $\Delta I\&A_t$ expenditures were $15,000; in 1961 they increased to $176,000 and to $371,000 in 1962.

This results in two periods of great expansion in the firm. The first period is from 1954 to 1957, the second from 1961 to 1964. Both have called for large amounts of funds. The largest part of the funds was needed for expansion of subsidiaries while a smaller part was due to increasing fixed assets and replacement of worn-out fixed assets.

Figure 3 shows that in 1957 the largest net borrowing took place in the money market. In 1961 and 1962 the borrowing was also large. Evidently the need for funds for the expansion during these times was primarily financed by going to the money market, rather than internally.

The second half of business transactions is the operating budget. Like the capital budget it also has many components. The Equation 2-8 which contains the operating budget in mathematical notation is too general. It makes no allowance for individual current liabilities, current assets,

or costs and expenses. The operating budget in a more specific form is

$$(2\text{-}10) \quad OB_t = (NSOI_t - \Delta TR_t) - (CSO_t - \Delta AP_t + \Delta Inv_t + \Delta OCA_t) - (PIT_t - \Delta RIT) - Div_t$$

where:

ΔTR_t = the change in trade receivables during t,

CSO_t = costs, selling, and other expenses during t,

ΔAP_t = the changes in accounts payable during t,

ΔInv_t = the change in inventories during t,

ΔOCA_t^* = the change in other current assets during t,

PIT_t = provision for income taxes during t,

ΔRIT_t = the change in reserve for income taxes during t,

Div_t = dividends during t, and

$NSOI_t$ = net sales and other income during t.

The firm has had an increase in sales in 16 out of 18 years. This would lead one to expect the operations payments to exceed the operations receipts due to increases in inventory, trade receivables, and other earning assets. This is because of the firm's desire to achieve as large as profits possible when the probability of obtaining them is large. Figure 4, however, which shows the operations

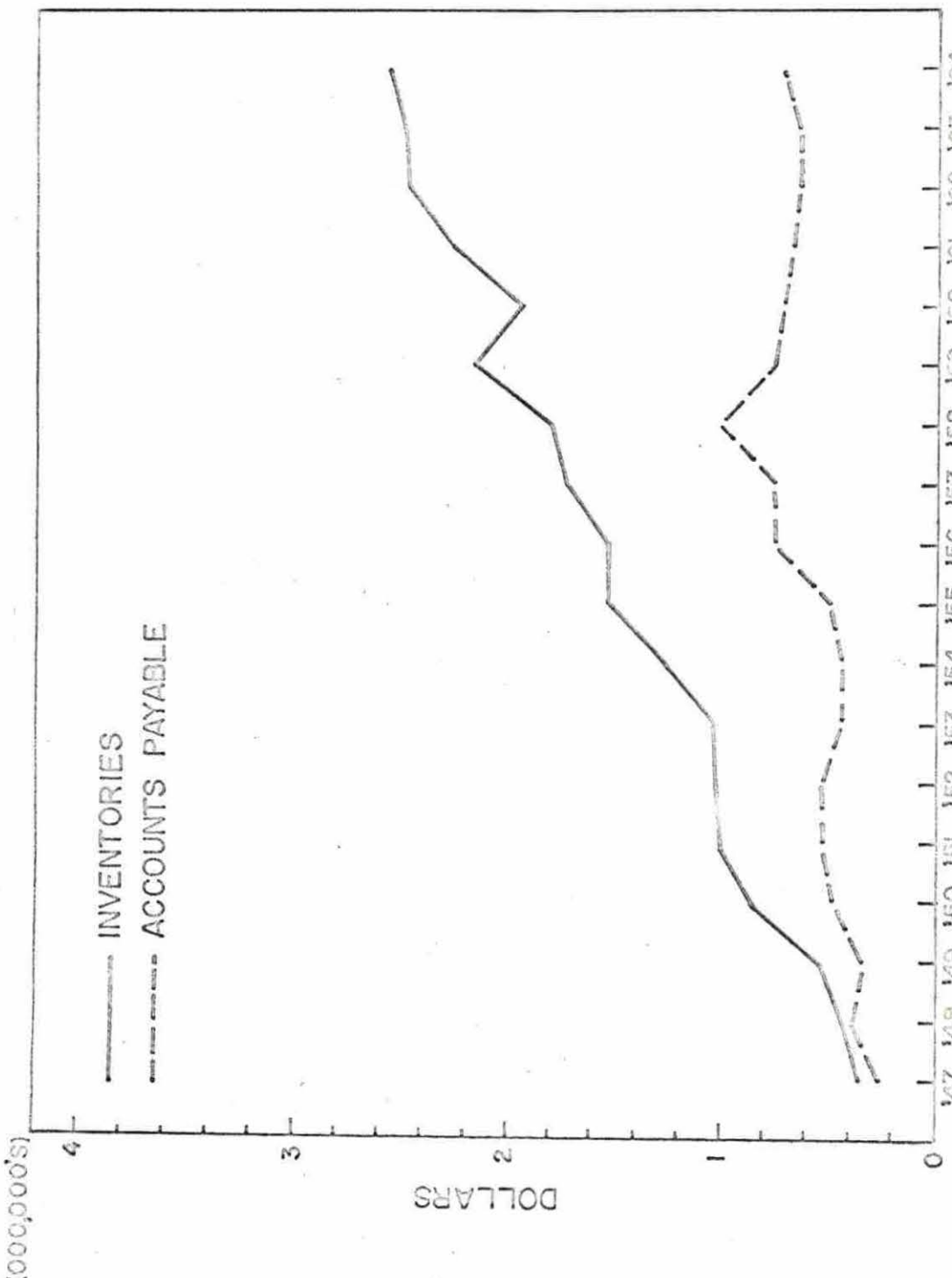

Figure 5. Inventories and accounts payable

budget as well as the capital budget indicates that in fact operations payments have exceeded operations receipts in only four years. In 1962, one of the four years, sales actually declined. This leaves only three years when operations payments have exceeded operations receipts when sales have increased.

One reason for expecting payments to exceed receipts when sales go up is the expansion of trade receivables. This amounts to the firm financing its sales with a type of credit. If the firm expands trade receivables when increasing sales, it actually puts off the day when the money arrives at the firm. Figure 1 plots sales and business receipts. Receipts lag behind sales by about one period, as was expected. This lag of receipts means operations payments should exceed operations receipts.

The explanation of why operations receipts exceed operations payments must lie in other components of Equation 2-10. Since dividends are not usually paid until the following period as are income taxes, these two are eliminated as explanations.

The part of Equation 2-10 left, $-(CSO_t - \Delta AP_t + \Delta Inv_t + \Delta OCA_t)$, must be the area where the answer lies. The most likely contenders are ΔInv_t and ΔAP_t. Figure 5 shows the magnitude of each of these elements. In 1956, 1958, 1963,

and 1964 ΔAP_t was larger than ΔInv_t and in 1960 ΔAP_t was not as negative as ΔInv_t. This means that as inventory increased accounts payable were increased more, or that the firm was using accounts payable to finance itself, and explains to some degree why operations receipts have been able to exceed operations payments. It need not be true that as sales increase the current expenditures will exceed current receipts.

Debt Structure and Money Market Transactions

Money market transactions were defined to be those in which money principal is received or returned. A more specific statement of this is

$$(2\text{-}11) \quad MM_t = \Delta D_{sb_t} + \Delta D_{so_t} + \Delta D_{L_t} + \Delta IPS_t - \Delta G_t$$

where:

ΔD_{sb_t} = the change in short-term bank debt,

ΔD_{so_t} = the change in short-term other debt, and

$\Delta D_{s_t} = \Delta D_{sb_t} + \Delta D_{so_t}$.

Government securities transactions or ΔG_t have been quite small in the firm. From 1947 to 1953 the amount held was about $1,000. In 1954 it purchased $20,000 worth and in 1955 it purchased $20,000 more. The firm has not held any since 1959. This indicates while it did hold government

securities, it was not participating very actively.[4]

Another component which has not contributed much to money market transactions is ΔIPS_t. Appendix A shows that the issuance of capital stock, or ΔIPS_t, has been small. The reason for this is that the firm is primarily owned by one family. To issue more capital stock is either to dilute its control over the corporation or increase the family's investment in it. Both can be undesirable from the individual's point of view. An increase in investment in the firm means that the owners are unable to diversify their personal portfolios as much as they may want. In this case the issuance of capital stock depends on many things outside of the firm as well as on the inside.

Since government securities and issued and paid-in surplus play a rather insignificant role in the exchange of money principal, the bulk of the money market transactions lies in the other three components, $\Delta D_{s_{b_t}}$, $\Delta D_{s_{c_t}}$, and ΔD_{L_t}. Of these, $\Delta D_{s_{c_t}}$ needs clarification. This debt is made up of loans to the company by stockholders and company officers. There are two primary reasons for its existence.

The first is that if no credit is available from other

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[4]It is the author's opinion that the firm, more or less, didn't want to be bothered with government securities so sold them for convenience.

sources and there is a need for funds, then the owners are going to have to finance the need by themselves or cut down on expenditures. If profits look good, they will be reluctant to do the latter. They could finance expansion of the firm by issuing capital stock to themselves but this amounts to a permanent type of loan and may interfere with their plans for their personal portfolios. Although they may not be willing to make changes in their personal portfolios for a long time they may be willing to do so for a short period of time. But in that case the best thing to do would be simply to lend to the firm on a short-term basis.

The second reason for stockholders and officer loans is that the loans pay interest at a rate which is less than the rate paid on bank loans. At the same time the rate is above rates paid on savings deposits at savings-and-loan associations. The result is to encourage owners and officers to alter the structure of their personal portfolios. The first reason or the desire to expand the firm seems to be the most important during the first years of the study because the firm could not get a long-term loan until 1954. Additions to long-term funds then had to come from profitable operations and short-term loans from owners and officers. In this case, the title "short-term" loan is probably an indication of optimism rather than the actual length of time the debt existed.

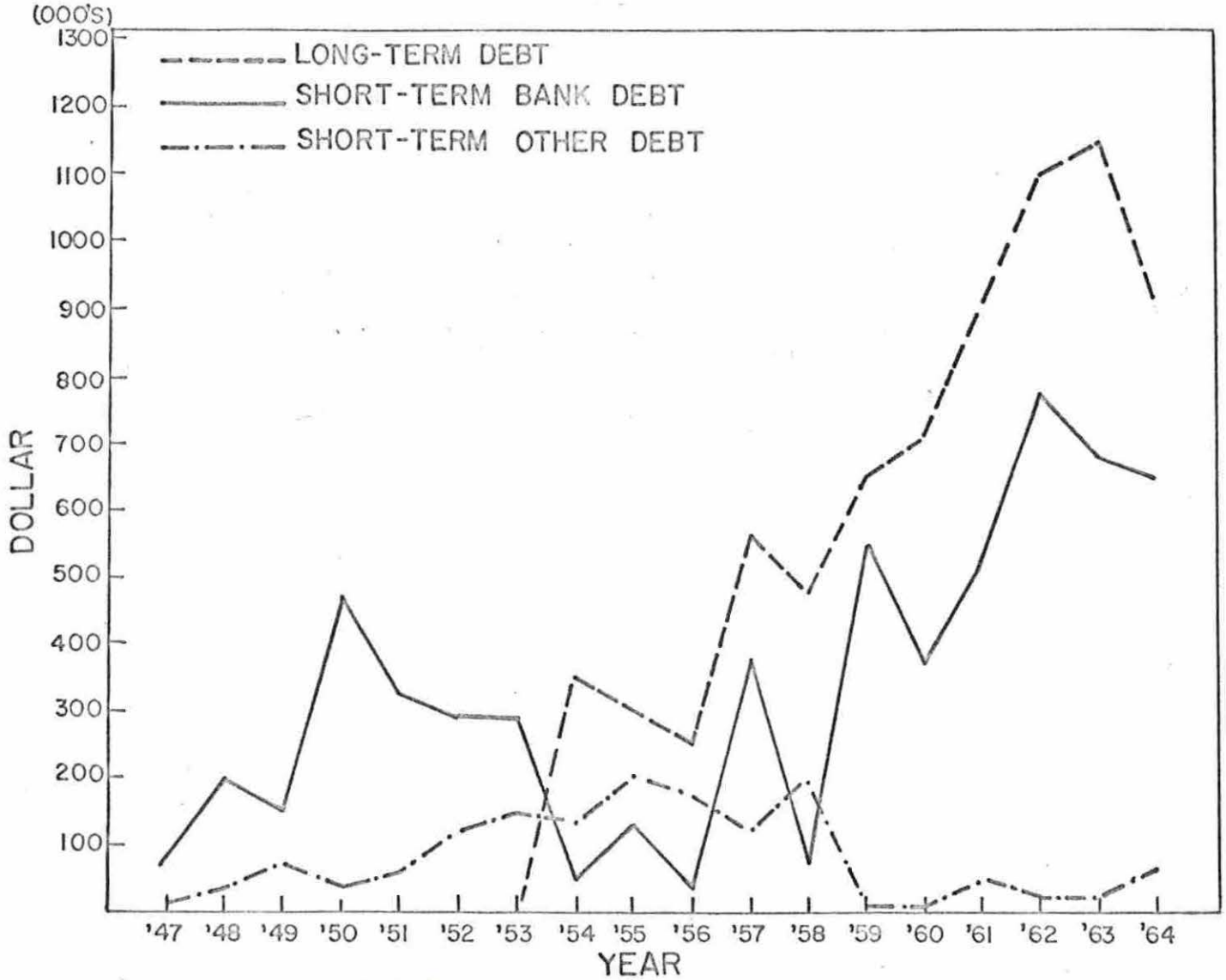

Figure 6. Structure of debt

Figure 6 shows the magnitudes of the three types of debt for the years 1946 to 1964. An interesting thing happens here. The long-term debt increases in 1954 and then tapers off for two years. In 1957 it increases again, and drops down in 1958. It is as though the firm first borrowed and then returned money in order to convince the sources of the funds that it could pay off the debt. This is not too unlikely with any firm in its first dealings with an outside source of funds. From 1959 on long-term debt increases substantially until finally decreasing in 1964.

Short-term bank loans appear always to have been a primary source of funds. They vary quite a lot and have in general increased. The particular information in Figure 6 about short-term bank debt, however, has some of the unreliable aspects of the cash balances discussed earlier. That is, each year's magnitude is only one out of a population of 250 possible values for a year. Although it probably is not quite so bad as cash, since the short-term loans are for 30-90 days, it does miss entirely seasonal variations.

The last type of debt on Figure 6 is short-term other debt. It played a more prominent role before long-term debt came into existence. Since that time it has decreased to a negligible amount. It would appear that up to 1958 the first factor, or the expansion of the firm, was the most im-

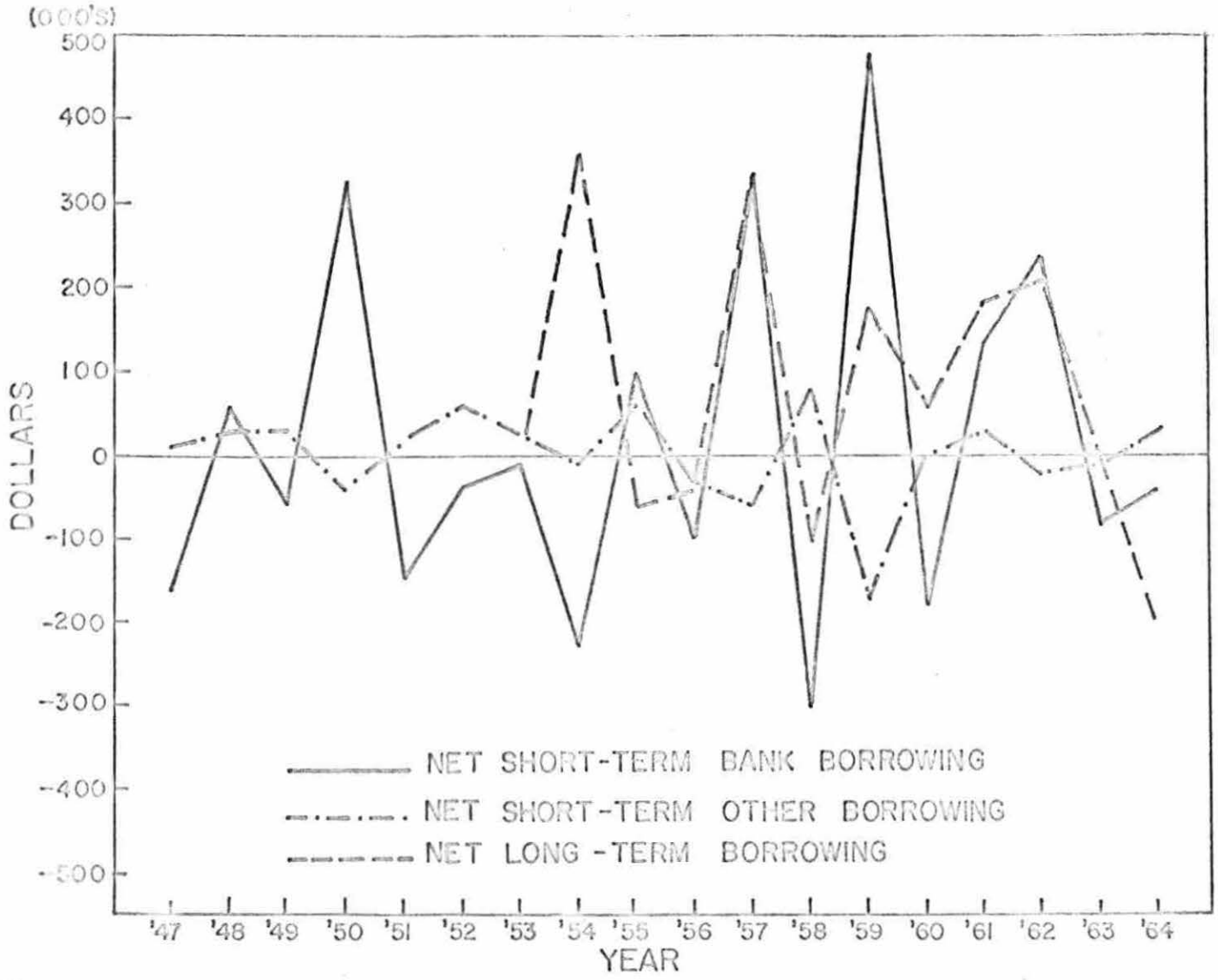

Figure 7. Changes in debt

portant for its existence. Since that time the higher interest rate than that paid on savings deposits at financial institutions appears to be the most important reason for officers and stockholders maintaining loans to the firm.

In order to show the relations among the various types of debt, Figure 7 has been drawn to show the excess of receipts over payments for the various types of debt. The excess is actually the net borrowing for each type of debt over the period.

The short-term debts tend to vary inversely with each other. This is especially true in the periods, 1947-1954, and 1957-1964. However, the excess in the short-term other debt is rarely of the same magnitude as for short-term bank debt. This indicates that they may be only partial substitutes for one another.

After 1957, the excess in long-term debt tends to vary in the same direction as the excess in short-term bank debt. This means that they do not appear to be substitutes for one another. Short-term debt should grow as current assets expand. At the same time, fixed assets could be expanding and long-term debt could be used for that purpose. It consequently is not possible to specify an exact relationship between these two types of debt.

Summary

In studying receipts and payments of the firm, certain things have come to light. First, much of the variation in the capital budget is due to variations in investments and advances. Only a smaller part of the variation is due to increases in expenditures on fixed assets. Most of the expenditures on fixed assets are replacement of worn-out fixed assets.

Operations receipts have been able to exceed operations payments in many years even though sales have increased in most of these years. This has been due to reductions in inventories and increases in accounts payable.

Long-term debt and short-term bank debt have both increased over the years, while at the same time short-term other debt has decreased to a very small amount. There appears to be little use of the different types of debt as substitutes for one another. However, short-term bank debt has gone up when short-term other debt has gone down. Also it has been since the introduction of long-term debt that short-term other debt has become small, although there does not appear to be any other direct relation between the two.

Non-Financial Flows

It is possible to substitute the more specific Equations 2-9, 2-10, and 2-11 into 2-8 to obtain

$$(2\text{-}12)\quad \Delta C_t = (NSOI_t - \Delta TR_t) - (CSO_t - \Delta AP_t + \Delta Inv_t + \Delta OCA^*_t) - (PIT_t - \Delta RIT_t) - Div_t - (Dep_t + \Delta NFA_t) - \Delta I\&A_t - \Delta OA^*_t + \Delta D_{s_{b_t}} + \Delta D_{s_{o_t}} + \Delta D_{L_t} + \Delta IPS_t - \Delta G_t.$$

It was mentioned above that $(\Delta ES_t - RED_t)$ could be left out of Equation 2-8 depending on one's preferences because it is always equal to zero. It must be in Equation 2-12 if it is desirable to subtract out the income statement. The income statement is

$$(2\text{-}2)'\quad NSOI_t - CSO_t - PIT_t - Dep_t - Div_t - RED_t = 0$$

Subtracting Equation 2-2' from Equation 2-12 plus $(\Delta ES_t - RED_t)$ leaves

$$(2\text{-}12)\quad \Delta C_t = -\Delta Inv_t - \Delta TR_t - \Delta OCA^*_t + \Delta AP_t + \Delta RIT_t + \Delta ES_t - \Delta NFA_t - \Delta I\&A_t - \Delta OA^*_t + \Delta D_{s_{b_t}} + \Delta D_{s_{o_t}} + \Delta D_{L_t} + \Delta IPS_t - \Delta G_t.$$

As it appears to people on the outside loaning money to the firm the left- and right-hand sides of Equation 2-12 have been negative much of the time. The view from the inside is different: management would look at it as an expansion of the firm. To portray the role of the firm, Equation 2-12 is multiplied by (-1) and the money market transactions are shifted to the left-hand side to obtain

$$(2\text{-}13)\quad \Delta D_{s_{b_t}} + \Delta D_{s_{o_t}} + \Delta D_{L_t} + \Delta IPS_t - \Delta C_t - \Delta G_t = \Delta Inv_t +$$

$$\Delta TR_t + \Delta OCA^*_t - \Delta AP_t - \Delta RIT_t - \Delta ES_t + \Delta NFA_t + \Delta I\&A_t + \Delta OA^*_t$$

The assets and liabilities on the left-hand side are called financial in this case because they are ones that are cash, close to cash, or obtained cash for the firm. Those on the right-hand side will be called non-financial assets and liabilities.

For the most part the left-hand side of Equation 2-13 has been positive. It represents a flow of funds into the firm with a resultant burgeoning of non-financial assets. The components on the right-hand side are net changes in the respective accounts for the period. The sum of these components will be called a net non-financial flow or B_t. It comes about by the firm either increasing debt or lowering cash or both. It was shown above that the firm has preferred most often to increase debt.

The net non-financial flow can be broken or simplified into three main components. The first part, to be denoted ΔA_{c_t}, is the change in current non-financial assets minus the change in current non-financial liabilities. It is the net change on non-financial current accounts. The second part is the net expenditures on fixed assets and other non-current assets. This includes ΔNFA_t, $\Delta I\&A_t$, and ΔOA^*_t. For simplicity's sake it will be called net investment, denoted

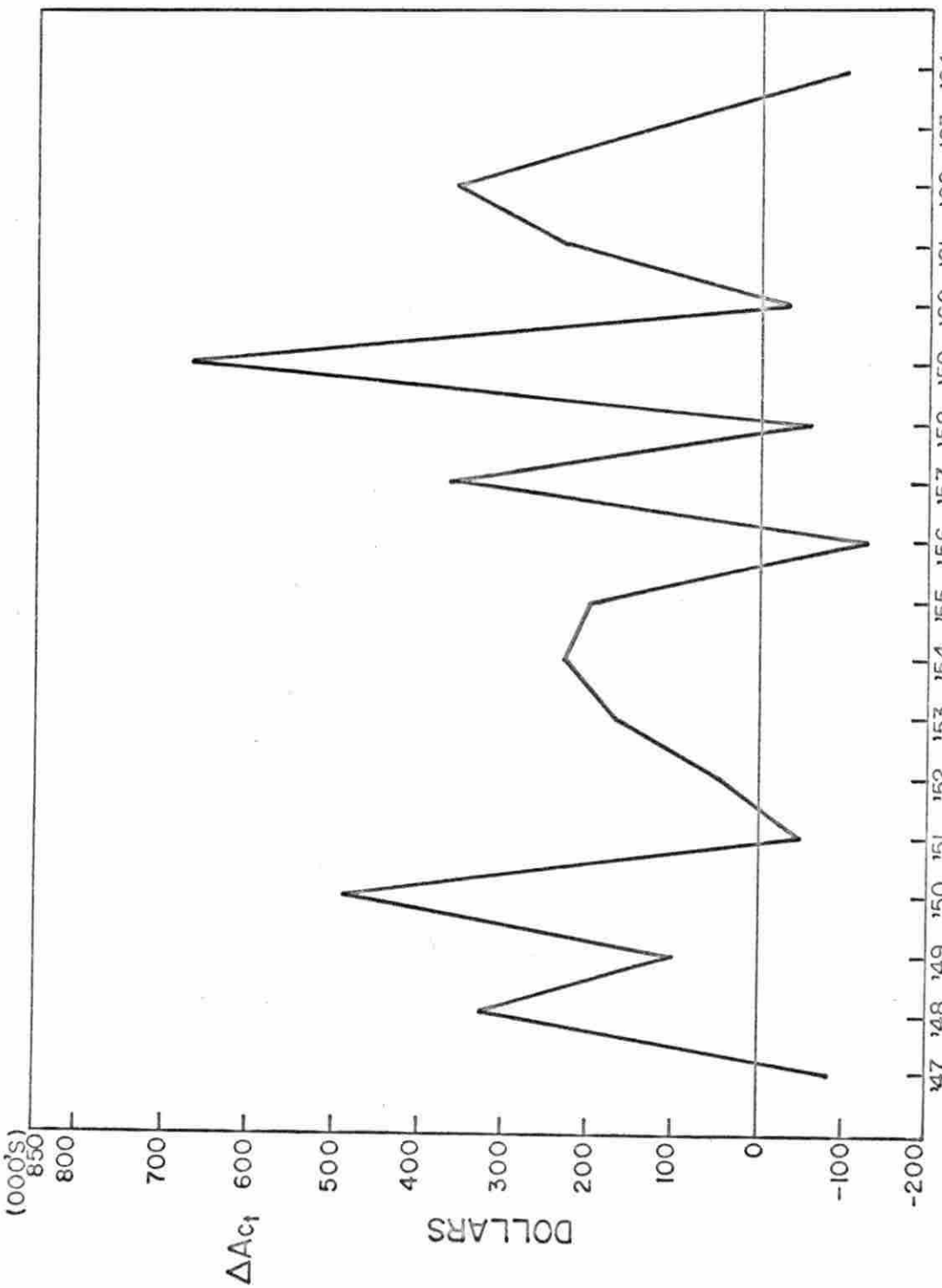

Figure 8. Net change in current non-financial assets

by I_t. The third part is $\Delta ES_t = RED_t$.

ΔA_{c_t} should vary quite a bit since as anticipations of sales go up, the firm will increase inventories to be ready for the increase in sales. Also, as sales go up trade receivables will go up. This increase in current non-financial assets will be dampened to some extent by increases in accounts payable. Most of the variation should be due to seasonal factors---for example, in the early spring the firm adds inventory to get ready for the big sales which take place in the spring, summer, and fall.

If accounts payable do not increase as much as current non-financial assets, then the firm must increase debt or lower its cash or government securities position to pay the difference. Most of this effect should go to short-term debt.

Figure 8 shows ΔA_{c_t} on an annual basis. This is shown for historical and not for analytical purposes because it misses seasonal variation.

Summary

Over the years the firm has increased its debt while expanding its non-financial assets. This means that the net non-financial flow has been positive and has been primarily financed by debt. Changes in debt can be modified to some extent by lowering cash and government securities. Cash,

however, has remained constant over time and government security transactions have been largely insignificant. The firm has chosen, so to speak, a combination of debt and liquidity to meet the net non-financial flow. In the next chapter a theory about this choice of debt and liquidity will be presented. In the following chapters a statistical model will be used to test this theory using monthly information rather than the annual data which has been presented in this chapter.

A THEORY OF FINANCIAL DECISIONS

This chapter is essentially a restatement of a theory of W. H. L. Anderson in his book, Corporate Debt and Fixed Investment (1). His theory will be presented in the first part of this chapter. One change in his model made in the latter part of this chapter is the inclusion of short-term other debt. This is due to the particular characteristics of the firm and not to theoretical concepts.

The Theory

The right-hand side of Equation 2-13 was called a net non-financial flow. For the time being it will be denoted by B_t to simplify the discussion. Changes in the various types of debt plus the change in issued and paid-in surplus will be denoted by ΔD_t. Changes in cash and in government securities will be denoted by ΔL_t, the change in liquidity during period t. This gives

(3-1) $$B_t = \Delta D_t - \Delta L_t.$$

In order to develop the theory it is assumed that t is a short period of time (1, p. 30). The period of time is short enough so that the firm has decided what its production will be, the terms of credit it will give and take, and the prices at which it will sell goods and services.

According to the identity Equation 3-1 the firm must

choose a combination of debt and liquidity equal to B_t. The set of possible solutions is infinite. But since the firm does not want to add debt and liquidity in equal amounts forever, there must be a solution to Equation 3-1 which is an optimum combination of ΔD_t and ΔL_t. This is called an optimum solution.

It is also assumed that for the firm there is some safe level of debt denoted by D_t^* and some necessary level of liquidity by L_t^* (1, p. 32). Since in making a decision the firm knows the level of each, it can compare its actual debt with its safe level of debt and its actual level of liquidity with its necessary level of liquidity.

The smaller is $(L_t - L_t^*)$ in the system of real numbers the greater is the probability of being caught short of liquidity and being forced to dispose of other assets to raise cash. The smaller is $(D_t^* - D_t)$ the larger is the probability of not being able to pay off debts and, also, of being considered a poor risk by one's creditors (1, p. 32).

These risks or dangers should result in certain behavioral patterns in a firm. For example, the smaller is $(L_{t-1} - L_t^*)$, the greater borrowing or debt accumulation should be, because the firm dare not lower liquidity any further and must borrow additional funds to meet the requirements of B_t. Similarly, the smaller is $(D_t^* - D_{t-1})$ the more

hesitant the firm should be to borrow any larger amounts.

The risks or dangers should also affect liquidity accumulation. In this case the smaller is $(L_t^* - L_{t-1})$ the less liquidity the firm would like to accumulate. Finally, the smaller is $(D_t^* - D_{t-1})$ the less liquidity the firm will accumulate, because it will be hesitant to accumulate any further debt and will try to satisfy Equation 3-1 by lowering liquidity or at least not accumulating it as quickly.

It should be true that interest rates have an effect on safe debt and necessary liquidity. As the interest rate goes up, it makes debt more costly and requires a larger payment to the lender. This means that as the interest rate on borrowing increases, the amount of safe debt should decrease.

The treasury bill rate should affect safe debt and necessary liquidity too. As the treasury bill rate goes up, liquidity is more desirable to hold than previously and necessary liquidity is therefore higher.

The above discussion indicates that there are two components of the marginal cost of outside funds. The first is increasing risk as D_{t-1} gets larger. The second is the cost of the interest rate. Similarly, there is a marginal benefit of liquidity. The first component of it is the decreasing risk as liquidity accumulates, and the second com-

ponent is the treasury bill rate or lending rate.

An optimal solution of ΔD_t and ΔL_t would be one that equates the marginal cost of debt with the marginal benefit of liquidity subject to Equation 3-1.

The above discussion can be written as

(3-2) $\Delta D_t = f(B_t, D_{t-1}, D_t^*, L_{t-1}, L_t^*, i_t, i_t')$, and

(3-3) $\Delta L_t = g(B_t, D_{t-1}, D_t^*, L_{t-1}, L_t^*, i_t, i_t')$,

where:

i_t = the borrowing rate during t, and

i_t' = the lending or treasury bill rate during t.

According to Anderson the following should be true of the partial derivatives of f and g

(3-4) $$0 < \frac{\partial f}{\partial B_t} = 1 + \frac{\partial g}{\partial B_t} < 1,$$

(3-5) $$\frac{\partial f}{\partial D_{t-1}} = \frac{\partial g}{\partial D_{t-1}} < 0,$$

(3-6) $$0 < \frac{\partial f}{\partial D_t^*} = \frac{\partial g}{\partial D_t^*},$$

(3-7) $$\frac{\partial f}{\partial L_{t-1}} = \frac{\partial g}{\partial L_{t-1}} < 0,$$

(3-8) $$0 < \frac{\partial f}{\partial L_t^*} = \frac{\partial g}{\partial L_t^*},$$

$$(3\text{-}9) \quad \frac{\partial f}{\partial i_t} = \frac{\partial g}{\partial i_t} < 0, \text{ and}$$

$$(3\text{-}10) \quad 0 < \frac{\partial f}{\partial i_t'} = \frac{\partial g}{\partial i_t'} \text{ (1, p. 33).}$$

The partials in Equation 3-4 take the values they do because the larger B_t is the larger the right-hand side of Equation 3-1 has to be. Part of an increase in B_t will probably be taken care of by an increase in ΔD_t. The rest of B_t must be made up by a decrease in ΔL_t because

$$(3\text{-}11) \quad \frac{\partial f}{\partial B_t} = \frac{\partial(\Delta D_t)}{\partial B_t} = \frac{\partial(B_t + \Delta L_t)}{\partial B_t} = 1 + \frac{\partial(\Delta L_t)}{\partial B_t} = 1 + \frac{\partial g}{\partial B_t}.$$

In Equation 3-5 if D_{t-1} increases that means that $(D_t^* - D_{t-1})$ will be less. Then ΔD_t should decrease or be less than it would have had there been a smaller D_{t-1}. Because of constraint, Equation 3-1, liquidity must decrease in order to satisfy Equation 3-1 because

$$(3\text{-}12) \quad \frac{\partial f}{\partial D_{t-1}} = \frac{\partial(\Delta D_t)}{\partial D_{t-1}} = \frac{\partial(B_t + \Delta L_t)}{\partial D_{t-1}} = 0 + \frac{\partial(\Delta L_t)}{\partial D_{t-1}} = \frac{\partial g}{\partial D_{t-1}}.$$

The formulation of Equation 2-6 is very close to Equation 2-5. As the amount of safe debt increases this means that D_t can be larger or that ΔD_t can be larger than before D_t^* increased. According to Equation 3-1 ΔL_t has to be larger and by the same amount as ΔD_t increased.

It should be clear because of the constraint, Equation

3-1, that the partials of ΔD_t and ΔL_t in Equation 3-3 through Equation 3-10 must be equal. In the following explanations of the various partials the discussion of equality will be omitted.

In Equation 3-7, the $\frac{\partial f}{\partial L_{t-1}}$ is less than zero because as L_{t-1} gets larger this means that $(L_t^* - L_{t-1})$ is smaller and less need exists for more L_t. In Equation 3-8 as L_t^* gets larger it means that $(L_t^* - L_{t-1})$ is larger and the risk associated with it is larger. Therefore, the firm should prefer a larger amount of L during t and thus, ΔL_t should be larger.

In the discussion previous to Equation 3-2 it was stated that as i increased, debt would be more costly to accumulate. This is why its partial is less than zero in Equation 3-9. In Equation 3-10 the partials follow what was mentioned previous to Equation 3-2 about liquidity accumulating faster as the treasury bill rate goes up.

Anderson expresses Equation 3-2 and Equation 3-3 as the following linear approximations:

(3-13) $\Delta D_t = a + b(D_{t-1} - D_t^*) + c(L_{t-1} - L_t^*) + eB_t + hi + ji'$, and

(3-14) $\Delta L_t = a + b(D_{t-1} - D_t^*) + c(L_{t-1} - L_t^*) + (e - 1)B_t + hi + ji'$,

where:

b, c, and h are < 0, and

e and j are > 0 (1, p. 33).

Letting F be equal to $a - bD_t^* - cL_t^* + hi + ji'$, and substituting, the results are:

(3-15) $\Delta D_t = bD_{t-1} + cL_{t-1} + eB_t + F$, and

(3-16) $\Delta L_t = bD_{t-1} + cL_{t-1} + (e - 1)B_t + F$.

The first difference of Equation 3-15 is

(3-17) $\Delta^2 D_t = b\Delta D_{t-1} + c\Delta L_{t-1} + e(\Delta B_t) + \Delta F$.

Hence,

$(\Delta D_t - \Delta D_{t-1}) = b\Delta D_{t-1} + c\Delta L_{t-1} + e(\Delta B_t) + \Delta F$, or

$\Delta D_t = \Delta D_{t-1} + b\Delta D_{t-1} + c\Delta L_{t-1} + e(\Delta B_t) + \Delta F$.

Adding $(c\Delta D_{t-1} - c\Delta D_{t-1})$ to the right-hand side the following is obtained:

(3-18) $\Delta D_t = \Delta D_{t-1} + b\Delta D_{t-1} + c\Delta D_{t-1} + c\Delta L_{t-1} - c\Delta D_{t-1} + e(\Delta B_t) + \Delta F$, or $\Delta D_t = \Delta D_{t-1}(1 + b + c) - c(B_{t-1}) + e(\Delta B_t) + \Delta F$.

For constant $B_t = \overline{B}$ and $\Delta F = \overline{\Delta F}$, $\Delta B = 0$ and

(3-19) $\Delta D_t = \Delta D_{t-1}(1 + b + c) + \overline{\Delta F} - c\overline{B}$.

For t = 1,

$\Delta D_1 = \Delta D_0(1 + b + c) + \overline{\Delta F} - c\overline{B}$.

For t = 2,

$$\Delta D_2 = \Delta D_1(1 + b + c) + \overline{\Delta F} - c\bar{B}, \text{ or}$$

$$= \Delta D_0(1 + b + c)^2 + (\overline{\Delta F} - c\bar{B})(1 + b + c) + (\overline{\Delta F} - c\bar{B}),$$

$$= \Delta D_0(1 + b + c)^2 + (\overline{\Delta F} - c\bar{B})(1 + b + c) + \overline{\Delta F} - c\bar{B}.$$

In general, the solution for period t is:

(3-20) $$\Delta D_t = \Delta D_0(1 + b + c)^t + (\overline{\Delta F} - c\bar{B})(1 + b + c)^{t-1} + \ldots + (\overline{\Delta F} - c\bar{B})(1 + b + c)^{t-t}.$$

In equilibrium $\Delta D_t = \Delta D_{t-1}$ which implies

$$\Delta D_t = \Delta D_t(1 + b + c) + \overline{\Delta F} - c\bar{B}.$$

Hence,

$$\Delta D_t - \Delta D_t(1 + b + c) = \overline{\Delta F} - c\bar{B}, \text{ or}$$

$$\Delta D_t(-b - c) = \overline{\Delta F} - c\bar{B}, \text{ so}$$

(3-21) $$\overline{\Delta D_t} = \frac{(\overline{\Delta F} - c\bar{B})}{-(b + c)}$$ which is the equilibrium solution for ΔD_t.

A similar procedure can be applied to Equation 3-14 to obtain

(3-22) $$\Delta L_t = \Delta L_0(1 + b + c)^t + (b\bar{B} + \overline{\Delta F})(1 + b + c)^{t-1} + \ldots + (b\bar{B} + \overline{\Delta F})(1 + b + c)^{t-t},$$ and the equilibrium solution is

(3-23) $$\overline{\Delta L_t} = \frac{(b\bar{B} + \overline{\Delta F})}{-(b + c)}.$$

If $2 + b + c > 0$ or if $b + c > -2$ then for any devia-

tion of D_{t-1} from D_t^* an adjustment will be made according to Equation 3-20. For example, if $(D_{t-1} - D_t^*)$ is greater than zero, the firm would lower ΔD_t but too far. The next period it would increase ΔD_{t+1} but again too far. However the distance in t+1 would not be as far from $\overline{\Delta D}$ as it was in t and ΔD eventually will converge to the equilibrium value of $\overline{\Delta D}$. This case is shown in Figure 9. The case of $2 + b + c < 0$ is shown in Figure 10.

If $1 + b + c > 0$ or $b + c > -1$, then ΔD_t would come closer to the equilibrium value without going past it. This case is shown in Figure 11.

Assume that there is no secular trend upwards or downwards in B_t (1, p. 34). If this is the case, B_t can be represented by its cyclical average even if it does vary over the course of a business cycle.

Let the secular change in F be $\Delta F = -b\Delta D^* - c\Delta L^*$. Substituting this into Equation 3-21 results in

$$\Delta D = \frac{- b\Delta D^* - c\Delta L^* - cB}{- (b + c)} \text{ so,}$$

$$- (\Delta D)(b + c) = - b\Delta D^* - c\Delta L^* - cB, \text{ or}$$

$b\Delta D + c\Delta D = b\Delta D^* + c\Delta L^* + cB$. This can be changed into:

$$b\Delta D - b\Delta D^* = c\Delta L^* - c\Delta D + cB. \text{ Thus,}$$

$$\Delta D - \Delta D^* = \frac{c}{b}(\Delta L^* - \Delta D + B), \text{ or}$$

(3-24) $\Delta(D - D^*) = \frac{c}{b}(\Delta L^* - \Delta D + B)$

If ΔD^* is substituted for ΔD, then $\Delta(D - D^*) = (\frac{c}{b})$ $(\Delta L^* - \Delta D^* + B)$. If $(\Delta L^* - \Delta D^* + B) > 0$ or $B > (\Delta D^* - \Delta L^*)$ then $\Delta(D - D^*) > 0$. This results in the firm moving into a more and more risky situation because the average net non-financial flow exceeds the difference in the growth of safe debt and necessary liquidity. Since the firm is sensitive to this risk it should try to alter B if it can such that the average net non-financial flow is equal to $(\Delta D^* - \Delta L^*)$.

It was assumed on page 38 that the firm had made its decisions about production, the prices of goods and services, and the terms it would issue and receive credit. In the long run this assumption does not have to hold. It can alter at least a part of B which will be denoted by B_{con}. The part which is uncontrollable will be denoted by B_{ucon} such that $B_{con} + B_{ucon} = B_t$.

The firm will try to alter B_{con} such that it is maximizing profits while $B_t = (\Delta D^* - \Delta L^*)$. If it neglects profits and raises prices and cuts back its expenditures, it can lower B_t but only to some minimum. It then crosses a point where the flow of receipts into the firm is stemmed or else retained earnings are lowered to the point where again B_t increases to equality with $(\Delta D^* - \Delta L^*)$. In this latter

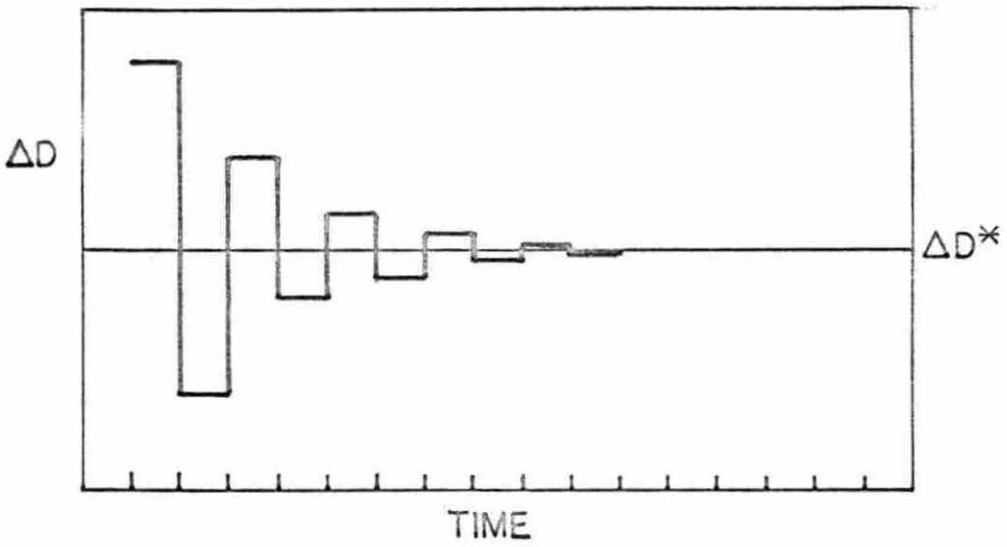

Figure 9. Converging situation

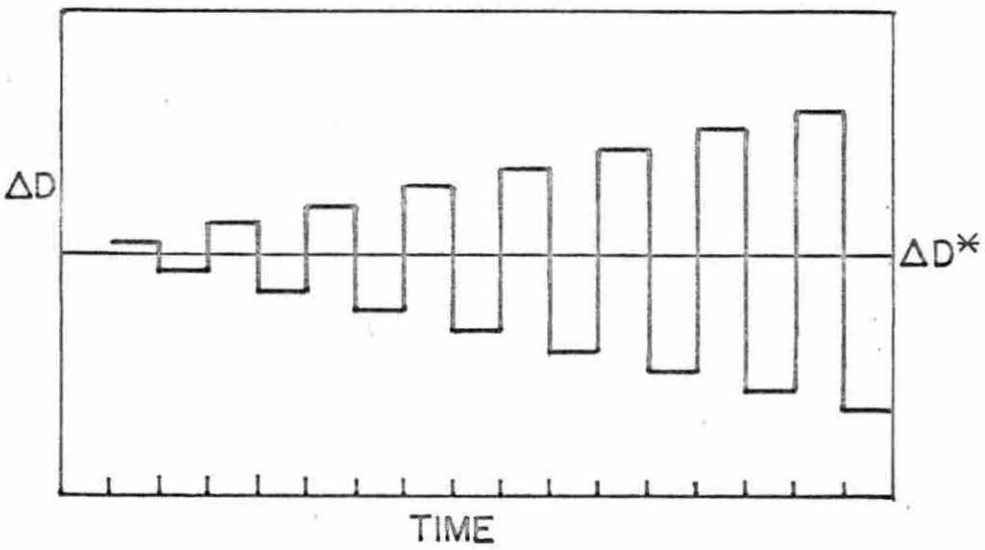

Figure 10. Diverging situation

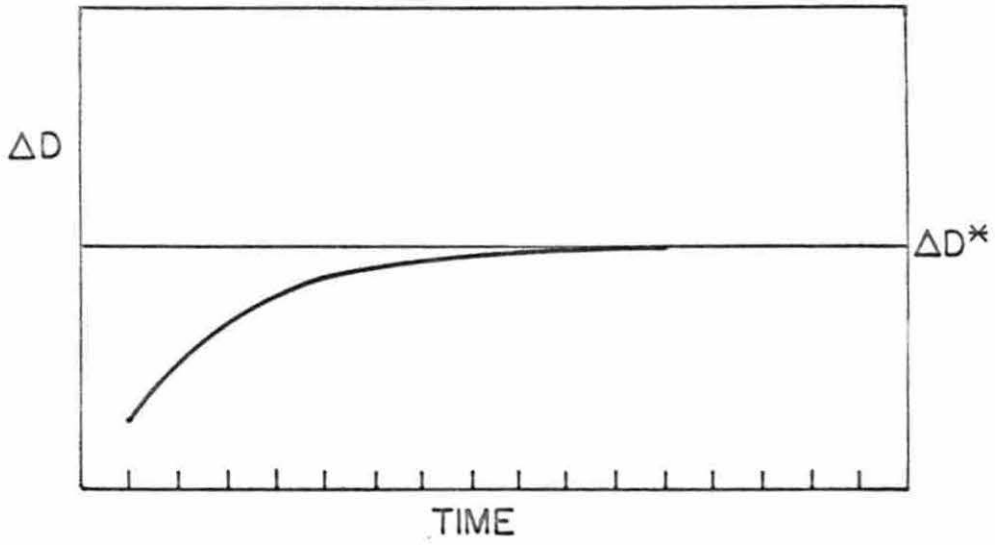

Figure 11. Monotonically converging situation

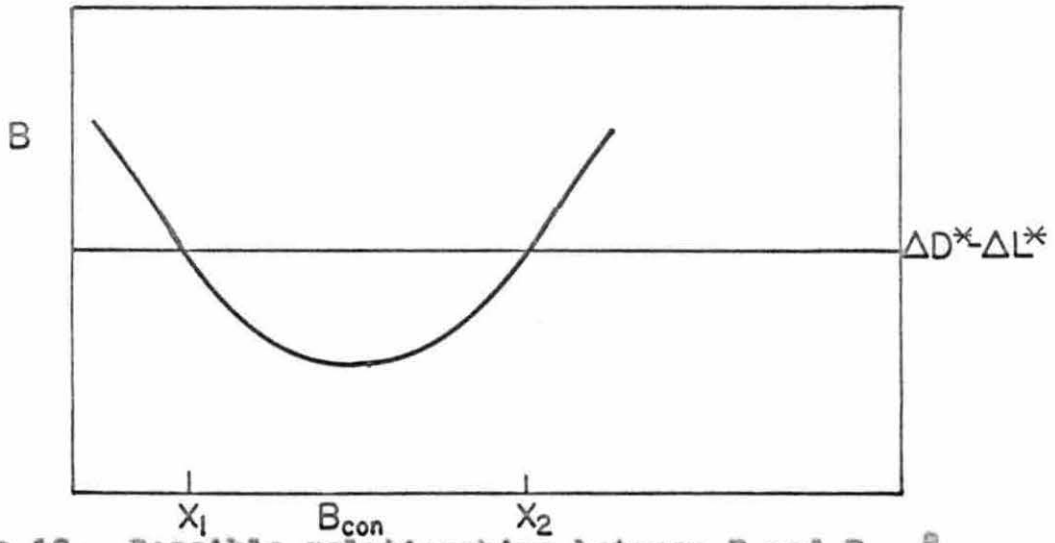

Figure 12. Possible relationships between B and B_{con}[a]

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[a]Source: (1, p. 36)

case, however, the firm is not maximizing profits. This is shown in Figure 12, where X_1 and X_2 represent points of B_{con} where $B_{con} + B_{ucon} = (\Delta D^* - \Delta L^*)$. What it amounts to is that as the firm tries to lower B_{con} the uncontrollable part of B increases more than B_{con} lowers. This is because as the firm raises prices on the goods it sells, the firm decreases total revenue because the demand curve has an elastic portion in it. Also, the firm may cut out some services which shift the demand curve back and, consequently decrease total revenue more than the decrease in expenditures.

Though Anderson doesn't mention it, there may be an exception to the above rule. That is, a firm may lower prices to the point where B_t becomes greater than $(\Delta D^* - \Delta L^*)$, but have larger profits in the long run so that the average net non-financial flow = $(\Delta D^* - \Delta L^*)$. This might happen in a case where the lower prices enable a firm to acquire a monopoly and consequently reap larger profits and, therefore, larger retained earnings in the future.

Safe Debt and Necessary Liquidity

This section will spell out more clearly just what safe debt depends on. In the previous section the determination of D^* was mentioned in a naive manner by using the interest rate and the treasury bill rate. Other factors than these affect it.

In addition, the various types of debt will be listed in this section. It should be pointed out that the only addition to Anderson's theory here is to split short-term debt into two types---short-term bank debt and short-term other debt.

The term "liquidity" implies that an asset can either be used as a medium of exchange or be converted into a medium of exchange at short notice with only a small sacrifice in the price of the asset. Cash is obviously liquid, since it is a medium of exchange. Government securities are also liquid because they can be readily converted into cash due to the organized market for them. Other assets are not so liquid because of the time involved in disposing of them or because of the reduction in the price of the goods which may have to take place in order to dispose of them quickly. Examples of less liquid assets are inventories, fixed assets, and trade receivables. In this paper the set of liquid assets consists only of cash and government securities.

It was hypothesized by Keynes that as transactions go up, so should the demand for money (11). This is the same thing as saying that necessary cash should go up as transactions go up. Using sales as a measure of transactions, necessary cash should rise as sales rise.

A second factor entering into the demand for cash is the amount of current liabilities. Liabilities are called

"current" if there is some expectation of having to pay them in the near future. If there are expectations of having to pay larger current liabilities, the amount of necessary cash should increase.

The current liabilities are short-term bank debt, short-term other debt, accounts payable, accrued tax liabilities, and dividends payable. Short-term bank debt and short-term other debt will be measured by their balance at the end of the previous period. Tax liability will be measured as of the current period. Dividends payable will be measured by those payable in the next period. Accounts payable will not be included because it is generally collinear with sales (1, p. 40).

The factors that necessary cash depend on can be summarized as

$$(3\text{-}25)\quad C_t^* = f_c^*(S_t, D_{s_{b_{t-1}}}, T_{a_t}, D_{s_{o_t}}, Div_{t+1}),$$

where:

C_t^* = necessary cash,

S_t = sales during t,

$D_{s_{b_{t-1}}}$ = debt outstanding to banks at the end of the previous period,

$D_{s_{o_{t-1}}}$ = debt owed to others at the end of the previous period,

T_{a_t} = accrued tax liability at the end of t, and

Div_{t+1} = dividends payable in the next period.

The other type of liquidity is government securities. Government securities can not usually be used as a medium of exchange but, as was pointed out above, they can be converted into cash rather quickly. Their greatest attribute relative to cash is that they earn interest. Since they are essentially a buffer stock against expected and unexpected needs for cash, they should depend on the things that necessary cash depends on. Government securities should especially depend on current liabilities that have a known payment date---for example taxes, dividends, etc. Government securities should also depend on the lending or treasury bill rate. As the treasury bill rate increases, it is more profitable to hold them, so the holdings of government securities should increase.

The necessary amount of government securities can be written as

$$(3\text{-}26) \quad G_t^* = f_{g^*}(S_t, T_{a_t}, D_{s_{b_{t-1}}}, D_{s_{o_{t-1}}}, Div_{t+1}, i'_t)$$

where:

G_t^* = necessary amount of government securities, and

i'_t = the treasury bill rate during t, and the other terms are as previously defined.

The firm has four tools which it can combine to determine its debt structure. These are short-term bank debt, short-term other debt, long-term debt, and issued and paid-in surplus.

Firms with short-term debt must be concerned with their ability to repay them since the notes usually have a date on which repayment must be made. Ability to repay at a specific time will depend on the stock of liquid assets and expected cash flows. The more liquid assets the firm has and the larger its profits, the greater will be the firm's ability to repay. Additionally, the larger the tax liability, the smaller the amount of liquidity that the firm may use for debt repayment. These relationships can be written in mathematical notation as

$$(3\text{-}27) \quad D^*_{s_{b_t}} = f_{d^*_{s_b}}(RED_t, C_{t-1}, G_{t-1}, T_{a_t})$$

where:

$D^*_{s_{b_t}}$ = safe short-term bank debt during t, and

RED_t = retained earnings during t.

The other type of short-term debt is that which is loaned to the company by stockholders and officers. This debt should be dependent on other factors than short-term bank debt is because of the stockholders' and officers' desire to diversify their investment portfolios, and of possible greater returns on other investments than the company.

It can be hypothesized that such loans are dependent on the same factors as short-term bank debt and test the hypothesis to see if it should be rejected. This will be written as,

(3-28) $D^*_{s_{o_t}} = f_{d^*_{s_o}}(RED_t, C_{t-1}, G_{t-1}, T_{a_t})$

where:

$D^*_{s_{o_t}}$ = safe level of short-term other debt.

In an interview study of a group of large manufacturing firms it was found that there was a widespread use of a long-term debt limit based on total assets (4). Most firms seemed to have some idea as to the amount of safe long-term debt. The amount was formulated in the policy of the firms and was considered a routine matter. The firms interviewed seemed to adhere closely to the policy and to avoid actions which might push them over the limit. Accepting this as general behavior, we write

(3-29) $D^*_{L_t} = f_{d^*_L}(TAS_{t-1})$

where:

$D^*_{L_t}$ = safe long-term debt during t, and

TAS_{t-1} = total assets at the end of the previous period.

The last type of debt to be considered is equity financing. This is quite different from the other types of debt. In this case there is no obligation to repay the principal,

although there is usually an obligation to pay dividends. Apparently the worst disadvantage to equity financing is that the number of shares has to be added to the denominator in calculating the earnings per share. Donaldson found that manufacturers felt their primary obligation to the stockholders was to maintain or improve earnings per share (4). Consequently, they were reluctant to issue shares unless the possibility of lowering earnings per share was considered quite remote. As a result, established firms rarely use equity financing to raise funds. Anderson points out that efforts to explain the variations in equity financing have, more or less, been fruitless (1). Anderson, therefore, leaves it out of his theory and is satisfied with an approximation. This omission has little consequence for the firm dealt with in this study. It has been reluctant to issue equity because it is a family corporation and doesn't want to dilute control.

One problem with the discussion so far is that there can be relations among the types of debt and among the types of liquidity. That is they can be substitutes for one another. This means that there may be some correlation between the dependent variables. For example, if one kind of debt is high and another is low, we might expect less accumulation of the former and more of the latter. The same

could be true for liquidity. Due to feedback in t+1 from what the debt and liquidity were at the end of t there may be some revisions in the structure of debt and liquidity because of regret or some other principle of choice. Consequently, in the statistical model in the next chapter, this feedback will be included as independent variables as well as the independent variables of this chapter. Feedback will be included in the analysis by regressing the dependent variables on all possible independent variables.

THE STATISTICAL MODEL AND THE HYPOTHESES

The purpose of this chapter is twofold. First, a statistical model for firms in general and a specific model for the firm of this study will be presented. Second, the values the estimators of the impact of the independent variables with respect to the various dependent variables will be hypothesized.

The General Statistical Model

The first assumption made in order to get a model for firms in general is that the impact of the independent variables on the dependent variables is linear. The general form of the statistical model is

$$
\begin{aligned}
(4\text{-}1)\quad Y_{t(r)} = {} & \beta_{1(r)}X_{1t} + \beta_{2(r)}\Delta A_{c_t} + \beta_{3(r)}I_t + \beta_{4(r)}RED_t \\
& + \beta_{5(r)}C_{t-1} + \beta_{6(r)}S_t + \beta_{7(r)}G_{t-1} + \beta_{8(r)}T_{a_t} \\
& + \beta_{9(r)}D_{s_{b_{t-1}}} + \beta_{10(r)}D_{s_{o_{t-1}}} + \beta_{11(r)}i_{t-1} \\
& + \beta_{12(r)}D_{L_{t-1}} + \beta_{13(r)}TAS_{t-1} + \beta_{14(r)}i'_t \\
& + \beta_{15(r)}Div_{t+1} + u_{t(r)},
\end{aligned}
$$

where:

$Y_{t(r)}$ = the particular value of the r^{th} dependent variable in the t^{th} period,

X_{1t} = 1 for all t and r,

$\beta_{1(r)}$ = the intercept of the r^{th} dependent variable,

$\beta_{2(r)}$ ---- $\beta_{15(r)}$ = the coefficients of the 2nd through the 15^{th} independent variables for the r^{th} dependent variable,

$u_{t(r)}$ = the error term in period t for the r^{th} dependent variable, and the rest of the variables are as previously defined.

Other assumptions which are made are:

(4-2) $E(u_{t(r)}) = 0$,

(4-3) $E(u_{t(r)}^2) = \sigma_{(r)}^2$, and

(4-4) $E(u_{t_1(r)} u_{t_2(r)}) = 0$ where $t_1 \neq t_2$.

Also the distribution of $u_{t(r)}$ is assumed to be normal with mean 0 and variance $\sigma_{(r)}^2$. In addition it is assumed that the independent variables are fixed and have no probability distribution. Finally, it is assumed that there are no exact linear relations between any of the independent variables (10).

The Specific Statistical Model

Equation 4-1 is the statistical model for testing the theory over many firms. This model requires some modifica-

tions before it can be used for a single firm. $\beta_{14(r)}$ will not be estimated because the firm has used government securities only sparingly. Because of this, it was thought that it would not be worthwhile to test ΔG_t as a dependent variable. Moreover, the lending rate, i'_t, was to have its greatest impact on government securities and is of little use if ΔG_t is not being tested. However, it was decided to leave G_{t-1} in the model in order to see if there is any relation between ΔC_t and G_{t-1}. It costs much less to put in an extra independent variable than to test an extra dependent variable. $\beta_{15(r)}$ will not be estimated because the firm has paid no dividends over the period in consideration. The variable $Div_{t+1} = 0$ for all t.

The variables TAS_{t-1} and $D_{L_{t-1}}$ are independent variables in the general model. Both will affect the same dependent variable. Anderson has found that the correlation coefficient between the two is usually very high and because of this he finds it useful to combine the two into a single variable called long-term debt capacity (1, p. 48). This is formulated by

$$K_{t-1} = v(TAS_{t-1}) - D_{L_{t-1}}, \tag{4-5}$$

where:

K_{t-1} = long-term debt capacity, and

v = a constant such that $.10 \leq v \leq .30$.

The constant v is used because of the debt limit that seems to exist with most firms. This debt limit most frequently lies between .10 and .30 of total assets (1, p. 48). For this firm it was arbitrarily decided to set v = .20 for ease of calculation and because this was felt to be a realistic value of v for this firm. The coefficient which measures the impact of K_{t-1} is equal to $\frac{-\beta_{13(r)}}{\beta_{12(r)}}$ and will be denoted by $\beta^*_{12(r)}$.

The specific model for this firm will thus be:

$$(4\text{-}6)\quad Y_{t(r)} = \beta_{1(r)}X_{1t} + \beta_{2(r)}A_{o_t} + \beta_{3(r)}I_t + \beta_{4(r)}RED_t + \beta_{5(r)}C_{t-1} + \beta_{6(r)}S_t + \beta_{7(r)}G_{t-1} + \beta_{8(r)}T_{a_t} + \beta_{9(r)}D_{s_{b_{t-1}}} + \beta_{10(r)}D_{s_{o_{t-1}}} + \beta_{11(r)}I_{t-1} + \beta^*_{12(r)}K_{t-1} + u_{t(r)}$$

for the t^{th} time period and the r^{th} dependent variable.

The data available for the firm are given monthly for the years, 1956-1964. Thus t = 1, 2, 3, ..., 108, where t = 1 corresponds to January of 1956 and t = 108 corresponds to December of 1964. It was decided to regress Equation 4-6 on only seven dependent variables. Hence, r = 1, 2, 3, ..., 7.

The seven dependent variables to be used are:

(1) $\Delta D_{s_{b_t}}$

(2) $\Delta D_{s_{o_t}}$

(3) ΔD_{L_t}

(4) ΔC_t

(5) $\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$

(6) $\Delta D_t = \Delta D_{s_{b_t}} + \Delta D_{s_{o_t}} + \Delta D_{L_t}$

(7) $B_t = \Delta D_{s_{b_t}} + \Delta D_{s_{o_t}} + \Delta D_{L_t} - \Delta C_t - \Delta G_t$.

The last dependent variable has little additional to offer after the first six. It will be used only as a check on the model to see if the model measures B_t to any extent. Little of the results will be displayed for B_t because ΔD_t and ΔL_t are the variables of interest.

The Hypotheses

The hypotheses will be taken one at a time, spelling out the anticipated effect of each independent variable. In a few cases the specific role of the independent variables won't be discussed if the case seems to follow prior cases.

The change in short-term bank debt

The first three independent variables, ΔA_{c_t}, I_t, and RED_t are the components of B_t. ΔA_{c_t} enters B_t being positive so its coefficient should be positive. The same

should be true for I_t, although its impact on short-term bank debt is questionable because it may have most of its effect on long-term debt. That is, long-term debt is generally used to acquire long-term or fixed assets. RED_t is negative in B_t, so it should have a negative coefficient, although there is some possibility of its having a positive coefficient because the firm may become more optimistic as profits rise. The firm would in this case increase its assets and hence acquire more debt.

The variable C_{t-1} should have a negative coefficient because the higher are cash and liquidity, the less need there is to borrow more cash. S_t should have a positive coefficient because as sales go up the transactions demand for the cash should rise. To get this cash the firm may have to borrow from a bank.

The higher is G_{t-1}, the more liquidity the firm has and the less need it has for more. It should consequently have a negative coefficient. T_{a_t} indicated a need for liquidity. One way to get this liquidity is to borrow it from a bank. T_{a_t} should therefore have a positive coefficient. $D_{s_{b_{t-1}}}$ should be a very important element of the equation since the higher it is the more risky is any addition to it. This should make it have a negative coefficient. The same reasoning could be true for $D_{s_{o_{t-1}}}$ because the higher is $D_{s_{o_{t-1}}}$

the larger is D_{t-1}. However, it may be that the types of debt are substitutes for one another so that the sign of the coefficient is questionable. This may happen if $D_{s_{o_{t-1}}}$ is high and the firm feels a larger $\Delta D_{s_{b_t}}$ is preferable to adding any more short-term other debt.

The higher is the interest rate the higher is the cost of borrowing. The variable i_{t-1} should therefore enter with a negative coefficient. The last variable, K_{t-1}, has a doubtful impact because of the substitutibility of long-term debt and short-term debt. The final result depends a lot on whether the firm uses the debt limit on all debt or just on long-term debt. Consquently, no specifications can be made concerning its effect on $\Delta D_{s_{b_t}}$.

The change in short-term other debt

The impact of the independent variables on short-term other debt should be about the same as on $\Delta D_{s_{b_t}}$ with only a few exceptions. The first exception is the effect of $D_{s_{b_{t-1}}}$. As the effect of $D_{s_{o_{t-1}}}$ on $\Delta D_{s_{b_t}}$ is questionable so is the effect of $D_{s_{b_{t-1}}}$ on $\Delta D_{s_{o_t}}$. Thus, no specification as to the impact of it will be made. In estimating $\Delta D_{s_{o_t}}$, though, $D_{s_{o_{t-1}}}$ should have a negative impact since the greater is debt of this type outstanding, the more risky is additional debt of that type. With these exceptions, the

results should be approximately the same as for $\Delta D_{s_{b_t}}$.

The change in long-term debt

ΔA_{c_t}, I_t, and RED_t should have much the same coefficients for D_{L_t} as for $D_{s_{b_t}}$ and $D_{s_{c_t}}$. The exceptions are that I_t will probably be stronger here and ΔA_{c_t} weaker, because it is expected that current accounts have more impact on short-term debt, and that fixed assets accounts have more impact on long-term debt.

C_{t-1}, S_t, and G_{t-1} should have impacts in the same sign but with less magnitude than on changes in short-term debt. The effects of $D_{s_{b_{t-1}}}$ and $D_{s_{c_{t-1}}}$ are questionable because D_L may be a substitute for each but over time they all may grow together. In estimating ΔD_{L_t}, i_{t-1} may have a negative impact, although the interest rate used is the rate on commercial bills and strictly speaking should have more relevance for short-term debt. The last variable, K_{t-1}, should have a strong impact in the equation because it is a measure of long-term debt capacity. The smaller is the capacity the smaller is the ability to accumulate more long-term debt, so it should enter with a positive coefficient.

The change in cash

B_t should have a negative effect on ΔC_t because it has generally been positive and ΔC_t should decrease to satisfy

$B_t = \Delta D - \Delta L$. ΔA_{c_t} and I_t are positive components of B_t so should enter with a negative sign. On the other hand, RED_t is negative and so should enter with a positive sign.

C_{t-1} should have an important effect on ΔC_t because the larger is cash and the less need there is for more of it. C_{t-1} should enter with a negative sign. S_t is also an important variable because it indicates the transactions demand for money. The larger are the transactions, the larger ΔC_t should be.

G_{t-1} will have a questionable impact because the larger it is, the less government securities will be accumulated. But at the same time ΔC_t may have to be positive to balance out to equal B_t. However, it may be that when G_{t-1} is high there is little need to accumulate more liquidity so cash will not increase much. T_{a_t} is a current liability and it should turn out that the higher it is the larger is the need for cash to pay it off. Thus, it should enter with a positive coefficient.

The higher $D_{s_{b_{t-1}}}$ and $D_{s_{o_{t-1}}}$, and the lower is K_{t-1}, the less likely it is the firm will borrow more to accumulate more cash. The first two should therefore enter with a negative sign and K_{t-1} should have a positive sign. The last variable, i_t, should have about the same effect on cash as the three variables just mentioned. This is because a

higher interest rate makes it more expensive to accumulate debt so cash should accumulate less or even decumulate in order to meet the requirements of B_t.

The change in debt in general

The independent variables should have about the same effect on the aggregate as on the individual types of debts. Because of this, the impact of the coefficients will not be discussed in detail. The dependent variables are $\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$ and $\Delta D_{s_{o_t}} + \Delta D_{s_{b_t}} + \Delta D_{L_t} = \Delta D_t$.

The reason for choosing these particular dependent variables in the regression equation is to see if there is any substitution among the types of debt. In the aggregate there should occur more actual explanations of the variation than for the individual type of debt since there should be less variation to explain. The less variance there is, of course, the less variance the estimator will take on, and consquently confirmation of the results from the previous regressions will be obtained.

REGRESSION RESULTS

The Dependent Variables

The F-test was used to test the hypothesis that all the β's, or coefficients of the independent variables, are equal to each other and equal to 0. For all six of the dependent variables, the value of F was large enough to reject the hypothesis that coefficients are all equal to 0. The F-value with 11 and 96 degrees of freedom at the .05 level is 1.90. The F ratios from the regression were 30.7747, 2.252, 7.370, 9.84, 33.85, and 26.727 for r = 1, 2, 3, ..., 6 respectively. Table 2 lists these values of the regression results.

Table 2. F's and R^2's, t = 1, 2, 3, ..., 108

	r = 1	r = 2	r = 3	r = 4	r = 5	r = 6
R^2	.7747	.2051	.4508	.5300	.7950	.7538
F	30.0097	2.2523	7.3700	9.8434	33.8512	26.7273

Overall, the statistical model explained much of the variation in most of the dependent variables. One exception was the variation of the changes in short-term other debt. Here the multiple correlation coefficient was only .2051. The actual and estimated values of $\Delta D_{s_{ot}}$ are shown in Figure 14. This poor result was to be expected because it was felt that other factors not related to the firm could influence this strongly. One of these factors mentioned above was the desire of the owners to diversify their personal portfolios.

The R^2 of the changes in short-term bank debt was .7747. This means that about .77 of the variation was due to regression. The results of the regression as compared with the actual values of $\Delta D_{s_{bt}}$ are shown in Figure 13. The result of $\Delta D_{s_{bt}} + \Delta D_{s_{ot}}$ was surprising. This is shown in Figure 17. The correlation coefficient between the two as shown in Table 4 was only .0271, indicating that they were substitutes only to a small degree. However, the R^2 for the sum of the two was higher than for either alone.

The R^2 of ΔD_{L_t} was .4578. This indicates that the model explained about half of the variation. The regression with the estimates of ΔD_{L_t} are shown in Figure 15. One reason for the low multiple correlation coefficient may be that the period of a month considers too much variation which is irrelevant to ΔD_{L_t}. Perhaps deseasonalized var-

iates would do a better job of indicating the sensitivity of ΔD_{L_t} to particular variates.

The explanation of ΔC_t was not high as shown in Figure 16. The R^2 was .53005. This is not as good as one might hope for a variate like cash. However, these results should be tempered by some of the factors mentioned in the digression on cash balances above.

The partial correlation coefficient between $\Delta D_{s_{b_t}}$ and ΔD_{L_t} was very small. Apparently the use of the one debt does not depend much on the use of the other; they are more or less independent of one another. The partial correlation coefficient between $\Delta D_{s_{o_t}}$ and ΔD_{L_t} is also very small. The regression of $\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$ and $\Delta D_{s_{b_t}} + \Delta D_{s_{b_t}} + \Delta D_{L_t} = \Delta D_t$ are shown in Figures 17 and 18.

The multiple correlation coefficient of the model in its attempt to explain variations in B_t was relatively good; .7627. To come extent, however, it merely reflects the large role played by $\Delta D_{s_{b_t}}$.

The Role of the Independent Variables

Table 3 lists the values of the regression result; the r's or dependent variables are column headings and the independent variables are row headings. The intersection of the r^{th} column with the first independent variable has three figures in it. The top figure is the estimated coefficient

or the impact of the independent variable on the r^{th} dependent variable. The middle figure is the standard error of the estimated coefficient. The last number is the t-value of the estimate.

The change in short-term bank debt

The first two components of B_t, ΔA_{c_t} and I_t, had positive coefficients. It follows that increases in B_t are to some degree financed by short-term debt. The third variable RED_t entered with a positive coefficient, although on a priori grounds it was assigned a negative coefficient. This may be because the firm feels it can borrow more when its profits go up. $\hat{\beta}_6$ is interesting in that it was thought that as sales went up the cash required would also increase, leading to an increase in borrowing. The estimate is negative, however, indicating that as sales go up short-term debt accumulates at a slower rate or possibly decreases. One possible explanation is that the firm had its assets high for an expected seasonal increase in sales. And as it reached the point of increased sales, it expected a seasonal decrease in sales and lowered assets at that time. It appears as though the firm was lowering assets as sales went up. The important variable it may have been looking at was expected sales rather than actual sales.

It was expected that the higher liquidity was in the

Table 3. Estimated coefficients of independent variables where r = 1, 2, 3, ..., 6 and t = 1, 2, 3, ..., 108

	r = 1	r = 2	r = 3	r = 4	r = 5	r = 6
Ac_t	.6554	.0032	-.0149	-.0554	.6725	.6296
	.0530	.0130	.0234	.0192	.0508	.0578
	12.3668	.2406	-.6344	-2.8893	13.2370	10.9014
I_t	.2839	-.0134	.4555	-.0575	.2793	.7346
	.1400	.0344	.0619	.0507	.1342	.1526
	2.0277	-.3899	7.3595	-1.1334	2.0811	4.8143
RED_t	.1627	.0351	-.1029	.1235	.0906	.0151
	.2907	.0715	.1285	.1052	.2786	.3168
	.5597	.4908	-.8012	1.1733	.3252	.0476
C_{t-1}	-.8553	-.0525	-.2203	-.9744	.9174	-1.2531
	.2708	.0666	.1197	.0980	.2596	.2951
	-3.1586	-.7888	-1.8407	-9.9409	-3.543	-4.2464
S_t	-.1341	-.0453	-.0649	.0090	-.1577	-.1655
	.0816	.0201	.0360	.0295	.0782	.0889
	-1.6441	-2.2565	-1.8009	.3033	-2.0176	-1.8624
G_{t-1}	-3.5746	.7971	-.3503	.0564	-2.5780	-3.0921
	1.3625	.3350	.6022	.4932	1.3060	1.4848
	-2.6236	2.3793	-.5817	.1143	-1.9754	-2.0825

Table 3 (Continued)

	r = 1	r = 2	r = 3	r = 4	r = 5	r = 6
T_{a_t}	.0514	.0032	-.0375	.0797	.0598	-.0202
	.1220	.0300	.0539	.0442	.1170	.1330
	.4216	.1078	-.6960	1.8050	.5115	-.1520
$D_{sb_{t-1}}$	-.0808	.0094	.0190	-.0230	-.0746	-.0915
	.0520	.0128	.0230	.0188	.0498	.0567
	-1.5399	.7365	.8262	1.2192	-1.4975	-1.6140
$D_{s_{o_{t-1}}}$	.4803	-.3061	-.1515	-.1722	.1473	-.1263
	.3422	.0841	.1512	.1239	.3280	.3729
	1.4037	-3.6382	1.0015	-1.3902	.4491	-.3388
i_t	8967.17	-12798.687	-16079.202	-1790.4443	-2679.67	-33263.404
	20080.118	4937.5058	8875.3577	7269.1760	19248.226	21882.676
	.4465	-2.5921	-1.8116	-.2463	-.1340	-1.5200
K_{t-1}	.0083	.0021	.1630	.0427	.0237	.2540
	.0889	.0219	.0393	.0322	.0852	.0968
	.0938	1.0125	14.1484	1.3273	.2785	.2622

Table 4. Correlation matrix where t = 1, 2, 3, ..., 108

	ΔA_{c_t}	I_t	RED_t	C_{t-1}	S_t	G_{t-1}
ΔA_{c_t}	1.0000					
I_t	.0912	1.0000				
RED_t	.2679	-.0278	1.0000			
C_{t-1}	-.2777	-.0615	-.1663	1.0000		
S_t	-.1285	-.1062	.6627	-.0647	1.0000	
G_{t-1}	.1147	-.0861	.0218	-.2060	-.1998	1.0000
T_{a_t}	-.2606	-.0951	-.1699	.2475	.1007	-.4027
$D_{s_{b_{t-1}}}$	-.1314	-.0863	.5005	.0127	.7906	.4641
$D_{s_{o_{t-1}}}$	.1634	-.1119	.0609	-.2405	-.1572	.9046
i_t	-.1189	.0150	-.2187	.1110	-.1076	-.1894
K_{t-1}	-.2021	-.1580	.0843	.0645	.2318	.4710
$\Delta D_{s_{b_t}}$	.8175	.2131	.0670	-.3442	-.3212	.0491
$\Delta D_{s_{o_t}}$	.0295	.0278	-.1068	.0095	-.1991	-.0766
ΔD_{L_t}	-.0662	.5640	-.1663	-.0717	-.1371	-.0438
ΔC_t	-.0868	-.0595	.1168	-.6290	.1704	.0123
$\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$	.8236	.2191	.0415	-.3453	-.3479	.0423
ΔD_t	.7445	.3610	.0252	-.3656	-.3197	.0326
B_t	.7652	.3732	-.0038	-.2085	-.3639	.0333

Table 4 (Continued)

	T_{a_t}	$D_{s_{b_{t-1}}}$	$D_{s_{o_{t-1}}}$	i_t	K_{t-1}	$\Delta D_{s_{b_t}}$
ΔA_{c_t}						
I_t						
RED_t						
C_{t-1}						
S_t						
G_{t-1}						
T_{a_t}	1.0000					
$D_{s_{b_{t-1}}}$	.2196	1.0000				
$D_{s_{o_{t-1}}}$	-.3783	-.4438	1.0000			
i_t	.2292	.1268	-.2529	1.0000		
K_{t-1}	-.0354	.0288	.4885	.1039	1.0000	
$\Delta D_{s_{b_t}}$	-.2095	-.2967	.1245	-.2684	-.0670	1.0000
$\Delta D_{s_{o_t}}$	.0002	-.0823	-.1972	-.1609	-.1080	-.0271
ΔD_{L_t}	-.0602	-.0847	-.0617	.1239	.0096	.0002
ΔC_t	.0497	.0947	.0143	.0417	-.0266	.0584
$\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$	-.2070	-.3108	.0995	-.2895	-.0777	.9911
ΔD_t	-.2302	-.3067	.0842	-.2058	-.1139	.9233
B_t	-.2378	-.3322	.0829	-.2123	-.1059	.9075

Table 4 (Continued)

	ΔD_{so_t}	ΔD_{L_t}	ΔC_t	$\Delta D_{sb_t} + \Delta D_{so_t}$	ΔD_t	B_t
ΔM_{c_t}						
I_t						
RED_t						
C_{t-1}						
S_t						
G_{t-1}						
T_{a_t}						
$D_{sb_{t-1}}$						
$D_{so_{t-1}}$						
i_t						
K_{t-1}						
ΔD_{sb_t}						
ΔD_{so_t}	1.0000					
ΔD_{L_t}	-.0082	1.0000				
ΔC_t	-.0390	.0346	1.0000			
$\Delta D_{sb_t} + \Delta D_{so_t}$	.1016	-.0002	.0537	1.0000		
ΔD_t	.0944	.2646	.1149	.9315	1.0000	
B_t	.1016	.2559	-.1277	.9166	.9701	1.0000

previous period there would be less desire or need to borrow additional funds in the next period. $\hat{\beta}_{5(1)}$ is consistent with these expectations. $\hat{\beta}_{7(1)}$, the impact of G_{t-1}, seems also to agree with the expectations. $\hat{\beta}_{9(1)}$ is not significantly less than zero. This is in agreement with our hypothesis that the higher is $D_{s_{b_{t-1}}}$, the more reluctant the firm is to accumulate that debt further.

The last result of importance for $\Delta D_{s_{b_t}}$ is as the interest rate goes up, $\Delta D_{s_{b_t}}$ is larger. This is contrary to the hypothesis. What it means is that the firm probably pays little or no attention to the interest rate when getting short-term loans.

The change in short-term other debt

Though the statistical model did not explain much of the variation of $\Delta D_{s_{o_t}}$, the effect of one of the independent variables' is interesting. This is the effect of the interest rate. It was anticipated that as the interest rate increased it might be an indication of a tightening of credit as well as a rise in the cost of borrowing. If credit is less available, then the owners should have to go to their own pockets to finance the firm assuming profitable uses for additional funds exists. In this case the regression analysis says that this does not happen but that the firm looks at the higher interest rate and decreases short-

-term other debt as i increases.

The change in long-term debt

Three variables seem to play an important role here. The first is I_t, which was expected. In this case the t-value was 7.36 indicating its coefficient was greater than zero. This means that this part of B_t seems to have a positive influence on ΔD_{L_t}.

The second important variable is the interest rate. As the interest rate goes up long-term debt accumulates at a slower rate. This is as was hypothesized.

The last important variable is long-term debt capacity. The larger is K_{t-1}, the larger is long-term debt accumulation. These three variables are the ones which it was hypothesized would have the largest effect on ΔD_{L_t}.

The change in cash balances

The explanatory value of the model on ΔC_t was only fair. The R^2 was .53, yet, as in the above dependent variables, certain variables played a quite significant role. The first important variable is ΔA_{c_t}. B_t always has to equal $\Delta D - \Delta L$. This means that ΔA_{c_t} should have a negative impact on cash accumulation because ΔA_{c_t} is usually a positive component of B_t. A positive ΔA_{c_t} does, in fact, produce a negative ΔC_t in this firm.

The most significant variable for predicting ΔC_t was cash at the end of the previous period. The higher the cash balances the less tendency there was to increase cash in the subsequent period. It was hypothesized that this would result because only a certain amount of cash would be necessary at a given time. Anymore cash would tend to be redundant and the firm could earn a higher return elsewhere on it.

Another important variable was the accrued tax liability at the end of t. It appears that the higher is the tax liability the larger is ΔC_t. This is consistent with the hypothesis.

The change in debt in general

The two dependent variables which are sums of specific types of debts have about the same results as for the individual debts. The only differences were mentioned at the beginning of the chapter.

A Qualification to the Results

The data on which the regression was run has one qualification. The firm had no records for the month of January and February as individual units. Instead the information of these two months was grouped together. In order to get monthly information for these two months, all changes from

December 31 to February 28 were divided into two equal parts; one part being called the change in January and the other part being called the change in February. Stock variables were determined for the end of January by taking an average of the December 31st value and the February 28th value.

Since it is possible that this might have influenced the results in a manner inconsistent with the information of the other months, it was decided to run the regression on the data omitting the information in January and February. These results are contained in Appendix C. No significant differences were obtained by deleting the information for January and February.

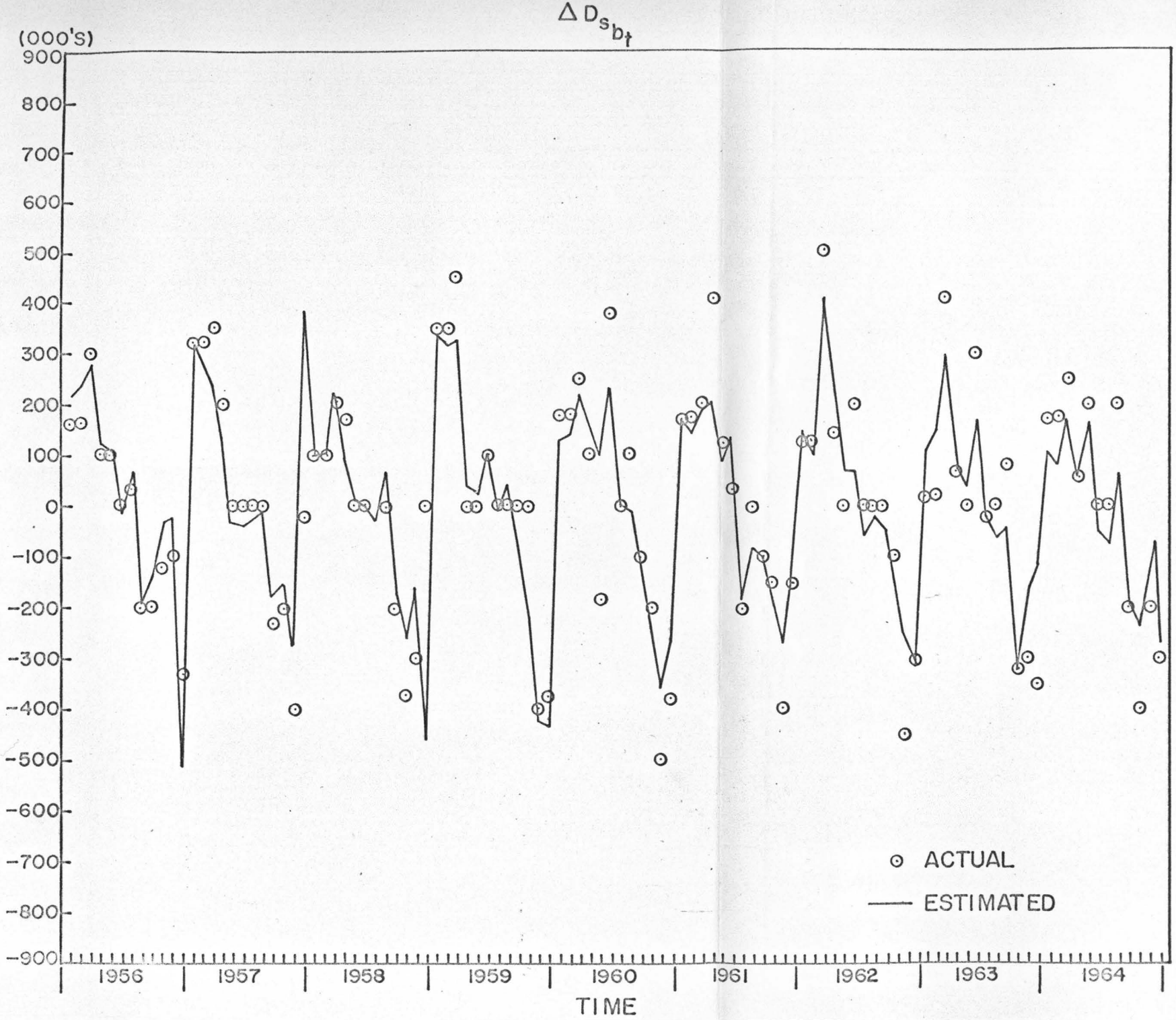

Figure 13. The change in short-term bank debt

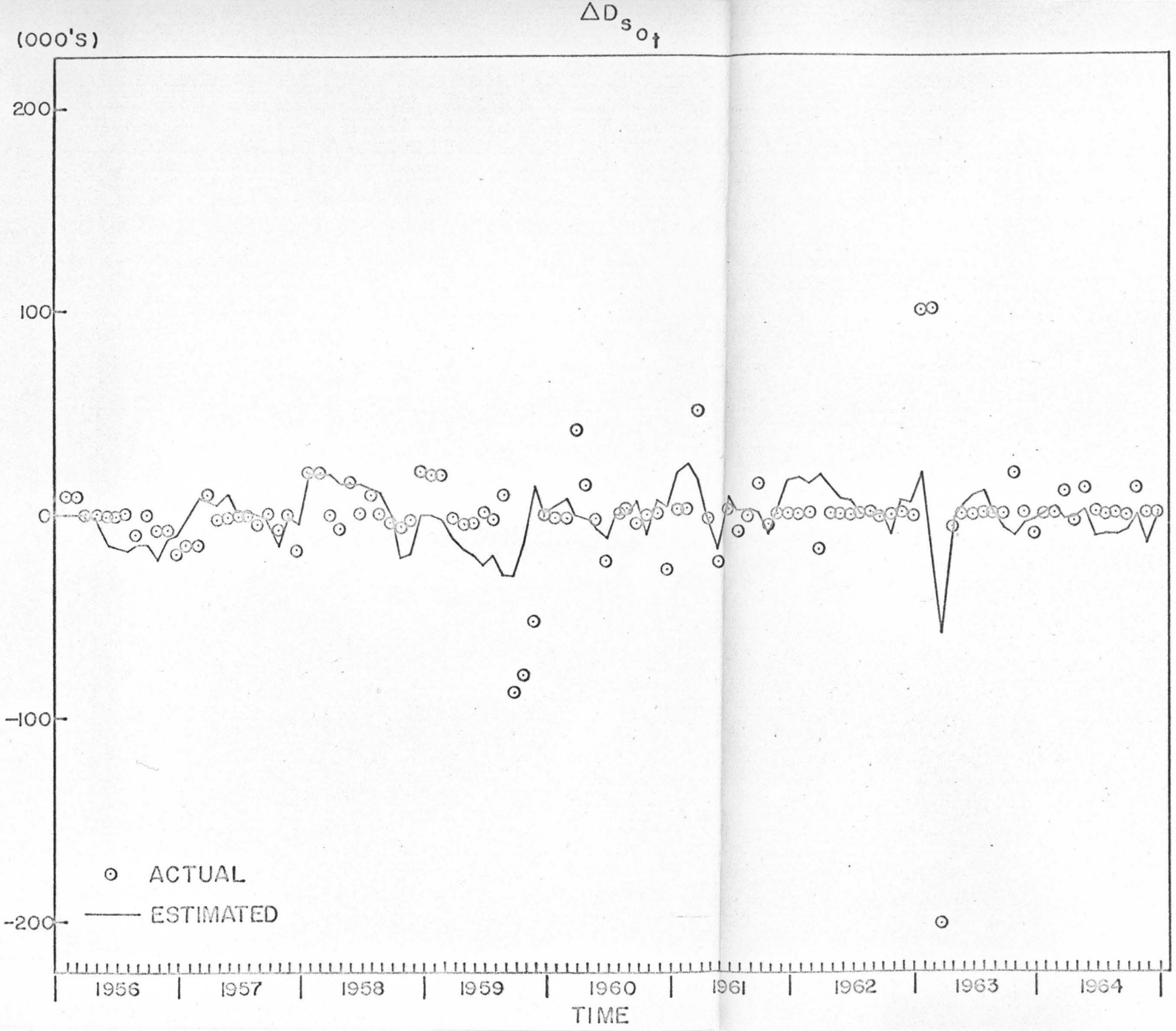

Figure 14. The change in short-term other debt

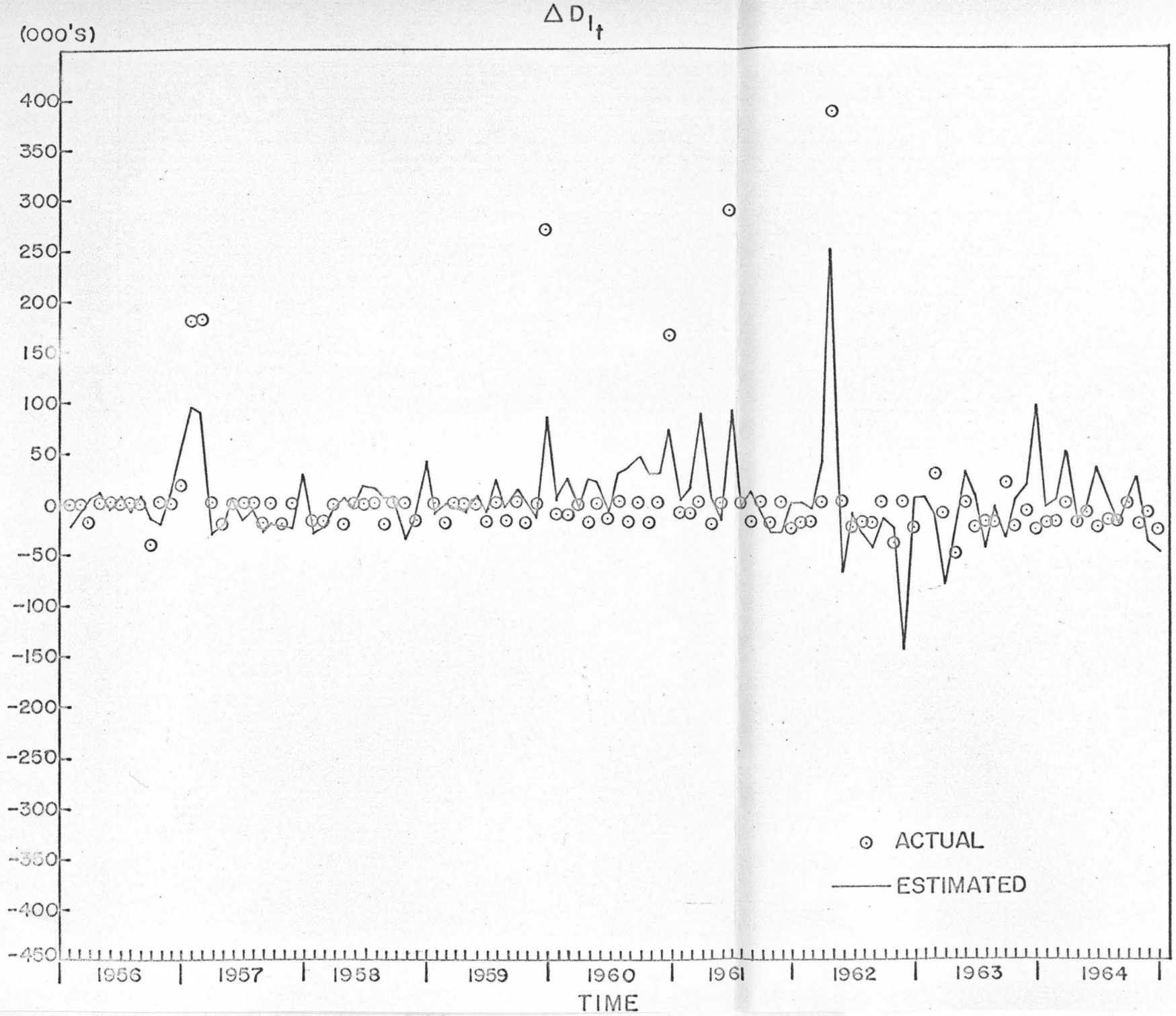

Figure 15. The change in long-term debt

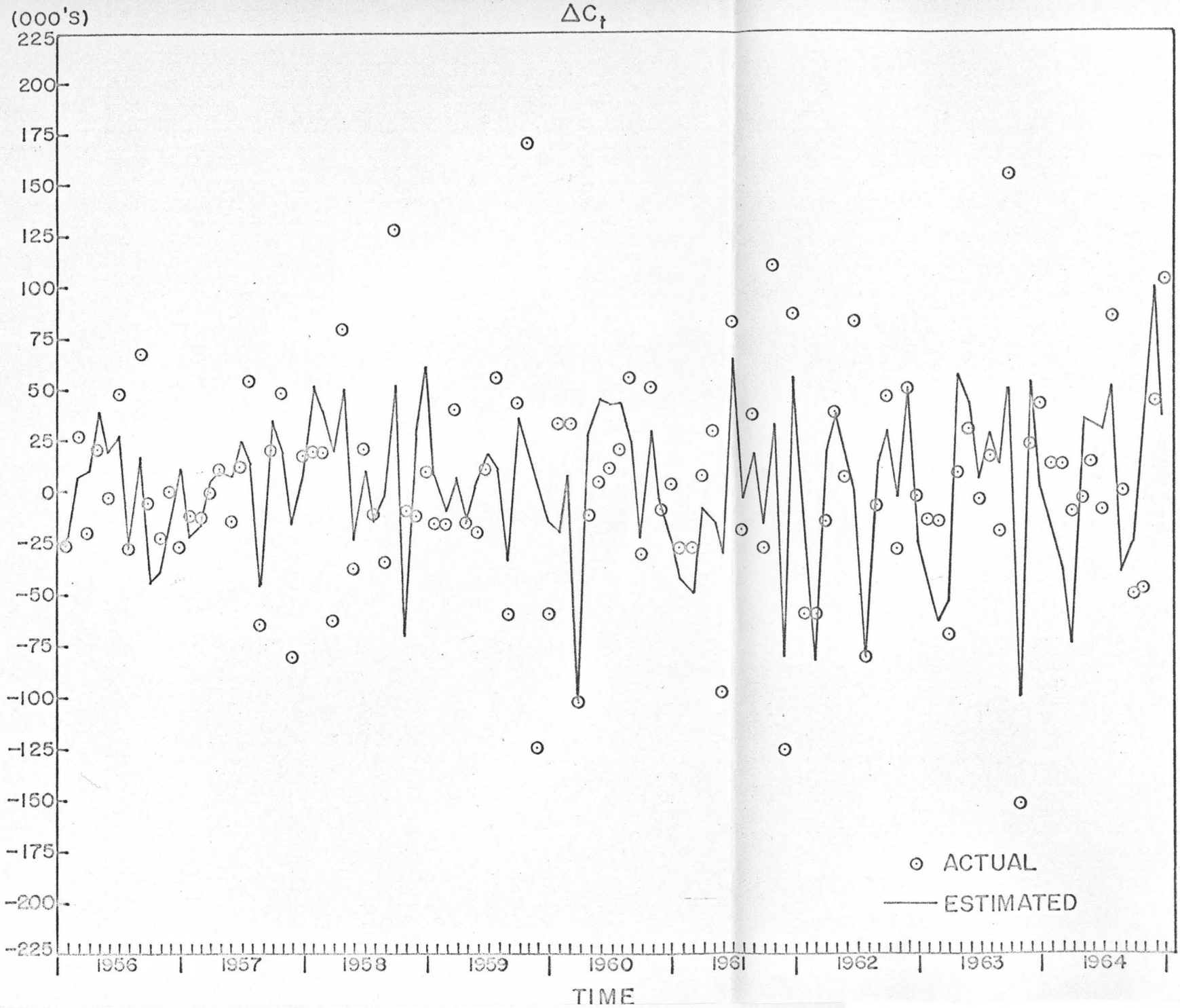

Figure 16. The change in cash

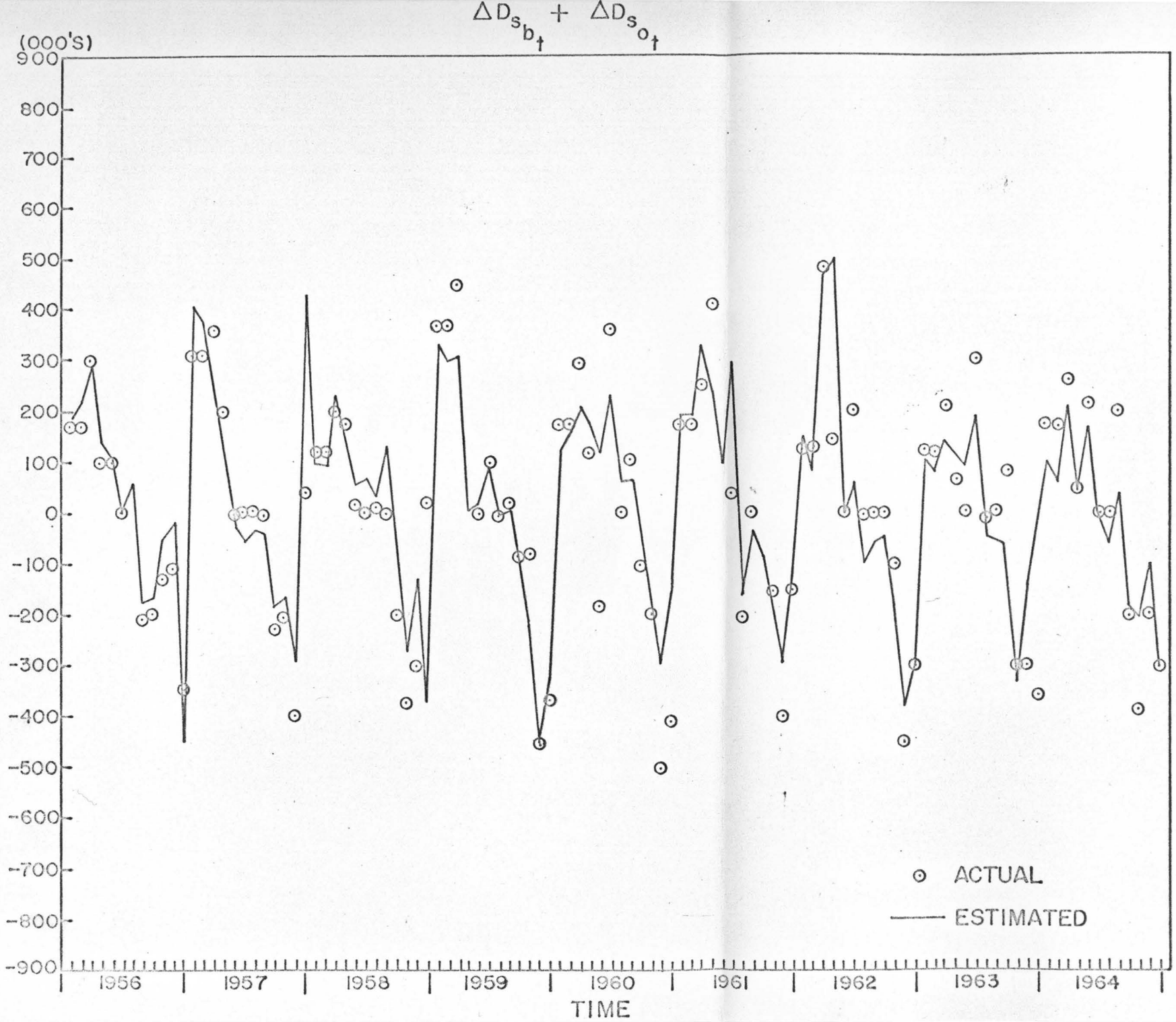

Figure 17. The change in short-term debt

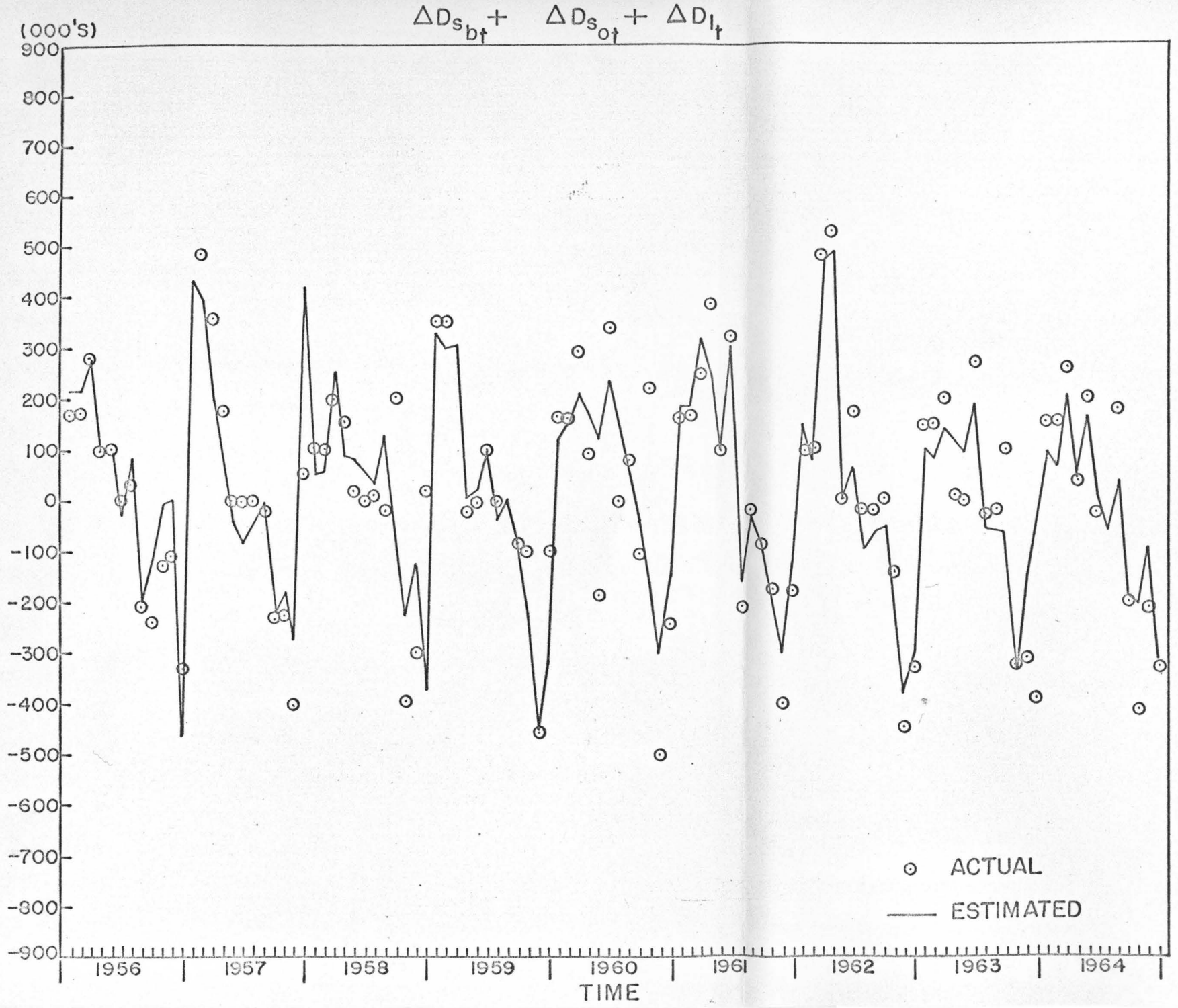

Figure 18. The change in debt in general

CONCLUSION

It is apparent that the statistical model does explain debt and liquidity except where it was expected that the dependent variable might be a function of variates outside the firm. The only dependent variable where the R^2 was surprisingly low was the change in long-term debt. It appears that the model and theory do not give as good as explanation as they might for this variable.

A difficulty of the model is its assumption of linearity. It might be that a non-linear model would explain the role of some of the variates better. This would be especially true of the long-term debt with respect to the capacity variable that was included. The firm may pay little attention to debt capacity until it approaches the limit, but then responds greatly.

However, the over-riding difficulty of the study is the suspicious results with respect to sales. Sales and short-term debt were negatively correlated. Theoretically, this should not be so. It is possible to explain it away but still it sheds some doubt on the validity of the model. That is, it brings to mind the prospect of putting any independent variable in and getting a high R^2 even though the exact role of the independent variable is incorrect, insignificant, or irrelevant.

A sample containing only one firm is too small to test a theory. This study can only be used to point out concern for certain parts of the theory. It would be very interesting to test the theory using several firms and monthly information. If it turned out that the sales variable again had a negative coefficient, it would call for a reformulation of parts of the theory. It may be possible to substitute expected sales for actual sales and have a more realistic theory.

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Finally, I appreciate the tolerance and helpfulness of my wife, Jane, who sometimes inspired me to complete the study. Little of it could have been done without her inspiration and assistance.

APPENDIX A

Glossary of Symbols Used

AP_t = accounts payable at the end of t

B_{con} = controllable part of B

B_t = net non-financial flow during t

BT_t = business transactions affecting cash during t

B_{ucon} = uncontrollable part of B

C_t = cash at the end of period t

C_t^* = necessary cash at the end of t

CB_t = capital budget during t

CSO_t = cost, selling, and other expenses during t

D_{sb_t} = short-term debt owed to banks at the end of t

D_{so_t} = short-term debt owed to others at the end of t, usually officers and stockholders

D_{s_t} = short-term debt outstanding at the end of t

Dep_t = depreciation during t

Div_t = dividends payable in t

D_{L_t} = long-term debt outstanding at the end of t

D^* = safe debt

$D^*_{L_t}$ = safe long-term debt in t

$D^*_{sb_t}$ = safe short-term bank debt in t

$D^*_{so_t}$ = safe short-term other debt in t

ΔA_{c_t} = the change in current non-financial assets during t

minus the change in current non-financial liabilities during t

$\overline{\Delta D}$ = equilibrium value of ΔD_t

$\overline{\Delta L}$ = equilibrium value of ΔL_t

ΔX_t = change in X during t

ES_t = earned surplus at the end of t

G_t = government securities at the end of t

G_t^* = necessary government securities

I_t = net investment during t

Inv = inventory at the end of t

I&A = investments and advances at the end of t

IPS_t = issued and paid-in surplus at the end of t

L_t = liquidity at the end of t

L^* = necessary to liquidity

MM_t = money market transactions during t

NFA_t = net fixed assets at the end of t

$NSOI_t$ = net sales and other income during t

OA = other assets at the end of t

OA_t^* = other assets at the end of t excluding $I\&A_t$

OB_t = operating budget during t

OCA_t = other current assets at the end of t

OCA_t^* = other current assets at the end of t excluding TR_t and Inv_t

OCL_t = other current liabilities at the end of t

PIT_t = provision for income tax during t

RED_t = retained earning during t or transfer to earned surplus during t

RIT_t = reserve for income taxes at the end of t

TR_t = trade receivables at the end of t

APPENDIX B

Transactions Affecting Cash

Table 5. Transactions affecting cash, 1947-1964

	1947	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		4411203
Production payments	4120273	
Income tax payments	44148	
Dividends	11360	
Other current assets		
Subtotal	4175782	4411207
Subtotal difference		235421
Capital budget		
Investments & advances		5411
Expenditures on fixed assets	61568	
Expenditures on other assets		81
Subtotal	61568	5492
Subtotal difference	56076	
Total business transactions	4237349	4416699
Difference		179345
Money-market transactions		
Government securities		
Notes payable-banks	161980	
Notes payable-other		10000
Long term liabilities		
Issued and paid-in surplus		14292
Total money-market transactions	161980	24293
Difference	13768	
Total payments and receipts	4399329	4440992
Effect on cash	41658	

Table 5 (Continued)

	1948	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		5558446
Production payments	5448738	
Income tax payments	89064	
Dividends	12480	
Other current assets		
Subtotal	5550282	5558442
Subtotal difference		8159
Capital budget		
Investments & advances		299
Expenditures on fixed assets	79467	
Expenditures on other assets	2885	
Subtotals	82351	299
Subtotal difference	82052	
Total business transactions	5632633	5558739
Difference	73894	
Money-market transactions		
Government securities		
Notes payable-banks		65000
Notes payable-other		30353
Long term liabilities		
Issued and paid-in surplus		29812
Total money-market transactions		125164
Difference		125164
Total payments and receipts	5632633	5683903
Effect on cash	51271	

Table 5 (Continued)

	1949	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		5605443
Production payments	5434760	
Income tax payments	77023	
Dividends	12480	
Other current assets		
Subtotal	5524263	5605443
Subtotal difference		81179
Capital budget		
Investments & advances	8320	
Expenditures on fixed assets	130071	
Expenditures on other assets		2634
Subtotals	138391	2634
Subtotal difference	136757	
Total business transactions	5662655	5608077
Difference	54578	
Money-market transactions		
Government securities		
Notes payable-banks	55000	
Notes payable-other		27948
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	55000	27948
Difference	27940	
Total payments and receipts	5717655	5636025
Effect on cash		81630

Table 5 (Continued)

	1950	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		6666666
Production payments	6745863	
Income tax payments	94873	
Dividends	12480	
Other current assets		
Subtotal	6853216	6666666
Subtotal difference	186550	
Capital budget		
Investments & advances		4213
Expenditures on fixed assets	115507	
Expenditures on other assets	2362	
Subtotals	117869	4213
Subtotal difference	113657	
Total business transactions	6971086	6670879
Difference	300196	
Money-market transactions		
Government securities		
Notes payable-banks		330666
Notes payable-other	38450	
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	38450	330666
Difference		292216
Total payments and receipts	7355586	7001545
Effect on cash		7991

Table 5 (Continued)

	1951	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		7489897
Production payments	7126084	
Income tax payments	133127	
Dividends	12480	
Other current assets		
Subtotal	7271690	7489896
Subtotal difference		218206
Capital budget		
Investments & advances	9577	
Expenditures on fixed assets	84163	
Expenditures on other assets		2240
Subtotals	93741	2440
Subtotal difference	91300	
Total business transactions	7365432	7492338
Difference		126905
Money-market transactions		
Government securities		
Notes payable-banks	150666	
Notes payable-other		25250
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	150666	25250
Difference	125416	
Total payments and receipts	7516098	7517588
Effect on cash	1489	

Table 5 (Continued)

	1952	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		7688352
Production payments	7447153	
Income tax payments	123753	
Dividends		
Other current assets		
Subtotal	7570905	7688352
Subtotal difference		117446
Capital budget		
Investments & advances		4313
Expenditures on fixed assets	104573	
Expenditures on other assets		116
Subtotals	1045732	4480
Subtotal difference	100093	
Total business transactions	7675478	7692831
Difference		17353
Money-market transactions		
Government securities		
Notes payable-banks	45000	
Notes payable-other		61200
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	45000	61200
Difference		16200
Total payments and receipts	7720478	7754031
Effect on cash	33553	

Table 5 (Continued)

	1953	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		7583943
Production payments	7421748	
Income tax payments	102568	
Dividends		
Other current assets		
Subtotal	7524316	7583943
Subtotal difference		59627
Capital budget		
Investments & advances		25257
Expenditures on fixed assets	95079	
Expenditures on other assets	5	
Subtotals	95084	25257
Subtotal difference	69827	
Total business transactions	7619401	7609201
Difference	10200	
Money-market transactions		
Government securities		
Notes payable-banks	12640	
Notes payable-other		28550
Long term liabilities		
Issued and paid-in surplus		
Total money-market transactions	12640	28550
Difference		15909
Total payments and receipts	7632141	7637751
Effect on cash	5710	

Table 5 (Continued)

	1954	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		8060749
Production payments	7956049	
Income tax payments	93584	
Dividends		
Other current assets		
Subtotal	8049632	8060749
Subtotal difference		11117
Capital budget		
Investment & advances	17910	
Expenditures on fixed assets	83975	
Expenditures on other assets		83
Subtotals	101885	83
Subtotal difference	101803	
Total business transactions	8151519	8060831
Difference	90686	
Money-market transactions		
Government securities	19588	
Notes payable-banks	232360	
Notes payable-other	11500	
Long term liabilities		360000
Issued and paid-in surplus		
Total money-market transactions	263448	360000
Difference		96552
Total payments and receipts	8414967	8420831
Effect on cash	5865	

Table 5 (Continued)

	1955	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		8469602
Production payments	8260072	
Income tax payments	156738	
Dividends		
Other current assets		
Subtotal	8416810	8469602
Subtotal difference		52792
Capital budget		
Investments & advances	12529	
Expenditures on fixed assets	122701	
Expenditures on other assets		36
Subtotals	135230	36
Subtotal difference	135194	
Total business transactions	8552040	8469638
Difference	82402	
Money-market transactions		
Government securities	19870	
Notes payable-banks		100000
Notes payable-other		66650
Long term liabilities	60000	
Issued and paid-in surplus		
Total money-market transactions	79871	166650
Difference		86779
Total payments and receipts	8631911	8636288
Effect on cash	4377	

Table 5 (Continued)

	1956	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		9575884
Production payments	8998719	
Income tax payments	164631	
Dividends		
Other current assets		
Subtotal	9163351	9575884
Subtotal difference		412533
Capital budget		
Investments & advances	37297	
Expenditures on fixed assets	241450	
Expenditures on other assets		36
Subtotals	278746	36
Subtotal difference	278710	
Total business transactions	9442097	9575921
Difference		133823
Money-market transactions		
Government securities		1930
Notes payable-banks	98506	
Notes payable-other	30750	
Long term liabilities	44376	
Issued and paid-in surplus		12000
Total money-market transactions	173632	13930
Difference	159702	
Total payments and receipts	9615729	9589851
Effect on cash		25880

Table 5 (Continued)

	1957	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		9710643
Production payments	9609519	
Income tax payments	147650	
Dividends		
Other current assets		
Subtotal	9757168	9710643
Subtotal difference	46525	
Capital budget		
Investments & advances	476117	
Expenditures on fixed assets	100793	
Expenditures on other assets		36
Subtotals	576909	36
Subtotal difference	576873	
Total business transactions	10334078	9710680
Difference	623698	
Money-market transactions		
Government securities	1516	
Notes payable-banks		340038
Notes payable-other	55625	
Long term liabilities		313918
Issued and paid-in surplus		
Total money-market transactions	57141	653956
Difference		596815
Total payments and receipts	10391219	10364636
Effect on cash		26583

Table 5 (Continued)

	1958	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		11021316
Production payments	10405730	
Income tax payments	220978	
Dividends		
Other current assets		
Subtotal	10626528	11021316
Subtotal difference		394788
Capital budget		
Investments & advances		73698
Expenditures on fixed assets	131413	
Expenditures on other assets		36
Subtotals	131413	73734
Subtotal difference	57686	
Total business transactions	10757940	11095050
Difference		337109
Money-market transactions		
Government securities		1581
Notes payable-banks	299910	
Notes payable-other		83158
Long term liabilities	97023	
Issued and paid-in surplus		1566
Total money-market transactions	396933	86306
Difference	310627	
Total payments and receipts	11154873	11181356
Effect on cash	26482	

Table 5 (Continued)

	1959	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		11369938
Production payments	11427492	
Income tax payments		
Dividends		
Other current assets		
Subtotal	11746212	11369938
Subtotal difference	376274	
Capital budget		
Investment & advances		32207
Expenditures on fixed assets	160998	
Expenditures on other assets	7124	
Subtotals	168122	32207
Subtotal difference	135915	
Total business transactions	11914335	11402146
Difference	512189	
Money-market transactions		
Government securities		38400
Notes payable-banks		480100
Notes payable-other	184192	
Long term liabilities		175437
Issued and paid-in surplus		10920
Total money-market transactions	184192	704856
Difference		520664
Total payments and receipts	12098527	12107002
Effect on cash	8475	

Table 5 (Continued)

	1960	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		11130102
Production payments	10630488	
Income tax payments	166736	
Dividends		
Other current assets		
Subtotal	10797224	11130102
Subtotal difference		332878
Capital budget		
Investments & advances	15876	
Expenditures on fixed assets	143675	
Expenditures on other assets		1826
Subtotals	159551	1826
Subtotal difference	157724	
Total business transactions	10956775	11131928
Difference		175154
Money-market transactions		
Government securities		
Notes payable-banks	179955	
Notes payable-other	4401	
Long term liabilities		66443
Issued and paid-in surplus		
Total money-market transactions	184356	66443
Difference	117912	
Total payments and receipts	11141131	11198371
Effect on cash	57242	

Table 5 (Continued)

	1961	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		12464747
Production payments	12217295	
Income tax payments	166562	
Dividends		
Other current assets		
Subtotal	12383857	12464747
Subtotal difference		80890
Capital budget		
Investments & advances	176483	
Expenditures on fixed assets	231500	
Expenditures on other assets	5134	
Subtotals	413118	0
Subtotal difference	413118	
Total business transactions	12796975	12464747
Difference	332228	
Money-market transactions		
Government securities		
Notes payable-banks		145168
Notes payable-other		32435
Long term liabilities		181216
Issued and paid-in surplus		2020
Total money-market transactions		360840
Difference		360840
Total payments and receipts	12796975	12825587
Effect on cash	28612	

Table 5 (Continued)

	1962	
	Payments	Receipts
Business Transactions		
Operating budget		
Receipts from customers		11168662
Production payments	10951430	
Income tax payments		
Dividends		
Other current assets		
Subtotal	11203445	11168662
Subtotal difference	34782	
Capital budget		
Investments & advances	370697	
Expenditures on fixed assets	69675	
Expenditures on other assets		3781
Subtotals	440371	3781
Subtotal difference	436590	
Total business transactions	11654816	11172443
Difference	471373	
Money-market transactions		
Government securities		
Notes payable-banks		245113
Notes payable-other	21844	
Long term liabilities		213718
Issued and paid-in surplus	9695	
Total money-market transactions	31540	458832
Difference		427292
Total payments and receipts	11686356	11631275
Effect on cash		44081

Table 5 (Continued)

	1963	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		11887076
Production payments	11475309	
Income tax payments	198423	
Dividends		
Other current assets		
Subtotal	11673732	11887076
Subtotal difference		213344
Capital budget		
Investment & advances	138079	
Expenditures on fixed assets	111410	
Expenditures on other assets		2224
Subtotals	249490	2224
Subtotal difference	247266	
Total business transactions	11923222	11889300
Difference	33922	
Money-market transactions		
Government securities		
Notes payable-banks	80000	
Notes payable-other	5800	
Long term liabilities	1790	
Issued and paid-in surplus		123506
Total money-market transactions	87590	123506
Difference		35916
Total payments and receipts	12010812	12012806
Effect on cash	1994	

Table 5 (Continued)

	1964	
	Payments	Receipts
Business transactions		
Operating budget		
Receipts from customers		12767902
Production payments	12050586	
Income tax payments	204020	
Dividends		
Other current assets		
Subtotal	12254607	12767902
Subtotal difference		513295
Capital budget		
Investments & advances	174047	
Expenditures on fixed assets	83465	
Expenditures on other assets		4145
Subtotals	257512	4145
Subtotal difference	253367	
Total business transactions	12512119	12772046
Difference		259928
Money-market transactions		
Government securities		
Notes payable-banks	40000	
Notes payable-other		31452
Long term liabilities	190000	
Issued and paid-in surplus		
Total money-market transactions	230000	31452
Difference	198548	
Total payments and receipts	12742119	12803498
Effect on cash	61380	

APPENDIX C

Regression Results, t = 1, 2, 3, ..., 90

Table 6. F's and R^2's where t = 1, 2, 3, ..., 90

	r = 1	r = 2	r = 3	r = 4	4 = 5	r = 6
R^2	.7470	.3316	.4342	.5732	.7598	.7141
F	20.94	3.518	5.443	9.5223	22.426	17.713

Table 7. Estimated coefficients of independent variables where r = 1, 2, 3, ..., 6 and t = 1, 2, 3, ..., 90

	r = 1	r = 2	r = 3	r = 4	r = 5	r = 6
$\Delta^{A}c_t$	.6489	.0023	-.0193	-.0615	.6674	.6087
	.0608	.0121	.0259	.0220	.0591	.0664
	10.677	.1909	-.7476	-2.928	11.2976	9.1748
I_t	.268	-.0065	.3832	-.0588	.2721	.6615
	.1656	.0329	.0705	.0572	.1610	.1808
	1.618	-.1984	5.4371	-1.028	1.6903	3.6588
RED_t	.1337	.0478	-.1586	.0997	.0844	-.0928
	.3323	.0660	.1414	.1148	.3230	.3628
	.4024	.7253	-1.1218	.8679	.2612	-.2556
C_{t-1}	-.8228	-.1098	-.2228	-1.0688	-.942	-1.3309
	.3140	.0623	.1336	.1085	.3052	.3427
	-2.6206	-1.7618	-1.6676	-9.8529	-3.0866	-3.8830
S_t	-.1565	-.0221	-.0557	.0301	-.1592	-.1258
	.0960	.0191	.0408	.0332	.0933	.1048
	-1.6306	-1.1621	-1.3636	.9078	-1.7059	-1.1998
G_{t-1}	-3.9995	1.2517	-.5614	.4965	-2.514	-3.1015
	1.6168	.3209	.688	.5586	1.5715	1.7649
	-2.4736	3.901	-.8160	.8888	-1.5998	-1.7572

Table 7 (Continued)

	r = 1	r = 2	r = 3	r = 4	r = 5	r = 6
Ta_t	.0767	-.0161	-.0905	.0890	.0741	-.0968
	.1518	.0301	.0646	.0524	.1475	.1657
	.5053	-.5350	-1.4020	1.698	.5022	-.5842
Dsb_{t-1}	-.0571	-.0026	.0282	-.0161	-.067	-.0659
	.0645	.0128	.0274	.0223	.0627	.0704
	-.8859	-.1995	1.0261	-.7218	-1.0687	-.9353
Dso_{t-1}	.6953	-.4746	-.1744	-.2212	.1826	-.1296
	.4192	.0832	.1784	.1448	.4075	.4576
	1.6585	-5.5046	-.9774	-1.5276	.4483	-.2832
i_t	728.487	-11167.992	-16517.3	-5223.41	-9052.93	-41147.87
	23428.056	4649.334	9969.18	8093.84	22771.6	25573.72
	.0310	-2.4020	-1.6568	-.6453	-.3975	-1.6089
K_{t-1}	-.0233	.0517	.1743	.0536	.0224	.2741
	.1006	.0200	.0428	.0348	.0978	.1098
	-.2314	2.5910	4.0695	1.5426	.2290	2.4949

Table 8. Correlation matrix where t = 1, 2, 3, ..., 90

	ΔA_{c_t}	I_t	RED_t	C_{t-1}	S_t	G_{t-1}
ΔA_{c_t}	1.0000					
I_t	.0719	1.0000				
RED_t	.3906	-.0246	1.0000			
C_{t-1}	-.3319	-.0778	-.0871	1.0000		
S_t	.0609	-.0978	.6250	.0536	1.0000	
G_{t-1}	.0743	-.1327	-.0310	-.1198	-.2837	1.0000
T_{a_t}	-.3248	-.0883	-.1340	.2592	.2665	-.4758
$D_{s_{b_{t-1}}}$	.0643	-.0440	.4508	.0866	.6955	-.5398
$D_{s_{o_{t-1}}}$	.1334	-.1567	.0186	-.1826	-.2424	.9054
i_t	-.1287	-.0112	-.2285	.1355	-.0877	-.1774
K_{t-1}	-.1922	-.1797	-.0382	.1817	.0813	.4646
$\Delta D_{s_{b_t}}$	.8043	.1885	.2065	-.4394	-.1313	.0107
$\Delta D_{s_{o_t}}$	-.0223	.0659	-.0015	-.0520	-.0318	-.0593
ΔD_{L_t}	-.1131	.4944	-.1927	-.0701	-.1342	-.1199
ΔC_t	-.0648	-.0613	.0741	-.6337	.1506	-.0023
$\Delta D_{s_{b_t}} + D_{s_{o_t}}$	.8113	.2012	.1930	-.4514	-.1404	.0077
ΔD_t	.7249	.3283	.1644	-.4708	-.1093	-.0209
B_t	.7486	.3469	.1462	-.3022	-.1509	-.0190

Table 8 (Continued)

	T_{a_t}	$D_{s_{b_{t-1}}}$	$D_{s_{o_{t-1}}}$	i_t	K_{t-1}	$\Delta D_{s_{b_t}}$
ΔA_{c_t}						
I_t						
RED_t						
C_{t-1}						
S_t						
G_{t-1}						
T_{a_t}	1.0000					
$D_{s_{b_t}}$	.3966	1.0000				
$D_{s_{o_{t-1}}}$	-.4510	-.5433	1.0000			
i_t	.2657	.2036	-.2257	1.0000		
K_{t-1}	-.0014	-.1083	.4889	.1403	1.0000	
$\Delta D_{s_{b_t}}$	-.2881	-.0913	.1154	-.2520	-.1178	1.0000
$\Delta D_{s_{o_t}}$	-.0539	.0388	-.2474	-.0301	-.1131	-.0869
ΔD_{L_t}	-.0505	-.0259	-.1317	.1385	.0079	-.0564
ΔC_t	.0708	.0601	.0120	.0105	-.0792	.0955
$\Delta D_{s_{b_t}} + \Delta D_{s_{o_t}}$	-.2937	-.0947	.0870	-.2585	-.1282	.9920
ΔD_t	-.3130	-.0892	.0539	-.1704	-.1705	.9157
B_t	-.3320	-.1051	.0504	-.1711	-.1479	.8983

Table 8 (Continued)

	ΔD_{so_t}	ΔD_{L_t}	ΔC_t	$\Delta D_{sb_t} + \Delta D_{so_t}$	ΔD_t	B_t
ΔA_{c_t}						
I_t						
RED_t						
C_{t-1}						
S_t						
G_{t-1}						
T_{a_t}						
D_{sb_t}						
$D_{so_{t-1}}$						
i_t						
K_{t-1}						
ΔD_{sb_t}						
ΔD_{so_t}	1.0000					
ΔD_{L_t}	.0017	1.000				
ΔC_t	-.0204	.0498	1.0000			
$\Delta D_{sb_t} + \Delta D_{so_t}$	.0336	-.0556	.0939	1.0000		
ΔD_t	.0365	.2139	.1647	.9239	1.0000	
B_t	.0388	.2032	-.0992	.9064	.9649	1.0000