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No 8

Financial asset portfolio allocation by industrial and commercial companies

by

Mrs P D Jackson

February 1984

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The object of this Technical Series of Discussion Papers is to give wider circulation to econometric research work predominantly directed towards revising and updating the various Bank models. Any comments should be sent to the author at the address given below.

Mrs Jackson is grateful for helpful comments made by colleagues at the Bank but the views expressed are her own and not necessarily those of the Bank of England. The author would like to thank Miss H Burdett for typing the manuscript.

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Introduction

This paper examines the allocation of Industrial and Commercial Companies' gross liquid asset balances among a number of different types of financial asset. It reports the results of the estimation of a system of demand equations for several financial asset categories, assessing their response to movements in interest rates and activity variables. The main impetus for this research came from the difficulties experienced in recent years in estimating stable broad money demand equations for the non-bank private sector as a whole. At least part of the instability appeared to reflect different financial portfolio behaviour between sectors and large swings in the size of sectoral balances. Analysis at the sectoral level appeared the logical response. Portfolio allocation models are potentially a fruitful source of information on issues of importance to the conduct of monetary policy. If successful, they could provide information on the interest sensitivity of a sector's financial asset demands and could also cast some light on the relative substitutability of various kinds of asset. Another area into which they could provide some insight is the question of the speed of adjustment of portfolios to changes in interest rates and alterations in the level of economic activity. However, much of the experience in this area to date has highlighted the difficulty in producing sufficiently good results from portfolio models to enable many policy-related conclusions to be drawn from them.

The system of portfolio demand equations which was estimated for industrial and commercial companies produced mixed results. For most of the equations, both the sign and the magnitude of the majority of the coefficients on the interest-rate terms agreed with prior expectations. But the activity terms in all the equations proved difficult to interpret. Some interesting policy-related conclusions can be drawn from this system. Company sector holdings of sterling time deposits, which account for around 15% of £M3, appear to be relatively sensitive to alterations in the competitiveness of various assets. But an increase in the general level of interest rates (both short and long) would probably leave company sector demand for time deposits largely unchanged. In contrast, company sector holdings of M1 balances appear to be relatively sensitive to alterations in the general level of interest rates. A 10% increase in rates, from say 11 1/2% to 12 3/4%, would lead to a reduction in the share of M1 holdings in companies' portfolios in the long run of around 5%. However, this work does not indicate that portfolio models will be able to fill as great a role as had been hoped. This is probably as much because of the relatively poor quality of the disaggregated portfolio data as any difficulties in the technique.

A company's financial portfolio allocation is just part of an extensive decision-making process, but it is probably best viewed as distinct from choices concerning production, the build up of physical stocks and perhaps even long-term borrowing via equity or bond issues. The approach adopted in this work was therefore that companies' portfolio allocation is part of a hierarchy of decisions - a decision tree. Decisions regarding all the aspects of production and trading (the prime purposes of the company) are made first along with decisions about long-term borrowing, dividend payments and physical stocks. The outcome of these aspects of the companies' activity then determine the companies' net liquid assets position - gross liquid financial assets less bank finance. It is less clear whether this net liquid assets position should be subdivided further into the two components: ie whether companies regard the allocation of gross financial assets independently from decisions about short-term borrowing, particularly overdraft finance, or whether an increase in a loan is regarded as a good substitute for a reduction in the holdings of an asset. Contact with Treasurers of several large UK companies indicated that their gross liquid assets position had an importance separate from that of the net position because money on deposit was thought to give a company more flexibility than unused credit lines. However, as it was not clear whether this was true for the whole company sector, it was decided to estimate, initially, two models, one in net terms - with bank lending (plus Issue Department's commercial bill holdings) as a negative asset - and one in gross terms. The results from the net liquid assets model were so poor in comparison with the gross model (the terms were mostly wrongly signed) that this formulation was abandoned.

This distinction which Treasurers appear to draw between gross liquid assets and bank finance does not of itself enable one to draw any conclusions about which if any particular asset or liability acts to absorb shocks in the system before agents can fully react to them. If the hierarchy of transactions outlined above is broadly correct and companies have a desired level of gross liquid assets, then overdraft finance is the buffer stock in the system. However, it is quite possible that either overdraft finance or total gross liquid assets might be the buffer stocks in given periods. In high risk periods when there are substantial numbers of bankruptcies (often triggered by insufficient liquid funds to meet an unexpected financial demand), gross liquid assets could well be the desired stock (making bank loans the buffer stock), but in other periods, when companies are worried about their gearing, say, the reverse might be true. The choice of buffer stock would only affect the allocation of the gross liquid assets total insofar as it affected the volatility of particular components. In periods when the volume of gross liquid assets was the desired total, companies' transaction balances would probably be more affected by unexpected payments.

Companies hold both nominal capital certain assets such as bank deposits and assets such as gilts, which involve a risk of capital gain or loss. Even for capital certain assets, the return over a quarter is unknown if the asset is of a maturity of less than three months because the funds have to be reinvested at the then prevailing interest rates. A practical approach to portfolio allocation is the mean-variance model associated with Tobin (1958) and Markowitz (1959). Investors are uncertain about the capital gain or loss that will result from holding a particular capital uncertain asset, and, according to the Tobin/Markowitz model, may be assumed to base their actions on their estimation of two parameters of the probability distribution of returns - the mean and the standard deviation. The mean of the distribution is the expected profit and the standard deviation of the return is a measure of the risk. One rationale for using the standard deviation as the measure of risk is that, if expected capital gains can be approximated by a normal distribution, the whole probability distribution is determined as soon as the mean and standard deviation are specified. As Deaton and Muellbauer (1980) point out, this is questionable because, in practice, the distribution of yields rarely appears to be normal. They also question the alternative condition needed to make the mean-variance model exact, the assumption of a quadratic utility function, because this implies that the rich insure more heavily than the poor against the same risk and that the rich hold more cash and less risky assets (absolutely) than do the poor.

While accepting that there may be drawbacks to the mean variance approach, it does provide a tractable method of tackling portfolio allocation. One frequently used formulation of desired portfolio shares is that quoted by Friedman and Roley (1979). In discrete time, linear asset demand functions (as shown below) can be derived rigorously (if the time unit is small) from utility functions exhibiting constant relative risk aversion if joint normal (or log normal) expected yield distributions are assumed.

$$\alpha^*_{it} \equiv \frac{A^*_{it}}{W_t} = \sum_{k=1}^{N} \beta_{ik} r^e_{kt} + \sum_{h=1}^{M} \gamma_{ih} X_{ht} + \pi_i \qquad (1)$$

where the α_i are portfolio shares

- A_i are asset holdings valued in £
- W is total portfolio size - the sum of the individual asset holdings (A_i)
- r^e_k are expected yields
- X_h are other influences on portfolio selection
- π_i is the constant
- $*$ represents desired values

The coefficient on the constant term can be regarded as measuring the normal share of each asset in the portfolio when yields and other influencing variables are at their average levels. This equation is homogeneous in wealth, an assumption which can be tested by including $1/W_t$ as an additional variable. It is quite possible that when companies build up their liquid assets sharply a larger proportion than usual, given the relative interest rate structure, could go into, say, bank deposits. If equation (1) was rewritten in levels terms, it would be:

$$A^*_{it} = W_t \left(\sum_{k=1}^{N} \beta_{ik} r^e_{kt} \right) + W_t \left(\sum_{h=1}^{M} \gamma_{ih} X_{ht} \right) + W_t \pi_i$$

There are other possible explanatory variables which could be important in equations for desired portfolio allocation. The share of particular financial holdings in the portfolio, and thus the liquidity characteristics of the whole portfolio, could be affected by expectations about the future level of activity. A higher turnover of company assets would increase the total transactions costs resulting from investment in securities, leading to an increase in the demand for say deposits. In addition, holdings of foreign currency deposits may be a function of the relative importance of foreign activity of the company sector.

The desired portfolio shares could therefore be of the form:

$$\frac{A^*_{it}}{W_t} = \sum_{k=1}^{N} \beta_{ik} r^e_{kt} + \gamma_{i1} \frac{1}{W_t} + \gamma_{i2} \frac{M^e_t}{W_t} + \gamma_{i3} \frac{G^e_t}{W_t} + \pi_i \qquad (2)$$

Where: M^e_t/W_t is some measure of expected foreign currency transactions deflated by the size of the portfolio

G^e_t/W_t is some measure of expected domestic transactions deflated by the size of the portfolio

There is, however, every reason to believe that each company's asset shares may not have always adjusted fully to the desired level at the end of each quarter. These discrepancies will not always cancel out over the whole of the company sector. Nor can it be assumed that any unexpected payments or receipts always affect holdings of one particular "buffer" stock asset and that the holdings of all other assets are at a desired level. Transactions costs and costs of information make it likely that any one or all of the asset holdings could be in disequilibrium or only temporary equilibrium. Individual companies with increasing marginal costs entailed in adjusting their portfolios would have 'short run' demand functions. Or rather, as Laidler (1983) pointed out, an array of such functions each one defined with respect to a different period. Compared with institutions such as pension funds, companies have particular difficulties deciding whether a portfolio balance is optimal (ie whether the return on the portfolio will be maximised for a given degree of liquidity and risk), given the nature of some of the markets they invest in and the nature of their payments flows, which increases their information costs. Rates offered on certificates of tax deposit are not the result of market supply and demand but are set exogenously by the Government, although alterations are made to keep them broadly in line with market rates. Individual companies cannot therefore assume that other market participants through arbitrage have brought this market into line with all others and have discounted all available information. The same is also true of markets for large deposits which are separately negotiated and the new issue market for gilts. Actively traded markets offering securities of a similar maturity can be used as a guide to the competitiveness of a particular return but the relative illiquidity of markets such as that for CTDs (given the very substantial cost incurred in encashment other than for a tax payment date) and some large deposits makes the return on these assets to a significant extent non-comparable with market rates. Corporate treasurers also need a considerable amount of information on the likely payments flows of the company as a whole in order to achieve an optimal portfolio which, given the diversified nature of large companies and the decision making process within the company, is not achieved without cost. For some companies, inertia might also be a factor leading to delayed response to interest rate movements.

All this points to the need for some kind of partial adjustment portfolio model. The likelihood that in the short run the asset holdings are away from the desired long-run equilibrium position and that this influences the portfolio allocation in the following period, means that each of the lagged portfolio shares needs to be included in each of the portfolio shares equations.

Friedman and Roley (1979) have developed a model of portfolio adjustment which allows for the fact that flows of new money into a portfolio are probably more sensitive to interest-rate movements (the coefficients on the r_k^e terms would be larger for these flows) than already invested funds. This would be particularly true for institutions such as pension funds which invest a large proportion of their portfolios in illiquid assets, which imposes a substantial cost on reallocating an existing portfolio. This is not really the case for companies. The prime objective of corporate treasurers is to have the funds available to meet calls by any other part of the business. For this reason, financial assets are invested in highly liquid instruments; on average a very large proportion (95%) of company sector portfolios is invested in bank deposits or very short-term instruments such as local authority temporary debt. Their holdings of gilt-edged securities are also probably at the short-end of the maturity spectrum and even holdings of certificates of tax deposit which can only be surrendered for a tax payment, unless a substantial interest penalty is incurred, are not as illiquid as might at first appear to be the case. CTDs can be surrendered for mainstream corporation tax (paid once a year) and advance corporation tax (paid twice a year) as well as for all the petroleum taxes paid by oil companies - for an average company the gap between tax payments probably averages between three and six months. Thus, for companies, a large proportion of their existing portfolio is probably sufficiently liquid to make it the equivalent to new money.

There will be costs involved in reallocating illiquid items in the portfolio but because these are relatively minor the main factors behind any disequilibrium in the allocation of the portfolio are likely to be information costs (which would affect the allocation of the new funds and the old portfolio equally) and unexpected flows of funds into or out of say transactions accounts.

The model including partial adjustment is therefore of the form:

$$\frac{A_{it}}{W_t} = \sum_{k=1}^{N} \beta_{ik} r^e_{kt} + \gamma_{i1} \frac{1}{W_t} + \gamma_{i2} \frac{M^e_t}{W_t} + \gamma_{i3} \frac{G^e_t}{W_t} + \pi_i + \sum_{k=1}^{N} \delta_{ik} \frac{A_{kt-1}}{W_{t-1}} \qquad (3)$$

This model is a system of equations, one for each asset share. In order to estimate these equations, one of the lagged-dependent variables has to be omitted to avoid perfect collinearity with the intercept term (π). As Anderson and Blundell (1982) show, this means that the coefficients on the lagged-dependent variables are not identified but the coefficients on the explanatory variables are identified and the long-run coefficients on these variables are recoverable.

Because of the nature of the data (the asset shares sum to one) these equations, estimated using OLS, will automatically satisfy the adding-up restrictions so long as each equation contains identical regressors.

The adding-up restrictions are:

$$\sum_i \pi_i = 1$$

$$\sum_i \beta_{ik} = 0 \ \forall_k$$

$$\sum_i \gamma_{i1} = 0$$

$$\sum_i \gamma_{i2} = 0$$

$$\sum_i \gamma_{i3} = 0$$

$$\sum_i \delta_{ik} = 0 \ \forall_k$$

The coefficient on each variable sums to zero across all equations in the system and the coefficient on the intercept term sums to 1. Thus one of the equations is in essence redundant, although as pointed outby Brainard and Tobin (1968) it is important to check the plausibility of the redundant equation. Anderson and Blundell show that the adding-up restrictions have strong implications for the plausibility of models. If a diagonal matrix of lagged dependent variables is included, the implication of the adding-up restrictions on the general model is that all of the elements on the diagonal must be equal - suggesting in partial adjustment terms that, if equations are to adjust independently, they must all adjust at the same speed. For the adding up restrictions to hold, each of the coefficients on these lagged dependent variables would have to be zero (if a constant is included in the equation) or one (if a constant is not included). Thus extreme care needs to be exercised before any restrictions are placed on the parameters associated with lagged values of the dependent variable vector.

The equation is homogeneous in terms of interest rates if $\sum_k \beta_{ik} = 0$ - the sum of all interest terms in a particular equation equals zero. Thus an increase in all expected interest rates of the same magnitude would not affect asset shares. An equation for non-interest bearing assets would, of course, not be expected to have this property. But a large proportion of company sector M1 balances are interest bearing (overnight and call deposits) which makes the expected properties of this equation less clear. An increase in the general level of interest rates could lead to a shift from non-interest-bearing to interest-bearing M1, leaving company sector holdings of the aggregate as a whole unaffected. It is not clear whether the other equations should have this property either. If one of the equations is not homogeneous in interest rates, then at least one other equation (and perhaps all the other equations) will also not be homogeneous (because of the adding up constraint). The homogeneity constraint would in any case apply to the expected returns and if these are a complex function of the included interest rates and activity terms this will be impossible to test. For these reasons homogeneity is not imposed.

Another property that might be expected is symmetry.

$\beta_{ik} = \beta_{ki}$ The coefficient on asset i's expected return in the equation for asset k should equal the coefficient on asset k's return in the equation for asset i. However, this would also be difficult to test if expectations are proxied by a number of different terms.

On the expected sign of the coefficients, all the long-run coefficients on the own price terms should be positive and the long-run coefficients on price terms of assets which are substitutes should be negative. Although the expected sign on the interest rate terms for assets which entail a possible capital gain or loss is not certain because a fall in the own interest rate could lead to the expectation of capital gains in the future. The expected sign of the coefficients on interest rates related to assets which are not substitutes is not clear. It is possible that just income effects would be picked up. An increase in income perhaps gives the company Treasurers the opportunity to enjoy more security along with more yield. The coefficients on interest rates related to assets which are not substitutes for transactions balances could therefore have positive coefficients in the M1 equation. The coefficient on foreign currency transactions should be positive in the foreign currency equation and that on real domestic activity should be positive in equations for assets with low transactions costs.

Data

The data for ICCs' financial assets are all Bank of England or CSO flow of funds data. Levels series were created by taking a single level and accumulating the flows. The assets were divided into five categories, chosen so that the assets within each category had reasonably similar interest rates.

The categories were as follows:

1	M1 components	(M1)	£ sight deposits (1) Notes and coin (2)
2	Short-term assets	(TIM)	£ time deposits Deposits with building societies Deposits with OFIs LA temporary debt
3	Long-term assets	(LNG)	Gilts including revaluations Local authority long-term debt
4	Foreign curency deposits	(FCD)	with banks in the UK
5	Tax certificates	(CTD)	

This breakdown of the portfolio data for ICCs is not available before mid-1970, which restricts the possible length of the estimation period. The estimation period used was Q2 1972 to Q2 1982 to avoid some extremely poor data at the beginning of the series. The shares of the gross liquid assets portfolio accounted for by these categories are shown in Chart 1. The mean shares over the estimation period were 43% for short-term assets, 33% for M1 components, 18% for foreign currency deposits, 4% for long-term assets and 2% for CTDs. These data were all end-quarter,

(1) Non-interest bearing and interest-bearing M1 because a split between these components is not available before end-1982.

(2) The estimates for this category are extremely poor.

not seasonally adjusted. The change in ICCs' holdings of long-term assets is calculated from the outstanding stock and includes revaluations. The same is true of foreign currency deposits in the period up to the third quarter of 1975 but from then onwards the flows exclude the effect of foreign currency movements. A dummy variable was included to pick up the effects of the change in measurement of foreign currency deposits but it proved insignificant.

The representative interest rates taken were all quarterly averages. The representative rate used for the long-term category was the yield on five-year gilts taken from the par yield curve - it is the gross redemption yield (which is the same as the coupon) on a five-year gilt sold at par. The three-month euro-dollar rate was used for the return on foreign currency deposits and various exchange rates ($/£ and effective) were tried as proxies for the expectations of exchange rate gains but these terms were not significant. The three-month local authority rate was used as the representative rate for the return on short-term deposits. Certificates of tax deposit presented a problem because the period taken for the portfolio allocation was one quarter, whereas often these certificates are bought because of bonuses and supplements which come into effect only if the certificates are held for a longer period. For these instruments, the CTD rate, including bonuses and supplements to give the rate on holdings for one year, was used. In some periods, CTDs were not for sale - a dummy variable (1) and the average interest on new certificates in the year before their removal from sale (included in the interet rate term) were used to pick up availability effects. No own rate was included for M1 balances. This also presents difficulties because, on balances which carry no interest, there is of course an implicit return from the services provided by the banks. In recent years, the problem has been exacerbated by an increasing movement by companies into interest bearing sight deposits (2) - carrying negotiable overnight rates - but a split is unavailable for the period as a whole.

The estimation period includes the end of exchange controls in October 1979, which must have had some impact on company foreign currency deposit holdings. A dummy variable (1) was included to pick up this effect.

Nominal GDP was used as a proxy for expected domestic activity by industrial and commercial companies and imports of goods in value terms were used as a proxy for foreign currency transactions; multinationals could well be influenced by the extent of their overseas operations when considering foreign currency holdings in the UK but

(1) A (0,1) dummy variable.

(2) Included within the category of their M1 holdings.

for a number of companies, expected imports could well be the important variable. GDP and imports were both deflated using total assets - the portfolio size. Other transactions proxies were tried as an alternative to imports. Total world industrial production - TWIP - (in nominal terms deflated by W_t) was tried in an attempt to pick up companies' world activity. In addition, expectations for both TWIP and GDP, produced using Box-Jenkins univariate models, were used (deflated by W_t) but the results were not quite as satisfactory as those from the equations including just current values of imports (or TWIP) and GDP deflated by W_t.

Estimation

The estimation period was 1972 Q2 to 1982 Q2, giving 45 observations. The relatively small number of observations placed a limit on both the lags which could be included in the equations and the tests which could be carried out on the final equations; for example, all tests involving the splitting up of the estimation period were precluded.

OLS was used as the initial estimation method. There is, however, a considerable potential problem because of the possible endogeneity of some of the interest rate terms. The CTD rate is exogenous, as it is set by the Treasury and is only altered to keep pace with market developments with a lag. The three-month euro-dollar rate can be regarded as exogenous. But purchases of gilts by companies could affect yields at the margin, although, as companies are relatively minor purchasers of gilts, their influence in this market could be relatively small. More importantly, short-term interest rates could be affected by companies' willingness to hold deposits. In any case, as all the interest rates used were to a degree lagged, because they were quarterly averages (implicitly relating to the middle of the quarter) and the shares related to the end of the quarter, the problem might be less than at first sight would appear to be the case.

The theoretical model (above) contains a large number of expectations variables. All the interest-rate terms are expected returns and both the domestic activity term and the foreign currency transactions terms are expectations for the following quarter. The return on a CTD is known for the following quarter as is the return on a three-month asset, but the expected return on gilt holdings comprises the known coupon, and a price change which is unknown. The expectation of the gilts price change was modelled by lags of the price change. Rubinstein (1975) shows that even in a perfectly competitive economy investors will only perceive all the information they have as fully reflected in securities prices if and only if they have consensus beliefs.

Consensus beliefs are those which, if held by all individuals in an otherwise similar economy, would generate the same equilibrium prices as in the actual heterogeneous economy. It is therefore reasonable to assume that Treasurers make some judgement about likely capital gains. The factors taken into account would be extensive - all the developments which could lead to a change in the interest rate level. But the path of securities prices to date, which provides some indication of the demand by other investors, is probably also taken into account. The change in the gilt price was calculated using the yields from the five year par yield curve (1).

Original price at 5 years = 100 (at par yield Y_1).
New price at 5 years at par yield $Y_2 = P^*_2$

$$P^*_2 = \left\{ \frac{Y_1}{Y_2} \left[1 - \frac{1}{\left(1 + \frac{Y_2}{200}\right)^{10}} \right] + \frac{1}{\left(1 + \frac{Y_2}{200}\right)^{10}} \right\}$$

implied gross price taking into account the fact that after one quarter the length of time to maturity will be 4 3/4 years is:

$$P_2 = P^*_2 \quad 1 + \frac{Y_2}{2}^{1/2}$$

the net price taking into account accrued interest is:

$$NP_2 = P_2 - Y_{1/4}$$

Various other methods of modelling capital gains expectations were tried, including a rational expectations form with instruments for the actual price change, but none of these proved particularly satisfactory. The final form of the equation included the coupon (the par yield) and lags of the price change. Activity expectations were also modelled using lags initially but the current values proved more satisfactory.

Each asset share equation was estimated separately, including four lags on the change in the gilt price and the lagged values (2) of four of the asset shares. Three seasonal dummy variables were included as well as dummy variables for the unavailability of CTDs and the removal of exchange controls.

The coefficient on the exchange control dummy was insignificant in the equation for the share of foreign currency deposits (t statistic of 0.3) and was therefore dropped. The dummy for the unavailability of CTDs was significant in the share of CTDs equation and also in two other equations and was therefore retained.

(1) The formula was created by J Richardson in the Bank's Maths Techniques section.
(2) All the lags up to fourth quarter were included.

Results

A general model was estimated of the form:

$$A_{it}/W_t = \alpha_i + \beta_{i1}\ RE\$ + \beta_{i2}\ CTDR + \beta_{i3}\ LA3 + \beta_{i4}\ 5\ Yr\ G + \sum_{J=0}^{4} \beta_{i5+J} GPR_{t-J} \quad (4)$$

$$+ \gamma_{i1}\ 1/W_t + \gamma_{i2}\ M_t/W_t + \gamma_{i3}\ G_t/W_t + \sum_{k=1}^{N} \sum_{j=1}^{4} \delta_{ikj}\ A_{kt-j}/W_{t-j} + \lambda_{i1}\ DUM$$

$$+ \lambda_{i2}\ QD_1 + \lambda_{i3}\ QD_2 + \lambda_{i4}\ QD_3$$

Where:

RE\$ = The three-month euro-dollar rate (quarterly average)

CTDR = The CTD rate (quarterly average)

LA3 = Three-month local authority rate (quarterly average)

5 Yr G = The five year gilt yield (quarterly average)

GPR = The change in price of a five-year gilt - calculated from quarterly average gilt yield

W_t = Companies' liquid assets

M_t/W_t = Imports deflated by companies' liquid assets

G_t/W_t = GDP deflated by companies' liquid assets

DUM = The unavailability of CTDs dummy variable - the value is 1 in periods when CTDs are not available and 0 when they are

QD = Quarterly dummy variable

Various combinations of restrictions on the lags were tested using F tests and the final restricted model was:

$$A_{it}/W_t = \alpha_i + \beta_{i1}\ RE\$ + \beta_{i2}\ CTDR + \beta_{i3}\ LA3 + \beta_{i4}\ 5\ Yr\ G + \beta_{i5}\ GPR \quad (5)$$

$$+ \beta_{i6}\ GPR_{-4} + \gamma_{i1}\ M_t/W_t + \gamma_{i2}\ G_t/W_t + \lambda_{i1}\ DUM$$

$$+ \sum_{k=1}^{N} \delta_{ik}\ A_{kt-4}/W_{t-4}$$

the lagged dependent variables were:

$SLNG_{-4}$ = The share of long-term assets in t-4 (A_{jt-4}/W_{t-4})

$STIM_{-4}$ = The share of time deposits in t-4

$SCTD_{-4}$ = The share of CTDs in t-4

$SFCD_{-4}$ = The share of foreign-currency deposits in t-4

$SM1_{-4}$ = The share of M1 balances in t-4

The nineteen restrictions could not be rejected at the five percent significance level ($F_{19, 12} = 2.5$) for four of the five equations (see below) and because of the adding up restrictions would hold for the fifth.

SLNG $F_{19,12} = 2.4$

STIM $F_{19,12} = 1.4$

SFCD $F_{19,12} = 1.3$

SM1 $F_{19,12} = 2.3$

The results are shown in attached Table 1.

The retention of just the lagged-dependent variables in period t-4 probably reflects seasonality. It can be argued that, because of the pattern of companies' tax payments etc, the optimal allocation of their portfolio varies seasonally through the year. The current portfolio shares would therefore be related to portfolio shares in the same quarter a year before modified by current interest-rate expectations and activity expectations.

The short-run interest-rate responses of the asset share categories in the main look plausible. The short-run elasticities evaluated at the point of means of the independent variables ($E_j = \bar{X}_j/\bar{Y}_j$) are shown below:

	GPR	GPR_{-4}	5 Yr G	LA3	CTDR	RE$	M_t/W_t	G_t/W_t
SLNG	-0.001	-0.003	-0.46	0.11	-0.09	-0.04	0.56	0.45
STIM	-0.001	0.001	-0.15	0.21	-0.03	-0.03	-0.26	-0.01
SCTD	-0.007	-0.024	-2.37	-0.79	0.38	0.81	0.34	-4.18
SFCD	0.005	0.000	0.70	-0.32	0.08	0.17	0.14	0.40
SM1	-0.001	0.000	-0.01	-0.07	-0.01	-0.09	0.18	-0.06

The long-run coefficients, calculated by taking into account the lagged dependent variables in the system as a whole, are also, in the main, correctly signed. The coefficients were calculated as $(I-B)^{-1}\Gamma$ where B is the matrix of lagged dependent variable coefficients and Γ is the matrix of independent variable coefficients. One of the share equations, that for M1 assets, was omitted to make the B matrix square, but the long-run coefficients of this equation can be retrieved by using the long-run adding-up constraints. The long-run interest rate and activity coefficients are shown below:

	5 Yr G	LA3	CTDR	RE$	M/W	G/W
SLNG	-0.003	-0.012	0.002	-0.001	0.49	-0.09
	(3.0)	(3.4)	(2.5)	(1.9)	(4.3)	(3.0)
STIM	0.004	0.097	-0.018	-0.002	-3.24	0.71
	(1.1)	(6.9)	(6.1)	(1.2)	(7.4)	(5.9)
SCTD	-0.003	-0.033	0.007	0.004	1.05	-0.25
	(1.1)	(3.1)	(2.9)	(3.4)	(3.1)	(2.8)
SFCD	0.025	0.0744	-0.014	0.002	-2.59	0.72
	(9.8)	(8.2)	(7.2)	(2.5)	(9.1)	(9.3)
SM1	-0.023	-0.126	0.023	-0.004	4.29	-1.08
	(8.5)	(13.1)	(11.4)	(3.7)	(14.3)	(13.2)

T statistics for the long-run coefficients can be calculated through the reparametisation of the equations in the Bewley fashion to give the long-run solutions as part of each equation - Bewley (1979). With an equation system where Y_t is an nx1 vector of endogenous variables, X_t is a kx1 vector of exogenous variables, π is an nxn matrix and Γ is an nxk matrix.

$$Y_t = \pi Y_{t-4} + \Gamma X_t + e_t$$

the reparametisation would be achieved as follows:

Subtract Y_{t-4} from both sides:

$$Y_t - Y_{t-4} = -(I - \pi)\, Y_{t-4} + \Gamma X_t + e_t$$

pre-multiply through by $(I-\pi)^{-1}$ so that the long-run solution to Γ is in the equation

$$(I-\pi)^{-1}(Y_t - Y_{t-4}) = -Y_{t-4} + (1-\pi)^{-1}\Gamma X_t + (1-\pi)^{-1} e_t$$

Add Y_t to both sides

$$Y_t = Y_t - Y_{t-4} - (1-\pi)^{-1}(Y_t - Y_{t-4}) + (1-\pi)^{-1}\Gamma X_t + (1-\pi)^{-1} e_t$$

Let $P = 1 - (1-\pi)^{-1}$

$$Y_t = P\,(Y_t - Y_{t-4}) + (1-\pi)^{-1}\Gamma X_t + (1-\pi)^{-1} e_t$$

Equation (5) was reparametised as:

$$A_{it}/W_t = \alpha_i + \beta_{i1}\,\mathrm{RE\$} + \beta_{i2}\,\mathrm{CTDR} + \beta_{i3}\,\mathrm{LA3} + \beta_{i4}\,\mathrm{5\ Yr\ G} + \beta_{i5}\,\mathrm{GPR}$$

$$+ \beta_{i6}(\mathrm{GPR}-\mathrm{GPR}_{-4}) + \gamma_{i1}\, M_t/W_t + \gamma_{i2}\, G_t/W_t + \lambda_{i1}\,\mathrm{DUM} \qquad (6)$$

$$+ \delta_{i1}(\mathrm{SLNG}-\mathrm{SLNG}_{-4}) + \delta_{i2}(\mathrm{STIM}-\mathrm{STIM}_{-4}) + \delta_{i3}(\mathrm{SCTD}-\mathrm{SCTD}_{-4}) + \delta_{i4}(\mathrm{SFCD}-\mathrm{SFCD}_{-4})$$

Where β_{i1}, β_{i2}, β_{i3}, β_{i4}, β_{i5}, γ_{i1} and γ_{i2} are all the long run coefficients.

Because of the presence of current values of the dependent variables on the right hand side of equation (6), it must be estimated using 2SLS. The instruments are all the variables in equation (5). Estimating equation (6) by 2SLS is directly equivalent to estimating(5) by OLS.

The standard errors shown in the table above were derived by this method.

Evaluation of the equation

(a) Misspecification Testing etc

The hypotheses that the LA3 rate and the 5-year gilt yield are exogenous was tested using the Engle test (1982). To test the exogeneity of the gilt yield, the residuals from the SLNG equation were regressed on the RHS variables from that equation and on the residuals from an equation for the five-year gilt yield based on the work by Modigliani and Shiller (1973).

$$5YrG = \sum_{\tau=1}^{15} W_\tau \ LA3_{t-\tau} + \sum_{\tau=1}^{9} B_\tau \ P_{t-\tau} + \gamma\sigma^2 \ LA3 \qquad (7)$$

Where 5YrG = the yield to maturity on a five year gilt (quarterly average)

LA3 = the three-month local authority rate (quarterly average)

P = the inflation rate measured by $\frac{PC - PC_{-1}}{PC_{-1}}$

where PC is the consumer price index

σ^2 LA3 = an eight quarter moving variance of the LA3 rate

The test statistic is TxR^2 where T is the number of observations.
The hypothesis of exogeneity of the five-year gilt yield could not be rejected at the 2.5 percent significance level - although it could be rejected at the 5% level.

$TxR^2 = 4.1$ which is less than the critical value, $\chi^2_1 = 5.0$. (2.5% significance level

The residuals from the STIM equation were regressed on the RHS variables from that equation and the residuals from an autoregressive equation for the LA3 rate.

$$LA3 = \sum_{\tau=1}^{15} \beta_\tau \ LA3_{t-\tau} \qquad (8)$$

The hypothesis of exogeneity of the three-month LA rate could not be rejected, at the 5% significance level, as $TxR^2 = 2.7$.

Thus simultaneity bias does not appear to be a problem.

The equations were tested for misspecification in a number of ways. Charts showing the residuals are attached (Charts 2 to 6). As can be seen, outliers are not a problem. The hypothesis of white noise errors was tested using an LM test for up to 4th order autocorrelation. The hypothesis was rejected at the five percent significance level - critical value 9.5 - for three out of the five equations (see below):

SLNG = 13.3
STIM = 7.8
SCTD = 11.7
SFCD = 10.3
SM1 = 5.1

However, if the results are adjusted for the small number of degrees of freedom, the hypothesis is not rejected for any of the equations. The test statistic used was:

$$\frac{TSS - RSS}{RSS} \times \frac{T-K-J}{J} \quad F_{J,T-K-J}$$

Where J = order of autocorrelation being tested

T = number of observations

K = number of parameters in the original equation

TSS = the total sum of squares from the regression (2) of the residuals from the original equation on four lags of the residuals and the independent variables from the original equation

RSS = the residual sum of squares from regression (2)

The value of the statistic for SLNG was 2.9, which is just over the critical value given by $F_{4,23}$ at the 5% significance level (2.8), but it is less than the critical value at the 1% significance level (4.3). The statistics for SCTD and SFCD were 2.4 and 2.0 respectively.

The eigenvalues of the lagged dependent variable matrix were calculated to test the stability of the system. The four eigenvalues were all positive and less than 1. The values were:

0.959

0.838

(0.349658, 0.288495)(1)

(0.349658, -0.288495)(1)

This indicates that the system is stable.

Because of the shortage of observations, few could be retained to test parameter stability using post-estimation-period forecast tests. The equations were used to forecast out of estimation period, over the final two quarters of 1982. The chi-square test statistics were as follows:

SLNG = 10.6

STIM = 27.11 χ^2_2 = 5.99 at the 5% significance level

SCTD = 3.2

SFCD = 45.6

SM1 = 4.4

Unfortunately, the hypothesis of parameter stability could be rejected for three out of the five equations at the 5% significance level. But this test using only two observations is rather inconclusive.

(1) Complex numbers.

(b) The Results

INTEREST ELASTICITIES

	5YrG	LA3	CTD	RE$	
SLNG	-0.5	0.1	-0.1	-0.0	SR
	-0.9	-3.4	0.6	-0.2	LR
STIM	-0.2	0.2	-0.0	-0.0	SR
	0.1	2.6	-0.5	-0.1	LR
SCTD	-2.4	-0.8	0.4	0.8	SR
	-2.1	-23.5	5.0	2.4	LR
SFCD	0.7	-0.3	0.1	0.2	SR
	1.6	4.7	-0.9	0.1	LR
SM1	-0.01	-0.1	0.01	-0.1	SR
	-0.8	-4.3	0.8	-0.1	LR

ACTIVITY ELASTICITIES

	m/w	G/w	
SLNG	0.56	0.45	SR
	4.6	-4.1	LR
STIM	-0.26	-0.01	SR
	-2.8	3.0	LR
SCTD	0.34	-4.18	SR
	24.9	-28.1	LR
SFCD	0.14	0.40	SR
	-5.5	7.3	LR
SM1	0.18	-0.06	SR
	1.5	-5.8	LR

The results from equation 5 (equation 6 in the Bewley reparametised version) are moderately satisfactory but some of the interest-rate terms look implausibly large. A 10% increase in all expected interest rates (at their mean value - eg an increase in the LA3 rate from 11.4% to 12.5%), ceteris paribus, would reduce the proportion of M1 holdings in companies' portfolios by 44% in the long run (eg from .34 to .19). In addition, the activity terms are difficult to interpret. Because of sharp increases in holdings of companies' financial assets in periods of strong economic growth, G_t/W_t moves inversely in relation to normal activity. In equation 5 there is no term to pick up any effect of movements in the total portfolio on individual asset shares because $1/W_t$ (included in the general model) was excluded in the restricted version. All the restrictions on the general model (including whether the coefficient on $1/W_t$ was significantly different from zero) were tested as a block using an F test - the restriction was not rejected at the 5% significance level. However, the perverse sign on G_t/W_t in the equation for the share of M1 in companies' portfolios and on M_t/W_t in the SFCD equation raises the question whether there is in fact some relation between certain of the asset shares and W_t (which is being picked up in these activity terms).

Re-estimation of equation 6 including $1/W_t$

Equation 6 was re-estimated as:

$$A_{it}/W_t = \alpha_i + \beta_{i1}\,RE\$ + \beta_{i2}\,CTDR + \beta_{i3}\,LA3 + \beta_{i4}\,5YrG + \beta_{i5}\,GPR + \beta_{i6}\,(GPR - GPR_{-4})$$

$$+ \gamma_{i1}\,M_t/W_t + \gamma_{i2}\,G_t/W_t + \gamma_{i3}\,1/W_t + \lambda_{i1}\,DUM + \delta_{i1}\,(SLNG - SLNG_{-4})$$

$$+ \delta_{i2}\,(STIM - STIM_{-4}) + \delta_{i3}\,(SCTD - SCTD_{-4}) + \delta_{i4}\,(SFCD - SFCD_{-4})$$

The long-run coefficient on $1/W_t$ was significantly different from zero in the equations for all of the asset shares (see below), although the short-run coefficients are not significantly different from zero - see table 2. In the long-run, a 1% increase in the size of the portfolio, ceteris paribus, at the mean values of the variables, causes a 0.5% increase in the share of M1, a 0.4% increase in the share of long-term assets and a 2.4% increase in the share of CTDs. It is not clear why these three assets in particular should be positively related to the size of the portfolio while the shares of time deposits and foreign currency deposits are inversely related to the portfolio size, but there are some possible explanations. One rationale for the link with the share of M1 is that, in some periods, the total size of the portfolio could be the buffer stock in companies' financial transactions, rather than borrowing from banks, and it is companies' transactions balances which bear the brunt of any payments shocks. The link between both the share of long-term assets and that of CTDs and the size of the portfolio could be explained by the risk entailed in investing in both of these assets. They are the least liquid of the assets in the portfolio - CTDs can only be surrendered at a tax payment date and gilts can only be sold before maturity at the risk of a capital loss. It is possible that the larger the size of the portfolio, other things being equal, the more scope the Treasurer has to invest a bigger proportion in relatively high risk assets.

With $1/W_t$ included in the equations, the interest rate terms look somewhat more plausible, but the activity terms still have perverse signs in the SM1 and SFCD equations.

Long-run coefficients

	5YrG	LA3	CTDR	RE$	G/W	M/W	1/W
SLNG	-0.0027	-0.00191	0.0002	-0.0009	-0.0050	0.1497	- 164.7
	(2.8)	(1.0)	(0.4)	(2.2)	(0.3)	(2.6)	(3.5)
STIM	0.00178	0.02454	-0.00567	-0.0009	0.1001	-0.8764	1,145.9
	(0.5)	(3.3)	(2.9)	(0.6)	(1.7)	(4.0)	(6.4)
SCTD	-0.00241	-0.00932	0.00261	0.00366	-0.0537	0.28278	- 373.2
	(0.8)	(1.6)	(1.7)	(3.1)	(1.1)	(1.6)	(2.6)
SFCD	0.0233	0.01863	-0.00443	0.00318	0.2485	-0.7633	883.8
	(9.5)	(3.9)	(3.4)	(3.2)	(6.2)	(5.2)	(7.4)
SM1	-0.01992	-0.03194	0.00729	-0.00505	-0.2899	1.2072	-1,491.8
	(7.7)	(6.3)	(5.3)	(4.8)	(6.9)	(7.8)	(11.9)

Short and long-run elasticities (1)

	5YrG	LA3	CTDR	RE$	G/W	M/W	1/W	
SLNG	-0.54	0.13	-0.08	-0.04	0.53	0.56	-0.12	SR
	-0.77	-0.54	0.06	-0.22	-0.24	1.50	-0.43	LR
STIM	-0.09	0.19	-0.04	-0.02	-0.07	-0.26	0.09	SR
	0.05	0.65	-0.15	-0.02	0.02	-0.81	0.28	LR
SCTD	-2.39	-0.78	0.38	0.80	1.60	0.34	-0.06	SR
	-1.72	-6.64	1.86	2.22	-6.31	7.07	-2.44	LR
SFCD	0.65	-0.31	0.08	0.16	0.50	0.14	-0.09	SR
	1.49	1.19	-0.28	0.17	2.62	-1.72	0.52	LR
SM1	-0.05	-0.06	-0.01	-0.09	0.02	0.18	-0.05	SR
	-0.68	-1.09	0.25	-0.15	-1.63	1.44	-0.47	LR

(1) The full short-run results are shown in table 2 (attached).

One possible explanation for the apparently perverse signs on the activity terms in the equations for SM1 and SFCD is that imports are not a good proxy for foreign-currency transactions of UK companies. For a number of companies, the magnitude of their foreign activities would be the important factor rather than the size of their import bill.

The equations were re-estimated including $TWIP_t/W_t$ (total world industrial production in nominal terms, deflated by the portfolio size) as one of the activity terms rather than imports.

The short-run results are shown in full in table 3 and the long-run coefficients and short and long-run elasticities are shown below:

The long-run coefficients are:

	5YrG	LA3	CTDR	RE$	G /W	TWIP/W	1/W
SLNG	-0.00013	0.0004	-0.00079	-0.00116	0.02039	0.04829	- 224.8
	(0.1)	(0.3)	(1.4)	(1.4)	(2.0)	(2.2)	(3.0)
STIM	-0.01496	0.01031	0.00055	-0.00015	-0.05522	-0.29001	1,461.6
	(2.4)	(1.7)	(0.3)	(0.05)	(1.4)	(3.4)	(5.1)
SCTD	-0.00127	-0.00678	0.00177	0.00054	-0.02297	0.07235	- 581.2
	(0.3)	(1.8)	(1.8)	(0.3)	(0.9)	(1.4)	(3.2)
SFCD	0.01699	0.01021	-0.00129	0.00943	0.15079	-0.21135	1,365.0
	(5.2)	(3.3)	(1.1)	(5.4)	(7.4)	(4.8)	(7.1)
SM1	-0.00063	-0.01415	-0.00024	-0.00866	-0.09299	0.38072	-2,020.5
	(0.2)	(3.9)	(0.2)	(4.2)	(3.9)	(7.3)	(11.4)

Short and long-run interest rate and activity elasticities are:

	5YrG	LA3	CTDR	RE$	G /W	TWIP/W	1/W	
SLNG	-0.03	0.13	-0.11	-0.10	0.87	0.37	-0.34	SR
	-0.04	0.11	-0.23	-0.28	0.96	0.81	-0.59	LR
STIM	-0.26	0.22	0.003	-0.0002	-0.14	-0.34	0.27	SR
	-0.40	0.27	0.01	-0.003	-0.24	-0.45	0.35	LR
SCTD	-2.99	-0.37	0.90	0.62	-2.59	-2.49	1.18	SR
	-0.90	-4.8	1.3	0.33	-2.70	3.03	-3.80	LR
SFCD	0.79	-0.35	0.02	0.16	0.40	0.38	0.29	SR
	1.09	0.65	-0.08	0.51	1.59	-0.79	0.80	LR
SM1	0.09	-0.09	-0.05	-0.10	0.01	0.31	-0.22	SR
	-0.02	-0.48	-0.008	-0.25	-0.52	0.76	-0.63	LR

The activity terms in the SM1 and SFCD equations still appear to have perverse signs but there are possible explanations. G_t/W_t may be acting as a risk proxy rather than as a transactions term. In periods of very low growth, when there are high bankruptcy levels, companies may keep a larger proportion of their portfolios in highly liquid form - money at call, overnight balances and non-interest bearing transactions accounts, all of which are included within M1 and short-term time deposits. Companies are particularly at risk in these periods if funds are not readily available to meet unexpected demands. For multinationals holdings of short term assets, which are included within M1, could be related to their worldwide business, not just transactions in the UK. A company might take a view about what proportion of its portfolio it wishes to keep in sterling (given exchange rate expectations) but the split of that portfolio into liquid and less liquid items could well depend upon the worldwide needs of the organisation. For these companies, TWIP could well be a more important activity term than GDP. Thus TWIP might be acting as the activity proxy, while GDP is picking up risk factors. The signs on the activity terms in the SLNG equation remain difficult to interpret however.

The interest-rate terms in this final set of equations are rather more plausible than those in the equations including imports rather than TWIP. The picture from the short and long-run interest-rate elasticities is quite illuminating. Time deposits appear to be the main substitute for CTDs and M1 balances (with relatively large and negatively signed long-run coefficients on LA3 in these equations). At the mean value of the variables, a 10% increase in the three month local authority rate (from 11 1/2% to 12 3/4%)relative to the other rates would, in the long run, reduce the share of M1 assets by just under 5% and CTDs by 48%. The large coefficient on the LA3 rate in the equation for the share of CTDs probably reflects the nature of tax deposits. Relatively small divergences in rates cause very substantial movements in the proportion of companies' portfolios accounted for by CTDs. In some periods, when interest rates have been declining, CTD rates have lagged behind reductions in other market rates (sometimes by a relatively small margin) leading to large purchases. In periods of falling interest rates, CTDs are particularly attractive when there is any divergence in rates. They are fixed rate but there is no risk of a capital loss if rates continue to fall because CTDs are surrendered at par. Although, if rates rise, companies would be to a degree locked in because CTDs can only be surrendered for payment of tax unless a substantial penalty is incurred. Because CTDs account for a relatively small proportion of companies' portfolios, a 48% increase in their share is equivalent to a fairly small amount in monetary terms. At the mean size of the share (1.6%), it would be equivalent to around £100 million. The peak proportion of CTDs in companies' portfolios was 4%. This was reached in the fourth quarter of 1980 after a doubling in their holdings to £1 billion. CTD holdings are positively related to alterations in companies' worldwide activities (proxied by world economic activity) and negatively to UK activity - this is perhaps what one might expect if UK economic growth is acting as a risk proxy. To the extent that profits (and therefore tax payments) are related to worldwide activity via exports, the sign on $TWIP/W_t$ is also plausible.

Company sector sterling deposits account for a significant proportion of £M3 (15% in Q4 1983) and the results from the portfolio equations indicate that their holdings of time deposits are relatively sensitive to shifts in the competitiveness of various assets. A 10% reduction in the own rate (1), at the mean level, would, other things being equal, reduce the share of time deposits in companies' portfolios by 2 3/4% - at the mean value of the variables, this is equivalent to around £150 million. However, relative shifts in rates are difficult to achieve and sustain. A 10% increase in UK short rates would be reflected to some extent in rates at the long-end of the market, unless it was completely discounted as a very short term phenomenon. The increase would be unlikely to be fully reflected in an increase in gilt yields because it would probably not lead to a reassessment of the expected prevailing short-term interest rates over the entire life of the bond. But the net result on company time deposit holdings of an increase in both long and short rates would probably be small.

On the other hand, company sector holdings of M1 balances do appear to be relatively sensitive to movements in the level of interest rates. A 10% increase in all sterling interest rates (at the mean value of the variables - eg an increase in the three month local authority rate from 11 1/2% to 12 3/4%) would lead to a 5% reduction in the share of M1 in companies' financial balances in the long run. This is a somewhat larger long-run elasticity than has been indicated by some econometric studies(2) of the non-bank private sector's demand for M1. But one would expect corporate treasurers to have a considerably more sophisticated approach to portfolio allocation than households and the interest elasticities would therefore be likely to be larger. However, this estimate of the interest elasticity of M1 balances could well be an overstatement of the current position because of the substantial growth in

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(1) The local authority rate is used as the representative rate.

(2) For example, Hendry (1979) found a long-run interest elasticity of -0.45 for the non-bank private sector's demand for M1.

companies' holdings of interest bearing M1 balances in recent years. These interest-bearing M1 holdings would be less sensitive to movements in the general level of interest rates. A 1% increase in companies'worldwide activity would increase the proportion of M1 balances in company portfolios by 0.8% in the long run, but a 1% increase in G_t/W_t would lead to a shift into other assets (foreign currency deposits and long term assets).

The apparently perverse interest-rate effects in the SLNG equation probably reflect the influence of interest-rate movements on expectations of capital gains. In the short and long-run, a rise in short rates increases the share of gilts in companies' portfolios and the share is reduced by increases in long-term rates - although none of these coefficients are significant. In some periods, sharp upward movements in short-term rates have encouraged market participants to purchase gilts in the hope of making substantial capital gains, but in general it is easier to sell gilts on a rising market, ie when long-term interest rates are falling. The main substitutes for long-term assets appear to be foreign currency deposits and CTDS.

Most of the equations estimated including $1/W_t$ and $TWIP/W_t$ do not show any signs of misspecification. The results from a Lagrange multiplier test for up to fourth order autocorrelation were as follows:

SLNG	15.7	
STIM	16.8	
SCTD	15.3	$\chi^2_4 = 9.5$ at the five percent significance level
SFCD	11.7	
SM1	5.2	

Once these results had been adjusted for the small number of degrees of freedom using the test statistic

$$\frac{TSS - RSS}{RSS} \times \frac{T-K-J}{J} \quad F_{J,T-K-J}$$

the hypothesis of white noise errors was not rejected for any of the equations at the 1% significance level, although it is rejected for three of the equations at the 5% significance level.

SLNG	3.4	$F_{4,22}$ = 2.8 at the 5% significance level
STIM	3.8	= 4.3 at the 1% significance level
SCTD	3.2	
SFCD	2.2	

The eigen values of the lagged dependent variables matrix are all positive and less than one.

0.751506

0.272057

0.232689, 0.243591 (1)

0.232689, -0.243591 (1)

The residuals are shown in charts 7 to 11.

Parameter stability was tested with an outside estimation period test. The equations were used to forecast over the final two quarters of 1982. The hypothesis of parameter stability could be rejected for only two of the equations. The results were:

SLNG	5.8	
STIM	17.3	
SCTD	4.6	χ^2_2 = 6.0 at the five percent significance level
SFCD	42.5	
SM1	1.3	

The very small number of observations which are available for post-estimation period stability tests make it difficult to draw any firm conclusions on misspecification. However, the results do indicate that the equations for foreign currency deposits, and to a lesser extent time deposits, may be misspecified. None of the terms tried in the equations as proxies for foreign currency transactions appears to have been successful and further work needs to be carried out to improve this part of the system.

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(1) Complex numbers.

Conclusions

The approach adopted in this work was that companies' portfolio allocation is part of a hierarchy of decisions - a decision tree. Decisions regarding all the aspects of production and trading (the prime purposes of the company) are made first along with decisions about long-term borrowing dividend payments and physical stocks. The outcome of these aspects of the company's activity then determine the company's net liquid assets position - gross liquid financial assets less bank finance. This net liquid assets position is further subdivided into the two components - ie an increase in bank finance is not regarded as the exact equivalent of a reduction in a company's gross liquid assets. This approach was supported by the evidence from corporate treasurers. Holdings of financial assets probably give a company more flexibility and possibly more security than just an overdraft commitment. No assumption was made as to whether companies have a desired level of gross liquid assets as such; it was just assumed that decisions regarding the allocation of this gross liquid assets total are made separately from decisions regarding borrowing.

Even if companies have a desired level of gross liquid assets, this does not mean that each asset holding within the total is always at the desired level. It is far more likely that, because of factors such as transactions costs and information lags, these individual holdings are often in disequilibrium. For this reason, the portfolio equations were modelled including lags of all the asset shares in all the equations to allow for some kind of adjustment process. The final equations include the portfolio shares lagged four quarters. Because of the very seasonal nature of companies' financial activities - reflecting factors such as heavy tax payments in the first quarter, seasonality in output and trading etc - the portfolio allocation at the end of one quarter is probably made with reference to the allocation in that period the previous year updated using the latest information on interest rates and activity.

For the most part, the interest rate terms in the equations look plausible. Companies' holdings of M1 balances appear to be relatively sensitive to movements in the general level of interest rates. An increase in the level of interest rates from 11 1/2% to 12 3/4% would lead to a 5% reduction in the proportion of M1 holdings in company balances in the long run. In contrast, their holdings of time deposits which account for a significant proportion of £M3 appear to be sensitive to alterations in competitiveness but not to changes in the level of interest rates. Modelling of companies' demand for foreign currency deposits did not prove to be particularly successful and more work needs to be carried out in this area. One of the problems is in finding a good proxy for UK companies' foreign currency transactions.

TABLE 1

Estimation period 1972 Q2 to 1982 Q2
45 observations - 14 independent variables

	SLNG	STIM	SCTD	SFCD	SM1
RE$	-0.00014	-0.00116	0.00133	0.00301	-0.00304
	(0.6)	(1.2)	(1.8)	(4.9)	(4.7)
CTDR	-0.00032	-0.00123	0.00053	0.00120	-0.00017
	(0.8)	(0.9)	(0.5)	(1.3)	(0.2)
RLA	0.00037	0.00797	-0.00112	-0.00508	-0.00214
	(0.8)	(4.4)	(0.8)	(4.3)	(1.7)
5YrG	-0.00162	-0.00565	-0.00331	0.01095	-0.00037
	(2.5)	(2.3)	(1.7)	(6.7)	(0.2)
GPR	-0.00006	-0.00048	-0.00022	0.00174	-0.00099
	(0.5)	(1.0)	(0.6)	(5.4)	(2.9)
GPR_{-4}	-0.00030	0.00118	-0.00097	0.00007	0.00002
	(2.1)	(2.2)	(2.4)	(0.2)	(0.1)
CNST	0.10618	0.11820	0.17529	-0.34729	0.94761
	(4.4)	(1.3)	(2.5)	(5.8)	(15.0)
DUM	-0.00064	0.00058	-0.00096	0.00539	-0.00437
	(0.4)	(0.1)	(0.2)	(1.3)	(1.0)
M_t/W_t	0.05652	-0.28297	0.01367	0.06190	0.15088
	(3.8)	(4.9)	(0.3)	(1.7)	(3.8)
G_t/W_t	0.00959	-0.00203	-0.03554	0.03817	-0.1018
	(1.9)	(0.1)	(2.4)	(3.0)	(0.8)
$SLNG_{-4}$	-0.08713	0.71078	0.16446	0.75598	-1.5441
	(0.7)	(1.5)	(0.5)	(2.5)	(4.7)
$STIM_{-4}$	-0.15575	0.75706	-0.23354	0.43041	-0.79818
	(5.5)	(7.0)	(2.8)	(6.1)	(10.6)
$SCTD_{-4}$	-0.19429	0.08298	0.50587	-0.15023	-0.24432
	(3.1)	(0.3)	(2.7)	(1.0)	(1.5)
$SFCD_{-4}$	-0.06782	0.36326	0.12787	0.56662	-0.98992
	(1.7)	(2.4)	(1.1)	(5.7)	(9.3)
RSS =	0.000275	0.004046	0.002387	0.001715	0.001925
$\bar{R}^2$ =	0.925	0.958	0.662	0.866	0.9554

TABLE 2

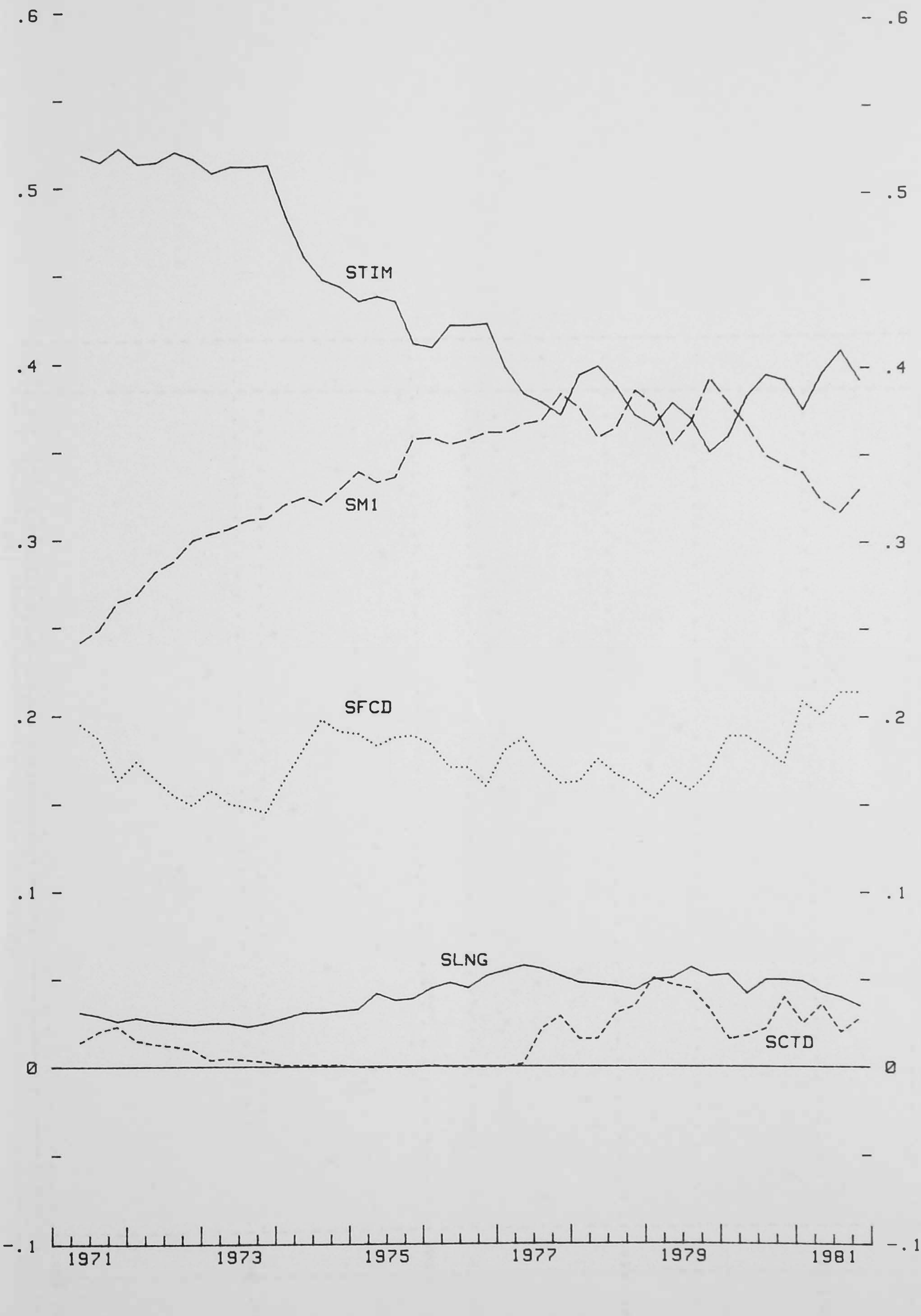
Estimation period 1972 Q2 to 1982 Q2
45 observations - 14 independent variables

	SLNG	STIM	SCTD	SFCD	SM1
RE$	-0.00017	-0.00094	0.00132	0.00293	-0.00314
	(0.7)	(1.0)	(1.8)	(4.6)	(4.7)
CTDR	-0.00028	-0.00153	0.00054	0.00131	-0.00004
	(0.7)	(1.0)	(0.5)	(1.4)	(0.0)
RLA	0.00046	0.00728	-0.00110	-0.00481	-0.00183
	(0.9)	(3.8)	(0.7)	(3.8)	(1.4)
5YrG	-0.00189	-0.00352	-0.00336	0.01010	-0.00133
	(2.3)	(1.1)	(1.4)	(5.0)	(0.6)
GPR	-0.00009	-0.00026	-0.00022	0.00166	-0.00108
	(0.6)	(0.5)	(0.5)	(4.8)	(2.9)
GPR_{-4}	-0.00028	0.00102	-0.00097	0.00013	0.00009
	(1.9)	(1.9)	(2.3)	(0.4)	(0.2)
CNST	0.09527	0.20564	0.17304	-0.38193	0.90797
	(3.0)	(1.7)	(1.9)	(4.9)	(11.0)
DUM	-0.00077	0.00160	-0.00099	0.00499	-0.00483
	(0.5)	(0.3)	(0.2)	(1.2)	(1.1)
M_t/W_t	0.05624	-0.28073	0.01361	0.06102	0.14986
	(3.7)	(4.9)	(0.3)	(1.6)	(3.8)
G_t/W_t	0.01134	-0.01607	0.03518	0.04373	-0.00381
	(1.9)	(0.7)	(2.0)	(2.9)	(0.2)
$1/W_t$	-47.2	378.3	-9.76606	-149.875	-171.48
	(0.6)	(1.2)	(0.04)	(0.7)	(0.8)
$SLNG_{-4}$	-0.07434	0.60825	0.16711	0.79660	-1.49761
	(0.6)	(1.3)	(0.4)	(2.5)	(4.5)
$STIM_{-4}$	-0.13323	0.57659	-0.22888	0.50191	-0.71638
	(2.7)	(3.1)	(1.5)	(4.0)	(5.5)
$SCTD_{-4}$	-0.19205	0.06501	0.50633	-0.14311	-0.23618
	(3.0)	(0.3)	(2.7)	(0.9)	(1.4)
$SFCD_{-4}$	-0.05515	0.26170	0.13049	0.60685	-0.94389
	(1.2)	(1.5)	(0.9)	(5.2)	(7.7)
RSS =	0.000273	0.003869	0.002387	0.001687	0.001889
$\bar{R}^2$ =	0.9229	0.95849	0.650455	0.86369	0.95474

TABLE 3
Estimation period 1972 Q2 to 1982 Q2
45 observations - 14 independent variables

	SLNG	STIM	SCTD	SFCD	SM1
RE$	-0.00043	-0.00001	0.00103	0.00291	-0.00351
	(1.5)	(0.01)	(1.4)	(4.9)	(5.0)
CTDR	-0.00037	0.0001	0.00126	0.00034	-0.00134
	(0.7)	(0.1)	(1.0)	(0.3)	(1.1)
RLA	0.00044	0.00831	-0.00052	-0.00551	-0.00272
	(0.7)	(3.4)	(0.3)	(4.3)	(1.8)
5YrG	-0.00098	-0.00976	-0.00420	0.01233	0.00262
	(1.0)	(2.4)	(1.7)	(5.9)	(1.1)
GPR	0.00007	-0.00103	-0.00016	0.00181	-0.00069
	(0.5)	(1.7)	(0.4)	(5.7)	(1.8)
GPR	0.00007	-0.00103	-0.00016	0.00181	-0.00069
	(0.5)	(1.7)	(0.4)	(5.7)	(1.8)
GPR_{-4}	-0.00018	0.00076	-0.00080	0.00007	0.00014
	(1.0)	(1.1)	(1.9)	(0.2)	(0.3)
CNST	0.0778	0.43616	0.25682	-0.50453	0.73374
	(1.6)	(2.3)	(2.2)	(5.2)	(6.4)
DUM	-0.00173	0.00649	-0.00114	0.00386	-0.00749
	(0.9)	(0.9)	(0.2)	(1.0)	(1.6)
$TWIP_t/W_t$	0.0221	-0.21588	-0.05954	0.10037	0.15298
	(1.0)	(2.4)	(1.1)	(2.2)	(2.8)
G_t/W_t	0.0185	-0.03297	-0.02203	0.03798	-0.00144
	(1.0)	(1.1)	(1.2)	(2.5)	(0.1)
$1/W_t$	-129.03	1,128.0	179.81	-485.3	-693.5
	(1.0)	(2.3)	(0.6)	(1.9)	(2.3)
$SLNG_{-4}$	-0.00912	0.05818	0.04511	1.02966	-1.12384
	(0.0)	(0.1)	(0.1)	(3.2)	(3.0)
$STIM_{-4}$	-0.10902	0.31760	-0.30778	0.62803	-0.52883
	(1.6)	(1.2)	(1.9)	(4.7)	(3.3)
$SCTD_{-4}$	-0.2594	0.17164	0.34921	-0.05027	-0.21120
	(3.1)	(0.5)	(1.7)	(0.3)	(1.1)
$SFCD_{-4}$	-0.0654	-0.01301	-0.07186	0.83124	-0.68099
	(0.8)	(0.0)	(0.3)	(4.8)	(3.3)
RSS =	0.000386	0.00584	0.002306	0.001586	0.002199
$\bar{R}^2$ =	0.89092	0.9374	0.66222	0.871921	0.947309

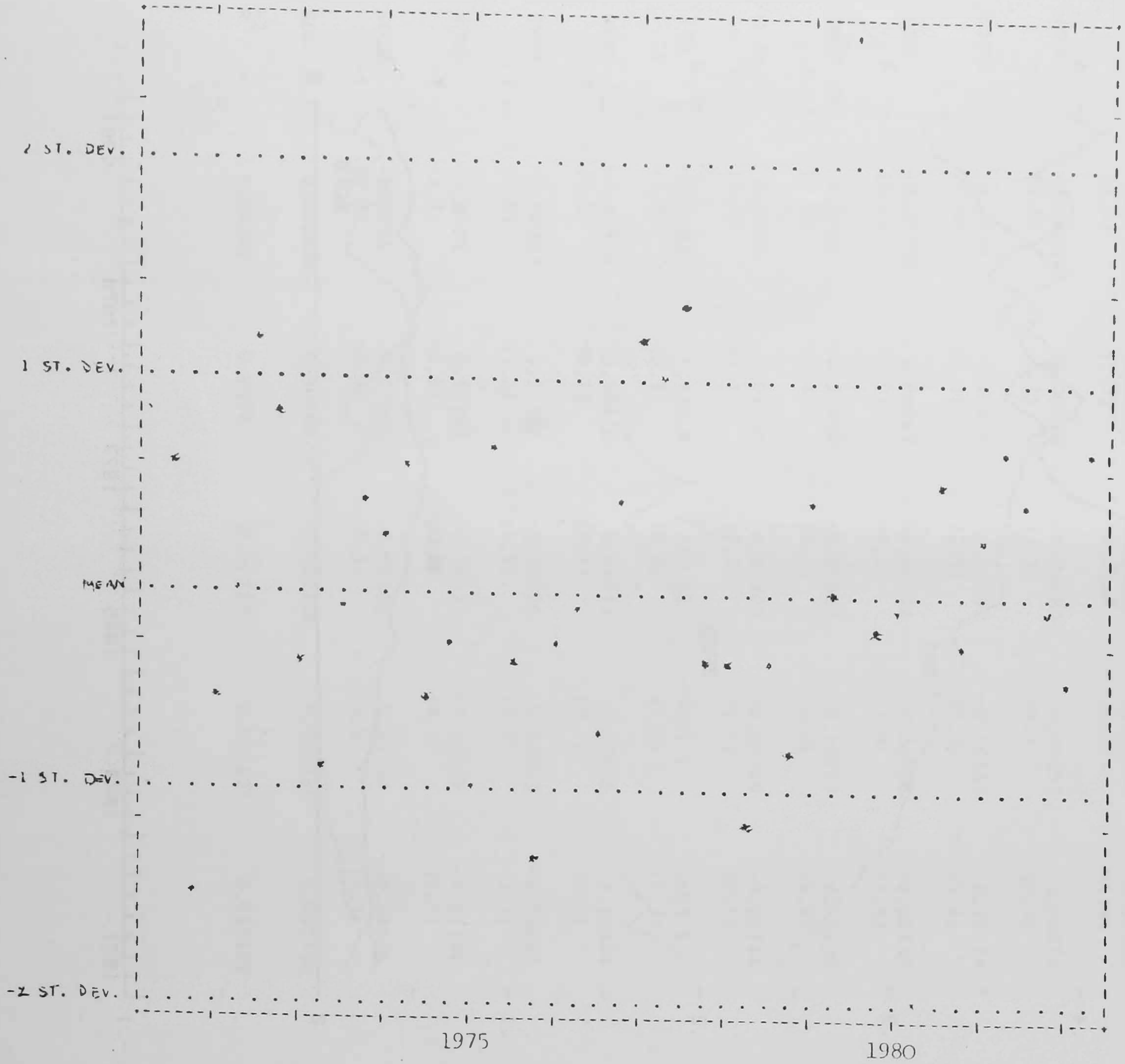
Shares of gross liquid assets portfolio
from constructed levels series



GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SLNG

SLNG

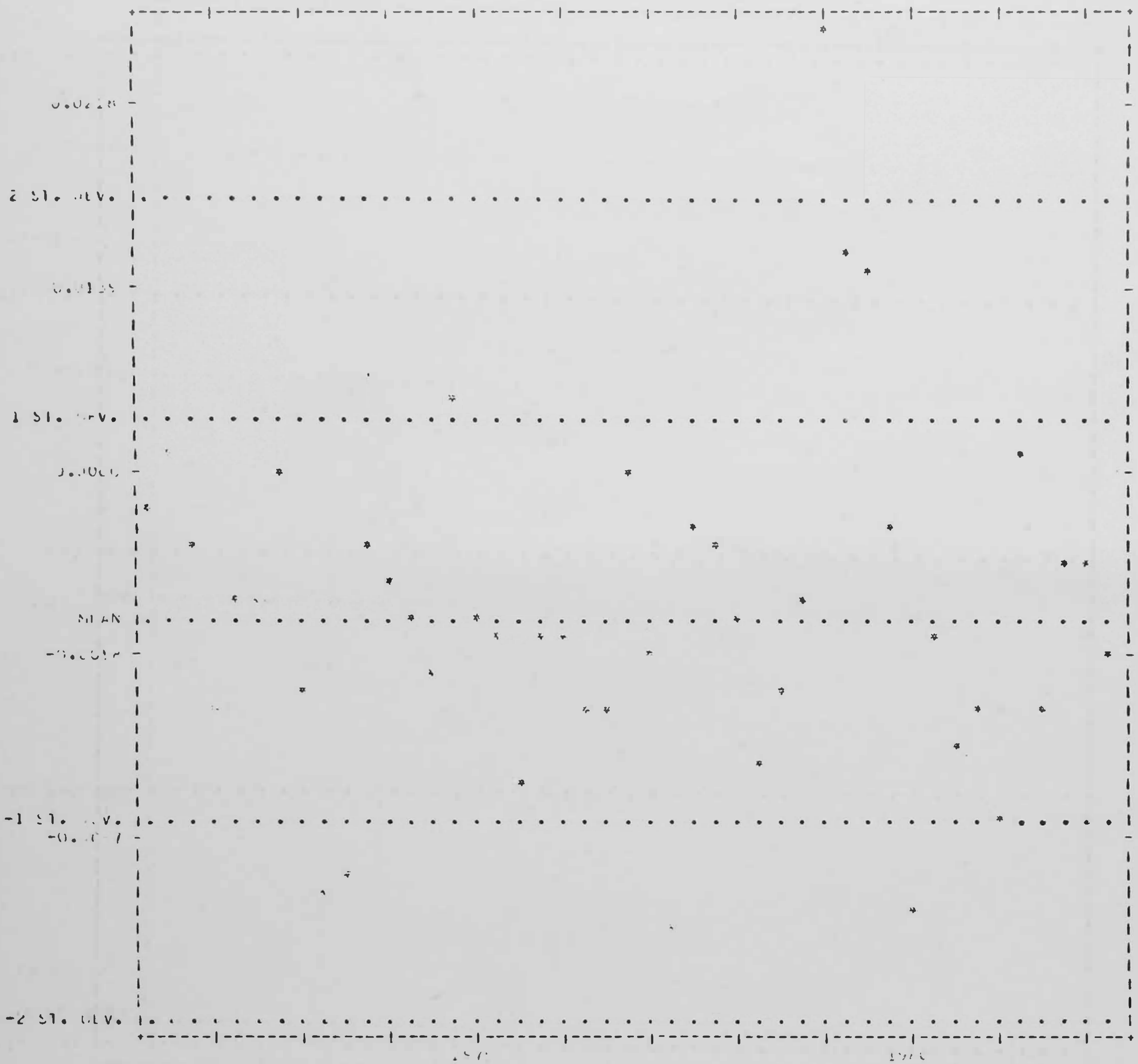
Chart 2



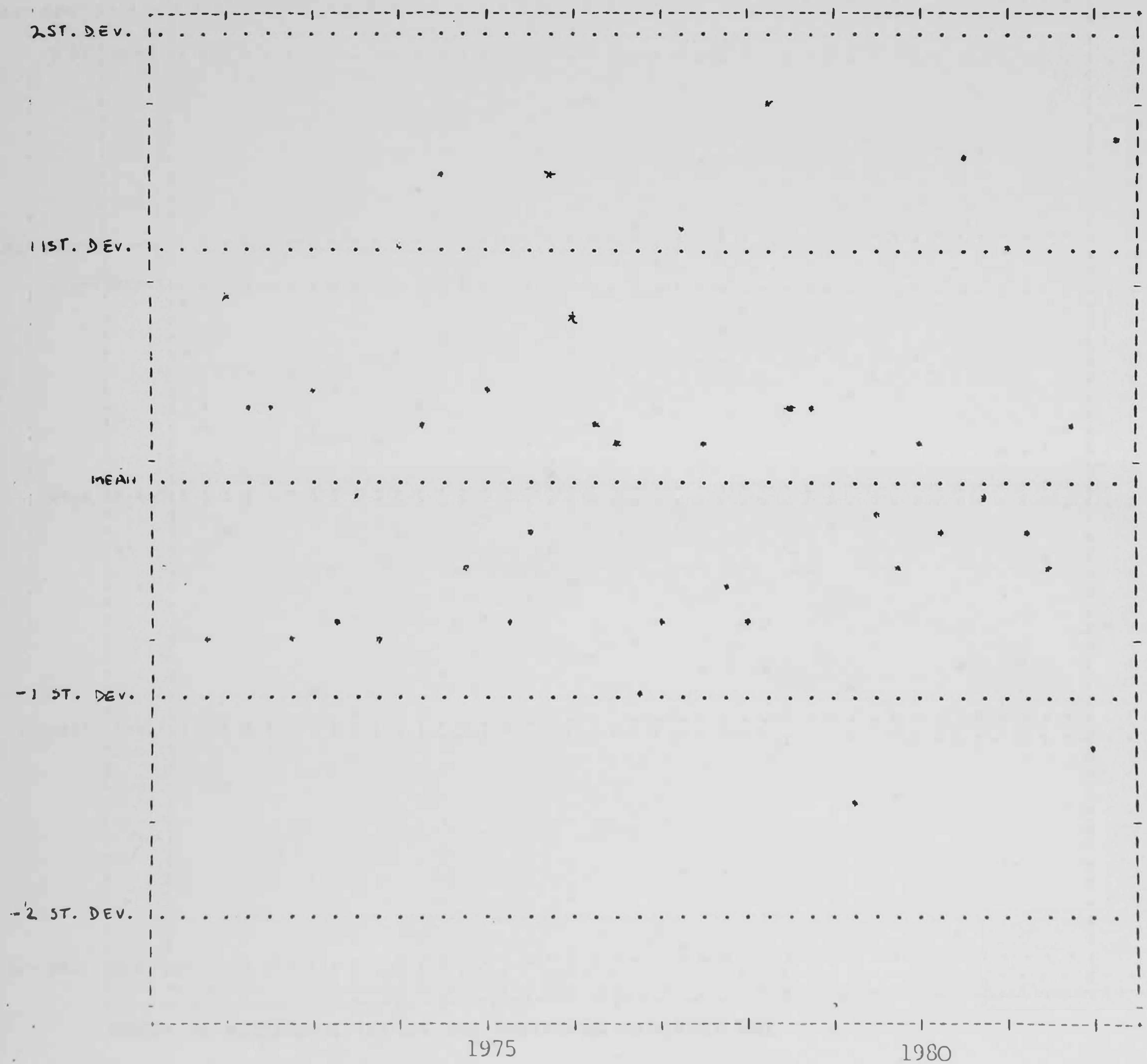
GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE STIM

SCTD Chart 4

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SCTD

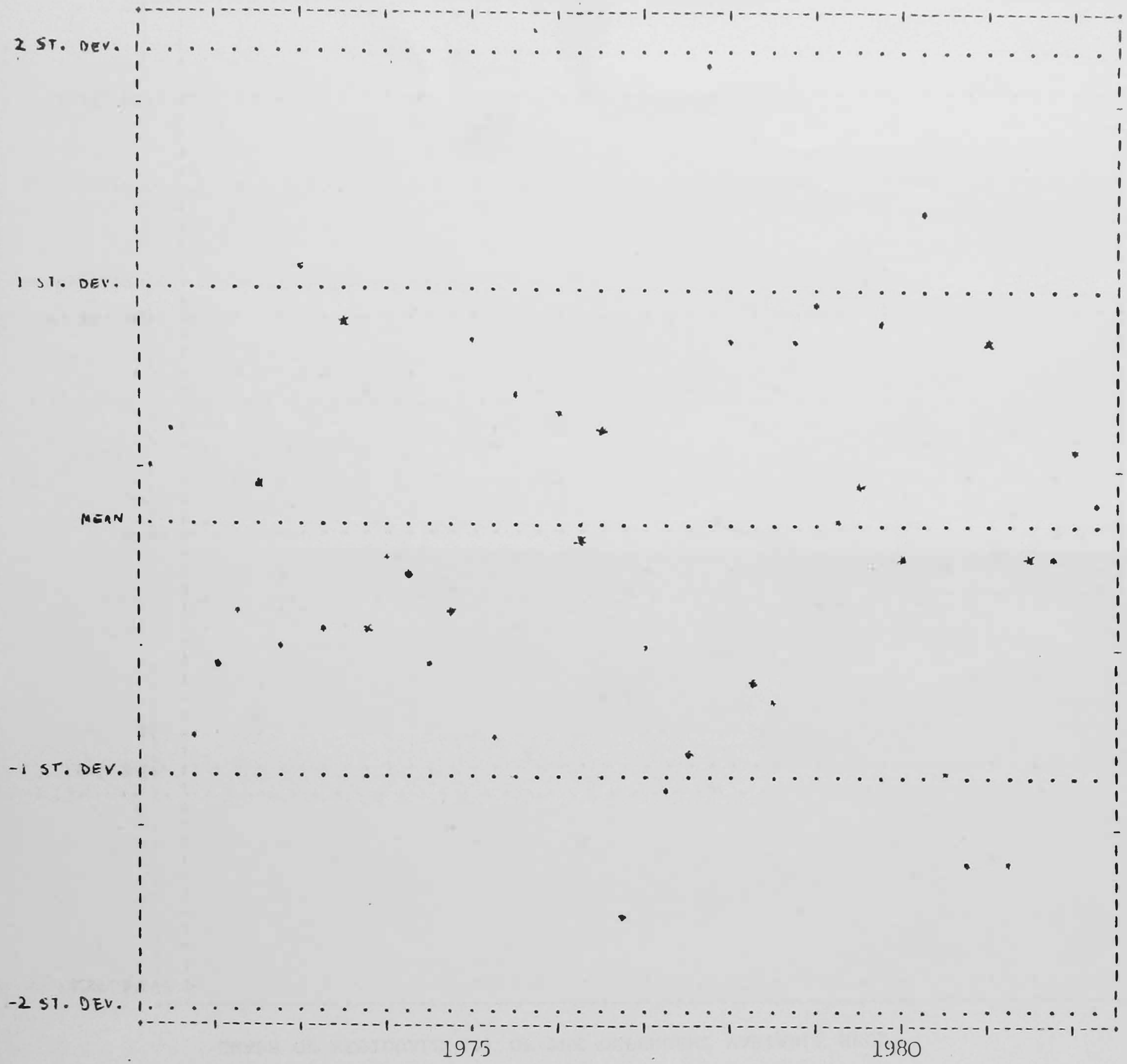


GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SFCD



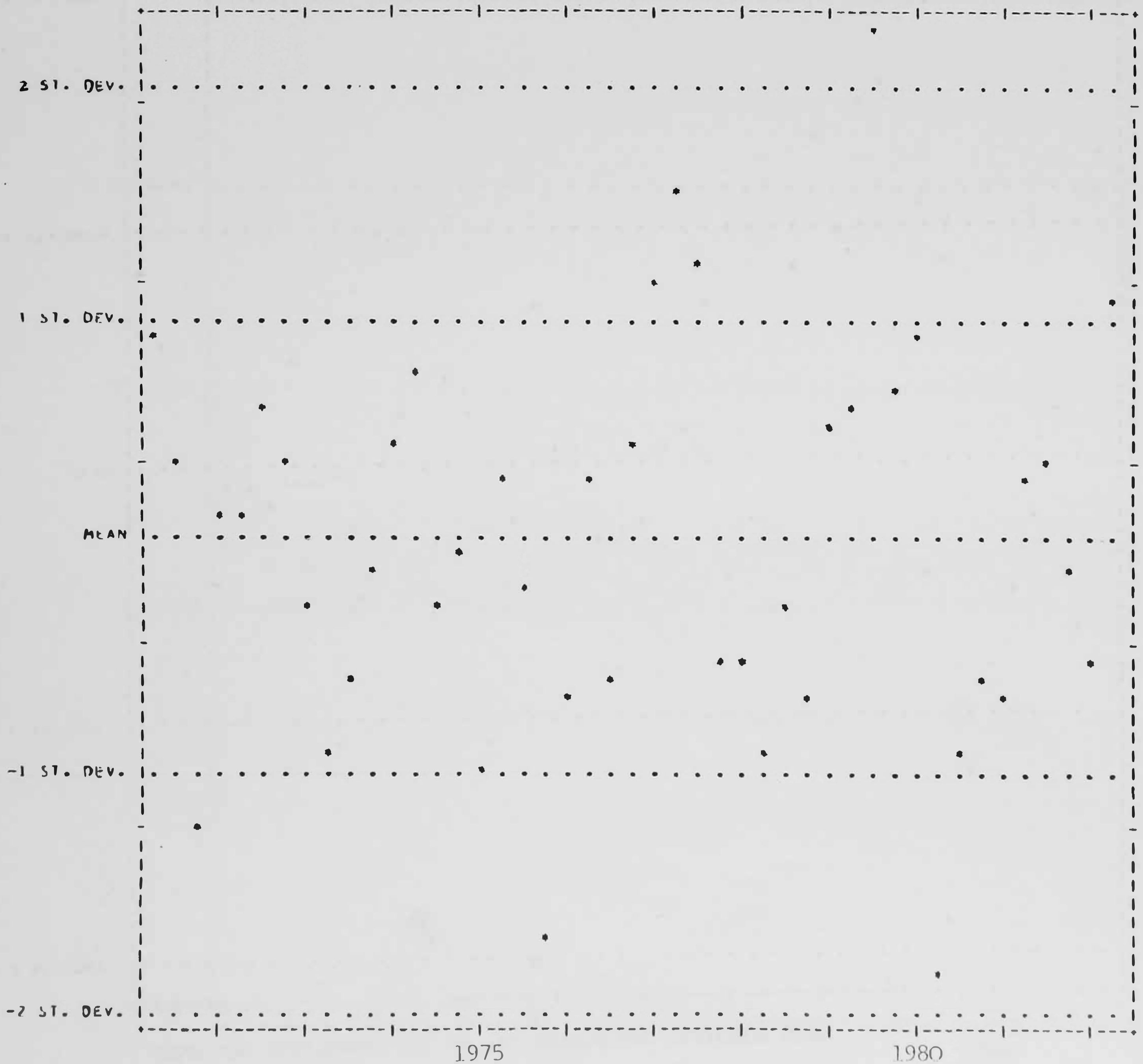
SM1 Chart 6

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SM1



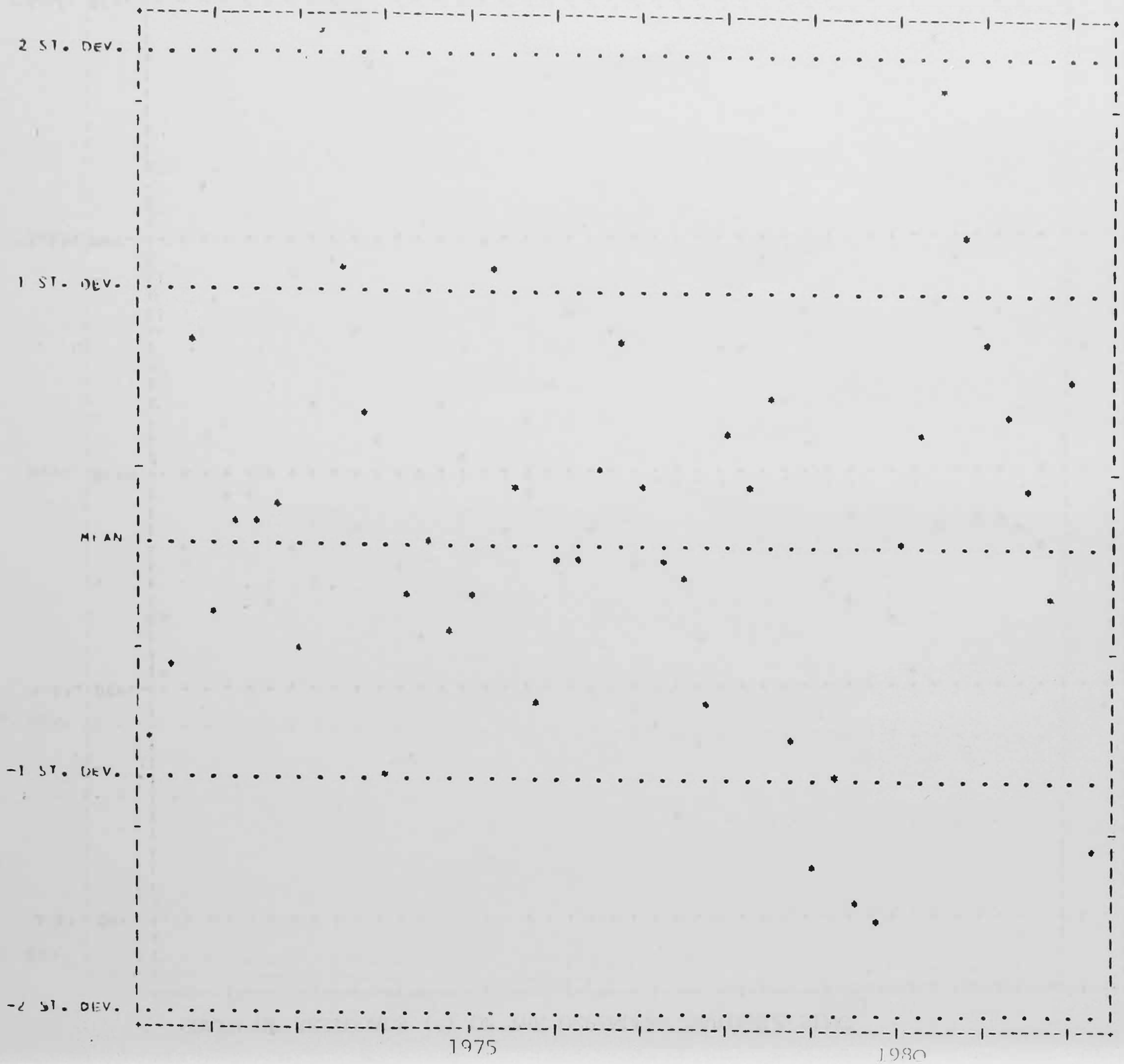
SLNG Chart 7

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SLNG



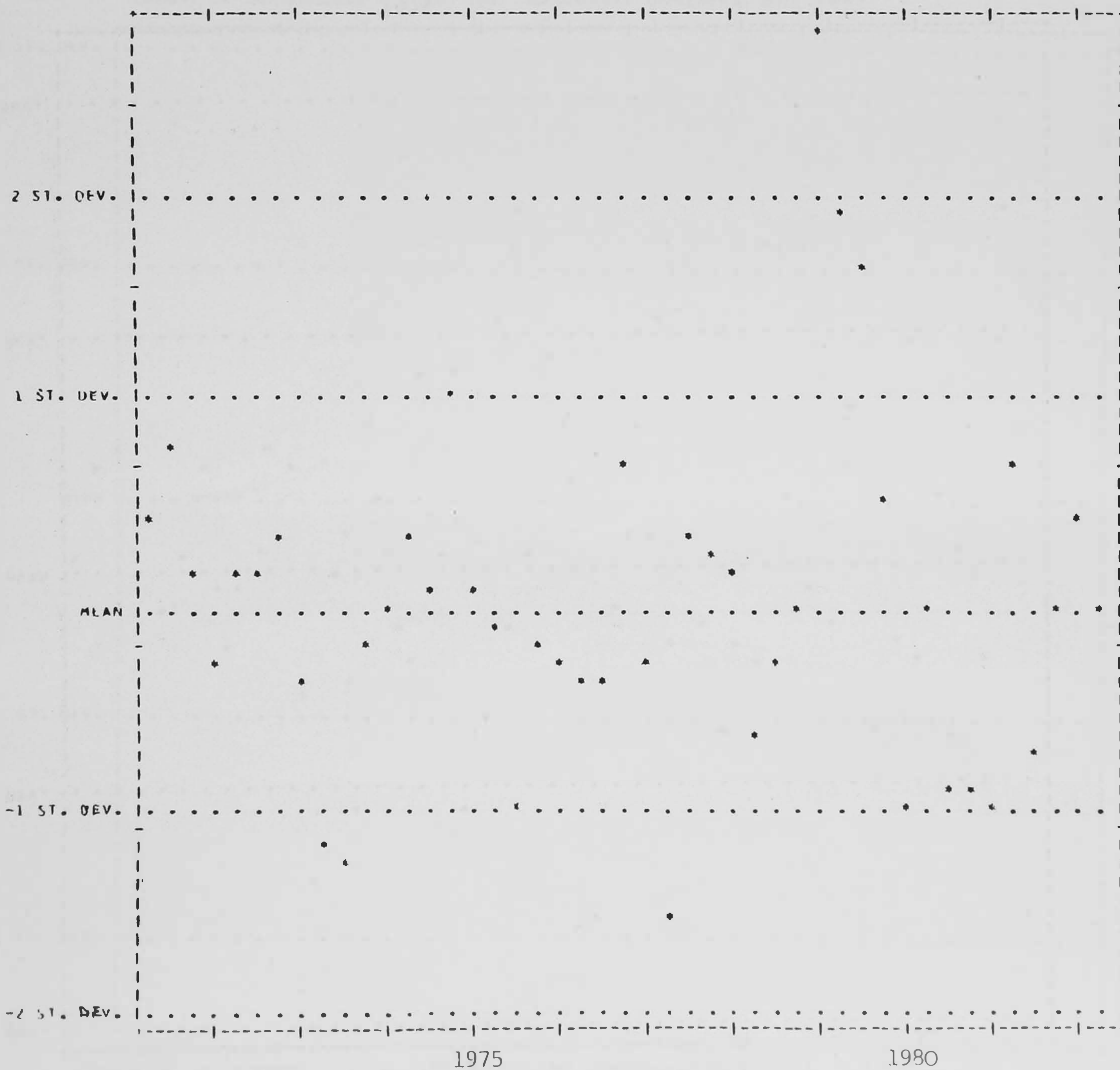
STIM Chart 8

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE STIM



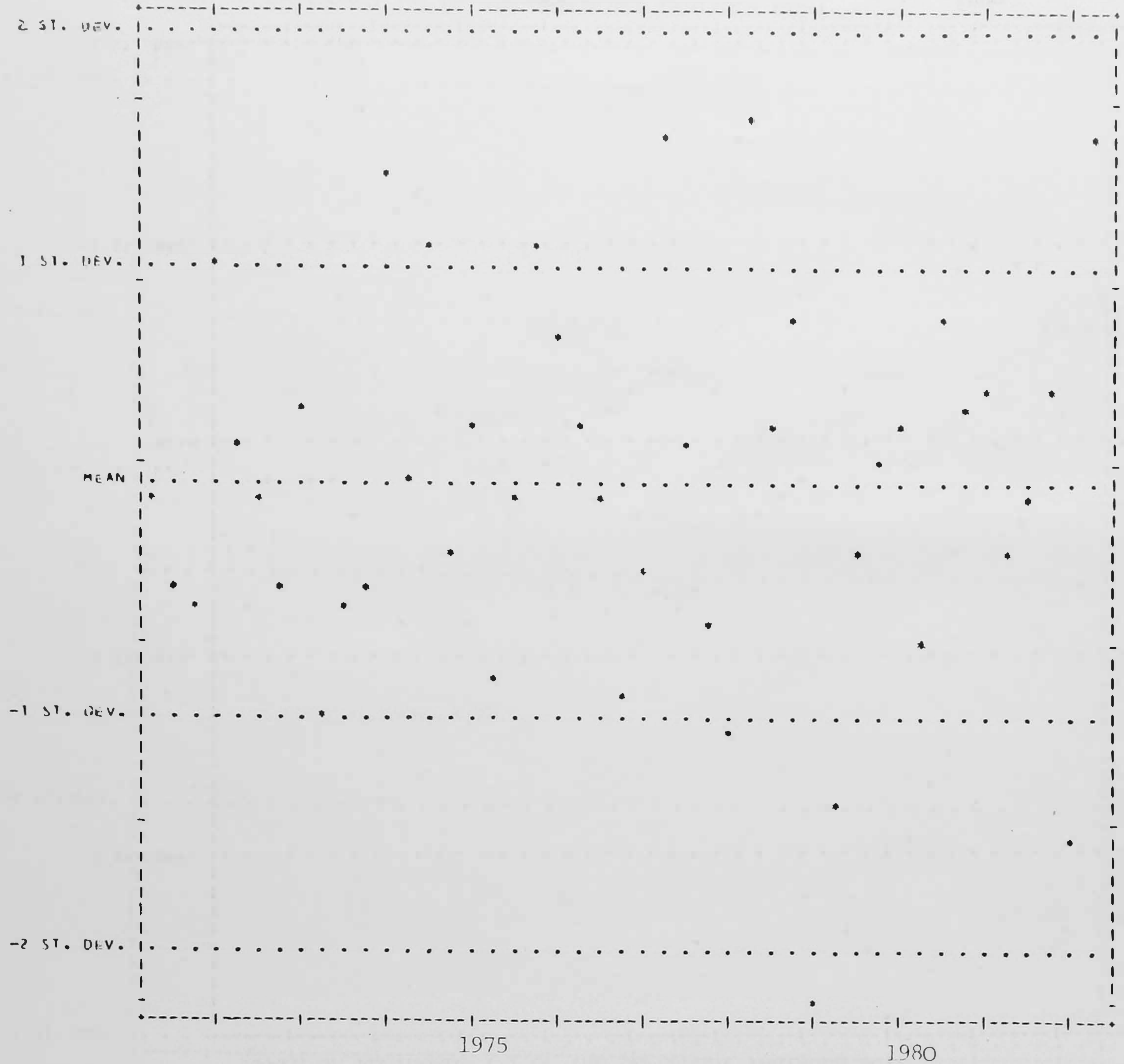
SCTD Chart 9

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SCTD



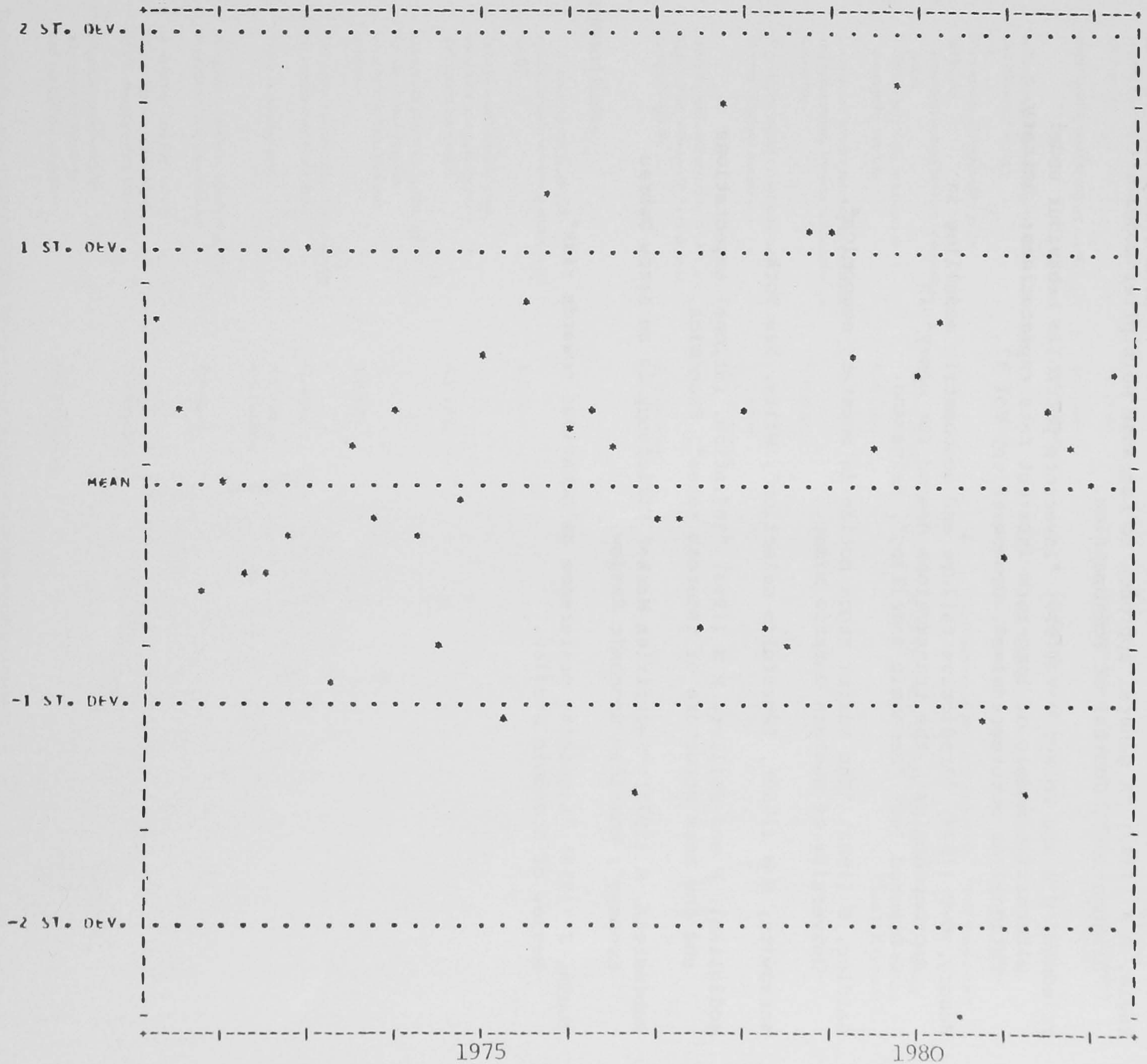
SFCD Chart 10

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SFCD



SM1 Chart 11

GRAPH OF RESIDUALS (*) OF THE DEPENDENT VARIABLE SM1



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