CHAPTER II

DESCRIPTION OF THE MODEL. DEMAND EQUATIONS FOR GOODS AND SERVICES

(2.0) General Introduction

In this chapter, a number of relations determining the *demand for goods and services* will be discussed. The demand for holding some types of assets will be considered in Chapter IV. The goods and services expressly considered in this study are:

(i) Consumers' goods and services, excluding "housing" services;

(ii) Agricultural raw materials;

(iii) Housing services;

(iv) Houses;

(v) All other investment goods;

(vi) Labour.

The demand for these types of goods and services will not, however, be studied separately. The reasons for this treatment are mentioned below.

Groups (i) and (iii) have been combined as consumers' goods and services, including housing, since the estimates of the demand for each do not seem to be accurate enough to make a distinction possible. A separate study of the demand for housing services on the one hand, and all other consumers' goods and services on the other hand, would require the consideration of two demand functions each depending on the prices of both categories. The combined demand may — as a first approximation — be supposed to depend only on the combined item, cost of living. Moreover, a study of the combined demand is the minimum basis sufficient for any realistic model of business-cycle mechanism.

The demand for agricultural raw materials has not been studied separately, since it may be assumed that it shows a fairly high degree of parallelism with the demand for consumers' goods and services as a whole, given (i) the proportionality between the output of any commodity and the intake of raw materials and (ii) the tendency of consumers to divide their consumption more or less regularly between agricultural and non-agricultural products. On the other hand, there is some cause to disregard any lack of parallelism, for the simple reason that the statistics of stocks of raw materials are not very satisfactory.

Nor has the demand for labour been considered separately. The output of all final goods and services (Groups (i), (iii), (iv) and (v) above) is very exactly parallel with employment as measured by the Federal Reserve Board index of factory employment. Evidently this reflects the fact that production is a linear function of employment for short-run variations in output.

On the other hand, the demand for consumers' goods and services will be split up into four parts — viz.:

(*a*) Demand exerted by non-farmer consumers;
(*b*) Demand by farmers for farm products;
(*c*) Demand by farmers for non-farm products;
(*d*) Demand by dealers corresponding with increases or decreases in stocks.

Although in some respects arbitrary, this subdivision is useful for statistical reasons. In the first place, the factors determining one of these categories of demand will be at least partly different from those determining the others; hence a more exact determination of the coefficients will be possible if they are studied separately. In the second place, the figures for (*c*) and (*d*) have still more the character of estimates than those for (*a*) and (*b*).

In the next chapter a number of supply equations, or their equivalents, will be discussed. This means that, for some categories of goods and services, both the demand and the supply relation will be determined. The well-known question whether, and in what circumstances, a statistical determination of both relations is possible has been touched upon in the preceding volume.[1] In section (3.5), an example is elaborated.

(2.1) "EXPLANATION" OF CONSUMERS' OUTLAY[2]

I. *Theoretical.*

As regards consumers' outlay — in which outlay for the purchase of new houses has not been included — it has been assumed that farmers' outlay for consumption goods is equal to their withdrawals[3] as estimated by Dr. KUZNETS.

The following variables would then, by *a priori* reasoning, seem to be of importance for the explanation of the rest of consumption fluctuations:

Wages and salaries $(L_w + L_s)$;
Urban non-workers' income E;
Capital gains G;
The rate of increase in farm prices $p^f - p^f_{-1}$, or Δp^f, as an indication of speculative profits, which are not included in E but may nevertheless have influenced consumption (agricultural prices have been selected as they are especially subject to speculative influences);
Some measure of the degree of inequality of income distribution, for which PARETO's α has been taken;[4]
Cost of living p;
A trend, standing for slow changes in habits, population growth and changes in population structure.

[1] Vol. I, pages 62-64.
[2] *Cf.* J. J. POLAK, "Fluctuations in United States Consumption, 1919-1932", *Review of Economic Statistics*, XXI, February 1939.
[3] All their savings being considered as business savings. *Cf.* page 25.
[4] This coefficient measures, in absolute amount, the slope of a curve representing log N_x as a function of log x; where x is income and N_x the number of persons having an income above x.

It has been proved by BORTKIEWICZ that, in general, α is not a very accurate index for distributions deviating from the Paretian; for this reason, the values of α have been tested by comparing them to another index of in equality — viz.: the difference between the median and the average income of the $2\frac{1}{2}$‰ of the population with the highest incomes. The correlation for this period was very high, and α showed considerable variations (the extremes being 1.39 and 2.04).

The influence of some of these variables, especially E, might be lagged. A lagged influence of G and p is somewhat less probable, as capital gains will be consumed fairly rapidly in so far as they are consumed at all; while the chief influence of cost of living will be that actual prices have to be paid which may differ from the price level upon which the consumption plans were based.

The signs of all coefficients except the trend must be positive. For E and G this will be clear at once; for p, the theoretical possibility exists of a negative influence. A negative influence would, however, mean an elasticity of total consumption which is larger than one, and this will hardly be assumed to prevail by any economist. The significance of PARETO's α being that an increase in α means a decrease in concentration, it seems logical to expect a positive influence of α on consumption.

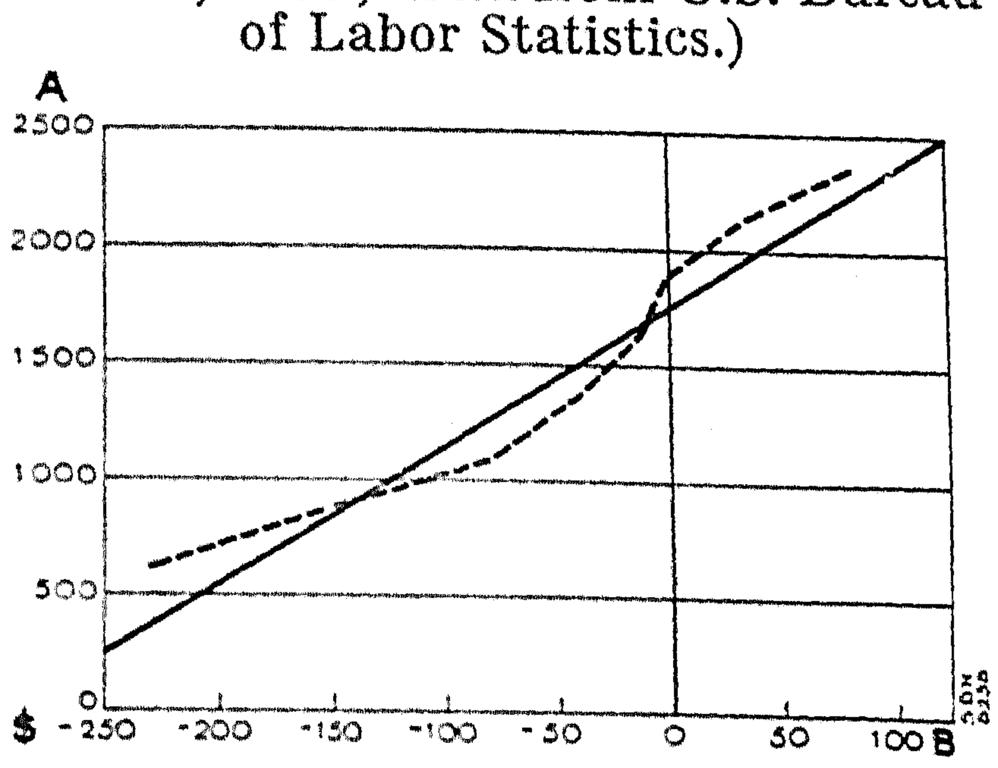
The two income series $(L_w + L_s)$ and E show a very high intercorrelation. Hence, the coefficients to be obtained for each by including both in a correlation calculation must be expected to be rather unreliable. There are two other ways by which more reliable information might be obtained regarding the two marginal propensities to consume — viz.: (i) to have recourse to knowledge from other sources on the propensity of one of the two income classes, or (ii) to try different reasonable values for one propensity and to see whether the coefficients which result for the other are acceptable.

Some information about the relation between wages and workers' savings may be taken from family budget statistics, though these statistics give figures relating to families with

Graph 2.11.

AMOUNT SAVED AT VARIOUS INCOME-LEVELS.

(Families in New York, Portland and Atlanta, 1936; data from U.S. Bureau of Labor Statistics.)



A = Income.
B = Savings or, where negative, deficit.
- - - - Observed data.
—— Straight line general trend.

different incomes at the same moment; and it is not certain that one family, when passing (temporarily) from one income to another, will show the same change in savings. The direction of the deviation between the figures depends on whether savings are a relatively "sticky" item in the budget or not. This in turn will depend on the form of saving. If saving is effected in the form of fixed payments of insurance premia, it may be "sticky"; if small amounts are paid from time to time into savings banks, savings may be more sensitive. From a number of family budget data, represented in Graph 2.11, it would appear that the fluctuations in savings are between 0.15 and 0.20 times the fluctuations in wages.

II. *Statistical.*

In view of these results, a number of correlation calculations have been made where, in each case, the alternative of a fixed coefficient for $(L_w + L_s)$ of 1.00 and 0.80 was calculated; the

Case	Variable explained	Regression coefficients								Correlation coefficient
		L_w+L_s*	E	G	Δp^f	α	p	E_{-1}	t	
1 *a*	$U'—E'_F$	1.00	0.78	0.35					0.31	0.992
b		0.80	1.20	0.36					0.18	0.989
2 *a*		1.00	0.75	0.27	0.046				0.32	0.995
b		0.80	1.17	0.26	0.054				0.18	0.994
c		0.95	0.86	0.27	0.048				0.28	0.995
3 *a*		1.00	0.52	0.26		—6.30			0.26	0.995
b		0.80	0.93	0.26		—6.40			0.12	0.993
4 *a*		1.00	0.77	0.35			0.001		0.31	0.992
b		0.80	1.03	0.36			0.069		0.35	0.989
5 *a*		1.00	1.37	0.22				—0.75	0.50	0.993
b		0.80	2.01	0.17				—1.03	0.44	0.991
6 *a*		1.00	0.71	0.28	0.046		0.016		0.36	0.995
b		0.80	0.95	0.27	0.056		0.087		0.41	0.994
c		0.95	0.77	0.28	0.049		0.034		0.37	0.994

* Fixed coefficient.

two values resulting for the coefficients of the other explanatory variables suffice to calculate such values for any other coefficient for $(L_w + L_s)$ by means of a straight-line interpolation or extrapolation. The results are shown in the table on page 37.

The regression coefficient for E, which represents the "partial marginal propensity to consume (in respect to E)" is unacceptable in cases 1*b*, 2*b*, 4*b*, 5*a* and 5*b*, where it is above unity. Cases 3*b* and 6*b* are also hardly acceptable, as they represent a propensity to consume for workers which would be lower than that for the higher incomes. By interpolation, we find that the minimum coefficient for (L_w+L_s), which is higher than the corresponding coefficient for E, is as follows:

In case 1	0.93
,, ,, 2	0.92
,, ,, 3	0.84
,, ,, 4	0.90
,, ,, 5	> 1.00
,, ,, 6	0.87

According to the principles set out above, cases 3 and 5 are both unacceptable for the supplementary reason that they yield a negative coefficient for α and E_{-1} respectively. The remaining cases point to a coefficient for $(L_w + L_s) > 0.87$. The value 0.95 has finally been chosen for the coefficient for $L_w + L_s$.

For G and Δp^f, coefficients are obtained which are only slightly dependent on the choice of the $(L_w + L_s)$ coefficient (the spread between cases *a* and *b* is negligible). The inclusion of Δp^f increases the correlation coefficient to a not unimportant extent (case 2 as compared with case 1). The increase in the correlation by the inclusion of p is immaterial, but its omission is theoretically unsatisfactory. These considerations lead to the choice of an equation which includes as "explaining" variables: $L_w + L_s$, E, G, Δp^f, p and t, with a fixed coefficient for $L_w + L_s$. It has, with the standard errors [1] of the coefficients, the following form:

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[1] *Cf.* Vol. I. For the calculation of standard errors it has been assumed throughout this publication that the random errors in all observations (to which errors the residuals are supposed to be due) are mutually independent.

$$U' - E'_F = 0.95\,(L_w + L_s) + (0.77 \pm 0.32)\,E + (0.28 \pm 0.13)\,G + (0.05 \pm 0.02)\Delta p^f + (0.03 \pm 0.09)p + 0.37t, \qquad (2.1)$$

where the left-hand member represents urban consumption outlay.

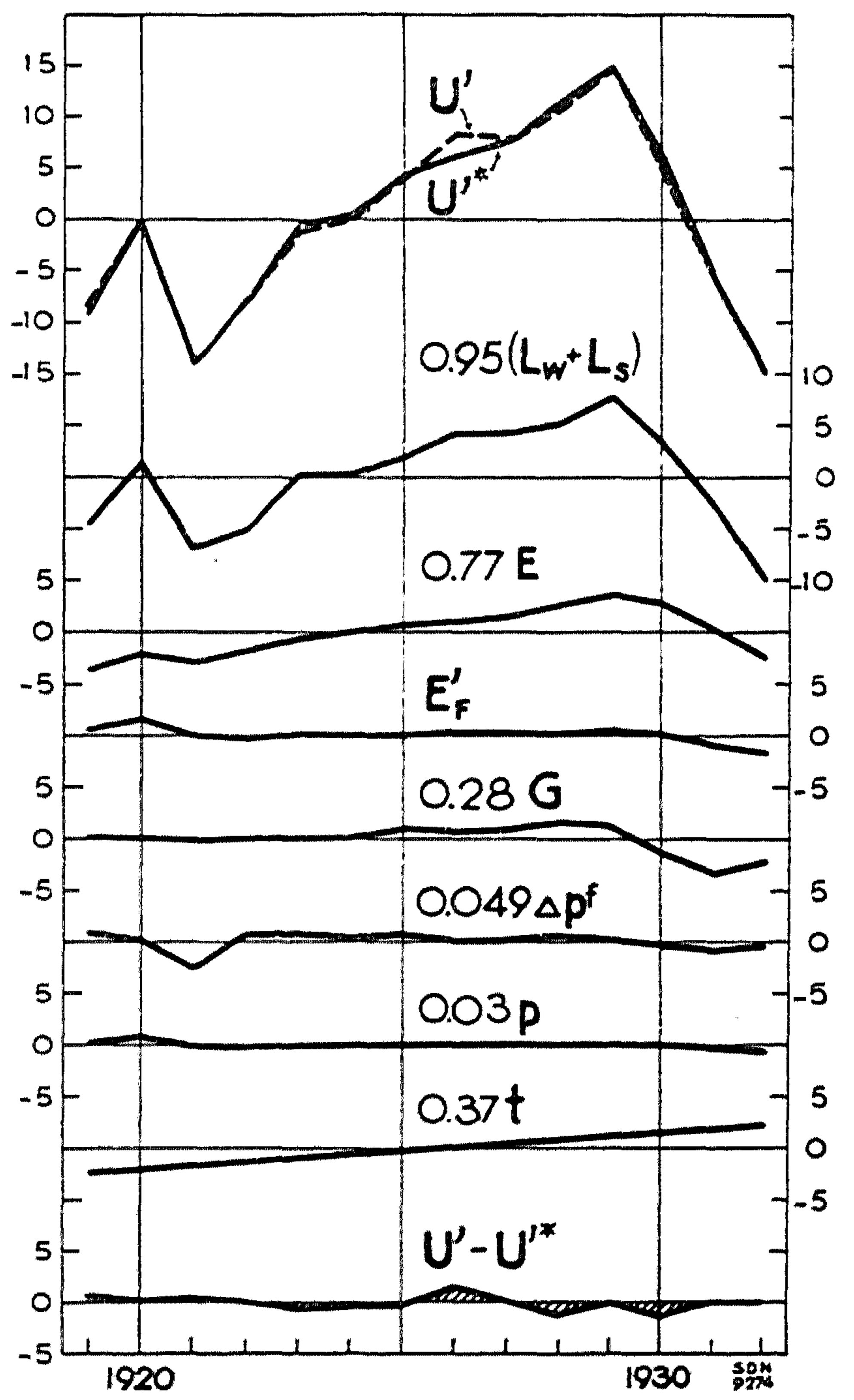
It will be seen that even after the coefficient for $(L_w + L_s)$ has been fixed, that for E is still relatively uncertain; this is principally due to the high intercorrelation between E and p. We are bound to conclude, then, that the values of three coefficients in this equation, those for $(L_w + L_s)$, E and p, cannot be found with a high degree of precision.[1] The consequences for the system as a whole of this interchangeability of the influences of these three variables will be considered in Chapter VI.

The result chosen would mean that workers and lower employees have a marginal propensity to consume of 95%, urban non-workers a "partial marginal propensity to consume" of 77% in relation to "pure income" E, and a "partial marginal propensity to consume" of about 28% of realised capital gains.

This latter coefficient is, however, also rather uncertain, not on the ground of multicollinearity, but because the amplitude of the fluctuations in capital gains has been estimated very roughly.[2]

It should be borne in mind that constancy in the partial marginal propensities does not imply any constancy of the proportion of

Graph 2.1.
"Explanation" of Fluctuations in Consumption Outlay.



[1] *Cf.* also page 42, note 2.
[2] *Cf.* also page 127.

incomes consumed, *i.e.*, of the ratio $\bar{\bar{U}}' \div (\bar{L}_w + \bar{L}_s + \bar{\bar{E}} + \bar{\bar{E}}'_F)$, which we may call e. First, when the marginal propensity to consume is smaller than the ratio of the *averages* of consumption and income, e will be lower in a boom than in a depression. Secondly, since capital gains will be high in the *rising* and low in the *declining* phase of the cycle, e has a tendency to behave accordingly. Thirdly, the trend term in the equation means that there is a slow secular increase in e (0.6 % per annum).

It is, of course, possible that the coefficients themselves are not constant either; but, given the nature of the statistical material, it seems almost impossible to obtain reliable information in this respect by the inclusion of more variables; the formula chosen may therefore be considered as about the best possible approximation.

III. *Durable and Non-durable Consumption Goods.*

The demand for durable goods and that for non-durable goods have not been included as separate equations in our system. This may be justified in the following way. When the demand U'_D for durable goods, apart from depending on income Y, depends on their price p_D and on the price of non-durable goods p_N:

$$U'_D = \omega_{11} Y + \omega_{12} p_D + \omega_{13} p_N,$$

and the demand U'_N for non-durable goods depends on the same factors:

$$U'_N = \omega_{21} Y + \omega_{22} p_D + \omega_{23} p_N,$$

then the equation for total demand U' may be found by adding up these two equations:

$$U' = \omega_1 Y + \omega_2 p_D + \omega_3 p_N.$$

This may be understood to mean that U' depends on income Y and some average price index for durable and non-durable goods — viz., an average with weights in the proportion of ω_2 to ω_3. It is not certain beforehand that the average price level p for consumers' goods will show such weights. Since, however, there will be a tendency to some parallelism between p_N and p_D — owing to the general competition on both the demand side and the supply side — there is no serious loss of generality if we replace the theoretically best average having weights ω_2 and ω_3 by our index p.

In the consumption equation (2.1), only "general variables" — *i.e.*, variables bearing on all goods, not on one category alone — occur. This implies the hypothesis that there are no factors bearing especially on durable or on non-durable goods.

Now there is one special feature in the demand for durable goods which may behave contrary to this hypothesis. Demand for durable goods consists of two parts — viz., replacement demand and so-called first purchases. The latter will, in general, depend on much the same general factors as the demand for non-durable goods — income, prices, tastes. The former will, however, depend on earlier purchases of the same goods[1] and will, in the simplest case, be equal to the quantity bought before some definite time period, representing the lifetime of the goods under consideration. (In more complicated cases — viz., where this lifetime is not a definite period, but purchases may be deferred — other determining elements may come in, such as income again. This does not, in theory, increase the difficulties.) If this echo effect proved to be of importance, it would be necessary to take it into account in the consumption equation — and it might then perhaps be useful to treat non-durable and durable goods separately. Now it appears, from a study by P. de Wolff on "The Demand for Passenger Cars in the United States", [2] that, at any rate for one commodity, the spread in the lifetime of the individual objects is large enough to smooth out the curve of replacement purchases to a mere trend curve. Hence, for all durable goods together, this will probably be even more so. A study of the year-to-year fluctuations in consumers' demand may for this reason neglect the echo effect.

Yet, though a separate study of the demand for durable and for non-durable goods is not essential to the present system of

[1] The so-called "echo effect".
[2] *Econometrica* VI (1938), page 113.

equations, this division is of such outstanding general interest that it may be worth while to digress slightly and give an "explanation" of both categories of goods. Apart from the explanatory variables used for U′, it will be necessary, as mentioned above, to include in both equations p_D and p_N, the prices of durable and non-durable goods respectively. In order not to have too large a number of variables, and in view of the high intercorrelations between some of them, the income series are here combined into two groups — ordinary incomes $(L_w + L_s)$, E and E'_F and speculative incomes G and Δp^f — and in each group the series are weighted according to the coefficients they have obtained in the "explanation" of U′.[1] The results run as follows, with standard errors of the coefficients added:

Series "explained"	Coefficients and standard errors of					R
	$0.95(L_w+L_s) + 0.86E + E'_F$	$G + 0.16\Delta p^f$	p_D	p_N	t	
U'_D	0.16 ± 0.05	0.03 ± 0.03	-0.028 ± 0.038	2.056 ± 0.020	-0.05	0.984
U'_N	0.73 ± 0.09	0.23 ± 0.05	-0.006 ± 0.075	0.069 ± 0.041	0.40	0.996
U′ (by addition)	0.89	0.26	-0.022	0.125	0.35	
U′ (case 2 c)	1.00	0.27			0.28	

The coefficient for the ordinary incomes is, for both groups together, below 1. This is due to the inclusion of p_D and p_N, which are rather highly correlated with incomes. It will be seen that in case 6*c*, where p is included in the explanation of U′, the coefficient for E is also much lower.[2]

[1] Here the case with the same explanatory variables as in (2.1) except p, and a coefficient of 0.95 for L_w+L_s (case 2*c*) was used.

[2] The four price coefficients make it possible to check the p-coefficient in equation (2.1), if we use the approximation that p_D and p_N move parallel. The coefficient of p in the "explanation" of U′ is then equal to the average of the sum of the two coefficients for p_D and the sum of the two coefficients for p_N, weighted according to the relative weights of p_D and p_N in p multiplied by their relative amplitudes. This yields 0.11, whereas we had found 0.03 ± 0.09 in the case chosen; both coefficients are, indeed, rather near to zero.

The figures point to the following elasticity of demand with respect to ordinary incomes,[1] price and the price of the competitive category of goods:

Goods	Income elasticity	Price elasticity	
		Own price	Other price
Durable	1.23$\pm$0.38	— 1.39$\pm$0.53	0.74$\pm$0.27
Non-durable	0.81$\pm$0.10	— 0.87$\pm$0.08	0.01$\pm$0.15

Somewhat higher income and price elasticities are brought out for the durable than for the non-durable group, but the significance of both differences is doubtful.

It may be interesting to apply to these data the "Slutsky condition" of the rational, consistent behaviour of consumers, the formulation of which in our symbols would be:[2]

$$\frac{\delta u'_D}{\delta p_N} - \bar{u}'_N \frac{\delta u'_D}{\delta Y} = \frac{\delta u'_N}{\delta p_D} - \bar{u}'_D \frac{\delta u'_N}{\delta Y}$$

where Y stands for $L_w + L_s + E + E'_F$.

Using the figures of the first table, this condition would be:[3]

$$5.4 - (51.8 \times 0.148) = 0.6 - (7.46 \times 0.675).$$
$$-2.0 = -4.5.$$

It will be seen that the coefficients, taken at their face value, do not exactly fulfil the condition. But when we take account of their standard errors,[1] the result becomes:

$$2.0 \pm 4.1 = -4.5 \pm 7.6.$$

[1] There would not be much sense in calculating average income elasticities with regard to speculative incomes, since their average is, by their very nature, zero or almost zero.

To arrive at one coefficient for the three ordinary income groups, the coefficients obtained for each of them have been weighted according to their standard deviations (relative amplitudes); the weighted marginal propensity to consume for all consumption goods would be 0.924.

[2] *Cf.* H. Schultz, *Theory and Measurement of Demand*, Chicago, 1938, page 621.

[3] The price coefficients are multiplied by 100 since the averages of p_D and p_N used in the transformation from U'_D to u'_D and from U'_N to u'_N are about 1, and not about 100. All coefficients, moreover, are corrected for the small deviations of $\bar{p}_D$ and $\bar{p}_N$ from 100.

It is quite possible, then, that the "true" coefficients do satisfy the condition.

(2.2, 2.3) "Explanation" of Farmers' Consumption

For this part of the investigation, rather rough assumptions have been made, as (i) the part of total income going to farmers is only about 10% and (ii) refinements would require the introduction of some new variables which would complicate the system without improving it very much.

The relative smallness of its fluctuations makes a very accurate consideration of this item unnecessary, while the rather rough estimates available do not seem to lend themselves to any detailed experiments with correlation calculus.

The prevailing factor governing gross as well as net farm incomes and the estimates of farmers' consumption is, of course, farm prices. The volume of farm production, which depends largely, in any case for the period up to 1932, on crop-yield variations, shows only irregular and not very wide fluctuations.

Farmers' consumption consists of two parts: viz., consumption of home-produced goods and of bought goods, the money values of which are indicated by E''_F and E'_F respectively. Both are supposed to depend only on farm prices p^f.

For E''_F this will be clear. For E'_F it means that the elasticity with respect to prices of non-farm products is just 1, which seems probable in view of the relatively low standard of living of the farm population. The formula found is:

$$E'_F = 0.025\, p^f \qquad (2.2).$$

As to E''_F, the formula found, viz.:

$$E''_F = 0.015\, p^f, \qquad (2.3)$$

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[1] Combination of standard errors according to formula:

$$\sigma^2_{(1-2)} = \sigma_1{}^2 + \sigma_2{}^2 - 2\sigma_1\sigma_2 r_{12},$$

$$\text{where } r_{12} = \frac{M_{11}}{(M_{22} \times M_{33})^{\frac{1}{2}}} \text{ (\textit{cf.} Vol. I, pages 142-143).}$$

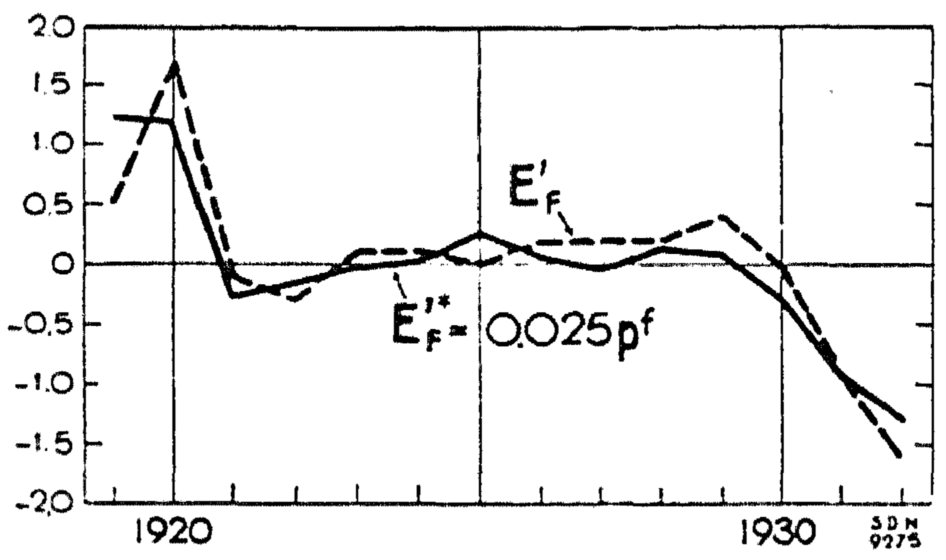
implies that the quantities of farm products retained — viz.,

$$\frac{\bar{\bar{E}}''_F}{\frac{1}{100}\,\bar{p}^f} = \frac{1.7 + 0.015\ p^f}{0.97 + 0.01\ p^f} = \frac{(1.7 + 0.015\ p^f)\ (1 - 0.01\ p^f)}{0.97}$$ [1]

$= 1.8 - 0.002\ p^f$, depend negatively on farm prices, with an average elasticity of demand of -0.11.

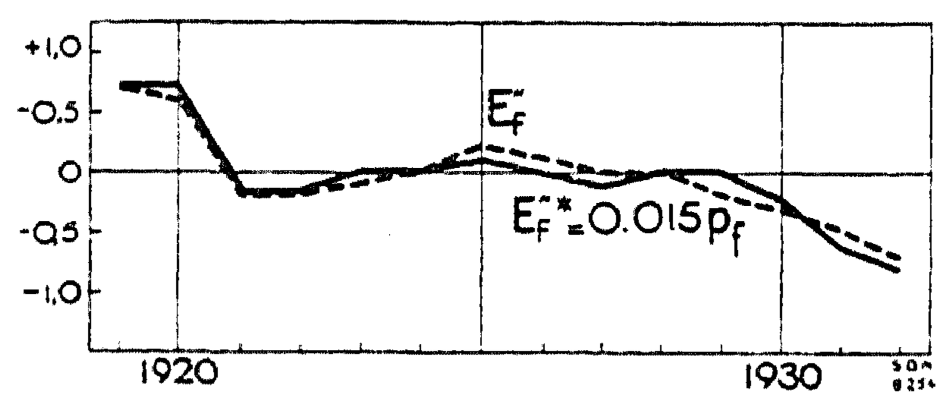
Graph 2.2.

"Explanation" of Fluctuations in FARMERS' CONSUMPTION EXPENDITURE.



Graph 2.3.

"Explanation" of Fluctuations in FARMERS' CONSUMPTION OF HOME-PRODUCED GOODS.



(2.4, 2.5) "EXPLANATION" OF INVESTMENT ACTIVITY

Investment may take various forms, each of which is subject to its own "laws". For the purpose of this investigation, a distinction has been made between:

- v' investment in durable producers' goods, including non-residential building;
- v_B investment in residential building;
- v_w investment in stocks of non-durable commodities (working capital).

Purchases of durable consumers' goods have simply been included in consumption.

The relations which "explain" the purchases of each type of these goods may be indicated as "demand equations for investment goods". As the first publication in this series [2]

[1] Owing to a well-known mathematical approximation.
[2] Vol. I, Chapters III and IV.

deals especially with these relations, they need only be mentioned briefly here.

The demand v' for *durable producers' goods and non-residential building* has been considered in combination. It has been assumed to depend on:

(i) Profits made in all industries, for which corporation profits Z^c have been taken;

(ii) Share yield m_{Ls}, as an indication of the "interest rate paid" on capital obtained by share issues;

(iii) The price of investment goods q;

(iv) The margin $p - \frac{1}{2} l$ between the price index for finished goods and the wage rate (with the weight it has in costs), as it is often held that, apart from total profits, this margin influences profit expectations.

(v) A trend, in order to account for slow changes in capital intensity of production.

For all variables a lag of half a year has been assumed.[1]

The introduction of share yield as one of the determining factors needs further elucidation. One way of looking at the matter is that, although no yield is contracted when shares are issued, the yield which satisfies investors will depend on the general situation in the share market as represented by the share yield on existing shares. It would not matter, in this train of thought, if the actual yield on new shares were systematically lower than the average yield on old shares, provided it could be maintained that there was a systematic relation in the fluctuations of both.

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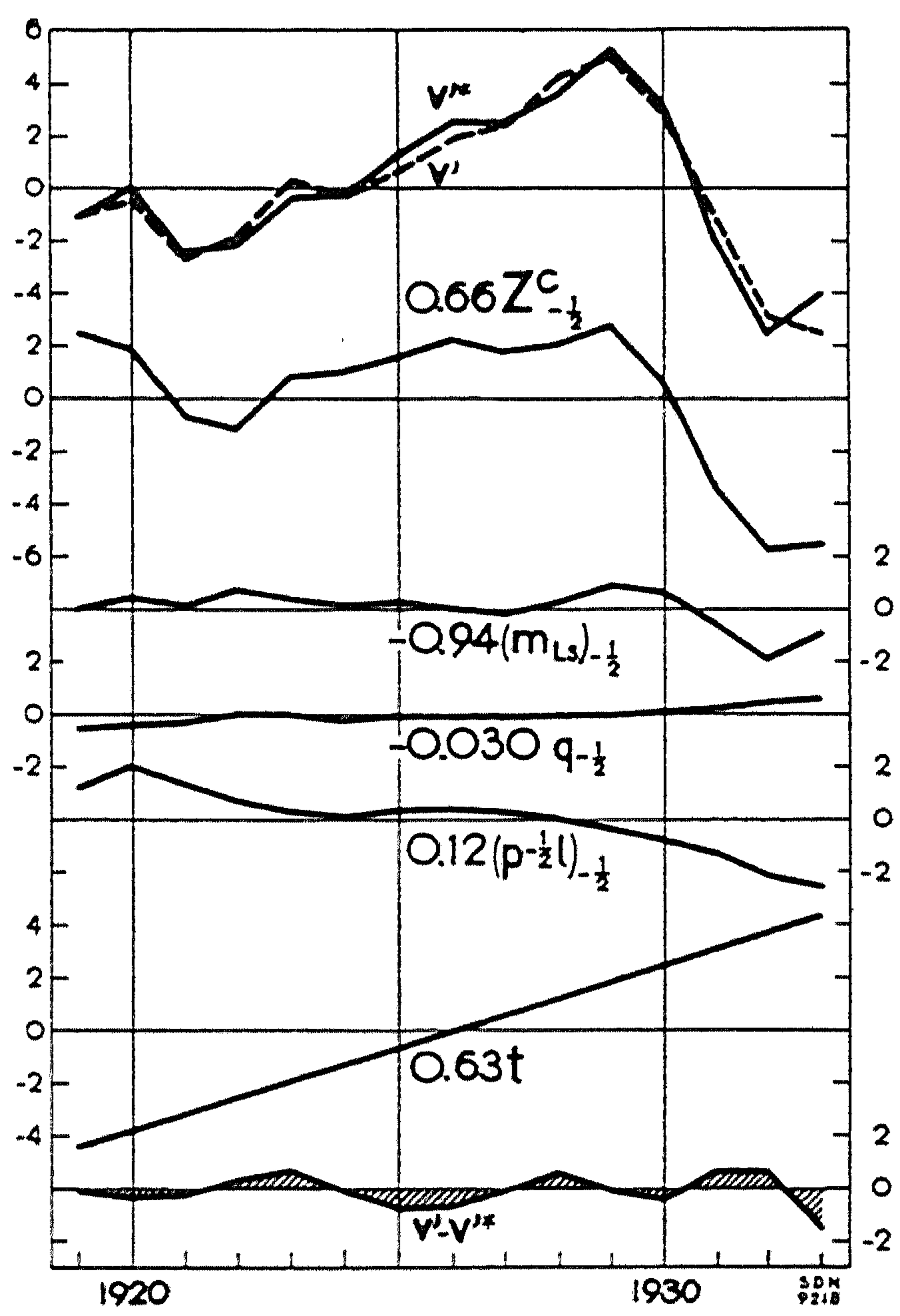
[1] Expressed somewhat more exactly, the lag is a distributed one with an average of half-a-year. In fact, by using annual data, one is only able to apply lags of 0, 1, 2 etc. years, but any combination may be taken which means a distributed lag. The average of these lags, weighted according to the regression coefficients obtained for the term corresponding to each, may be indicated shortly as "the" lag. If, *e.g.*, the following regression equation is found: $v = 0.3\,Z + 0.5\,Z_{-1}$, this weighted average of the lags 0 and 1 is $\frac{(0 \times 0.3) + (1 \times 0.5)}{0.3 + 0.5} = 0.63.$

Another way of interpreting the matter is that the "easiness" with which money is obtained by share issues could be given a numerical expression by the figure of share yields.

Still another way would be to point to the factors "behind" share yield, which fluctuates inversely to share prices and proportionately to dividends. Share prices themselves (*cf.* equation (4.82)) are influenced by both dividends and the rate of increase in share prices. Instead, therefore, of assuming investment activity to be negatively affected by share yield, one could formulate our hypothesis thus: that investment activity is favourably affected by the rate of increase in share prices, favourably affected by share prices themselves (the higher these prices, the higher the issue prices entrepreneurs are able to get), and unfavourably by dividends (which in a sense is the "payment" they are expected to make).

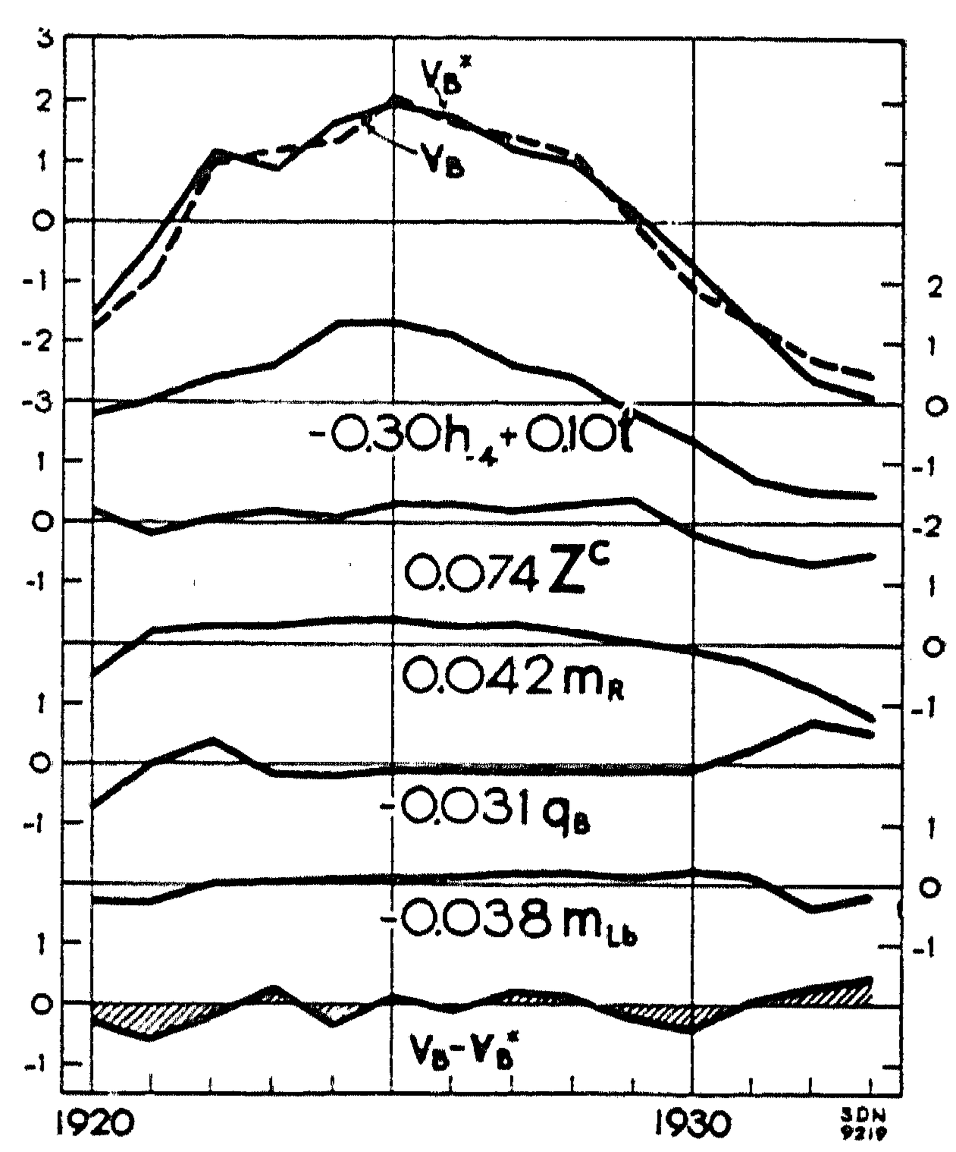
Graph 2.4.

"Explanation" of Fluctuations in DEMAND FOR DURABLE PRODUCERS' GOODS, including NON-RESIDENTIAL BUILDING.



Graph 2.5.

"Explanation" of Fluctuations in RESIDENTIAL BUILDING.



Three other variables were also tentatively included, but, as their regression coefficients were found to be exceedingly small, they have been left aside. These variables are:

(*a*) The rate of increase in consumers' goods' production, in order to account for a possible direct influence of the "acceleration principle";

(*b*) The rate of increase in prices of investment goods, in order to account for a possible speculative attitude.

(*c*) The interest rate for short credits (m_S).

The rejection of these variables has been considered at some length in the preceding volume in this series.[1]

The demand for new dwellings v_B has been assumed to depend on:

(i) Rent level m_R;

(ii) Cost of construction q_B;

(iii) Long-term interest rate m_{Lb};

(iv) Profits Z^c;

(v) Number of houses h;

with a lag of zero for the series (i) to (iv) and one of $3\frac{1}{2}$ years for (v). The first four series may be said to represent direct incentives which work without much lag,[2] but the last one only works slowly and indirectly. It seems to work especially through the financial condition of house-owners who let their houses. Some time after a relative scarceness or a relative abundance of houses occurs, the financial condition of owners will exhibit a reaction; and this again will only work slowly, through credit security in this branch of enterprise, upon building. This has been treated very accurately by Roos.[3]

The equations obtained for v' and v_B are, respectively:

$$v' = 0.33\,(Z^c + Z^c{}_{-1}) - 0.47\,[m_{Ls} + (m_{Ls})_{-1}] - 0.015\,(q + q_{-1}) + 0.06\,[p + p_{-1} - \tfrac{1}{2}\,l - \tfrac{1}{2}\,l_{-1}] + 0.63\,t \qquad (2.4)$$

[1] *Loc. cit.*

[2] The series v_B refers to the beginning of the building process.

[3] C. F. Roos: *Dynamic Economics*, Bloomington, 1934, pages 69-110.

$$v_B = -0.30h_{-4} + 0.074Z^c + 0.042m_R - 0.031q_B - 0.038m_{Lb} + 0.10t \quad (2.5).$$

For further details concerning these relations the reader may be referred to the first volume in this series.[1]

The way in which investment in working capital has been treated is somewhat indirect, but, in view of the rather deficient statistics, it is perhaps the best that can be adopted. It consists in regarding all enterprises as though they were integrated, without attempting to deal separately with the various vertical stages of production. This "body" of enterprises shows an output of goods and services in the final stage and an input of factors of production. If production in all stages were exactly synchronised, these factors would only be used for the production of the final goods leaving the "body". Investment in working capital means, however, that, at various places in the "body", stocks of raw materials and intermediate products accumulate — *i.e.*, that, in some earlier stages of the process, more is produced than corresponds to final output. This will reflect itself in a greater application of factors of production, and therefore in a larger total of wages — the other factors being mainly "overhead" factors. Investment in working capital therefore finds its expression in total wages L_w and farm incomes. Because, however, of the rather short series now available for all stocks, it has not been possible to consider separately what factors seem to be important in an explanation of working capital as a whole.

Only investment in stocks of finished consumers' goods may be treated more completely.

(2.6) "Explanation" of Commodity Stocks (Consumers' Goods)

This is one of the least satisfactory parts of the present study, chiefly because of lack of adequate data. It has only been possible to consider the most important causes of changes

[1] *Loc. cit.*

in stocks. After inspection of the curves, these seemed to be purely technical; they may be formulated as follows:

(i) There is a tendency to hold stocks which are proportional to sales; and

(ii) This tendency is counteracted by unforeseen changes in sales, of which production cannot immediately take account.

The first tendency points to considering as the first determining factor of stocks w the amount of sales u'; the second to including as a second factor the change in sales as compared with those of the previous year; this latter with a negative sign as an increase in sales will, *ceteris paribus*, lead to low stocks. This leads to the formula:

$$w = \Omega u' - \Omega' (u' - u'_{-1})$$
$$= \Omega_1 u' + \Omega_2 u'_{-1}; \ (\Omega_1 = \Omega - \Omega'; \ \Omega_2 = \Omega') \qquad (2.61).$$

Further, the interest rate and price changes would seem to influence the holding of stocks of finished consumers' goods.

For the series of department-store stocks, a slight influence of the former factor[1] was found; but price changes did not seem to have a marked influence either on this series or on that of stocks of manufactured goods. A final judgment on this question will be possible, however, only when more abundant material is available. After a number of years, the statistics of corporations will certainly yield a very useful contribution; the series of data now available is, however, too short.

The relation (2.61) was tested for department-store stocks, for which it was found to fit very well. The same type of formula was therefore used for the "explanation" of w, for which the relation

$$w = 0.105u' + 0.047u'_{-1} - 0.187(m_S)_{+\frac{1}{2}} - 0.307t \qquad (2.6)$$

was found. The trend was introduced to represent secular

[1] Represented in equation (2.6) by $(m_S)_{+\frac{1}{2}}$, since w represents stocks at the end of the year and m_S is an average over the year.

changes in the habits of holding stocks. It is equivalent to a decrease in stocks of some 4 % per annum, which does not seem unreasonable.

Graph 2.6.

" Explanation " of Fluctuations in
STOCKS OF CONSUMERS' GOODS.