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Part II

STATISTICAL ANALYSIS OF THE DEMAND FOR INSTALMENT SALES CREDIT

It is apparent from the foregoing discussion that the demand for consumer durable goods and the resulting demand for instalment sales credit are influenced by a complex and variously operating set of factors. Some of these exert a predominantly cyclical impact on credit demand, while others are more nearly of the nature of secular influences. Some, like the down payment and length of contract terms of instalment contracts, are closely inter-related; others, such as the rate of population growth, have a relatively independent influence on demand. In the following section an attempt is made to determine the strength of the influence on credit demand of consumer income and of the other factors which the above discussion suggests may be effective.

It will be convenient at this point to give in the following list a glossary of the principal symbols that will be used in the analysis: [29]

G = total instalment sales credit granted, in millions of current dollars
G_1 = automobile instalment sales credit granted, in millions of current dollars
G_2 = diversified instalment sales credit granted, in millions of current dollars
O = consumer credit outstanding at year ends, in millions of current dollars
Y = disposable personal income, in millions of current dollars
I = retail price index of total consumption goods, 1935-39 : 100
P = retail price index of durable consumer goods, 1935-39 : 100
P_1 = retail price index of automobiles, 1935-39 : 100
P_2 = retail price index of durable consumer goods other than automobiles, 1935-39 : 100
D = average monthly duration of all instalment sales contracts
D_1 = average monthly duration of automobile instalment sales contracts
D_2 = average monthly duration of diversified instalment sales contracts
D' = index of average monthly duration of all instalment sales contracts, 1935-39 : 100

29 A description of the series that are used at various points in the analysis and which are represented by the symbols listed in the text is given in Appendix A, along with references to the sources from which the materials were drawn.

D'_1 = index of average monthly duration of automobile instalment sales contracts, 1935-39 : 100

D'_2 = index of average monthly duration of diversified instalment sales contracts, 1935-39 : 100

S = index of estimated size of contractual monthly instalments in total durable consumer goods financing, 1935-39 : 100

S_1 = index of estimated size of contractual monthly instalments in automobile financing, 1935-39 : 100

S_2 = index of estimated size of contractual monthly instalments in diversified financing, 1935-39 : 100

N = percentage down payment

M = percentage finance charge

L = estimated amount of deposits and currency held by individuals at year ends, in millions of current dollars

R = estimated number of automobiles in use at year ends, in millions

C = total consumer expenditures, in millions of current dollars

F = thousands of consumer units

F′ = thousands of consumer units with incomes of less than $5,000

Z = investment, in millions of current dollars

T = time

EXPLANATION OF INSTALMENT SALES CREDIT DEMAND BY THE EQUATION-SYSTEM APPROACH

Model I

An explanation of the demand for instalment sales credit may be attempted first by means of a simple system of linear equations, as follows:

$$\frac{G}{FI} = a_0 + a_1\left(\frac{Y}{FI}\right) + a_2\left(\frac{Y}{FI}\right)_{-1} + a_3\left(\frac{P}{I}\cdot\frac{1}{D'}\right) + u_1 \qquad (1.1)$$

$$\frac{C}{FI} = b_0 + b_1\left(\frac{Y}{FI}\right) + b_2\left(\frac{Y}{FI}\right)_{-1} + u_2 \qquad (1.2)$$

$$\frac{P}{I} = c_0 + c_1\left(\frac{P}{I}\right)_{-1} + u_3 \qquad (1.3)$$

$$\frac{Y}{FI} = \frac{C}{FI} + \frac{Z}{FI} \qquad (1.4)$$

In the foregoing sequence of equations, equation (*1.1*) describes a hypothesis to the effect that the demand for instalment sales credit (G) depends on the disposable income of the current year (Y), the disposable income of the preceding year (Y_{-1}), the size of the monthly instalment payment $\left(\frac{P}{D'}\right)$, and a random factor ($u_1$) representing the influence of a great variety of forces affecting consumer behavior.[30] Equation (*1.2*) is the consumption function, indicating that consumer expenditures (C) depend on the disposable income of the current year and of the preceding year and a random factor (u_2). Equation (*1.3*) is introduced in order to explain the level of prices (P) of consumer durable goods, and since it is an equation describing economic behavior it includes a random term (u_3).[31] The last equation of the system (*1.4*) merely states that the disposable income of a given period is the sum of the consumption and the net investment (Z) of that period; being an exact relationship it contains no random term.[32]

Several other factors of significance in determining instalment sales credit demand are taken into account either explicitly or implicitly in

30 Among these terms only the use of $\left(\frac{P}{D'}\right)$ requires explanation. A full definition of the monthly instalment sales credit payment is the price of the purchased commodity minus down payment plus finance charge divided by the length of contract $\left(\frac{P(1 - N + M)}{D}\right)$. Because of lack of data on down payment and finance charges, the price divided by length of contract was used as an indicator of the monthly instalment payment. A more detailed discussion of this variable is given on page 30.

31 Equation (*1.3*) is of the autoregressive type, and is derived from the equation for the demand for inventories of consumer durable goods, as follows:

$$\text{(A)} \qquad H = d_0 + d_1C + d_2P + d_3P_{-1} + d_4H_{-1} + v$$

and from the equation for the price adjustment of consumer durable goods, as follows:

$$\text{(B)} \qquad P - P_{-1} = e_0 + e_1(H - d_1C - d_4H_{-1}) + e_2P_{-1} + v'$$

Equation (A) is based on the assumption that the amount of durable consumer goods inventories (H) is determined by the current level of expenditures on durable consumer goods (C), the prices of these goods in the current year (P) and in the preceding year (P_{-1}) which, in combination, may be presumed to represent the speculative motive in inventory accumulation, and by the level of inventories at the period's beginning (H_{-1}). In equation (B), which shows how changes in the prices of consumer durable goods are determined, the term ($H - d_1C - d_4H_{-1}$) represents the relation between supply and demand, and implies that prices rise with excess demand and fall with excess supply taking (e_1) to be negative. It incorporates durable consumer goods prices at the beginning of the period (P_{-1}) as one of its terms, on the supposition that price changes in any given period are influenced by the level of prices at its beginning.

Substitution of ($d_0 + d_2P + d_3P_{-1} + v$) in equation (B) for the term ($H - d_1C - d_4H_{-1}$) as derived from equation (A) yields an equation of the (*1.3*) form. Though a loss of information is involved, the lack of data on durable consumer goods inventories requires that equation (*1.3*) be used in place of equations (A) and (B).

32 The meaning of the term net investment, as used here, becomes clear from the following definitional equations:

1. Gross national product = personal consumption expenditures + gross private investment + government expenditures
2. Gross national product = personal disposable income + business reserves + corporate saving + government receipts − transfers
3. Personal disposable income = personal consumption expenditures + (gross private investment − business reserves − corporate saving) + (government expenditures − government receipts + transfers).

In (3) above the second term on the right represents the amount that business firms pay out for producer goods minus what they retain, and the third term represents what the government pays out for goods and transfers minus what it receives from the public. The sum of these two terms is treated as net investment. (See National Income Supplement to *Survey of Current Business*, July 1947, pp. 19-20.)

these equations. Thus, changes in population are considered by expressing the amounts of instalment sales credit extended, consumer income of the current and preceding years, consumer expenditures, and net investment in amounts per consumer unit, i.e., by dividing each of these quantities by population (F). Also, all the variables involving a price element have been reduced to prices of 1935-39, i.e., they have been deflated to that level with an index of prices of total consumption goods (I). Through current income the equations recognize indirectly the potential amount of instalment sales credit commanded by that income and through the income of the preceding year the amount of indebtedness carried by consumers at the end of the preceding year. The representation of the former is perhaps obvious; as to the latter, credit outstandings are assumed to be represented by the income of the preceding year, since this chiefly determines the amount of credit granted during that year.[33] Income of the preceding year may also reflect a lag in the response of consumers to change in income.

In order to obtain consistent estimates of the parameters of the demand equation for instalment sales credit, all equations of the model must be considered simultaneously. This can be done by the method of reduced forms, which amounts to a solution of a system of linear equations for given endogenous variables as a function of predetermined variables (that is, exogenous variables and lagged endogenous variables) and random factors.[34]

In the model under consideration the variable representing the size of the monthly instalment payment $\left(\frac{P}{I} \cdot \frac{1}{D'}\right)$ is treated as endogenous with respect to its price term and as predetermined with respect to its average duration of instalment sales credit term. The price variable $\left(\frac{P}{I}\right)$ is explained by equation (*1.3*). As for the average duration of instalment sales credit contracts, it is essentially determined by past experience and therefore may be regarded as a predetermined variable. Net investment $\left(\frac{Z}{F\,I}\right)$ is also considered as a predetermined variable. The assumption that net investment is autonomous is perhaps not quite justified. While some economists regard investment as autonomous, it is doubtless more

[33] The actual correlation between disposable income of the preceding year and the credit outstanding at the end of that year is 0.87. The relationship between credit granted and outstanding may also be represented by the following hypothetical example. If we assume an eighteen-month contract length and a constant rate of credit extension on a monthly basis, then 87.8 percent of the credit outstanding at that point at which credit outstandings are constant will refer to the transactions of the current year.

[34] The observable variables used in econometric models may be divided into two categories, namely, endogenous variables, which are generated jointly by the economic system at any given period of time and have an influence on each other, and predetermined variables, which influence endogenous variables but are not influenced by them.

realistic to assume that it is partly autonomous and partly induced. To the extent that it is induced, the interpretation of investment as a predetermined variable introduces some error into the estimates.[35] Obviously, the income of the preceding year $\left(\frac{Y}{FI}\right)_{-1}$, being a lagged variable, is predetermined by definition.

The reduced form equations of the model required for the estimation of the structural parameter, after performing a linear transformation on the variables, are as follows:

$$(1.5) \quad \frac{G}{FI} = a_0 + \frac{a_1 b_0}{1 - b_1} + \left(a_2 + \frac{a_1 b_2}{1 - b_1}\right)\left(\frac{Y}{FI}\right)_{-1} + \frac{a_1}{1 - b_1}\left(\frac{Z}{FI}\right) + a_3\left[\left\{c_0 + c_1\left(\frac{P}{I}\right)_{-1}\right\} \cdot \frac{1}{D'}\right] + \frac{a_1 u_2}{1 - b_1} + u_1$$

$$(1.6) \quad \frac{Y}{FI} = \frac{b_0}{1 - b_1} + \frac{b_2}{1 - b_1}\left(\frac{Y}{FI}\right)_{-1} + \frac{1}{1 - b_1}\left(\frac{Z}{FI}\right) + \frac{u_2}{1 - b_1}$$

The parameters of these equations can be estimated by the method of least squares.[36] The following numerical results are obtained:

$$(1.7) \quad \frac{G}{FI} = 106.401 + \underset{(\pm.023)}{.044}\left(\frac{Y}{FI}\right)_{-1} - \underset{(\pm.384)}{1.045}\left(\frac{\hat{P}}{I} \cdot \frac{1}{D'}\right) + \underset{(\pm.063)}{.239}\left(\frac{Z}{FI}\right)$$

$$\overline{R} = .933 \qquad \overline{S} = \$10.916 \qquad \frac{\delta^2}{S^2} = 1.622$$

$$(1.8) \quad \frac{Y}{FI} = 1148.364 + \underset{(\pm.111)}{.311}\left(\frac{Y}{FI}\right)_{-1} + \underset{(\pm.305)}{2.549}\left(\frac{Z}{FI}\right)$$

$$\overline{R} = .967 \qquad \overline{S} = \$64.334 \qquad \frac{\delta^2}{S^2} = 1.676$$

where $\left(\frac{\hat{P}}{I}\right)$ are calculated values derived from the equation

$$(1.9) \quad \frac{P}{I} = 29.285 + \underset{(\pm.192)}{.714}\left(\frac{P}{I}\right)_{-1}$$

$$\overline{R} = .718 \qquad \overline{S} = \$2.287 \qquad \frac{\delta^2}{S^2} = 1.828$$

[35] Trygve Haavelmo has found that the estimated parameters of the consumption function which form a part of a model in which investment is taken as autonomous are only slightly different from those derived from a model in which investment is assumed to be partly autonomous and partly induced. See T. Haavelmo, "Methods of Measuring the Marginal Propensity to Consume," *Journal of the American Statistical Association,* March 1947, pp. 105 ff. Similar results were obtained by Lawrence Klein, who has assumed in one model that investment is totally autonomous and in another that it is totally induced. See *Econometrica,* Vol. 15, No. 2 (April 1947) pp. 111 ff.

[36] The underlying assumption for the application of the least-squares method to equations of reduced form of the model are that: (a) the random residual u's are stochastically independent of exogenous variables; (b) there is no serial correlation in the random residual u's; and (c) there are no errors of observation in the variables of the model. No assumption of normal distribution of u's is necessary to obtain consistent least-squares estimates.

The use of $\left(\frac{\hat{P}}{I}\right)$ in equation (*1.7*) is justified by the high degree of independence of the estimated u_8 from $\left(\frac{1}{D'}\right)$, which is indicated by $r = .033$.[37]

Equations (*1.7*) and (*1.8*) contain exactly enough information to determine the parameters of the original equations of the model.[38] When inverse linear transformations are performed on the variables in the reduced form equations the following results are obtained:

$$(1.10)\quad \frac{G}{FI} = -1.223 + .094\left(\frac{Y}{FI}\right) + .015\left(\frac{Y}{FI}\right)_{-1} - 1.045\left(\frac{\hat{P}}{I}\cdot\frac{1}{D'}\right)$$

$$S_{u_1} = \$7.393 \qquad \frac{\delta^2}{S^2} = 1.757$$

$$(1.11)\quad \frac{C}{FI} = 450.499 + .608\left(\frac{Y}{FI}\right) + .122\left(\frac{Y}{FI}\right)_{-1}$$

$$S_{u_2} = \$25.238 \qquad \frac{\delta^2}{S^2} = 1.676$$

Judged by statistical criteria, the parameters of the model seem to be reliably estimated. Except for the coefficient of $\left(\frac{Y}{FI}\right)_{-1}$ in equation (*1.7*), the regression coefficients in the reduced form equations are more than twice their standard errors, thus indicating that they are significant at the 5 percent level. The values of $\frac{\delta^2}{S^2}$ for all equations are high enough so that the hypothesis that the u's are nonautocorrelated cannot be rejected at the 5 percent level of significance.

Model II

We may turn now to the question of whether the size of the monthly instalment payments, which is a factor affecting the demand for instalment sales credit, also affects the amount of total consumption expenditures. The possibility that such an effect may be present rests on the supposition that changes in the size of monthly instalment payments may cause significant changes in consumer expenditures on durable goods,

37 The statistics $\bar{R}$ and $\bar{S}$ are corrected for degrees of freedom. The numbers in parentheses below the regression coefficients are standard errors. The statistic $\frac{\delta^2}{S^2}$ is the ratio of the mean square successive differences to the variance of the residuals, the so-called von Neumann statistic.

38 The present model may be said to be "just identified." When a system of equations is under-identified, the estimation of all the parameters of the behavior equations is not possible, whereas when a system is "over-identified" the estimation of the behavior equation parameters can be made by the method of "reduced forms," but with some loss of statistical efficiency. For a description of the estimating procedure see T. W. Anderson and Herman Rubin, "Estimation of the Parameters of a Single Equation in a Complete System of Stochastic Equations," *The Annals of Mathematical Statistics*, Vol. 20, No. 1 (March 1949) pp. 46 ff.

and that these changes may not be offset by changes in expenditures on nondurable consumer goods. The equations of Model I are modified by adding an additional variable $\left(\frac{P}{I} \cdot \frac{1}{D'}\right)$ to the consumption function, but all other equations are unchanged:

$$(2.1)\qquad \frac{G}{F\,I} = a_0' + a_1'\left(\frac{Y}{F\,I}\right) + a_2'\left(\frac{Y}{F\,I}\right)_{-1} + a_3'\left(\frac{P}{I} \cdot \frac{1}{D'}\right) + u_1'$$

$$(2.2)\qquad \frac{C}{F\,I} = b_0' + b_1'\left(\frac{Y}{F\,I}\right) + b_2'\left(\frac{Y}{F\,I}\right)_{-1} + b_3'\left(\frac{P}{I} \cdot \frac{1}{D'}\right) + u_2'$$

$$(1.3)\qquad \frac{P}{I} = c_0 + c_1\left(\frac{P}{I}\right)_{-1} + u_3$$

$$(1.4)\qquad \frac{Y}{F\,I} = \frac{C}{F\,I} + \frac{Z}{F\,I}$$

The reduced form equations of this system required for the estimation of the structural parameter are as follows:

$$(2.3)\qquad \frac{G}{F\,I} = a_0' + \frac{a_1'\,b_0'}{1 - b_1'} + \left(a_2' + \frac{a_1'\,b_2'}{1 - b_1'}\right)\left(\frac{Y}{F\,I}\right)_{-1} + \left(a_3' + \frac{a_1'\,b_3'}{1 - b_1'}\right) \left[\left\{c_0 + c_1\left(\frac{P}{I}\right)_{-1}\right\}\frac{1}{D'}\right] + \frac{a_1'}{1 - b_1'}\left(\frac{Z}{F\,I}\right) + \frac{a_1'\,u_2'}{1 - b_1'} + u_1'$$

$$(2.4)\qquad \frac{Y}{F\,I} = \frac{b_0'}{1 - b_1'} + \frac{b_2'}{1 - b_1'}\left(\frac{Y}{F\,I}\right)_{-1} + \frac{b_3'}{1 - b_1'}\left[\left\{c_0 + c_1\left(\frac{P}{I}\right)_{-1}\right\}\frac{1}{D'}\right] + \frac{1}{1 - b_1'}\left(\frac{Z}{F\,I}\right) + \frac{u_2'}{1 - b_1'}$$

When the method of least squares is applied to the estimation of *(2.3)* and *(2.4)* the following results are obtained:

$$(1.7)\qquad \frac{G}{F\,I} = 106.401 + \underset{(\pm.023)}{.044}\left(\frac{Y}{F\,I}\right)_{-1} - \underset{(\pm.384)}{1.045}\left(\frac{\hat{P}}{I} \cdot \frac{1}{D'}\right) + \underset{(\pm.063)}{.239}\left(\frac{Z}{F\,I}\right)$$

$$\bar{R} = .933 \qquad \bar{S} = \$10.916 \qquad \frac{\delta^2}{S^2} = 1.622$$

$$(2.5)\qquad \frac{Y}{F\,I} = 1292.297 + \underset{(\pm.130)}{.400}\left(\frac{Y}{F\,I}\right)_{-1} - \underset{(\pm2.204)}{2.761}\left(\frac{\hat{P}}{I} \cdot \frac{1}{D'}\right) + \underset{(\pm.360)}{2.294}\left(\frac{Z}{F\,I}\right)$$

$$\bar{R} = .969 \qquad \bar{S} = \$62.575 \qquad \frac{\delta^2}{S^2} = 1.706$$

From equations (*2.3*) and (*2.4*) we can derive estimates of the parameters in (*2.1*) and (*2.2*), as follows: [39]

$$(2.6)\quad \frac{\mathrm{G}}{\mathrm{F\,I}} = -28.191 + .104\left(\frac{\mathrm{Y}}{\mathrm{F\,I}}\right) + .002\left(\frac{\mathrm{Y}}{\mathrm{F\,I}}\right)_{-1} - .757\left(\frac{\hat{\mathrm{P}}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$$

$$\mathrm{S}_{u_1} = \$6.595 \qquad \frac{\delta^2}{\mathrm{S}^2} = 2.154$$

$$(2.7)\quad \frac{\mathrm{C}}{\mathrm{F\,I}} = 563.336 + .564\left(\frac{\mathrm{Y}}{\mathrm{F\,I}}\right) + .175\left(\frac{\mathrm{Y}}{\mathrm{F\,I}}\right)_{-1} - 1.204\left(\frac{\hat{\mathrm{P}}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$$

$$\mathrm{S}_{u_2} = \$27.278 \qquad \frac{\delta^2}{\mathrm{S}^2} = 1.706$$

The inclusion of $\left(\frac{\hat{\mathrm{P}}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$ in the consumption function does not seem to produce reliable estimates of all the parameters. Although the residual variation in (*2.5*), (*2.6*), and (*2.7*) is less autocorrelated than in the preceding system of equations, the standard error of the regression coefficient of $\left(\frac{\mathrm{P}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$ in (*2.5*) is so large that we cannot reject the hypothesis that its value is not significantly different from zero. The reduced form equation for instalment sales credit granted (*1.7*), which is also the forecast equation, is not affected by the unreliability of the regression coefficient of $\left(\frac{\hat{\mathrm{P}}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$ in (*2.5*) but the structural equations (*2.6*) and (*2.7*) are affected. Although the error with which the parameters in (*2.6*) and (*2.7*) are estimated is not the same as the standard error of the estimated coefficient of $\left(\frac{\hat{\mathrm{P}}}{\mathrm{I}}\cdot\frac{1}{\mathrm{D}'}\right)$ in (*2.5*), the results obtained provide no evidence that the size of the monthly instalment payments is a significant factor in determining total consumption expenditures, though it does appear to have a significant effect on the demand for instalment sales credit.

The above test is obviously only a tentative one but in order to obtain more definitive results the pattern of consumer expenditures would have to be taken into account and many other variables would have to be explicitly included in the system of equations. This would require the use of a larger number of equations and additional predetermined variables. With the limited number of observations that have been available for this analysis, an insufficient number of degrees of freedom would be left for statistical estimation of all the parameters of the reduced form equations. Accordingly, our findings are only suggestive of what one might expect to find in a more elaborate investigation.

[39] This model is also "just identified."

Explanation of Instalment Sales Credit by the Single-Equation Approach

Total Instalment Sales Credit

In this section, the demand for instalment sales credit is estimated by means of the single-equation approach. Although this method may lead to biased estimates of the parameters, it has the practical advantage of enabling one to consider relations involving more variables than can be handled without large-scale computational operations in the equation-system approach. Moreover, such bias as is present in the single-equation estimation of parameters may not be of major significance in a study of the present type.

The following general relation may be said to represent a reasonable description of the demand for instalment sales credit:

$$(3.0)\qquad \frac{G}{F\,P} = f_0 + f_1\left(\frac{Y - O_{-1}}{F\,I}\right) + f_2\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + f_3\left(\frac{P(1 - N + M)}{I\,D'}\right) + f_4\,T + \epsilon$$

Since the selection of a particular form of the relationship cannot be made on *a priori* grounds, a logarithmic transformation of the linear arithmetic function was also tried, as follows:

$$(4.0)\qquad \log\left(\frac{G}{F\,P}\right) = f_0^* + f_1^* \log\left(\frac{Y - O_{-1}}{F\,I}\right) + f_2^* \log\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + f_3^* \log\left(\frac{P(1 - N + M)}{I\,D'}\right) + f_4^*\,T \log e + \epsilon^*$$

These equations incorporate an item representing the consumers' disposable income in the period in question less the amount of total consumer instalment credit outstanding at the beginning of the year $\left(\frac{Y - O_{-1}}{F\,I}\right)$ on the assumption that the bulk of credit outstanding at the beginning of the year is repaid during the year in question, and that the potential purchasing power of the consumer is exaggerated unless a deduction is made to take account of this fact.[40] This item determines not only the amount of income that the consumer may spend on durable consumer goods but also, in so far as the availability of credit depends upon income, the amount of instalment sales credit which the consumer may command with this income.[41]

40 The average length of contract for all goods sold on the instalment plan was approximately sixteen months over the period under examination, indicating that the greater part of the credit granted in a given year would be repaid over a two-year period. For other types of consumer credit the average length of contract is considerably shorter.

41 The amount of instalment sales credit available for disposition by the consumer is presumably some multiple of the excess of his current income over his subsistence costs.

Since a consumer's decision to purchase durables on the instalment plan also depends to some extent on his past income, and since most down payments for current instalment purchases are accumulated out of past income, the second factor of the equations is consumer disposable income of the preceding year minus the amount of consumer credit outstanding at the beginning of that year. It may be added that the introduction into the equations of the income of the preceding period provides a link with the past and satisfies the possibility that individuals adjust their expenditures to current income with some lag.

The third term of equations (*3.0*) and (*4.0*)—hereafter referred to as S when convenient—is designed to reflect the composite effect on the demand for instalment sales credit of the price of durable consumer goods, the down payment requirement, length of contract, and finance charges characteristic of the instalment sales contract. This combination of factors represents the size of the monthly instalment payment, which may be regarded as a significant element governing the consumer's decision to purchase on the instalment basis, but unfortunately the data on down payments and finance charges are not available for the period under consideration and cannot be included in the calculation. For practical purposes it was necessary to represent the size of the required instalment payment by reference only to the prices of durable consumer goods and the length of the instalment contract.

The time trend (T) in the two equations is intended to approximate the long-run effect on the demand for instalment sales credit of the growth of the stock of durable goods in the hands of consumers, and long-run changes in the habits and preferences of consumers with respect to their use of instalment sales credit facilities. The use of T log e in equation (*4.0*) implies the assumption that all these factors change at a constant percentage rate per unit of time.

As in the preceding equations, population change is taken into account by expressing the volume of instalment sales credit and income in terms of amount per consumer unit. In addition, these variables, along with the size of monthly instalment payments, are expressed in real terms; for this purpose the volume of instalment sales credit is deflated to a level of 1935-39 prices by an index of consumer durable goods prices and the other quantities by the price index of total consumption goods. While the stock of durable consumer goods and of consumer liquid assets are not explicitly included in equation (*3.0*), they may be considered as represented by proxy by the time trend and by the income of the preceding year, respectively.[42]

[42] Whenever it was possible the variables in question were explicitly considered in the exploratory stage of the analysis. However, the inadequacy of the data used makes the results highly tentative.

It will be noted that equation (*3.0*) omits the distribution of consumer income as a separate variable affecting instalment sales credit demand. Shifts in income distribution may be of importance in connection with the demand for instalment sales credit in so far as consumers having real incomes above $5,000 do not for the most part use instalment sales credit; those in the income brackets of less than $5,000 have a great propensity to do so. It is probable, however, that the effect of these shifts is represented by both the coefficient of current disposable income, which accounts for short-term changes in the distribution of income, and by the coefficient of the time trend, which accounts for long-run changes.

The constants for the equations (*3.0*) and (*4.0*) were estimated by means of the traditional multiple correlation technique, and are represented in equations (*3.4*) and (*4.4*) in Tables 2 and 3, respectively. In

TABLE 2

EXPLANATION OF TOTAL DEMAND FOR INSTALMENT SALES CREDIT, 1929-41

Equation Number	*Constant Term*	*Regression Coefficients of:* [a] $\frac{Y-O_{-1}}{FI}$	$\frac{S}{I}$	$\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	T	$\frac{L_{-1}}{FI}$	*Index of Correlation* $\bar{R}$ [b]	*Standard Error of Estimate* $\bar{S}$ [b]
(*3.1*)	−116.1775	.1201					.919	$11.635
		(±.0148)						
(*3.2*)	−9.6384	.1142	−.9037				.976	6.444
		(±.0082)	(±.1777)					
(*3.3*)	3.4575	.0935	−1.1786	.0304			.981	5.738
		(±.0131)	(±.2144)	(±.0160)				
(*3.4*)	118.9442	.0934	−2.4941	.0592	−3.4304		.989	4.177
		(±.0096)	(±.4911)	(±.0490)	(±1.2143)			
(*3.5*)	−8.0485	.1143	−.9089			−.0011	.973	6.792
		(±.0090)	(±.2252)			(±.0268)		
(*3.6*)	1.6005	.1164	−1.0186		−.3737		.973	6.768
		(±.0120)	(±.4924)		(±1.4814)			

[a] The numbers in parentheses below the regression coefficients are standard errors.
[b] Adjusted for the number of variables and for the number of observations.

order to clarify the meaning and implication of the results separate analyses have been made of the demand for automobile instalment sales credit and of what is termed "diversified" financing.[43] These calculations are given in Tables 4, 6, 7, and 8.

A statistical and economic analysis of the data contained in Table 2 shows that the most satisfactory equation for explaining the demand for total instalment sales credit is *(3.3)*. As one would expect on *a priori* grounds, the signs of the two income coefficients are positive and the sign of the regression coefficient of the term representing the size of the required monthly instalment payment is negative. The equation shows that with an increase of one dollar in current disposable income, instalment sales credit demand increased, on the average for the period, by a little more than nine cents and that, in addition, an increase in the preceding year's income of one dollar was associated with an increase in credit demand of a little more than three cents; total instalment sales credit demand per consumer unit decreased, however, by about $1.20 with each increase of one point in the index representing the size of the required monthly instalment payment. The elasticities of the variables obtained at the point of averages were 1.78, 0.57, and —1.39 for disposable income of the current year, disposable income of the preceding year, and the size of the required monthly instalment payment, respectively,

43 The relation of the components of total instalment sales credit demand to the total is based on the following reasoning:

If we assume that the demand $\left(\frac{G_1}{F\,P_1}\right)$ for automobile instalment sales credit is dependent upon income of the current year $\left(\frac{Y - O_{-1}}{F\,I}\right)$, income of the preceding year $\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1}$, the size of the required monthly instalment payment for automobiles $\left(\frac{S_1}{I}\right)$, and on a trend T, then

$$\frac{G_1}{F\,P_1} = f_0' + f_1'\left(\frac{Y - O_{-1}}{F\,I}\right) + f_2'\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + f_3'\left(\frac{S_1}{I}\right) + f_4'\,T + \epsilon_1$$

If it is assumed, further, that the demand for instalment sales credit other than automobiles $\left(\frac{G_2}{F\,P_2}\right)$ is dependent on the same variables as automobile instalment sales credit demand except for $\left(\frac{S_1}{I}\right)$, which will be replaced by an index of the size of the required monthly instalment payments for consumer durables other than automobiles, then

$$\frac{G_2}{F\,P_2} = f_0'' + f_1''\left(\frac{Y - O_{-1}}{F\,I}\right) + f_2''\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + f_3''\left(\frac{S_2}{I}\right) + f_4''\,T + \epsilon_2$$

The equation of demand $\left(\frac{G}{F\,P}\right)$ for total instalment sales credit can be obtained by summing these two equations, as follows:

$$\frac{G}{F\,P} = f_0 + f_1\left(\frac{Y - O_{-1}}{F\,I}\right) + f_2\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + f_3\left(\frac{S}{I}\right) + f_4\,T + \epsilon$$

If there were no curvilinearity in the data, the sums of the regression coefficients of income of the current year, of the income of the preceding year, and of the time trend of the components would be close to the respective coefficients in the equation for total instalment sales credit demand. The regression coefficient of the size of the required monthly instalment payments in the equation for total instalment sales credit demand would represent some average of the corresponding regression coefficients in the equations for the components.

Equations *(3.0)* and *(4.0)* include only variables related to the demand for total instalment sales credit, thus implying that there are no specific factors influencing the different types of instalment sales credit, and that the responsiveness of the several broad types of instalment sales credit to relevant economic factors is generally similar. Obviously, these implied conditions are seldom fulfilled.

thus indicating that instalment sales credit was highly sensitive to the income of the current year, to a lesser extent to the size of monthly instalment payments, and only slightly to the income of the preceding year.

When that part of equation (*3.3*) involving the two income coefficients is rewritten as

$$.1240\left(\frac{Y - O_{-1}}{F\,I}\right) - .0304\left[\left(\frac{Y - O_{-1}}{F\,I}\right) - \left(\frac{Y - O_{-1}}{F\,I}\right)_{-1}\right]$$

it appears that while the demand for instalment sales credit is positively related to current disposable income it is negatively related to the rate of change of income. This suggests that instalment sales credit granted is subject to a dampening influence, i.e., it varies directly with income but tends to rise (fall) at a decreasing rate as the rate of increase (decrease) in income accelerates. It is, therefore, a lagged variable with respect to income. Equation (*3.3*) shows that the full effect of a given change in income is not felt for two or three months.[44]

Equation (*3.3*) seems to raise no serious statistical objections. Taken together, the three variables explain 96.2 percent of the annual changes in instalment sales credit demand for 1929 to 1941. The standard errors of the regression coefficients of current disposable income and the size of the monthly instalment payment are relatively small, and their values are significant at a level of 1 percent. The value of the standard error of lagged disposable income, however, is relatively large but even its level of significance falls between 5 and 6 percent. If we use the ratio of the mean square successive differences to the variance of the residuals, $\frac{\delta^2}{S^2}$, to test the randomness of the residual variation, we obtain a value of 2.046, which at a 5 percent level of significance suggests that we cannot reject the hypothesis that the residuals of instalment sales credit demand are random.[45]

A graphic representation of the contribution of the explanatory variables to the determination of the demand for instalment sales credit, using equation (*3.3*), is given in Chart 6, where it can be seen that variations in demand are explained with a relatively high degree of accuracy except in the years 1936, 1940, and 1941. The 1936 discrepancy between esti-

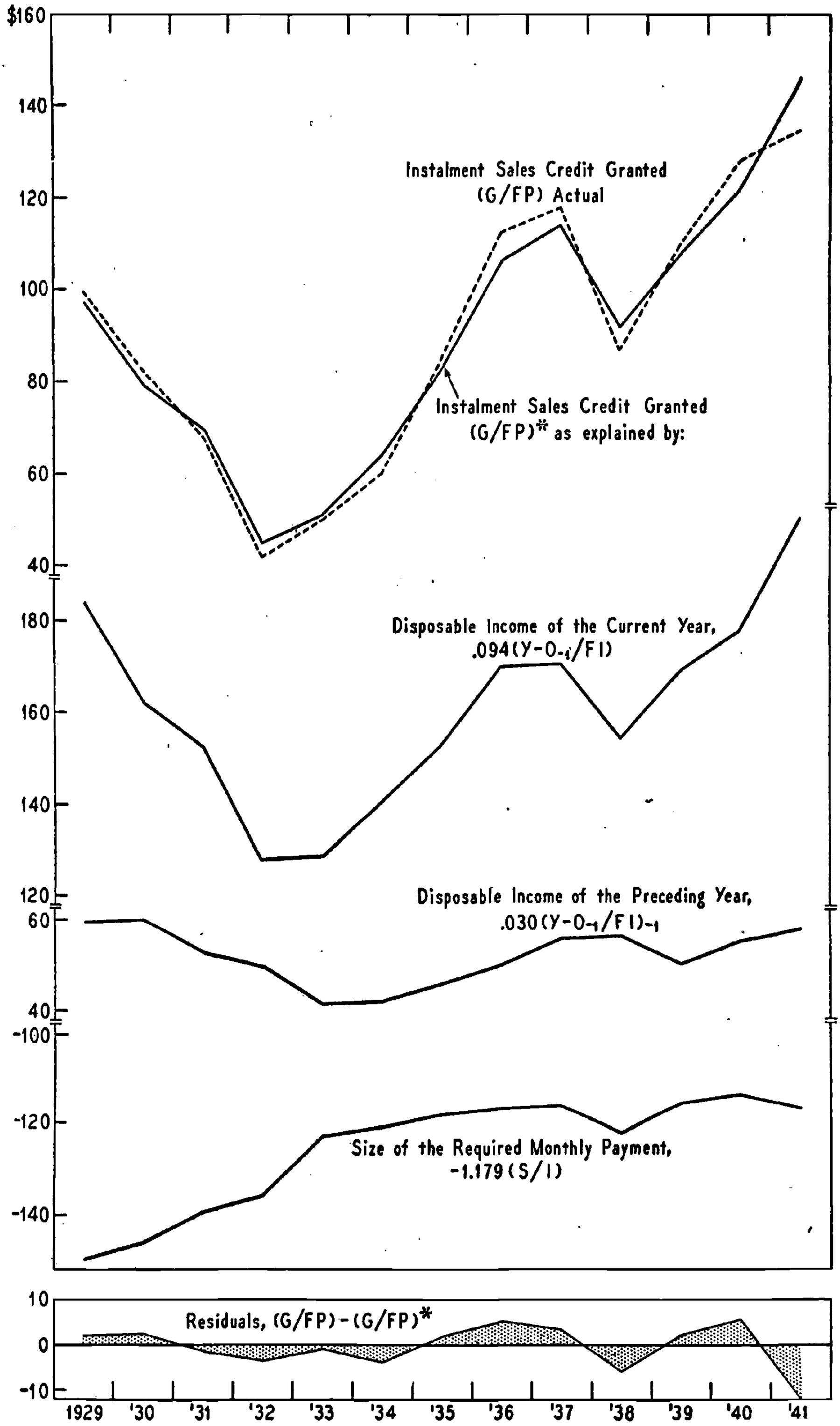
[44] The average lag attributed to the income influence may, as a first approximation, be considered as a weighted average of the two lags, zero and one year respectively, with weights proportional to the coefficients of the two income variables. The explicit calculation of the average lag is given by the formula

$$\frac{.0935(0) + .0304(-1)}{.0935 + .0304} = -.25 \text{ years}$$

[45] The statistic $\frac{\delta^2}{S^2}$ when applied to our problem yields indicative rather than conclusive results. See J. von Neumann, R. H. Kent, H. R. Bellinson, and B. I. Hart, "The Mean Square Successive Difference," in *The Annals of Mathematical Statistics,* Vol. 12, No. 2 (June 1941) pp. 153-62.

CHART 6 — "Explanation" of Demand Per Consumer Unit for Instalment Sales Credit in Terms of Disposable Income of the Current and Preceding Years and the Size of the Required Monthly Payment

(based on equation (3.3), table 2)



mated and actual values, however, may be attributed to the payment in June of that year of the veterans' bonus. The especially stimulating effect of this windfall on disposable income, on durable consumer goods expenditures and, accordingly, on the demand for instalment sales credit could be only inadequately taken into account in the analysis. As for the 1941 discrepancy it may be partly attributed to the introduction of Regulation W.[46]

A logarithmic version of the most important linear arithmetic functions considered above gave results which are summarized in statistical estimates as shown in Table 3. These do not differ substantially from the estimates presented in Table 2. A comparison of findings of the two sets can be made conveniently in terms of elasticities which are produced directly when the parameters of the logarithmic equations are estimated.[47] Thus in set *(3.3)* estimates of 1.78, —1.39, and 0.57 taken at the point of means, and in set *(4.3)* estimates of 2.17, —1.26, and 0.35, are given for current disposable income, the size of the required monthly instalment payments, and the income of the preceding year, respectively.

46 Other details of the calculations may be summarized as follows. Set *(3.4)* contains the time factor in addition to the variables included in *(3.3)* but while more complete, and showing some improvement in correlation over *(3.3)*, it raises serious statistical objections. In this equation the standard error of lagged disposable income becomes large and its value is now significant only at the 11 percent level. However, when disposable income of the preceding year is omitted from *(3.4)*, as in *(3.6)*, the regression coefficient of the trend factor decreases by about ten times, becomes highly unreliable, and the total correlation falls below that of set *(3.2)*. On the other hand, in *(3.3)*, where the trend factor is left out, total correlation decreases only moderately over that of *(3.4)* and still remains greater than in *(3.2)*. Disposable income of the preceding year, therefore, seems to be an important variable for any satisfactory explanation of changes in the demand for instalment sales credit. The two variables, size of the monthly instalment payment and the time factor, both of which appear in *(3.4)*, are rather highly correlated ($r = -.882$) and although the standard errors of the regression coefficients of these variables are small, the observed intercorrelation creates considerable uncertainty as to the contribution of each of the variables in question.

As a matter of fact, the regression coefficient of the size of the monthly instalment payments, which exhibits a relative stability in various sets, is more than doubled when the time factor is introduced by passing from *(3.3)* to *(3.4)*. Moreover, the regression coefficients of the size of the monthly instalment payments and the time factor are so high in *(3.4)* that it is hardly possible to reconcile them with the corresponding findings for the components of total instalment sales credit which will be presented at a later point. This statement probably would hold even if we made a liberal allowance for the bias involved in the least-squares estimates of the relevant parameters.

Equation *(3.5)* is clearly unsatisfactory, since its total correlation is smaller than that of *(3.2)*. This would indicate that the contribution of the liquid assets variable $\left(\frac{L_{-1}}{F\,I}\right)$ to the explanation of demand for instalment sales credit was negligible during the period 1929-41.

It would have been desirable to use a series on liquid asset holdings of individuals or of spending units in which liquid assets were defined in their usual general sense as consisting of currency, bank deposits, savings bonds and marketable securities, or at least to have had a series built on the more limited definition of liquid assets used in the 1946 Survey of Liquid Assets referred to above, namely, bank deposits and United States government securities. However, series are not available for individuals' holdings on either of these definitions. As an indicator of the movement of the liquid asset holdings of individuals over the period of our study, we have used estimates of currency and bank deposits, exclusive of those held by businesses, banks and public bodies. See Appendix A for the sources of these data.

47 In linear logarithmic equations the estimated regression coefficients represent constant elasticities.

TABLE 3

EXPLANATION OF TOTAL DEMAND FOR INSTALMENT SALES CREDIT, 1929-41
(logarithmic equations)

Equation Number	Constant Term	Regression Coefficients of:[a] $\log\left(\frac{Y-O_{-1}}{FI}\right)$	$\log\left(\frac{S}{I}\right)$	$\log\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	$T \log e$	Index of Correlation $\bar{R}$[b]	Standard Error of Estimate $\bar{S}$[b]
(4.1)	−6.2818	2.5414 (±.2823)				.932	.057
(4.2)	−3.7504	2.4177 (±.1841)	−1.0519 (±.2581)			.973	.037
(4.3)	−3.6542	2.1665 (±.3350)	−1.2573 (±.3459)	.3494 (±.3879)		.972	.037
(4.4)	−1.2145	2.0896 (±.2529)	−3.4313 (±.8121)	1.0843 (±.3904)	−.0511 (±.0181)	.984	.028

[a] The numbers in parentheses below the regression coefficients are standard errors

[b] Adjusted for the number of variables and for the number of observations.

Since the form of the two equations is not the same, the differences between the estimates could be expected.

It may be observed, however, that the reliability of the regression coefficients of the preceding year's income is decreased in (*4.3*), and the total correlation of the latter set is smaller than that of (*4.2*), which would indicate that the preceding year's income contributes nothing to an explanation of the demand for instalment sales credit. The latter finding, however, is in contradiction to corresponding findings for the components of instalment sales credit demand and cannot, therefore, be accepted. In general, the analysis indicates that greater uncertainty attaches to the influence of the income of the preceding year than to the effect of the other variables in the relations considered. If the lag in the effect of income is brief, it is difficult to account for it reliably by using annual data.

In (*3.4*), elasticities of 1.77, −2.94, 1.11, and in (*4.4*) of 2.09, −3.43, and 1.08, are obtained for disposable income of the current year, the size of the monthly instalments, and disposable income of the preceding year, respectively. Both sets contain a cumulative downward trend which was found to be 5.1 percent per annum in (*4.4*) and 3.8 percent per annum in (*3.4*), when taken at the mean point of $\left(\frac{G}{FP}\right)$.[48] The standard errors of the regression coefficients in (*4.4*) are all significant at a 1 percent level, but a strong intercorrelation between the size of the monthly instalment

[48] The relative rate of change of $\left(\frac{G}{FP}\right)$ per unit of time is $\frac{1}{\left(\frac{G}{FP}\right)} \cdot \frac{\partial\left(\frac{G}{FP}\right)}{\partial T}$.

TABLE 4

EXPLANATION OF DEMAND FOR AUTOMOBILE INSTALMENT SALES CREDIT, 1929-41

Equation Number	Constant Term	Regression Coefficients of:[a] $\frac{Y-O_{-1}}{FI}$	$\frac{S_1}{I}$	$\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	T	$\frac{L_{-1}}{FI}$	$\left(\frac{R}{F}\right)_{-1}$	Index of Correlation $\bar{R}$[b]	Standard Error of Estimate $\bar{S}$[b]
(3.7)	−68.6629	.0673 (±.0089)						.908	$7.005
(3.8)	−9.1239	.0544 (±.0096)	−.3483 (±.1571)					.933	6.015
(3.9)	16.2791	.0304 (±.0206)	−.5880 (±.2384)	.0245 (±.0188)				.938	5.815
(3.10)	35.0651	.0363 (±.0166)	−.7237 (±.1974)	.0206 (±.0150)	−1.1088 (±.4448)			.961	4.628
(3.11)	15.0357	.0583 (±.0092)	−.3364 (±.1434)			−.0298 (±.0183)		.943	5.573
(3.12)	18.4711	.0734 (±.0145)	−.1829 (±.1767)				−1.1676 (±.7105)	.943	5.561
(3.13)	14.9822	.0567 (±.0078)	−.5318 (±.1460)		−1.1720 (±.4636)			.957	4.849

[a] The numbers in parentheses below the regression coefficients are standard errors.
[b] Adjusted for the number of variables and for the number of observations.

payment and the time trend (r = .887), as well as the magnitude of the elasticities, raises against it the same objections as those raised against *(3.4)*.

Finally, it may be noted that fitting equations to the logarithms of the data results in a slightly smaller percentage of explained variation in the demand for total instalment sales credit than fitting equations to the original data.

Automobile Instalment Sales Credit

Table 4 (page 37) shows that, from the statistical point of view, the most satisfactory equation for explaining the demand for automobile instalment sales credit is *(3.13)*, which includes as explanatory variables the income of the current year, the size of the required monthly payment for automobile instalment sales credit, and the time factor. This relation excludes disposable income of the preceding year as an explanatory variable but when *(3.10)*, which includes this variable, is considered it is found that the sum of the two income regression coefficients is almost exactly equal to the regression coefficient of the income of the current year as given in *(3.13)*, suggesting that the latter variable may cumulate the influence of both current and past incomes. However, since the standard errors of the regression coefficients of the two incomes are quite large, some uncertainty must be attached to the reliability of each coefficient taken separately.

The numerical values obtained for the elasticities of the variables in *(3.10)* and *(3.13)* are shown in the table below.

TABLE 5

ELASTICITIES OF DEMAND FOR AUTOMOBILE INSTALMENT SALES CREDIT WITH RESPECT TO SPECIFIED EXPLANATORY VARIABLES, 1929-41

Explanatory Variable	*Elasticities of Demand Based on Equation:*	
	(3.10)	*(3.13)*
Income of the current year	1.33	2.07
Income of the preceding year	.75	..
Size of the required monthly instalment payment	—1.65	—1.22

These results suggest a relatively high responsiveness of the demand for automobile credit with respect to current and lagged incomes, when taken together, and a smaller responsiveness with respect to the size of the monthly instalment payment.

Both (*3.10*) and (*3.13*) contain a negative trend—about 2.5 percent per annum when taken at the point of averages—suggesting that after accounting for the influence of current and past income, consumers had a tendency over time to use decreasing amounts of automobile instalment sales credit. This is plausible and can be attributed mainly to any or all of the three following factors:

1. The increase in the stock of cars in the hands of consumers, and thus the growing importance of replacement demand, has increased the frequency of trade-ins. Since the value of automobiles traded in had a tendency to increase relative to the value of new cars, many consumers were probably able to pay the difference in cash.

2. Although there was a definite upward trend in the use of instalment sales credit for the purchase of used automobiles, this was more than offset by the downward trend in the purchase of new automobiles, owing to the smaller number of potential first buyers, and the resulting downward trend in the use of new car credit.

3. To an increasing extent, consumers financed their automobile purchases by borrowing from cash-lending institutions rather than by using instalment sales credit.

The stock of automobiles in the hands of consumers is introduced explicitly in equation (*3.12*). Although the $\overline{R}$ of this equation exceeds that for (*3.8*), which does not include the stock variable, (*3.12*) is unacceptable from the statistical point of view, because when we pass from (*3.8*) to (*3.12*) the value of the regression coëfficient for the size of the required instalment payment decreases, and its standard error increases. Moreover, the standard error of the regression coefficient for the stock of automobiles in (*3.12*) is quite large. It may be observed, however, that the sign of the regression coefficient of the stock of automobiles is negative, suggesting that an increase in the consumer's inventory of automobiles has a depressing effect on the demand for automobile instalment sales credit. Since the series on stock of automobiles used in the analysis represents estimates based on automobile registrations and, furthermore, since this series does not take into account the age distribution of automobiles, the results obtained in (*3.12*) are obviously of an inconclusive nature.

As indicated by (*3.11*) it would appear, and this is plausible, that the amount of liquid assets held by consumers exerted a negative influence on the demand for automobile instalment sales credit. The influence of this factor, in addition to that of the stock of automobiles, may be reflected in the negative trend in the demand for automobile instalment sales credit. However, since changes in the distribution of liquid assets among consumers are not taken into account in equation (*3.11*), and since the standard error of the regression coefficient for liquid assets is relatively large, much uncertainty attaches to our finding.

In order to test the validity of the assumption of linearity of the relationship among variables, partial scatter diagrams are presented in Charts 7, 8, and 9. It will be seen that only Chart 8, which relates the size of the required monthly instalment payment to the demand for automobile credit, exhibits a marked tendency to curvilinearity. This chart suggests that in the period under consideration consumers increased (or decreased) their use of automobile instalment sales credit more than proportionately with decreases (or increases) in the size of the monthly instalment payment.

The presence of curvilinearity in the data is also reflected in results obtained when equations are fitted to the logarithms of the variables (Table 6). The resulting correlation coefficients are substantially higher

TABLE 6

EXPLANATION OF DEMAND FOR AUTOMOBILE INSTALMENT SALES CREDIT, 1929-41
(logarithmic equations)

Equation Number	*Constant Term*	*Regression Coefficients of:* [a] $\log\left(\frac{Y-O_{-1}}{FI}\right)$	$\log\left(\frac{S_1}{I}\right)$	$\log\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	$T \log e$	*Index of Correlation* $\bar{R}$ [b]	*Standard Error of Estimate* $\bar{S}$ [b]
(4.5)	−7.7112	2.8935 (±.3721)				.912	.075
(4.6)	−3.2378	2.2384 (±.3676)	−1.1612 (±.4033)			.948	.058
(4.7)	−2.0927	2.3030 (±.2425)	−1.7802 (±.3125)		−.0322 (±.0086)	.978	.038
(4.8)	−.0114	1.0036 (±.4267)	−2.6912 (±.3495)	1.2295 (±.3715)	−.0333 (±.0059)	.990	.026

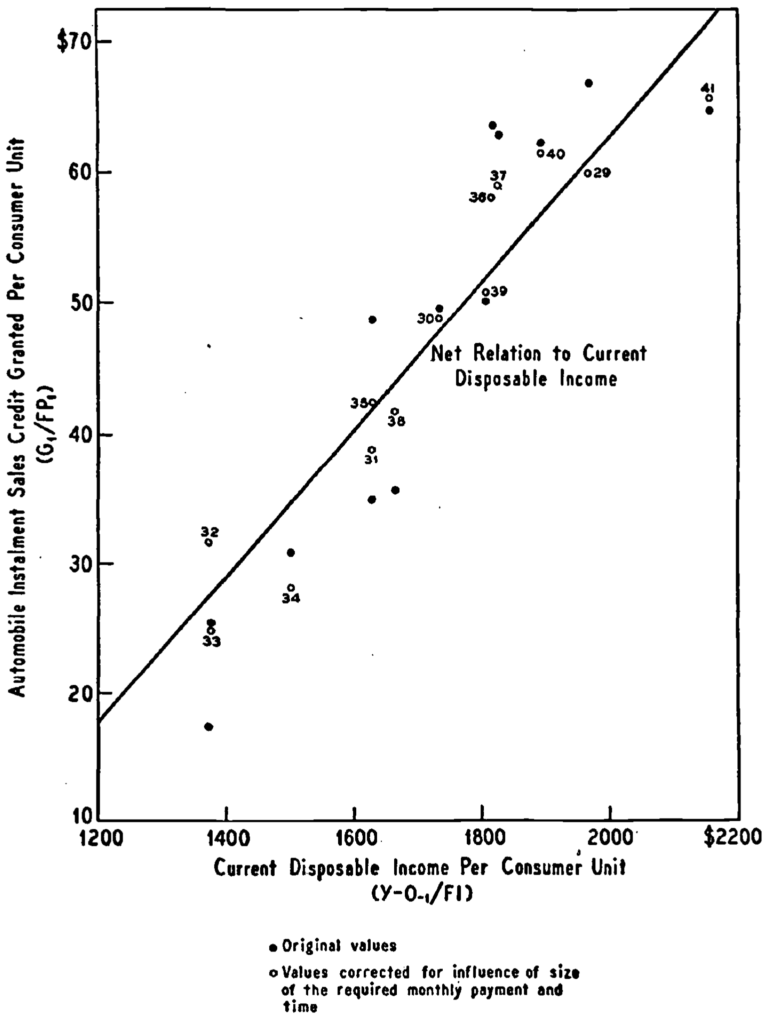
[a] The numbers in parentheses below the regression coefficients are standard errors.
[b] Adjusted for the number of observations and for the number of variables.

than those obtained for the corresponding sets based on original data (Table 4); moreover, the reliability of the regression coefficients in general becomes significantly greater.

The best equation describing the demand for automobile instalment sales credit appears to be *(4.8)* in which the four explanatory variables —income of the current year, income of the preceding year, size of the required monthly instalment, and time—explain 98 percent of the observed variation.[49] There is clearly a strong elasticity of demand for

[49] The standard errors of the regression coefficients are all significant at the 5 percent level; the value of $\frac{\delta^2}{S^2}$, 1.868, is also significant.

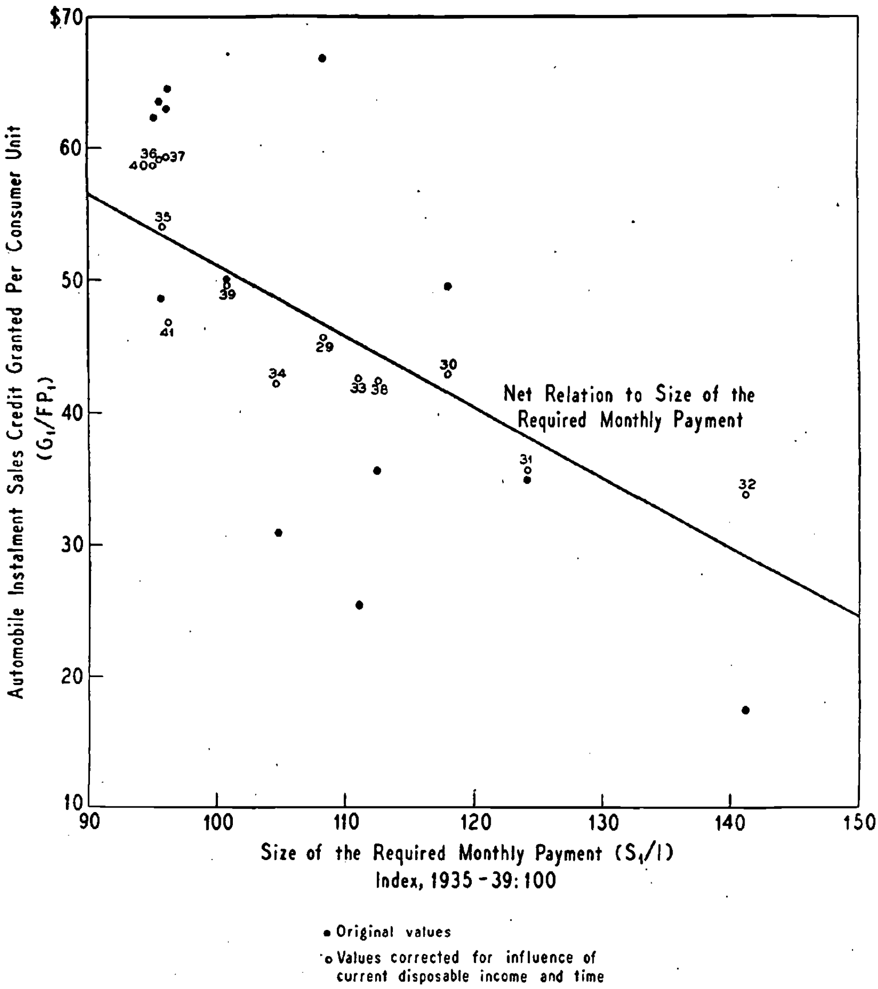
CHART 7 — Relation Between Automobile Instalment Sales Credit Granted and Current Disposable Income, Per Consumer Unit, in 1935-39 Dollars



automobile instalment sales credit with respect to the size of the required monthly instalment payment ($\eta = -2.7$) and a somewhat smaller elasticity with respect to the sum of the incomes of the current and preceding years ($\eta = 2.3$). It is interesting to note that the elasticity of demand for credit with respect to the income of the preceding year ($\eta = 1.23$) is slightly greater than that for the current year ($\eta = 1.00$), which suggests that the full effect on consumer use of automobile instalment sales credit of changes in consumer income lags about seven months after the change in income. There is also indication of a strong downward trend in consumer use of instalment credit for the acquisition of automobiles—3.3 percent per annum—which may be attributed to the factors discussed above in connection with *(3.10)* and *(3.13)*.

Chart 10 shows how closely in agreement are the observed and computed values of automobile instalment sales credit used *(4.8)*. The

CHART 8—Relation Between Automobile Instalment Sales Credit Granted Per Consumer Unit, in 1935-39 Dollars, and Size of the Required Monthly Payment



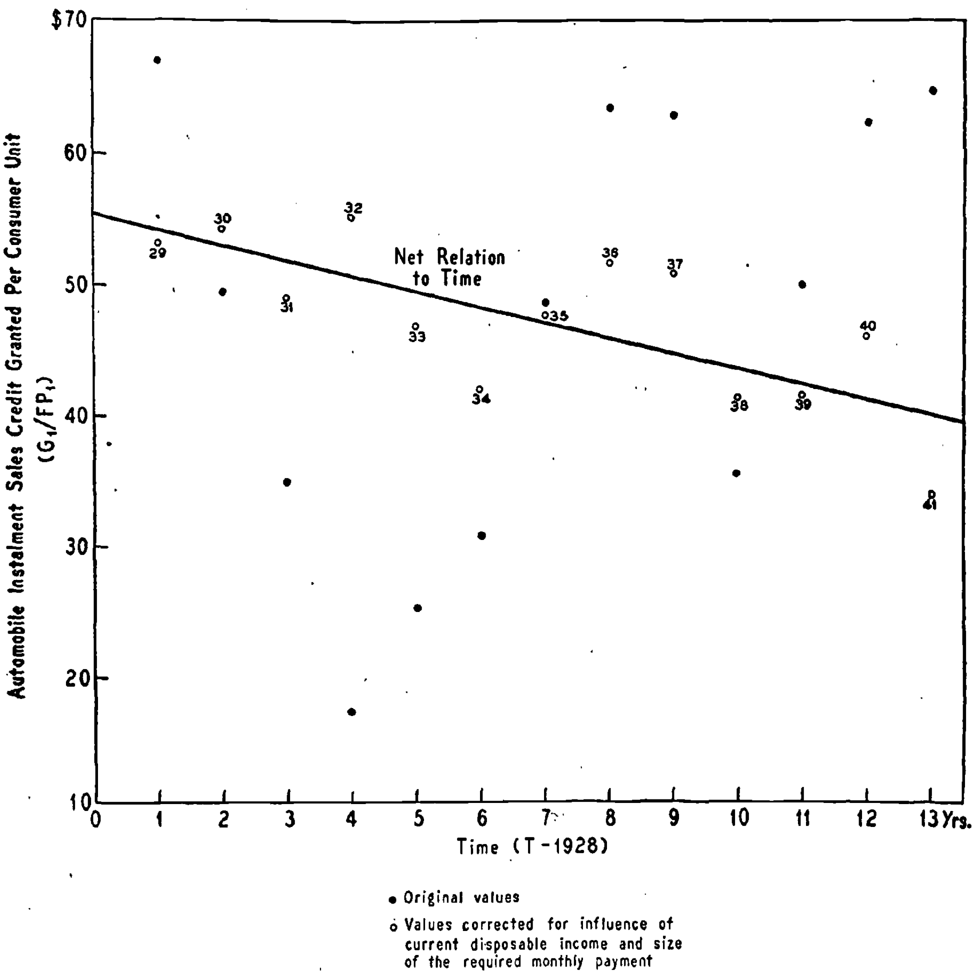
stimulating effect of the payment of the veterans' bonus on credit demand and the restrictive effect of Regulation W are again suggested by the residuals for 1936 and 1941, respectively.

Diversified Instalment Sales Credit

The demand for instalment sales credit in the so-called "diversified" financing field is defined as credit extended in connection with purchases at furniture, department, jewelry, and "all other" stores.[50] As will be seen in Table 7, the demand for this type of credit is about equally well explained by set *(3.16)*, in which the explanatory variables

[50] This classification follows that used by Duncan McC. Holthausen *et al., op. cit.,* pp. 114-20. "All other" stores include those in which appliances are a major line.

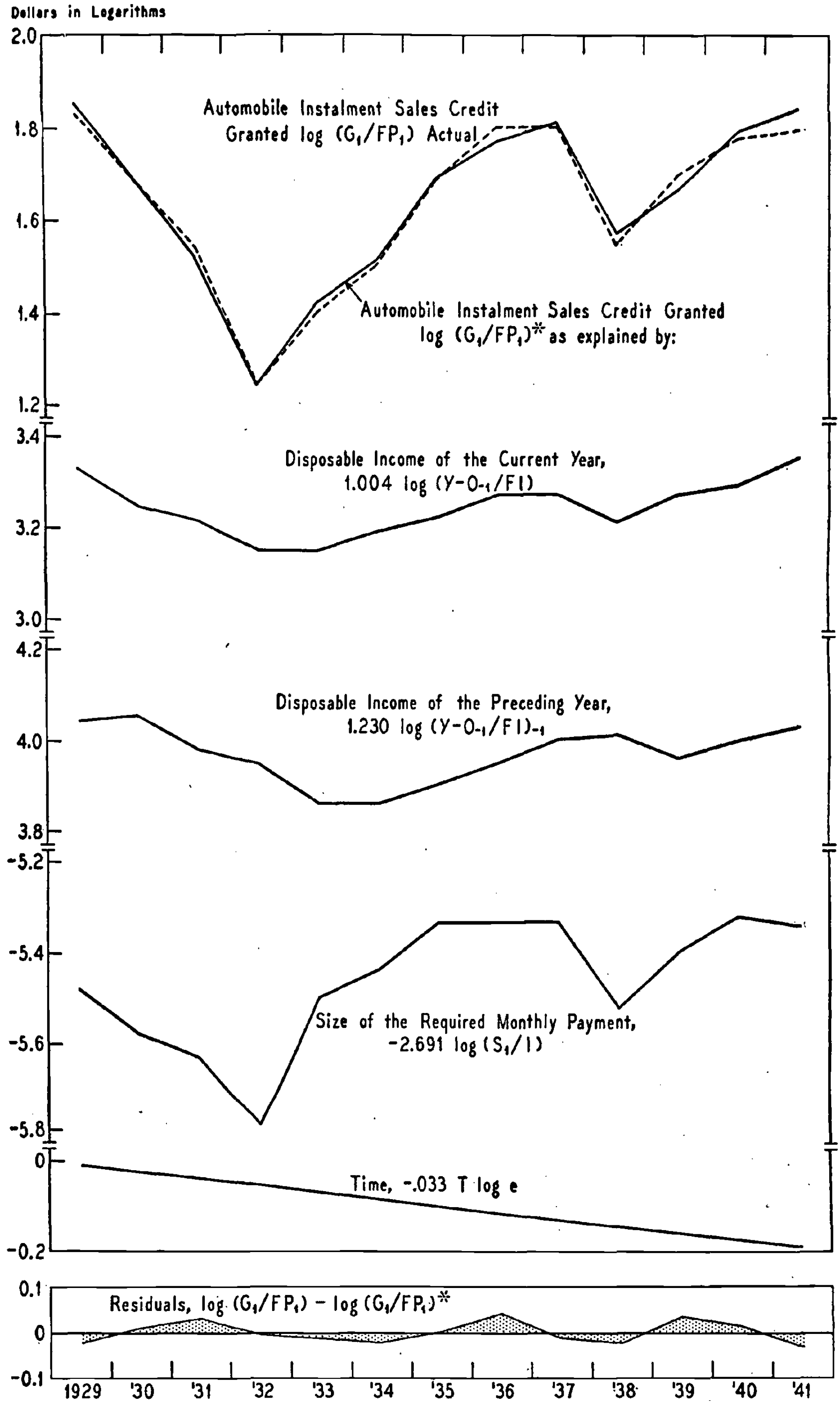
CHART 9 — Relation Between Automobile Instalment Sales Credit Granted Per Consumer Unit, in 1935-39 Dollars, and Time



are the income of the current year and of the preceding year, and the size of the required monthly instalment payment, and by *(4.11)* in Table 8, which is fitted to the logarithms of the original data for these same variables. The multiple correlation coefficients of both sets are high, 0.985 and 0.987, respectively, and the regression coefficients are all significant at the 1 percent level. The elasticities of demand for diversified instalment sales credit with respect to the explanatory variables are about the same for both sets, as Table 9 illustrates.

The elasticity of demand with respect to the size of the required monthly instalment payment is very high but smaller, nonetheless, than the sum of the two income elasticities, current and lagged. It also appears that consumers using instalment sales credit for the purchase of goods other than automobiles are more sensitive to changes in current income than to changes in the income of the preceding year and that the lag of the income effect is somewhat less than in the case of automobile

CHART 10 — "Explanation" of Demand Per Consumer Unit for Automobile Instalment Sales Credit in Terms of Disposable Income of the Current and Preceding Years and Size of the Required Monthly Payment
(based on equation (4.8), table 6)



credit demand: the coefficients of the two incomes suggest that the full effect on consumer use of instalment sales credit of changes in income occur only with a lag of three to four months after the change in income.

When the time factor is included in the equation of demand for diversified instalment sales credit (*3.17*) the total correlation is only slightly raised, suggesting that this is not an important explanatory variable (Table 7). Furthermore, the value of the regression coefficient of

TABLE 7

EXPLANATION OF DEMAND FOR DIVERSIFIED INSTALMENT SALES CREDIT, 1929-41

		Regression Coefficients of:[a]						Standard
Equation Number	*Constant Term*	$\frac{Y-O_{-1}}{FI}$	$\frac{S_2}{I}$	$\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	T	$\frac{L_{-1}}{FI}$	*Index of Correlation* $\bar{R}$[b]	*Error of Estimate* $\bar{S}$[b]
(*3.14*)	−46.1431	.0527 (±.0098)					.835	$7.794
(*3.15*)	14.8389	.0641 (±.0052)	−.7657 (±.1276)				.963	3.812
(*3.16*)	17.0324	.0524 (±.0044)	−.9845 (±.0976)	.0240 (±.0060)			.985	2.412
(*3.17*)	−5.2629	.0417 (±.0080)	−.6102 (±.2565)	.0211 (±.0059)	.9140 (±.5858)		.987	2.240
(*3.18*)	−17.1832	.0592 (±.0059)	−.6167 (±.1561)			.0229 (±.0153)	.967	3.595

[a] The numbers in parentheses below the regression coefficients are standard errors.
[b] Adjusted for the number of variables and for the number of observations.

the monthly instalment payment is greatly decreased, and its standard error is increased in equation (*3.17*) as compared with (*3.16*). The standard error of the regression coefficient of time is high in equation (*3.17*). Similar and even more conclusive results are shown by the logarithmic relation (*4.12*) in Table 8. The standard error of the regression coefficient of the time factor is almost three times as large as the regression coefficient itself, and in passing from (*4.11*) to (*4.12*) the total correlation coefficient is slightly decreased while the regression coefficients of the two incomes and the size of the required monthly instalment payment remain much the same.

It is interesting to note that the sign of the regression coefficients of the time factor in the two sets—(*3.17*) and (*4.12*)—is positive. It is not surprising to find evidence that a slowly but consistently growing replacement market for goods covered by diversified financing, and a large potential new demand for such goods, many of which first came

TABLE 8

EXPLANATION OF DEMAND FOR DIVERSIFIED INSTALMENT SALES CREDIT, 1929-41
(logarithmic equations)

Equation Number	*Constant Term*	*Regression Coefficients of:*[a] $\log\left(\frac{Y-O_{-1}}{FI}\right)$	$\log\left(\frac{S_2}{I}\right)$	$\log\left(\frac{Y-O_{-1}}{FI}\right)_{-1}$	$T \log e$	*Index of Correlation* $\bar{R}$[b]	*Standard Error of Estimate* $\bar{S}$[b]
(4.9)	5.4211	2.1807 (±.3553)				.868	.072
(4.10)	−3.0974	2.5821 (±.1916)	−1.7922 (±.3095)			.968	.036
(4.11)	−3.3998	2.1444 (±.1690)	−2.2966 (±.2404)	.8474 (±.2211)		.987	.023
(4.12)	−3.4634	2.0560 (±.3124)	−2.0880 (±.6571)	.8208 (±.2450)	.0046 (±.0134)	.985	.025

[a] The numbers in parentheses below the regression coefficients are standard errors.
[b] Adjusted for the number of variables and for the number of observations.

into the market just prior to 1930, has produced an upward trend in demand for diversified instalment credit. Equation (*3.18*) suggests that the trend may be due, also, to changes in the amount of liquid assets held by consumers.

Its relative simplicity recommends set (*3.16*) as an explanation of the

TABLE 9

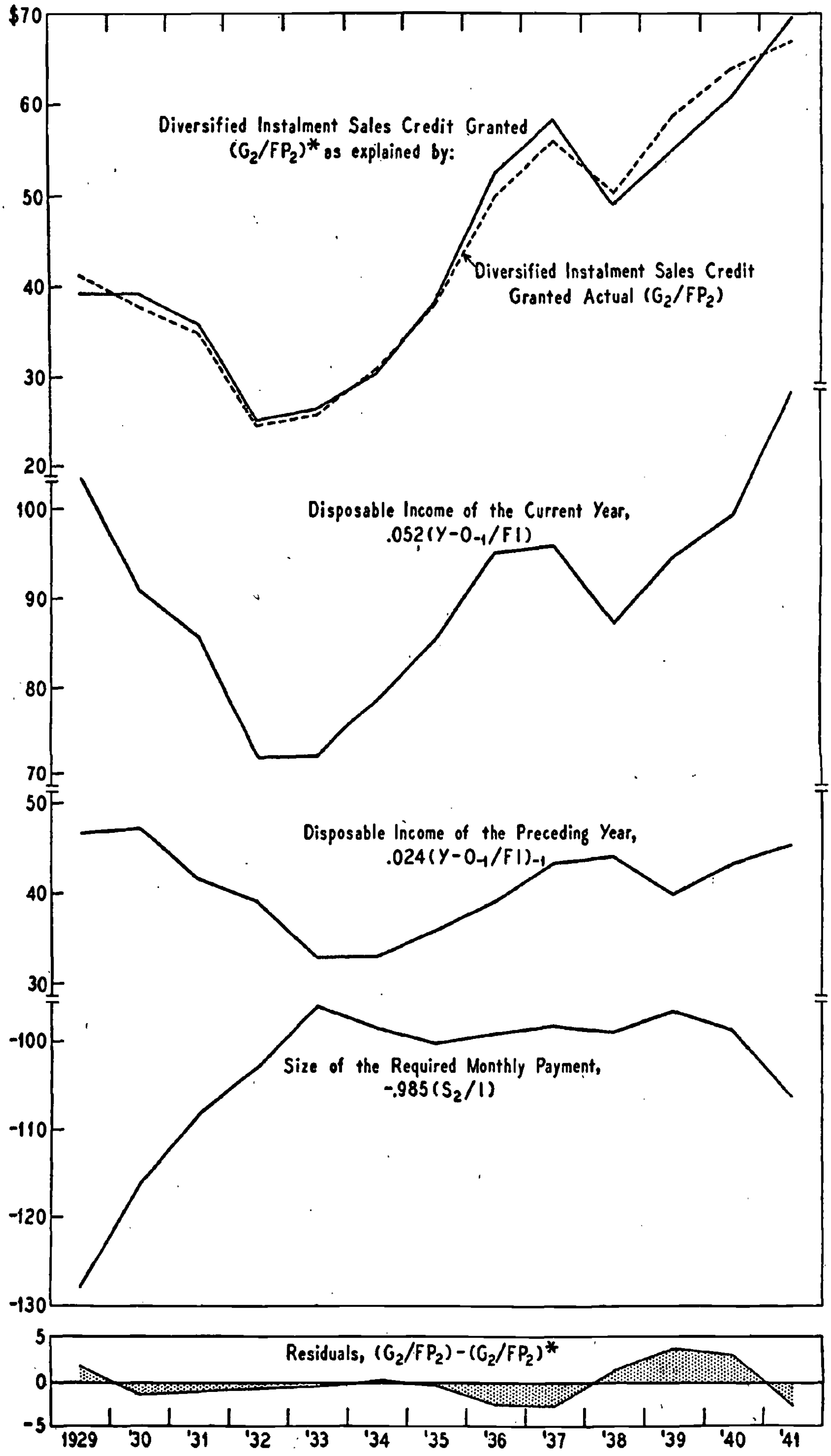
ELASTICITIES OF DEMAND FOR DIVERSIFIED INSTALMENT SALES CREDIT WITH RESPECT TO SPECIFIED EXPLANATORY VARIABLES, 1929-41

Explanatory Variable	*Elasticities of Demand Based on Equation:* (3.16)	(4.11)
Current disposable income	2.02	2.14
Disposable income of the preceding year	.92	.85
Size of the required monthly instalment payment	−2.32	−2.30

demand for diversified instalment sales credit; Chart 11 shows that this equation produces a satisfactory agreement between actual and computed values.[51] Residuals are relatively large in 1937, 1939, and 1940, but in other years they vary within quite narrow limits. It is interesting to observe that the residual in 1941 suggests that Regulation W had some effect on diversified financing similar to that which it had on total

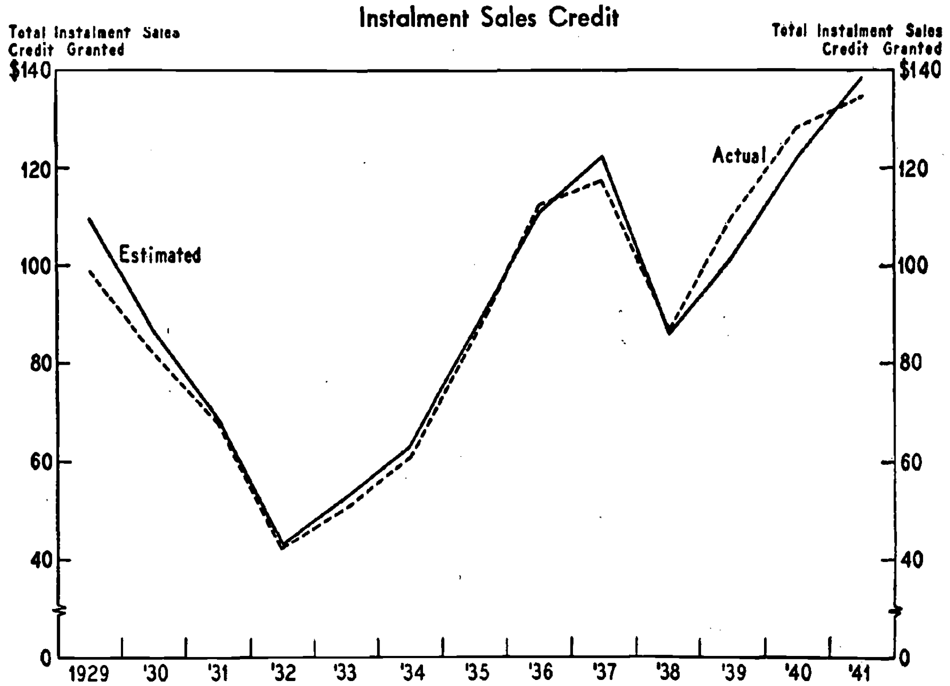
[51] The value of $\frac{\delta^2}{S^2}$ at 1.454 indicates that the hypothesis that the residuals are nonautocorrelated cannot be rejected.

CHART 11 — "Explanation" of Demand Per Consumer Unit for Diversified Instalment Sales Credit in Terms of Disposable Income of the Current and Preceding Years and Size of the Required Monthly Payment
(based on equation (3.16), table 7)



instalment sales credit and its automobile component. However, no stimulating effect of veterans' bonus payments is suggested by the residual in 1936.

CHART 12 — Actual Values of Total Instalment Sales Credit Granted and Values Estimated from Equations for Automobile and Other Than Automobile Instalment Sales Credit



Total Instalment Sales Credit Versus Components

The previous calculations may now be brought together and an attempt made to determine whether the difference between using the total function and component instalment sales credit functions is of significance in the explanation of demand for instalment sales credit. The degree of closeness of computed values to actual values may be used as a rough criterion for our purpose. When estimates of total instalment sales credit obtained from equation (*3.3*) and those obtained from equations (*4.8*) and (*3.16*) are correlated each with the actual values of total instalment sales credit the respective correlation coefficients were found to be .9858 and .9865. The difference between the two coefficients is so small that it provides no basis for the expression of preference for using either the total function or the component instalment sales credit functions for the explanation of the demand for instalment sales credit. Chart 12 shows how close are the calculated values obtained from equations (*4.8*) and (*3.16*) to the actual values of total instalment sales credit.[52] It may be observed that the estimates derived from these

52 Chart 6 shows the degree of closeness between the estimated and actual values derived from the equation (*3.3*) based on total instalment sales credit.

equations show no systematic difference in amplitude of fluctuation as compared with actual data, whereas the estimates obtained from the equation for the total demand for instalment sales credit (*3.3*) magnify the amplitude of fluctuation except in 1940 and 1941.

Additional Explanations of Credit Demand

Explanation Using Supersubsistence Adjusted Income

It may be argued that total disposable income is not an appropriate measure of the volume of consumers' purchasing power influencing the demand for instalment sales credit, in so far as a substantial part of it either is not available for the purchase of durable consumer goods, or is received by consumers whose incomes are so high that they generate only a negligible part of the total demand for instalment sales credit. Accordingly, an attempt has been made to isolate that part of consumer income which is most clearly relevant to the analysis of instalment sales credit demand. For this purpose it has been assumed (a) that consumers purchase durable goods only if they have already met, or have made provision to meet, the costs of the "necessities of life," and (b) that consumers with real incomes above certain levels do not use instalment sales credit.

The income that remains after subtraction of that part which is assumed to exert no influence on the demand for instalment sales credit—what may be termed "supersubsistence adjusted income"—is crudely approximated by the following equation:

$$Y_s = Y^o_r\,(1 - k) - \ln\,(1 - k')$$

where:

Y_s = adjusted supersubsistence annual income deflated by the price index of total consumption, 1935-36 : 100

Y^o_r = revised series of annual income payments to individuals less personal tax and nontax payments as given by the Department of Commerce (old concept) deflated by the price index of total consumption, 1935-36 : 100 [53]

k = the percentage of aggregate real disposable income received by consumer units with incomes above \$5,000 [54]

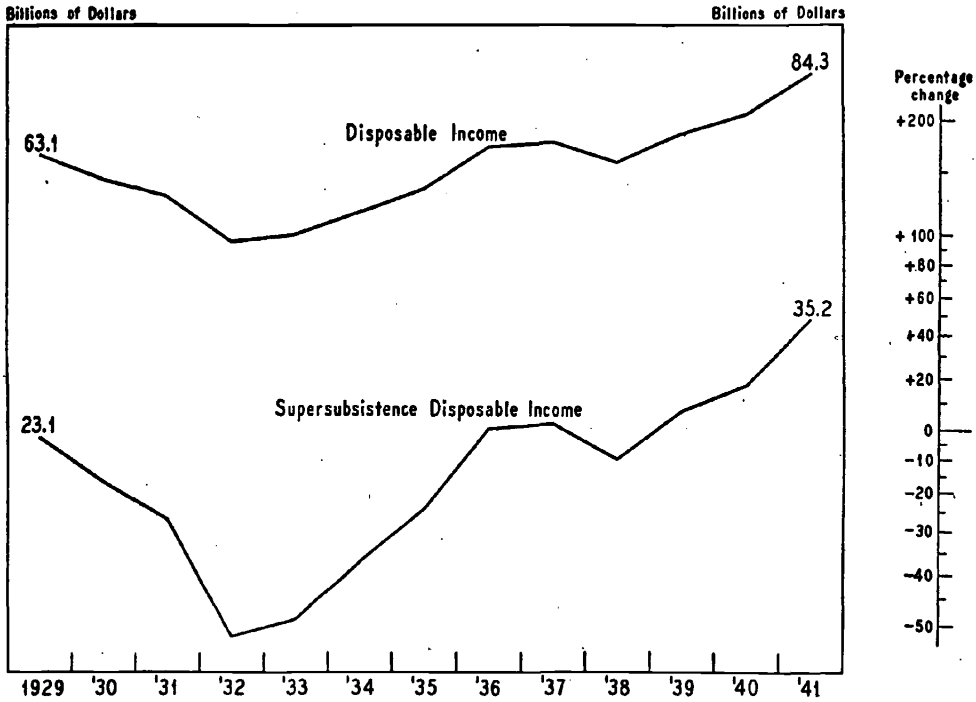
[53] National Income Supplement to *Survey of Current Business*, July 1947, pp. 14 and 19. This series was used instead of the series employed elsewhere in the analysis and reproduced in Appendix A (the so-called "new concept" of personal disposable income) because it corresponds more closely to our concept of supersubsistence income. The "old concept" series excludes certain items such as imputed rent which are presumed not to have an influence on consumer demand for durable goods. The new series might have been adjusted to exclude such items, though this could not have been done altogether satisfactorily, but since these are not present in the old series it was more convenient, and involved no significant loss of accuracy, to utilize it directly.

[54] This percentage is most reliably known for the years 1935-36; percentages for other years under consideration were computed on the assumption of an unchanged Lorenz curve for the income

l = annual subsistence costs of living per capita: $225.82 [55]
n = mid-year population of the continental United States
k' = percentage of the United States population with real incomes above $5,000 [56]

An inspection of Chart 13 in which supersubsistence adjusted income is compared with total disposable income reveals the expected difference in the levels, and similarity in direction of movement, of the two incomes but also a clear difference in the rates of change of each.

CHART 13 — Adjusted Series on Consumer Income, 1929-41
(logarithmic vertical scale)



Source: Data in Appendix A.

When total disposable income is replaced in the various equations by supersubsistence adjusted income, and the latter is adjusted according to the number of consumer units receiving it and corresponding price changes, the estimates of parameters of the thus modified total instalment sales credit relation, and its component relations, are as follows:

distribution of the years 1935-36. See Blanche Bernstein, *op. cit.*, pp. 124-25. For the method of estimation of k, see David Durand, "A Simple Method for Estimating the Size Distribution of a Given Aggregate Income," *The Review of Economic Statistics*, Vol. 25, No. 4 (November 1943) pp. 227-30.

[55] Estimated by the Works Progress Administration, Division of Social Research, "Intercity Differences in Costs of Living in March 1935, 59 Cities" (Research Monograph 12).

[56] This percentage is most reliably known for the years 1935-36; percentages for other years were computed on the assumption of an unchanged Lorenz curve for the income distribution of the years 1935-36. For the method of estimation, see David Durand, *loc. cit.*

Total Instalment Sales Credit

$$(5.1)\qquad \frac{G}{F'P} = \underset{}{105.019} + \underset{(\pm.0171)}{.1289}\left(\frac{Y_s - O_{-1}}{F'I}\right) - \underset{(\pm.1911)}{.9356}\left(\frac{S}{I}\right) + \underset{(\pm.0196)}{.0647}\left(\frac{Y_s - O_{-1}}{F'I}\right)_{-1}$$

$$\bar{R} = .984 \qquad \bar{S} = \$5.453 \qquad \frac{\delta^2}{S^2} = 2.507$$

Automobile Instalment Sales Credit

$$(5.2)\qquad \frac{G_1}{F'P_1} = 78.570 + \underset{(\pm.0226)}{.0599}\left(\frac{Y_s - O_{-1}}{F'I}\right) - \underset{(\pm.1964)}{.5979}\left(\frac{S_1}{I}\right) + \underset{(\pm.0185)}{.0352}\left(\frac{Y_s - O_{-1}}{F'I}\right)_{-1} - \underset{(\pm.4563)}{1.2924}\,T$$

$$\bar{R} = .963 \qquad \bar{S} = \$4.724 \qquad \frac{\delta^2}{S^2} = 2.361$$

Diversified Financing[57]

$$(5.3)\qquad \frac{G_2}{F'P_2} = 81.629 + \underset{(\pm.0077)}{.0655}\left(\frac{Y_s - O_{-1}}{F'I}\right) - \underset{(\pm.1122)}{.8231}\left(\frac{S_2}{I}\right) + \underset{(\pm.0102)}{.0464}\left(\frac{Y_s - O_{-1}}{F'I}\right)_{-1}$$

$$\bar{R} = .979 \qquad \bar{S} = \$3.005 \qquad \frac{\delta^2}{S^2} = 1.122$$

The elasticities of demand for total instalment sales credit, and of its two components, with respect to the explanatory variables are shown in Table 10.

These elasticities differ, as would be expected, from those obtained in the corresponding equations using disposable income; notably, they are substantially smaller. This is due mainly to the fact that percentage changes in supersubsistence income are greater than in disposable income.

On the whole, these results are in agreement with expectations. The use of the concept of supersubsistence adjusted income may be of particular value in periods of strong inflationary or deflationary move-

[57] The alternative equation for diversified financing in which the residual variation is less autocorrelated is as follows:

$$\frac{G}{F'P_2} = 32.149 + \underset{(\pm.0109)}{.0462}\left(\frac{Y_s - O_{-1}}{F'I}\right) - \underset{(\pm.2480)}{.3202}\left(\frac{S_2}{I}\right) + \underset{(\pm.0095)}{.0374}\left(\frac{Y_s - O_{-1}}{F'I}\right)_{-1} + \underset{(\pm.6174)}{1.3527}\,T$$

$$\bar{R} = .985 \qquad \bar{S} = \$2.520 \qquad \frac{\delta^2}{S^2} = 1.966$$

TABLE 10

ELASTICITIES OF DEMAND FOR INSTALMENT SALES CREDIT WITH RESPECT TO SPECIFIED EXPLANATORY VARIABLES, 1929-41

	Elasticities of Demand for Credit:		
Explanatory Variable	*Total*	*Automobile*	*Diversified*
Supersubsistence adjusted income of the current year	.635	.569	.657
Supersubsistence adjusted income of the preceding year	.309	.324	.451
Size of the required monthly instalment payment	—1.071	—1.329	—1.891

ments, when the dispersion of prices may be great and when significant changes in the distribution of income may be expected, since it explicitly reveals the margin of income related to instalment sales credit demand.[58]

Explanation Using Price and Contract Length Separately

It can also be assumed that consumers in deciding whether or not to use instalment sales credit place greater emphasis on the price of purchased goods and on the length of the instalment contract as separate factors than on the size of the required monthly instalment payment. When equations *(3.0)* and *(4.0)* are modified accordingly and statistically estimated, the following results are obtained:

Total Instalment Sales Credit

$$(6.1)\quad \frac{G}{F\,P} = -24.445 + \underset{(\pm.0134)}{.0972}\left(\frac{Y - O_{-1}}{F\,I}\right) - \underset{(\pm.6079)}{1.9852}\left(\frac{P}{I}\right) + \underset{(\pm2.1449)}{6.7616}\,D + \underset{(\pm.0150)}{.0281}\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1}$$

$$\bar{R} = .983 \qquad \bar{S} = \$.384 \qquad \frac{\delta^2}{S^2} = 2.355$$

Automobile Instalment Sales Credit

$$(6.2)\quad \log\left(\frac{G_1}{F\,P_1}\right) = -1.485 + \underset{(\pm.3475)}{1.5632}\log\left(\frac{Y - O_{-1}}{F\,I}\right) - \underset{(\pm.3077)}{3.1775}\log\left(\frac{P_1}{I}\right) + \underset{(\pm.2638)}{1.6426}\log D_1 + \underset{(\pm.2994)}{.7845}\log\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1}$$

$$\bar{R} = .993 \qquad \bar{S} = \$.0211 \qquad \frac{\delta^2}{S^2} = 2.273$$

58 Theoretically, similar results could be expected if total disposable income, a cost-of-living price index, the distribution of instalment sales credit by income brackets, and population were considered simultaneously in the same equation as separate variables. This procedure would be preferable if it were not that the number of variables and their intercorrelation are obstacles to the estimation of the relevant parameters.

Diversified Financing

$$(6.3)\quad \frac{G_2}{F\,P_2} = -112.286 \underset{(\pm.0046)}{+\,.0529} \left(\frac{Y - O_{-1}}{F\,I}\right) \underset{(\pm.1786)}{-\,.9920} \left(\frac{P_2}{I}\right)$$

$$\underset{(\pm 1.5298)}{+\,7.5763}\, D_2 \underset{(\pm.0061)}{+\,.0264} \left(\frac{Y - O_{-1}}{F\,I}\right)_{-1}$$

$$\bar{R} = .986 \qquad \bar{S} = \$2.352 \qquad \frac{\delta^2}{S^2} = 1.747$$

These results show that variations in the demand for total instalment sales credit, and for its components, can be satisfactorily explained without use of a factor representing the time trend. This fact, however, does not imply that instalment sales credit is not affected by general trend influences. The latter are probably covered up by D's, with which they are rather highly correlated.

When the influence of the explanatory variables in the three above relations is expressed in terms of the elasticities of demand for instalment sales credit with respect to each, we obtain the results summarized in Table 11.

It can be seen from this table that the relative prices of purchased durable goods are of great importance in determining the demand for instalment sales credit, and that the length of the instalment contract exercises a relatively greater influence on the demand for credit used for

TABLE 11

ELASTICITIES OF DEMAND FOR INSTALMENT SALES CREDIT WITH RESPECT TO SPECIFIED EXPLANATORY VARIABLES, 1929-41 [a]

	Elasticities of Demand for Credit:		
Explanatory Variable	*Total*	*Automobile*	*Diversified*
Income of the current year	1.847	1.563	2.041
Income of the preceding year	.529	.785	1.009
Relative prices of goods bought on instalment	−2.255	−3.178	−2.309
Length of instalment contract	1.149	1.643	2.769

[a] Elasticities for total credit and for diversified credit were taken at the point of averages; the logarithmic form of the automobile credit relation implies a constant elasticity at all points.

the purchase of durable consumer goods other than automobiles than on the demand for automobile credit. This fact may be due to the greater liberalization of contract terms in diversified financing than in automobile financing during the period 1929-41. As one could expect on *a priori* grounds, increases in the demand for instalment sales credit were more than proportionate to increases in current disposable income in the period under consideration. The data also suggest that changes in consumers' use of instalment sales credit occurred with only a small lag after changes in their disposable income.

Explanation of Monthly Repayment Commitment

The volume of instalment sales credit (G) which is borrowed by the consumer at any given time may be considered as the amount of the required monthly instalment payment (A) which he commits himself to repay, multiplied by the number of monthly instalments (D) specified in the contract. Since the instalment contract into which the consumer enters represents a monthly allocation of future income during its period, it may be said that the relevant variable to "explain" is $A = \left(\frac{G}{D}\right)$, i.e., the monthly repayment commitment.

Since the same variables that are assumed to influence the total amount of credit extended to consumers in a given period (G) may be assumed also to influence the monthly repayment commitment $\left(\frac{G}{D}\right)$ we have

$$(7.0)\quad \frac{G}{D\,F\,P} = g_0 + g_1\left(\frac{Y - O_{-1}}{F\,I}\right) + g_2\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + g_3\left(\frac{P(1 - N + M)}{I\,D'}\right) + g_4\,T + w$$

and

$$\frac{G}{F\,P} = D\left[g_0 + g_1\left(\frac{Y - O_{-1}}{F\,I}\right) + g_2\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} + g_3\left(\frac{P(1 - N + M)}{I\,D'}\right) + g_4\,T + w\right]$$

The most satisfactory statistical results obtained for the monthly repayment commitments are as follows:

Total Instalment Sales Credit Monthly Repayment Commitment

$$(7.1)\quad \frac{G}{D\,F\,P} = 7.454 + \underset{(\pm.00060)}{.00579}\left(\frac{Y - O_{-1}}{F\,I}\right) - \underset{(\pm.0309)}{.1623}\left(\frac{S}{I}\right) + \underset{(\pm.00308)}{.00483}\left(\frac{Y - O_{-1}}{F\,I}\right)_{-1} - \underset{(\pm.07676)}{.32681}\,T$$

$$\bar{R} = .989 \qquad \bar{S} = \$.263 \qquad \frac{\delta^2}{S^2} = 1.762$$

Since in this relation $\left(\frac{S}{I}\right)$ and (T) are highly intercorrelated the same relation, but without (T), is also given:

$$(7.2)\quad \frac{G}{DFP} = -3.554 + \underset{(\pm .00103)}{.00580}\left(\frac{Y - O_{-1}}{FI}\right) - \underset{(\pm .01671)}{.03700}\left(\frac{S}{I}\right) + \underset{(\pm .01205)}{.00209}\left(\frac{Y - O_{-1}}{FI}\right)_{-1}$$

$$\bar{R} = .966 \qquad \bar{S} = \$.449 \qquad \frac{\delta^2}{S^2} = 1.424$$

Automobile Instalment Sales Credit Monthly Repayment Commitment

$$(7.3)\quad \frac{G_1}{D_1 F P_1} = 3.520 + \underset{(\pm .00098)}{.00146}\left(\frac{Y - O_{-1}}{FI}\right) - \underset{(\pm .0116)}{.0538}\left(\frac{S_1}{I}\right) + \underset{(\pm .00088)}{.00248}\left(\frac{Y - O_{-1}}{FI}\right)_{-1} - \underset{(\pm .0262)}{.1759}\, T$$

$$\bar{R} = .966 \qquad \bar{S} = \$.272 \qquad \frac{\delta^2}{S^2} = 2.061$$

Diversified Financing Monthly Repayment Commitment

$$(7.4)\quad \frac{G_2}{D_2 F P_2} = -1.920 + \underset{(\pm .00028)}{.00269}\left(\frac{Y - O_{-1}}{FI}\right) - \underset{(\pm .00895)}{.02690}\left(\frac{S_2}{I}\right) + \underset{(\pm .00020)}{.00147}\left(\frac{Y - O_{-1}}{FI}\right)_{-1} + \underset{(\pm .02045)}{.07339}\, T$$

$$\bar{R} = .997 \qquad \bar{S} = \$.0782 \qquad \frac{\delta^2}{S^2} = 1.655$$

As can be seen, these results are basically the same as those obtained elsewhere. It is interesting to note, however, that the upward trend in diversified financing becomes significant.