

COUNTERINTUITIVE ECONOMIC CONSEQUENCES OF
ACCOUNTING POLICIES: A DYNAMIC ANALYSIS

by

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ABSTRACT

This paper uses a system dynamics simulation methodology to assess the potential effects of new accounting policies being considered by rule formulating bodies.

The key objective of this paper is to demonstrate that current ex-ante intuitive assessment of the effect of proposed accounting rules is inadequate due to the counterintuitive nature of economic consequences in a complex social system. For this purpose a very simplified model of the US economy is developed and its parameters varied to reflect potential accounting policy changes. The effects of these policy changes are shown to be counterintuitive in nature, requiring consideration of second and third harmonics of the feedback loops for adequate ex-ante impact assessment.

This paper is divided into six parts: the first part describes alternate approaches to economic consequence assessment and the advantages and disadvantages of utilizing the system dynamics methodology; the second part describes the skeleton of the system dynamics model; the third part examines the measurement problems of rates, levels and delays as well as reviews the details of their computation for model formulation; the fourth part discusses the problems and results of model validation efforts; the fifth part describes some of the results obtained from application of the model, and their meaning in comparison with traditional methodologies for accounting impact analysis; the sixth part concludes by suggesting the next step for macro-accounting modeling: evaluating the potential and shortcomings of this methodology.

INTRODUCTION

Economic consequence research is of interest not only to standard setting bodies but also to vested interest groups. These must be able to understand the actual consequences of accounting rules in order to be able to direct their event influencing actions. Simplistic extrapolation models are inadequate for this purpose as economic consequences may be counterintuitive in nature. Watts and Zimmerman (1979, p.301) state that

"Not only is there no generally accepted accounting theory to justify accounting standards, there never will be one."

This argument is based on the assertion that standards are justified by the needs of vested interest groups, and that different groups prevail on different issues--which leads to the adoption of an inconsistent set of theoretical justifications across different topics. Buckley (1976) calls for an analysis of the impact on the economy before the FASB makes any new major decision. Rappaport (1976) also suggests that

". . . a responsible posture of accountability calls for the explicit consideration of the economic impact of financial accounting standards by all accounting policymaking bodies. In the particular case of the FASB, such analysis will hopefully enable it to remain a major force in shaping financial reporting practices."

Economic consequence methodologies were examined in a conference sponsored by the FASB in July, 1978. Of the six studies presented, four (Markin, Dhalival, Abdel-Khalik et al., and Harrison) used "efficient market" methodologies to evaluate the impact of particular accounting rules, while the remainder used macro measures (Winn) and expert opinion surveys (Benston and Krasney) for a type of ex-ante assessment.

Ex post facto analysis can only provide insight into the effect of past regulation. There is no guarantee that the same effects can be expected of proposed rules. The Committee on Social Consequences of Accounting Information (AAA, 1978) defined "a priori" problems as

"...those for which solution frameworks or heuristics already exist. The value of having an "a priori" policy is to be able to deal generically with problems which have common attributes..."(p.34).

Methodologies are needed to provide forms of "a priori" evaluation of proposed accounting rules other than individual opinion and visionary forecast.

The main objective of this research is therefore to provide a new approach which demonstrates that economic consequences of accounting policy rulings are counterintuitive. This will be attempted by the application of the system dynamics methodology to accounting policy input analysis.

APPROACHES TO ACCOUNTING POLICY IMPACT ANALYSIS

The AAA (1977) listed a series of methods for monitoring socio-economic phenomena. Two major categories emerge: (1) opinion gathering, and (2) systematic modeling. The first approach includes piecemeal examination methods, survey and interview methods and the delphi techniques. The second approach includes input-output analysis, archival market reaction analysis and system dynamics.

None of the opinion-gathering methods is able to examine the dynamic consequences of policy changes on the economy. They do not take account of the interaction effects of the different sectors in society. Most often they consider the potential impacts in isolation.

Among the systematic modeling approaches, input-output analysis does examine the interrelationships of different sectors. But it is a static model. Archival market reaction analysis is an ex post study of aggregate behavior. It does not identify the impact of particular user groups or sectors. System dynamics is a systematic approach to developing a model. Verbal description and observations of the system are interpreted in flow charts which portray levels and flows of elements: information, money, orders, materials, personnel, and capital equipment.

System dynamics offers a holistic approach to determining the dynamic consequences when the assumptions within the model interact with one another. Ansoff and Slevin (1968, p. 384) suggest a series of steps for constructing and running a simulation and point out a few distinctive features of the "industrial dynamics approach." First is its totally quantitative approach; second is its lack of allowance for subjectivity, and third is its approach to the issue of model validation. The issue of validation has been extensively discussed in the literature as a common weakness of computer simulation studies.

Day (1974) examines the system dynamics methodology and criticizes the complexity of system dynamics charts and assumptions, but concludes that:

"We have found the basic logic of system dynamics to be unassailable. People should be able to disagree over underlying empirical assumptions without impugning one another's integrity." (p. 270)

His study is of interest to this paper as he examined both Solow's (1965) growth model and Forrester's (1971) world model.

Prakash and Rappaport (1975) in a recent note in Business Week, show a series of potential feedback effects of accounting rules and argue that:

"We suggest that the FASB should enlarge the scope of its concern and that it create a full-fledged research division responsible for conducting inquiry into the potential macroeconomic consequences of accounting methods under consideration. This research staff would draw up a brief to accompany each exposure draft, summarizing the technical considerations and economic consequences involved in each alternative." (p. 12)

This suggestion for research bears qualification by Forrester's statement that:

"It is my basic theme that the human mind is not adapted to interpreting how social systems behave. Our social system belongs to the class called multiloop nonlinear feedback systems." (1971, p. 58)

The present paper develops a simplified macroeconomic model in order to identify some of these non-linear loops and examines the model for potentially counterintuitive impacts.

THE STRUCTURE OF THE MODEL

An Initial Model

Forrester states that:

"The first step in a system study is to identify clearly the problem to be explored and questions to be answered. The initial example

must be kept simple ... Later we can range more broadly ... " (1961, p. 21).

For this initial model a three sector economy was devised, without a foreign sector and disregarding subsectors. A balance sheet was designed for each of the three sectors, and each of the accounts of these simplified balance sheets was considered as a level. Forrester (1968, p. 4-11) explains the differentiation of levels and flows:

"In financial accounting, for example, a clear separation is made between the balance sheet and the profit-and-loss statement. The balance sheet variables are levels, giving the financial condition of the business system at one point in time. The balance-sheet levels show the effect of accumulating the rates flow over all past time. The profit-and-loss statement, by contrast, gives the rates of flow that have existed since the previous balance sheet. The profit-and-loss rates cause the changes from the previous balance sheet to the present."

Figure 1 displays the key levels considered in each of the main sectors. We shall discuss the model being considered along with the key feedback loops used for its development.

Figure 1
Three Sector Economy
Levels Being Considered

BUSINESS		HOUSEHOLD	
Cash	Liabilities	Cash	Debt
Inventory	Owners Equity	Assets	Indiv. Wealth
PP & E		Securities	
Papers			
Receiv.			
<u>GOVERNMENT</u>			
Cash		Debt	
Assets		Wealth	

Generation of Business Activity

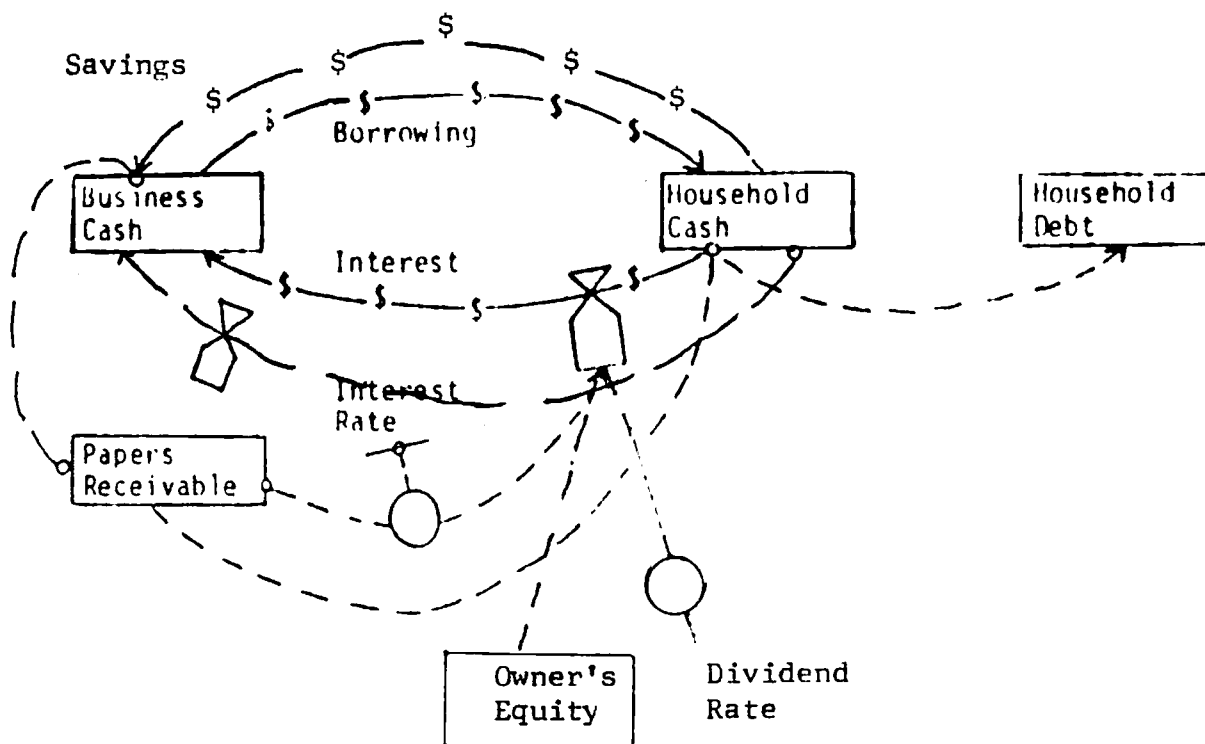
The model utilizes two superimposed functions to represent the basic economic cycle. One macro function takes an economic level variable as constant and mounts on

it a five-year cycle sinoid. The second function mounts the sinoid on an economic growth ramp. The basic economic cycle is used to drive macro variables such as sales from business to the government and household sectors.

Borrowing, Interest, Saving and Dividend Cycle

This cycle deals with the loan of funds from the business sector to the household sector and the payment of interest on the outstanding balance by the household sector. Cash flow information is accumulated in the household debt level and the business papers (notes) receivable level. Interest being paid is determined by the level of business papers receivable and the constant business interest rate. The other side of this cycle deals with the application of household funds to savings accounts, corporate bonds and savings certificates. Interest paid by business to the household for these funds is calculated in an aggregate manner. Figure 2 shows the key elements of this cycle.

Figure 2
Borrowing, Interest, Saving and Dividend Cycle

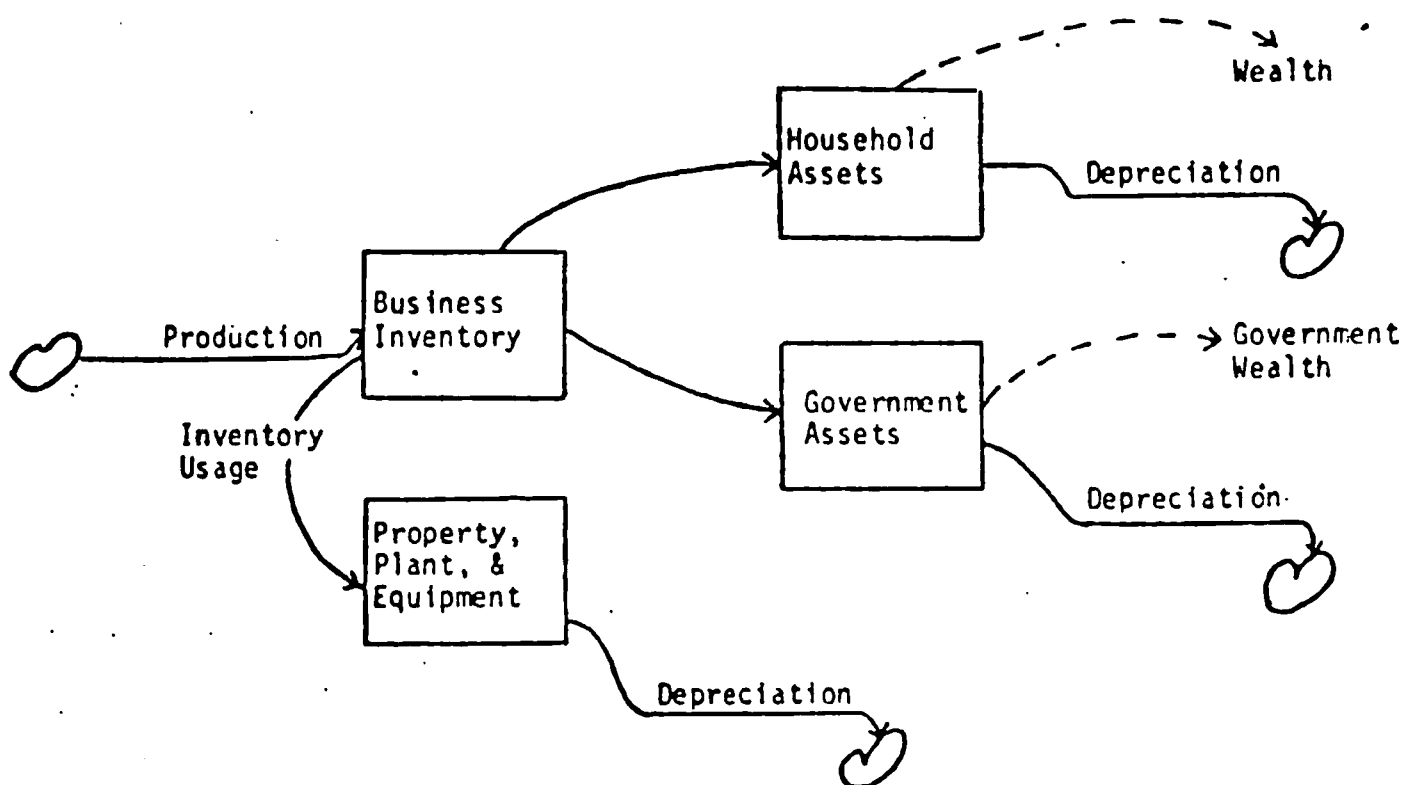


Another way in which funds flow between the business and household sectors is through equity ownership. Owner's equity reflects the accumulated business income net of depreciation and taxes. Dividends are paid as a function of the owner's equity.

Inventory Cycle

Inventories are recorded as a flow of materials. Inventory flows reflect the sales from business to business (in the form of property, plant and equipment production) and sales from business to government and household sectors. Inventory is used up at an average consumption rate based on sales and utilization. This consumption is also charged to the income of the corporation. Figure 3 shows the key inventory flows.

Figure 3
Inventory Cycle



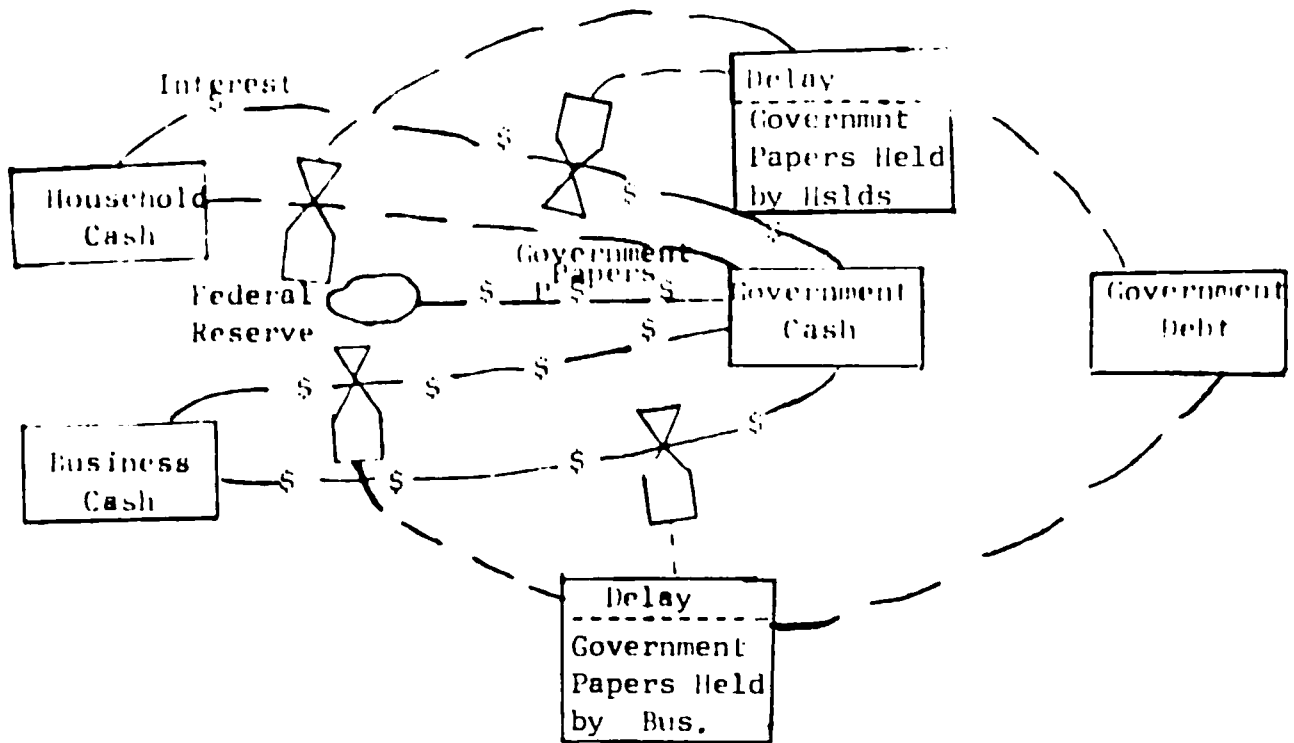
Government Papers Cycle

Government papers (including state and local bonds) are issued to balance the government's budget. The rate of government issuance of debt is a time series derived constant. The fraction of debt issued to the corporate and household sectors varies from period to period based on

historical trends.

The printing of cash is considered separately, and is shown as increased indebtedness of government to the federal reserve. Interest is paid on government papers at a rate 1% lower than the established prime lending rate. A one month delay is used for the increment of the outstanding government debt for the purpose of interest payment. Information flows also update the government debt level, household held securities level and papers receivable level by the business sector. Figure 4 reflects these flows.

Figure 4
The Government Paper Cycle



Taxation Cycle

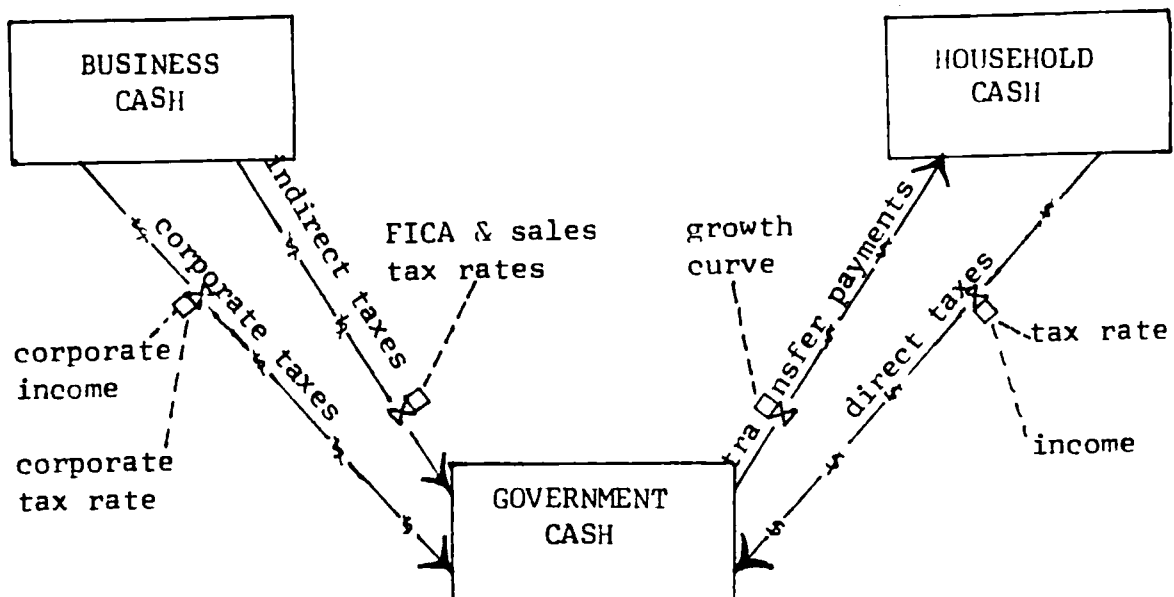
Three types of taxes are considered: (1) direct (individual) taxes, (2) indirect taxes (sales, FICA, etc.) and (3) corporate taxes. Direct taxes are paid by the household sector to government as the result of taxation on

salaries, dividends, proprietary income and interest. As these taxes are considered on an aggregate basis, a single tax rate is used for the aggregate income flows and their direct tax revenue effect.

The indirect taxes are sales taxes, gas taxes, property taxes, and other major indirect taxes paid to the government. This flow is directly connected to the income level of households in the same manner as the direct tax rate. In addition to the above taxes, FICA and other social security payments are also included in this category and determined by the same income figures, but at a different rate than the sales taxes. The corresponding outflow in this cycle is the rate of transfer payments from the government to the household sector.

Corporations are taxed on their current income flow levels at a constant tax rate. The level of corporate income is drawn from the same rate flow as the owner's equity accumulation discussed in the borrowing, interest, saving and dividend cycle. Figure 5 represents the key elements of the taxation cycle.

Figure 5
Taxation Cycle



Sales, Inventory and Salary Flows

Sales rates are based on a series of simulated macroeconomic cycle parameters. These parameters are proportionately divided between sales to the government and to the household sectors. Sales within the business sector

are ignored. Profits are generated as a fixed percentage of sales, with different rates for the government and the household sectors. Inventory rates are the complements of these profit-income rates. The combined image of all of these loops can be seen in figure 6.

MEASUREMENT PROBLEMS

Meaningful models are based on perceived logical relationships and carefully estimated parameters. These parameters, in a system dynamics model can be divided into three main classes: 1) initial values of levels, 2) rates of flow and their growth parameters and 3) curve forms and value of delays.

Level Values

A key measurement problem in this simulation was the establishment of initial values for levels. Once established, increments in these levels could be monitored through a comparison of historical with model developed values, variances could be computed and parameters adjusted to yield revised rate values.

This study encountered considerable difficulty in gathering values for levels. Most of the sources of macroeconomic data are gathered on a flow basis while levels at any point in time are difficult to ascertain.

Appendix 1 lists the developed model as implemented in the DYNAMO language and explains the defined variables through comments and notes. Initial values for levels are defined as N type equations.

Flow Rates

Flow rates were easier to gather from economic data. Flows on either a monthly or quarterly basis were available. Wherever possible, no parameters were assigned, but logical relationships were used. Constant rates for interest and inventory depletion were used to determine certain flows. On the other hand, a curve fitting approach was used where no logical relationship existed. A scattergram based on monthly data was developed, a time-series curve fitted, and parameters computed based on the regression line. Rates were scrutinized with considerably more care than levels, since the dynamic behavior of the system is more affected by flow rates and their changes than by initial levels.

The basic macroeconomic variable (GNP) had a base value (ramp function) with a five-year cycle sinoid mounted on it:

$$\text{GNP} = (a + (b * \text{TIME})) - (C * \sin(2 * \text{PI} * \text{TIME} / 120)) + (d * \text{NOISE})$$

where a, b, c and d are constants.

This variable served as input to two central economic rates: sales from business to the household and government sectors. These rates then moved the other basic time-dependent variables of the cycle. These variables were developed on a correlational basis to the sales rates or by logical linkages.

Rates were also dependent on indexes such as the interest rate (assumed initially to be fixed), the government bond interest rate, and the rate of inventory use (ratio of inventory produced to inventory used up in the business sector). These indexes, assumed fixed here, could become time-dependent or variable dependent in more sophisticated models.

Some of the more common rate equation formats are given below:

$$\text{INTGTB.KL} = \text{GPHEBU.K} \times \text{GPINRT}$$

where

INTGTB.KL	Interest paid by to business (on government notes) in period K to L
GPHEBU	Level of government papers held by business at time K
GPINRT	Government paper average interest rate (constant)

$$\text{PROD.KL} = \text{Delay 3 (INVS.JK, DIP)}$$

where

PROD.KL	Production of the corporate sector in the period K to L
DIP	Constant length of delay in production
Delay 3	Third order delay

$$\text{SALAGI.KL} = a + (b \times \text{Time}) + (c \times \text{Noise})$$

where

SALAGI.KL	salaries paid by the government during the period K to L
a,b,c	regression developed constants
NOISE	function providing random numbers between -1/2 and 1/2

Curve Forms and Delay Values

Most rates were defined as ramp functions with noise added. This implies a constant annual growth with small random fluctuations. Delays were only inserted as logically required. Macroeconomic leading and lagging indicators were used as an indication of potential delays.

Data Used

The model was developed with data from 1965 to 1974 drawn primarily from the Economic Report of the President (1979), Survey of Current Business (1965-1974), and Predicasts' Basebook. Considerable inconsistencies exist between sources of macro data and these were resolved within the simplified context of a three sector economy.

VALIDATION

One of the key problems of a system dynamics model is its validation. Ansoff and Slevin (1968) state that "Industrial dynamics shares with other simulation approaches some difficult problems of model validation." This study, as well as the others discussed above relies on predictive validity measures as well as logical process evaluation.

Model Logic

The internal logic of the model (internal validity) was designed with care and was intended to be realistic, but the impact of the simplifications introduced cannot easily be evaluated. The development of a detailed macro model of the economy is beyond the scope and intent of this paper. The external validity of the model should be evaluated based on model behavior characteristics.

Chart 1 displays a 120 period run of the basic model without the ramp function. The movements of the driving macroeconomic variable, GNP, can be compared with those of levels and flows in the various sectors. In an upsurge of the economy there is a slow increase in government spending, which flattens (but does not decrease) in a recession period. Transfer payments increase at a moderate rate, corporate incomes decrease, while sales follow the economy in depression periods. When the ramp function is added, the same effects continue to be observed, giving further evidence of the model's external validity.

Predictive Validity

Changes in levels due to computed flow rates were examined in light of the historical flows. Some additional adjustments were made to improve the model's external validity, but no claim can be made that the model was fully validated. Figure 7 displays a comparison of figures of related variables produced by the model for 1975 to 1976 with the actual figures for the period.

Figure 7
Predictive Validity

	YEAR	MODEL PREDICTION	ACTUAL DATA
Savings by Household (monthly flow)	1976	9.65	7.0
	77	10.20	7.4
Interest Household to Bus. (monthly flow)	76	1.88	2.0
	77	2.01	2.11
Business Sales to Households	75	74.27	81.1
	76	76.47	89.88
Corporate Salaries	75	66.72	62.75
	76	72.12	68.75
Currency Expansion (cumulative level)	75	84.943	87.2
	76	94.713	91.3
Corporate Dividend	75	3.03	2.8
	76	3.13	3.0
Borrowing (ave. monthly flow)	76	1.70	1.96
	77	1.75	1.96
Business Sales to Government	76	12.40	14.32
	77	12.98	16.09
Taxation Corporate	75	4.92	4.1
	76	5.08	5.2
Indirect Taxes	76	18.25	14.17
	77	19.00	15.63

A paired t-test comparing model predicted values with actuals failed to accept the hypothesis that these two

groups had significantly different means at a significance level of 5%.

The next section discusses some of the findings of the initial model runs. These are to be read as tentative in nature. This paper emphasizes model development and considers the theoretical framework for impact analysis. Future research will be directed to actual evaluation of the impact of accounting alternatives.

RESULTS AND EXPERIMENTAL METHOD

The basic time interval for integration increments was 0.2 months with one month established as the basic time period for reporting. Simulation runs lasted between 120 and 240 months. Plots and tables were obtained for the basic cash, inventory and liabilities of the three sectors.

This section of the paper will present four potential applications of the system dynamics method to economic consequence assessment. These are not to be considered as conclusive but as an illustration of model utilization. If this purpose is accomplished it will then be up to the standard setting bodies to contract for specific research dealing with potential rulings being considered.

Preliminary Analysis

The most interesting preliminary analyses are based on the insertion of pulses into the system. These show the system reaction to surges in specific elements. With the insertion of such pulses, different harmonic effects can be perceived. Such an effect could be observed on transfer payments and household cash. The latter presented a second harmonic about one period behind the former, before seasonality was introduced.

Another interesting and predictable effect is the increase in government indebtedness due to the fact that government expenditures take time to be compressed when revenues go down. On the other hand, these predictable effects do not seem to immediately explain total changes in cash levels. This leads to the previously mentioned perception of counterintuitive behavior. Further analysis tentatively attributed these effects to delayed feedback from government salary decreases, and a consequent decrease in purchasing power by the household sector, which in turn further affected the business income figure.

Effect of Depreciation Method

A pulse was introduced in the depreciation of business assets to represent the effect of passage of the legislation currently before Congress that would allow considerably accelerated depreciation. Secondary and tertiary effects were noted but the change in depreciation pattern did not affect long term system stability. Ripples were observed in corporate income, government spending, government indebtedness, and corporate taxation. These indicate counterintuitive effects from changes in depreciation rules. Charts 2 thru 7 represent runs with depreciation pulses.

Restructuring of Debt

In order to represent the effect of the proposed restructuring of debt regulation, a sudden change in the level of corporate indebtedness was inserted to represent the decrease in recognized (receivable) loans by banks. Direct effects of this change were observed in the flow of interest from the household sector as well as in corporate revenues. Secondary effects entailed changes in the flows of corporate taxation, government revenues and issuance of government debt. In addition tertiary effects were observed upon the household sector. The restructuring of debt, simulated by a sudden decrease of corporate debt, does not significantly affect system stability. A more complex model which separated the financial from the non-financial subsectors of the corporate area would have been more appropriate for this type of analysis.

Capitalization of Interest Cost

SFAS No. 34 required the capitalization of interest costs by business under specific circumstances. This procedure will postpone the taxation stream by distributing costs (through depreciation) over the lifetime of the asset in question. In estimating the magnitude of these effects they were considered to amount to less than 1% of corporate income and thus produced insignificant effects in the model. This illustrated a situation in which parameter estimation provided valuable insight into the importance of a ruling. It also was a case where a much more refined and detailed model would be necessary for economic consequence analysis.

Inflation Accounting

SFAS No. 33 required a series of changes in financial reporting to reflect inflationary conditions. The specific impact of this ruling would be contingent upon measurement

methods adopted and their consequences.

The GNP equation, initially composed of a ramp function and a sinoid, was changed into a simple sinoid in order to evaluate a no growth (or inflationary expansion economy). A more detailed analysis would have separated real growth from inflationary growth figures not only in the GNP equation (shown in Appendix 1) but also in the many flow equations.

Examining chart 9, which resulted from the elimination of the GNP ramp, it can be concluded that key sales and salary variables slowly and not proportionately respond to adjustment for inflation. Income reporting and its consequent taxation effects would be the main driving forces reflecting the effects of SFAS no. 33.

CONCLUSIONS

This paper displayed the key features of a simplified macroeconomic model oriented toward the examination of the impact of accounting rules. System dynamics, a continuous simulation methodology, was used for system modeling.

The processes and level changes observed in the model support Forrester's contention that the behavior of complex systems is counterintuitive. Such a finding will be of major concern to the accounting regulatory bodies. Most present accounting procedural changes or rule statements are based on accounting theory and the expected effects of these changes. These expectations are usually based on the intuition of accounting experts who are by no means economic experts. Such intuitive judgments are probably not very accurate. As a result, the regulatory bodies, especially the FASB, cannot accurately evaluate the effect or impact of their rulings by intuitive thinking and extrapolation.

The model presented in this paper permits a tentative evaluation of the impact of accounting rulings at different points. In its present structure, very few judgmental and no behavioral links were included. Many of these should later be incorporated to the model for a more accurate representation of reality. For example, a linkage between stock market valuation of a stock and its earnings should be included. Other behavioral links would include the effect of economic climate on stock and commodity valuation, the effect of elections and other major political events, or the effect of the monetary variables on investment resource allocation decisions between the stock market, land and other alternatives.

Immediate expansions of this model would hinge on the impact analysis objectives. The evaluation of the impact of FASB Statement No. 8 on the translation of foreign assets would require the inclusion of a foreign sector. Studies from past history on the fluctuation of earnings due to relative changes in foreign currency could provide data on elementary rate fluctuations in the business income stream. This situation could be carefully monitored at the different levels of the three sectors and the results compared with runs that allowed for "reserves" in foreign countries for currency fluctuations. This comparison might also provide a benefit for other proposed solution examinations and for the final ruling decision to be made on the tradeoffs between adequate "theoretically based reporting" and the dysfunctional effects of foreign currency fluctuations.

One potential enrichment to the present model would encompass the development of simulation parameters based not on historical values as here described, but on inflation adjusted values and the observation of processes within the economy related to the different types of reporting. The comparison of the predictive validity of these two approaches on certain key elements of the economy would lead to interesting conclusions on the simulation process and methodology. Other potential enrichments would provide further detail in the model to represent flows within sectors, a more detailed sector balance sheet, the inclusion of a foreign sector, a breakdown of the corporate sector into financial and nonfinancial areas, etc.

This paper attempted to evaluate the use of the system dynamics methodology for economic impact assessment. Four different rulings were superficially assessed using the three sector model and there was some evidence that such an analysis would provide additional insights into economic consequences. It was also concluded that changes in the model structure are necessary to represent different rules and that once these structural changes are made new external model validation becomes necessary. Once effects are detected by the use of this methodology it becomes reasonably easy to logically explain their causes. A focusing of attention on the feedback effects of accounting rulings may be the major potential benefit of a system dynamics methodology.

Concluding, this paper presented a simplified macroeconomic model for the examination of accounting policy impact analysis. It argued the need for extensive examination of the impact of accounting rulings on a non-intuitive basis, attempted to demonstrate that this impact is counterintuitive, and finally proposed a series of studies to examine the impact of actual FASB rulings and procedures.

REFERENCES

American Accounting Association, Report of the Committee to Monitor Socio-Economic Phenomena, Sarasota, Florida, 1977.

American Accounting Association, Report of the Committee on the Social Consequences of Accounting Information, Sarasota, Florida, 1978.

Abraham, S. C. The Public Accounting Profession: An Application of Futures Research Methods to Identifying and Clarifying Problems, unpublished Ph.D. Dissertation, UCLA, 1976.

Ansoff, H. I. and D. P. Slevin, "An Appreciation of Industrial Dynamics," Management Science, March, 1968, pp. 383-397.

Buckley, J. W., "The FASB and Impact Analysis," Management Accounting, April, 1976, pp.13-17.

Conley, B. C. "Inflation and Interest 'Expense' of the Federal Government," paper presented at the Eastern Economic Association Meeting, April 15, 1977.

Day, R. H., "On System Dynamics," Behavioral Science, 1974, pp. 260-271.

Financial Accounting Standards Board, Statement No. 2, Accounting for Research and Development Costs, October, 1974.

Financial Accounting Standards Board, Statement No. 8, Accounting for the Translation of Foreign Currency Transactions and Foreign Currency Financial Statements, October, 1975.

Financial Accounting Standards Board, Statement No. 14, Financial Reporting for Segments of a Business Enterprise, December, 1976.

Financial Accounting Standards Board, Conceptual Framework for Accounting and Reporting: Elements of Financial Statements and Their Measurement, Discussion Memorandum, December, 1976.

Financial Accounting Standards Board, Economic Consequences of Financial Accounting Standards, July, 1978.

Forrester, J.W., Industrial Dynamics, Cambridge, Mass.: The M.I.T. Press, 1961.

Forrester, J.W., "Industrial Dynamics--After the First Decade," Management Science, March, 1968, pp. 398-413.

Forrester, J.W., Principles of Systems, Cambridge, Mass.: Wright-Allen Press Inc., 1968.

Forrester, J.W., World Dynamics, Cambridge, Mass.: The M.I.T. Press, 1971.

Forrester, J.W., "Counterintuitive Behavior of Social Systems," Technology Review, January, 1971, pp.53-68.

Forrester, J.W., Collected Papers of Jay W. Forrester, Cambridge, Mass: Wright-Allen Press Inc., 1971.

Ibbotson, R.G. and Sinquefeld, R.A., "Stocks, Bonds, Bills, and Inflation: Simulations of the Future (1976-2000)," Journal of Business, July, 1976, pp. 313-338.

Mautz, R.K. "Problems in the Development of Accounting Standards," unpublished mimeograph dated April 26, 1975.

Prakash, P. and Rappaport, A. "Informational Interdependencies: System Structure Induced by Accounting Information," The Accounting Review, October 1975, pp. 723-734.

Prakash, P. and Rappaport, A., "Information Inductance and its Significance for Accounting," Accounting, Organizations and Society, 1977, pp. 29-38.

Prakash, P. and Rappaport, A. "The Feedback Effects of Accounting," Ideas and Trends, Business Week, January 12, 1976.

Rappaport, A., "The Economic Impact of Financial Accounting Standards - Implications for the FASB," paper presented at the Second Annual Accounting Research Convocation, University of Alabama, November, 1976.

Roberts, E.B., Abrams, D.I., and Weil, H.B., "A Systems Study of Policy Formulation in a Vertically-Integrated Firm," Management Science, August, 1968, pp. 674,694.

Schutz, R.L., "System Simulation: The Use of Simulation for Decision Making," Behavioral Science, 1974, pp. 344-350.

Solow, R., "A Contribution to the Theory of Economic Growth," Quarterly Journal of Economics, 1956, pp. 65-94.

Watts, R.L. and Zimmerman, R., "The Demand for and Supply of Accounting Theories: The Market for Excuses," The Accounting Review, April 1979, pp. 273-305.

APPENDIX 1

PAGE 1	THREE SECTOR ECONOMY SIMULATION - INFLATION	90.
	THREE SECTOR ECONOMY SIMULATION - INFLATION	100.
	MACROGENERATION	110.
1100	GNP.KL=031-(140*SIN(6.2832*TIME.K/120))*(ACISE(1)*5	120.
	BORROW INTEREST CYCLE	130.
	CASHDU.K=CASHBU.J*DT*(SAV.JK+INT.JK+SALEBH.JK+SALACO.JK-INTBTH.JK	140.
	-GPTA.JK+INTGTB.JK-DIV.JK-BORR.JK+SALEBG.JK-TAXCO.JK-(TAXIND.JK/31)	150.
	CASHBU=70 CASH IN BUSINESS (BILL \$)	160.
	SALACO.KL=26*(10.306*TIME.K)*NDISE(1)*5	170.
	INT.KL=INTRT*PPREL.K*INTREST RATE MULT PAPERS RECEIVABLE	180.
	BORR.KL=1.0*(10.0049*TIME.K)*01*(NDISE(1)) BORROWING BY INDIVS.	190.
	INTRT=.00604 MARKET INTEREST RATE (PRIME RATE)	200.
	PAPERS RECEIVABLE BY BUSINESS	210.
	PPRE=236 PAPERS RECEIVABLE BY BUSINESS ***	220.
	PPRE.K=PPRE.J*DT*(DORR.JK+GPIB.JK)	230.
	DIV.KL=INCOCO.JK*DIVDRT [VIDENDS+ BUS TO INDS (\$/MTH)	240.
	SAV.KL=DELAY(AUX1,DT5)	250.
	AUX1.K=11-COMRT-.02)*PDI.K	260.
	DIVDRT=-.26 DIVIDEND RATE	270.
	PPREI ACCUMULATION OF BUSINESS PAPER	280.
	PPREL.K=PPREL.J*DT*(BORR.JK BUSINESS PAPER LEVEL	290.
	PPREL=160	300.
	OWNER'S EQUITY VALUATION	310.
	OEKO.K=OEKO.J*DT*(INCOCO.JK-DIV.JK-TAXCO.JK)	320.
	OEKO=1200 OWNER'S EQUITY IN BUSINESS ***	330.
	SALEBH.KL=-53.70*(0.10E*GNP.JK	340.
	PROPIC.KL=.15*SALEBH.JK PROP S INCOME AND OTHER LABOR	350.
	COMRT=0.09 CONSUMPTION FACTOR	360.
	PDI.K=SALAGI.JK+SAACO.JK+TRAPAY.JK*DIV.JK+INTBTH.JK	370.
	TAXDTR.JK=INT.JK-PROPIC.JK PERSONAL DISPOSABLE INCOME	380.
	HOUSEHOLD SECTOR	390.
	CASHHO.K=CASHHO.J*DT*(SALACO.JK+DIV.JK+DORR.JK-SALEBH.JK-SAV.JK	400.
	+INTGTH.JK-GPTH.JK-INT.JK-TAXDIR.JK+SALAGI.JK+TRAPAY.JK+INTBTH.JK	410.
	+PROPIC.JK-(TAXIND.JK*0.666)) CASHHO=42.67 CASH HOUSEHOLD SECTOR	420.
	INVENTORY UTILIZATION CYCLE	430.
	INVBV.K=INVBV.J*DT*(PROD.JK-INVBTH.JK-INVBTG.JK	440.
	-INVUSE.JK) INVBV=130 INVENTORIES BY BUSINESS	450.
	PROD.KL=DELAY(11*VUS.JK,DIP) INDUSTRIAL PRODUCTION	460.
	INVS.KL=(INVBTH.JK+INVBTG.JK+INVUSE.JK)*INVGRT MATERIALS FLOWS	470.
	DIP=1 DELAY IN PRODUCTION (MTH)	480.
		490.
		500.
		510.
		520.
		530.
		540.
		550.
		560.
		570.
		580.
		590.
		600.
		610.
		620.
		630.
		640.
		650.
		660.

PAGE 2

THREE: SECTOR ECONOMY SIMULATION - INFLATION

1100	C	INVGRY=1.002 INVENTORY GROWTH FACTOR	670.
1100	R	INVTM-KL=(1-PRMG)*SALEBH-JK	680.
1100	C	PRMG=2.50 CORP TO HOUSEHOLD PROFIT MARGIN	690.
1100	R	INVTG-KL=(1-PRMG)*SALEBG-JK	700.
1100	C	SALEBG-KL=GNP*GOVRT*(10.03)*TIME.K)+(NOISE(1)	710.
1100	C	GOVRT=-.00687 GOVT. FACTOR, ECONOMY BASED	720.
1100	C	PRMG=-.220 CORP TO GOVT PROFIT MARGIN	730.
	NOTE		740.
	NOTE		750.
	NOTE		760.
1100	L	HOASST-K=HOASST-J*DI*(INVDTM-JK-DEPHO-JK)	770.
1100	N	HOASST-J=877 HOUSEHOLD ASSETS	780.
1100	H	DEPHO-KL=DEPHRT*HOASST-K DEP HOUSEH ASSTS	790.
1100	C	DEPHRT=-.0081 HOUSEH ASSTS DEPR RATE	800.
	NOTE		810.
	NOTE		820.
	NOTE		830.
1100	L	GOASST-K=GOASST-J*DI*(INVTG-JK-DEPGO-JK)	840.
1100	R	DEPGO-KL=DEPGRT*GOASST-K DEP GOV ASSTS	850.
1100	N	GOASST=449 GOVERNMENT ASSETS (BI OF \$)	860.
1100	C	DEPGRT=-.0081 GOVT ASSTS DEPR RATE	870.
	NOTE		880.
	NOTE		890.
	NOTE		900.
1100	L	PPRBU-K=PPEBU-J*DI*(INVUSE-JK-DEPRU-JK)	910.
1100	N	PPEBU=813 PROPERTY PLANT EQUIP BUS	920.
1100	R	INVUSE-KL=CAPRT*(SALEBG-JK+SALEDH-JK) INVENTORY USE	930.
1100	C	CAPRT=.15 CAPITALIZATION RATE	940.
110	C	DEPRU-KL=(OPBURT*PPEBU-K)+PULSE((10.60.1201)	950.
1100	C	DPBURT=-.0083 BUS DEPR RATE	960.
	NOTE		970.
	NOTE		980.
	NOTE		990.
1100	L	CASHGO-K=CASHGO-J*DI*(TAXCO-JK+TAXIND-JK+TAXDIR-JK-TRAPAY-JK	1000.
1100	X	-SALAGI-JK-SALEBG-JK+INDETR-JK-INTGIB-JK-INTGTH-JK+FCU-JK) CASH GOV	1010.
1100	N	CASHGO=50.33 CASH GOVERNMENT (BI \$)	1020.
1100	R	TAXCO-KL=TAXCRT*INCCO-JK CORPORATE TAXES PAID	1030.
1100	R	INCCO-KL=(SALEDH-JK+PRMG)+(SALEBG-JK+PRMG)-DEPRU-JK	1040.
1100	X	TAXCRT=-.422 CORPORATE TAX RATE	1050.
1100	C	TAXDIR-KL=HOIXRT*(DIV-JK+SALACO-JK+SALAGI-JK)	1060.
1100	R	SALAGI-KL=5.7*(0.07*TIME.K)+NOISC(1)	1070.
1100	R	FCU-KL=0.345	1080.
1100	L	FEDHLD-K=FEDHLD-J*(DT)*FCU-JK NATIONAL DEBT/FED HOLDINGS	1090.
1100	N	FEDHLD=39.1	1100.
1100	C	HOIXRT=.18 HOUSEHOLD TAX RATE	1110.
1100	R	TRAPAY-KL=(13.14*(0.082*TIME.K))+(NOISE(1)/2)	1120.
1100	R	TAXIND-KL=(13.14*(0.082*TIME.K))+(NOISE(1)/2)	1130.
1100	X	*SALAGI-JK) INDIRECT HOUSEHOLD TAXES	1140.
1100	X	SLTXRT=.016 SALES TAX RATE	1150.
1100	C	FICART=.016 FICA, ETC TAX RATE	1160.
	NOTE		1170.
	NOTE		1180.
	NOTE		1190.
1100	L	DEBTHO-K=DEBTHO-J*DI*(BORR-JK DEBT BY HOUSEHDS	1200.
1100	N	DEBTHO=870	1210.
1100	S	WEALTH-K=CASHHO-K+HOASST-K+SECUR-K-DEBTHO-K	1220.
			1230.
			1240.

1100	NOTE	SECURITIES	1250.
1100	NOTE	SECUR.K=DEBTBU.K+DECO.K	1260.
1100	NOTE	CALCULATION OF THE DEBT LEVEL	1270.
1100	NOTE	DEBTBU.K=DEBTBU.J+DT*SAV.JK	1280.
1100	NOTE	DEBTBU.K=DEBTBU.K+DEBTBU.K	1290.
1100	NOTE	BHRT.K=.00454*(1-.00002*TIME.K)	1300.
1100	NOTE	GOVERNMENT INDEBTNESS CYCLE	1310.
1100	NOTE	DEBTGO.K=DEBTGO.J+DT*INDEBT.JK	1320.
1100	NOTE	INDEBT.KL=1.14**3*NOISE1	1330.
1100	NOTE	DEBTGO=164.77	1340.
1100	NOTE	GPINRT.K=INIRI-0.00083	1350.
1100	NOTE	BUSINESS HELD GOVERNMENT NOTES	1360.
1100	NOTE	GPHEBU.K=GPHEBU.J+DT*GPTR.JK	1370.
1100	NOTE	GPTR.KL=DELAY1(BGPTR.K)	1380.
1100	NOTE	BGPTR.K=BGPHRT.J-.0008*(DT)	1390.
1100	NOTE	BGPTR=.107	1400.
1100	NOTE	DIGP=1 DELAY IN GOVERNMENT PAPER	1410.
1100	NOTE	HOUSEHOLD HELD GOVT. NOTES	1420.
1100	NOTE	GPHEHD.K=GPHEHD.J+DT*GPTH.JK	1430.
1100	NOTE	GPTH.KL=DELAY1(GPHEHD.K)	1440.
1100	NOTE	GPHEHD=71.9	1450.
1100	NOTE	GPHEHD=71.9	1460.
1100	NOTE	GPHEHD=71.9	1470.
1100	NOTE	GPHEHD=71.9	1480.
1100	NOTE	GPHEHD=71.9	1490.
1100	NOTE	GPHEHD=71.9	1500.
1100	NOTE	GPHEHD=71.9	1510.
1100	NOTE	GPHEHD=71.9	1520.
1100	NOTE	GPHEHD=71.9	1530.
1100	NOTE	GPHEHD=71.9	1540.
1100	NOTE	GPHEHD=71.9	1550.
1100	NOTE	GPHEHD=71.9	1560.
1100	NOTE	GPHEHD=71.9	1570.
1100	NOTE	GPHEHD=71.9	1580.
1100	NOTE	GPHEHD=71.9	1590.
1100	NOTE	GPHEHD=71.9	1600.
1100	NOTE	GPHEHD=71.9	1610.
1100	NOTE	GPHEHD=71.9	1620.
1100	NOTE	GPHEHD=71.9	1630.
1100	NOTE	GPHEHD=71.9	1640.
1100	NOTE	GPHEHD=71.9	1650.
1100	NOTE	GPHEHD=71.9	1660.
1100	NOTE	GPHEHD=71.9	1670.
1100	NOTE	GPHEHD=71.9	1680.
1100	NOTE	GPHEHD=71.9	1690.
1100	NOTE	GPHEHD=71.9	1700.
1100	NOTE	GPHEHD=71.9	1710.
1100	NOTE	GPHEHD=71.9	1720.
1100	NOTE	GPHEHD=71.9	1730.
1100	NOTE	GPHEHD=71.9	1740.
1100	NOTE	GPHEHD=71.9	1750.
1100	NOTE	GPHEHD=71.9	1760.
1100	NOTE	GPHEHD=71.9	1770.
1100	NOTE	GPHEHD=71.9	1780.
1100	NOTE	GPHEHD=71.9	1790.
1100	NOTE	GPHEHD=71.9	1800.
1100	NOTE	GPHEHD=71.9	1810.
1100	NOTE	GPHEHD=71.9	1820.
1100	NOTE	GPHEHD=71.9	1830.
1100	NOTE	GPHEHD=71.9	1840.
1100	NOTE	GPHEHD=71.9	1850.
1100	NOTE	GPHEHD=71.9	1860.
1100	NOTE	GPHEHD=71.9	1870.
1100	NOTE	GPHEHD=71.9	1880.
1100	NOTE	GPHEHD=71.9	1890.
1100	NOTE	GPHEHD=71.9	1900.
1100	NOTE	GPHEHD=71.9	1910.
1100	NOTE	GPHEHD=71.9	1920.
1100	NOTE	GPHEHD=71.9	1930.
1100	NOTE	GPHEHD=71.9	1940.
1100	NOTE	GPHEHD=71.9	1950.
1100	NOTE	GPHEHD=71.9	1960.
1100	NOTE	GPHEHD=71.9	1970.
1100	NOTE	GPHEHD=71.9	1980.
1100	NOTE	GPHEHD=71.9	1990.
1100	NOTE	GPHEHD=71.9	2000.

THREE SECTOR ECONOMY SIMULATION - INFLATION

CASHBU SAV INI SALEBH SALACO GPRB INIGTB
 DIV=0.27 LENGLTH=120/PRTPER=12/PLIPER=2
 CASHBU=BJ/CASHHO=H/CASHGO=G/CURR=C
 GNP=E/SALEBH=S/SALEBGL=L/SALEBCT=L/SALEBCC=C
 GPHENO=H/GPHENBU=B/DEBITGO=D/SEFCUR=S
 INCDCO=I/DECO=O/TAXCO=T/TAXDIR=H
 ONE

1182CC00
 11830000
 1184CC00
 1186CC00
 1187CC00
 1188CC00
 1189CC00
 1193CC00

THREE SECTOR ECONOMY SIMULATION - INFLATION

CASHBU SAV INI SALEBH SALACO GPRB INIGTB
 DIV=0.27 LENGLTH=120/PRTPER=12/PLIPER=2
 CASHBU=BJ/CASHHO=H/CASHGO=G/CURR=C
 GNP=E/SALEBH=S/SALEBGL=L/SALEBCT=L/SALEBCC=C
 GPHENO=H/GPHENBU=B/DEBITGO=D/SEFCUR=S
 INCDCO=I/DECO=O/TAXCO=T/TAXDIR=H
 ONE

1182CC00
 11830000
 1184CC00
 1186CC00
 1187CC00
 1188CC00
 1189CC00
 1193CC00

60.

70.

80.

90.

100.

110.

-GNP

SL

SL

SL

EI

SL, EI

SL

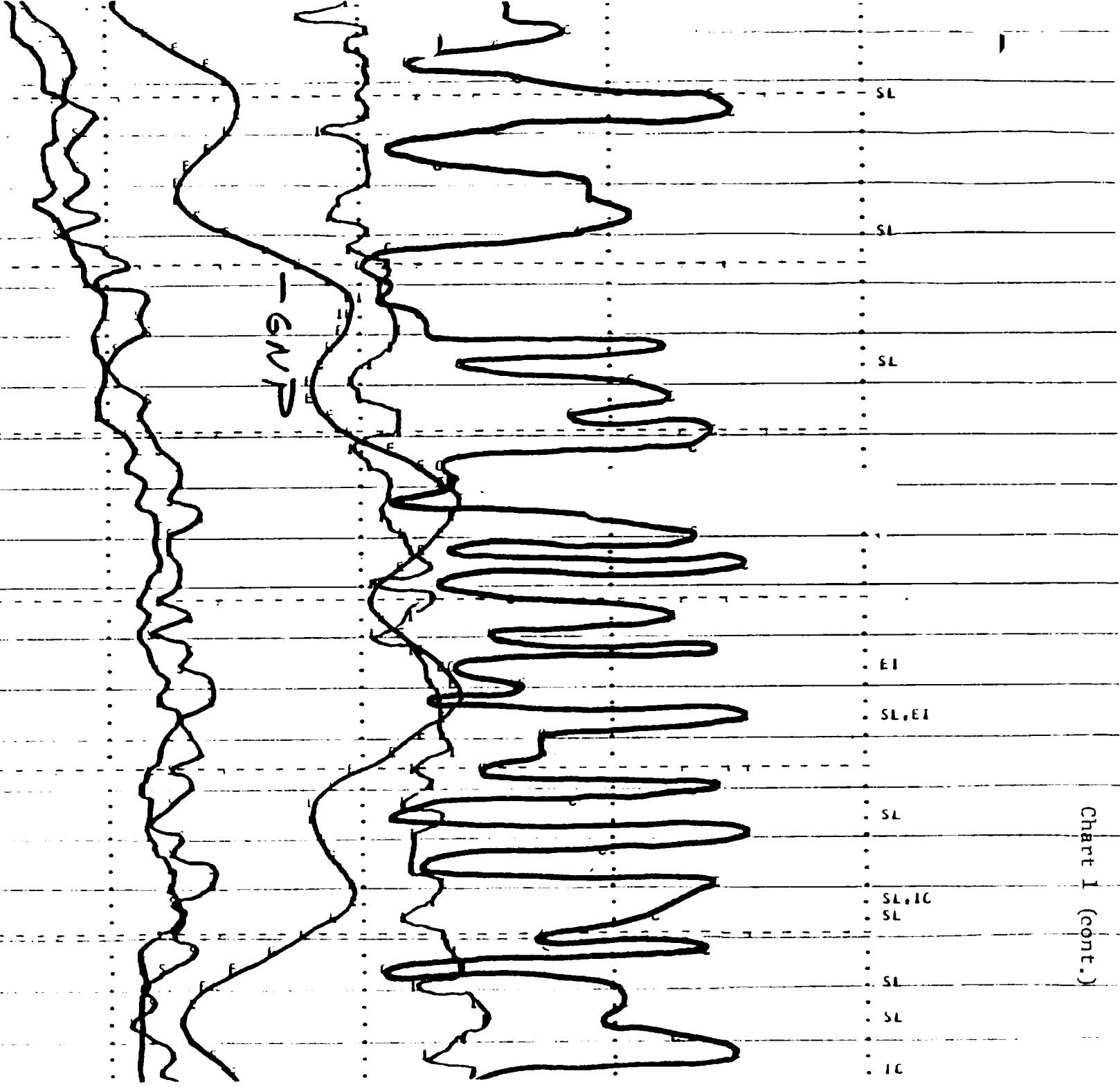
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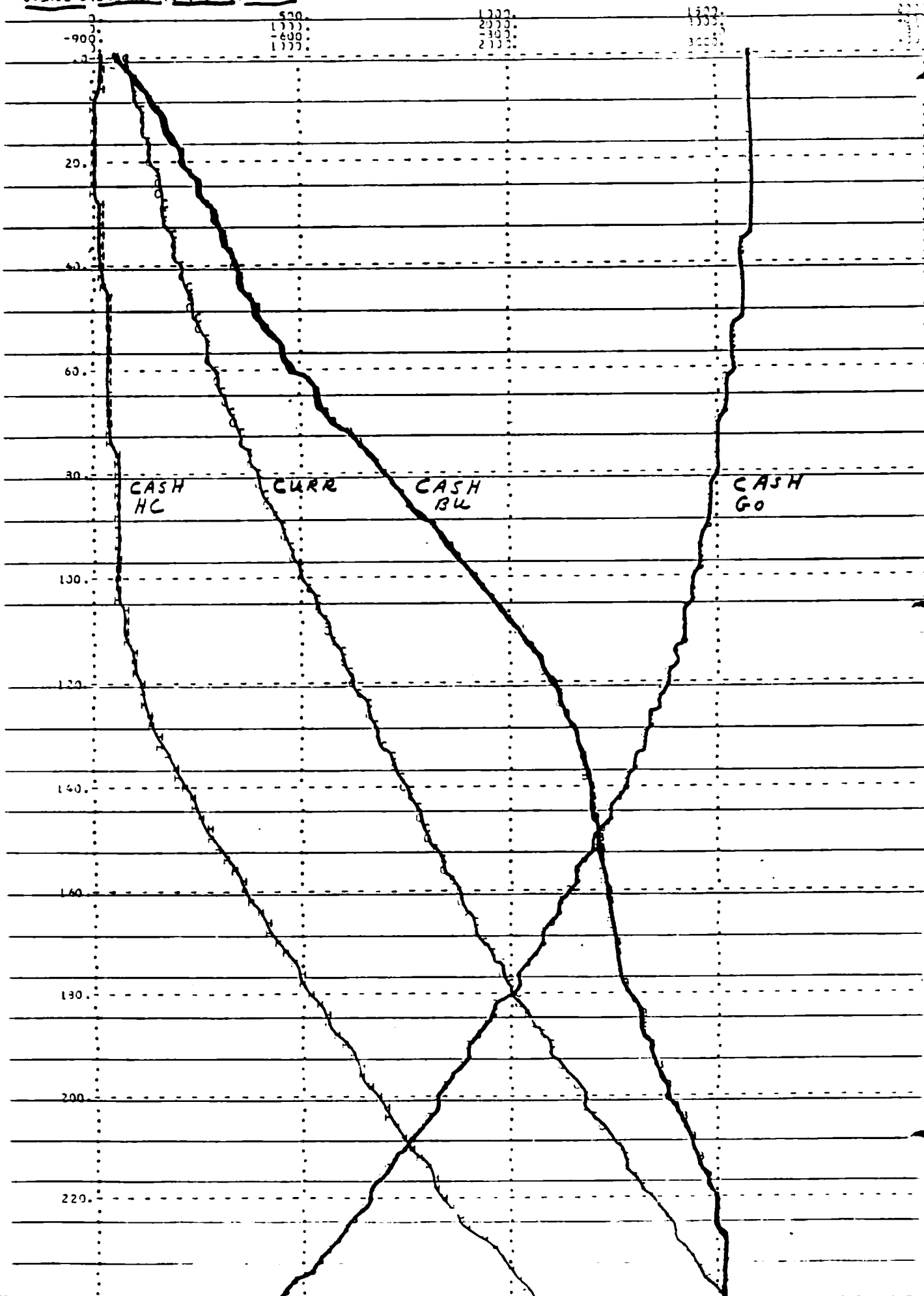
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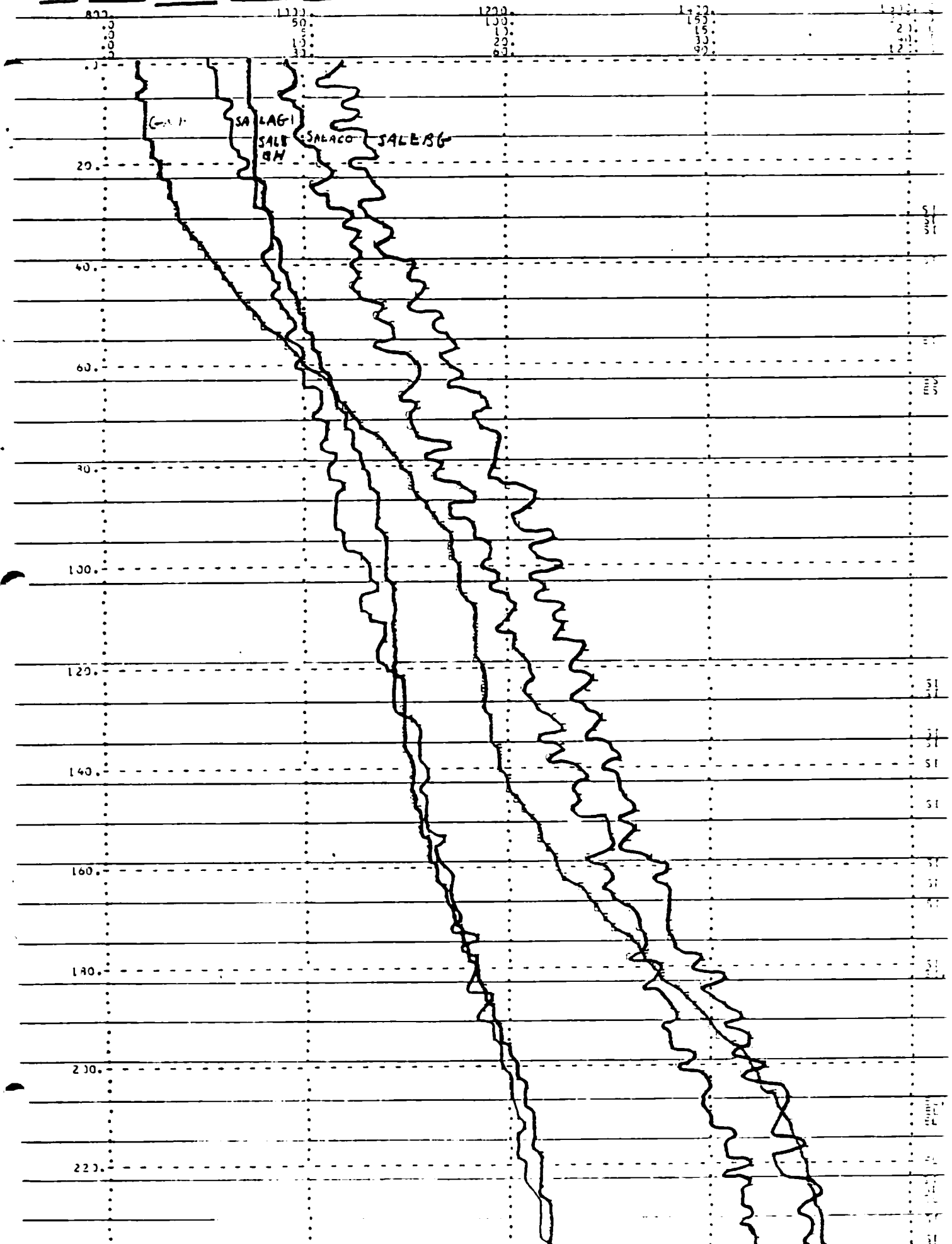
Chart I (cont.)



CASHBU=B, CASHHC=H, CASHGO=G, CURR=C



GNP=E, SALEBH=S, SALEBG=L, SALAGI=I, SALAGO=C



GNP

SALEBH
SALEBG
SALAGI

SALAGO

SALEBG

20.

40.

60.

80.

100.

120.

140.

160.

180.

200.

220.

51

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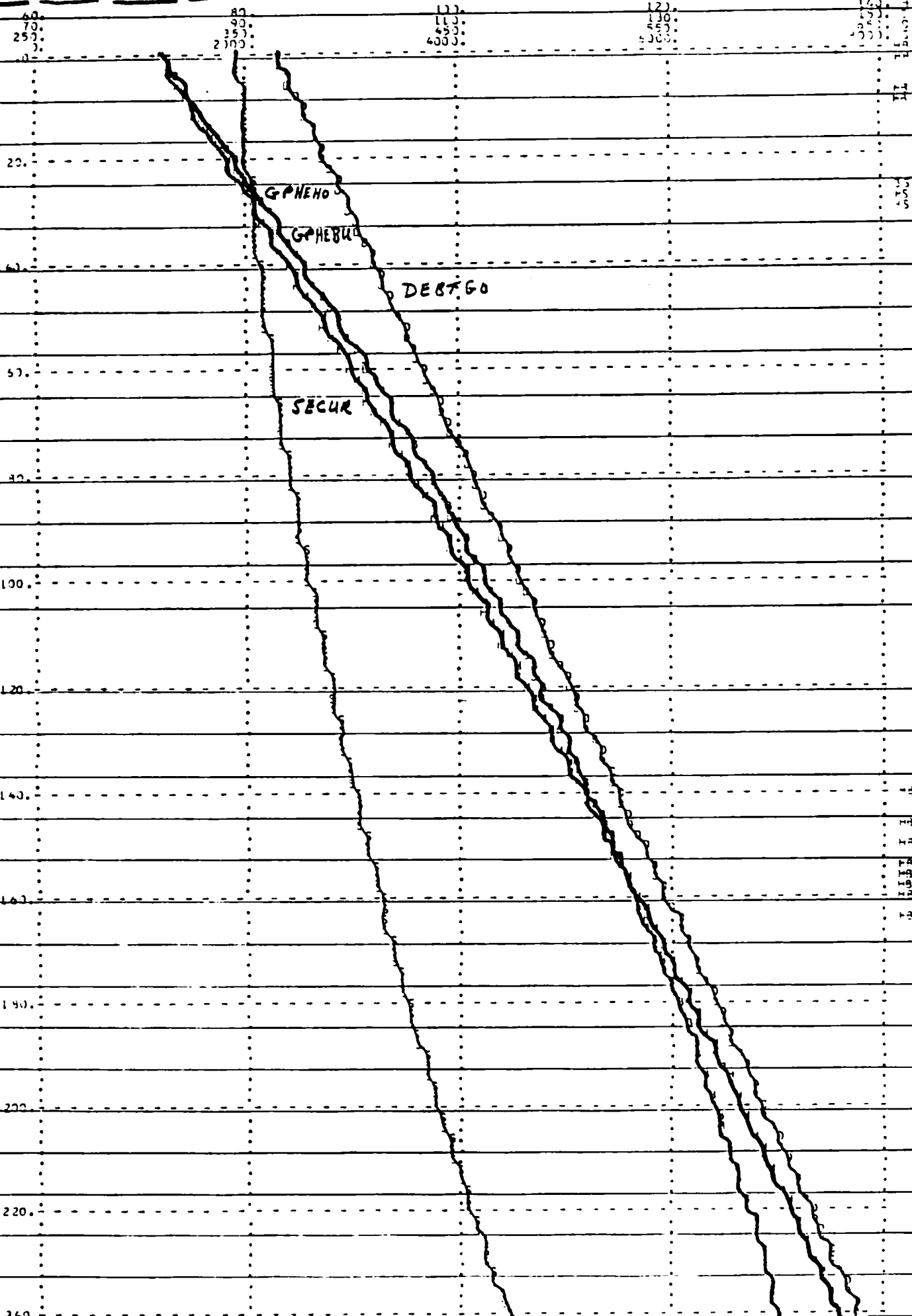
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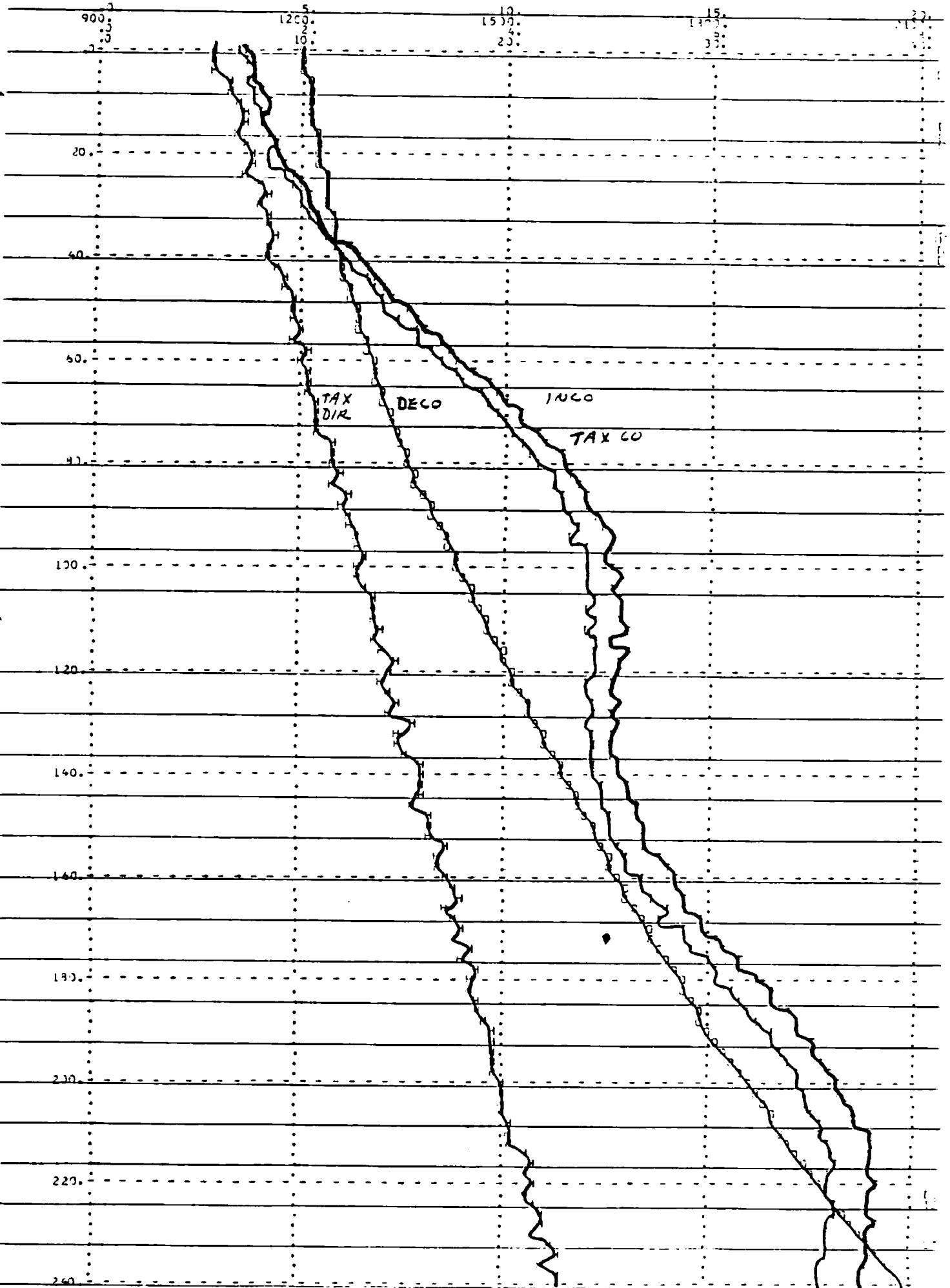
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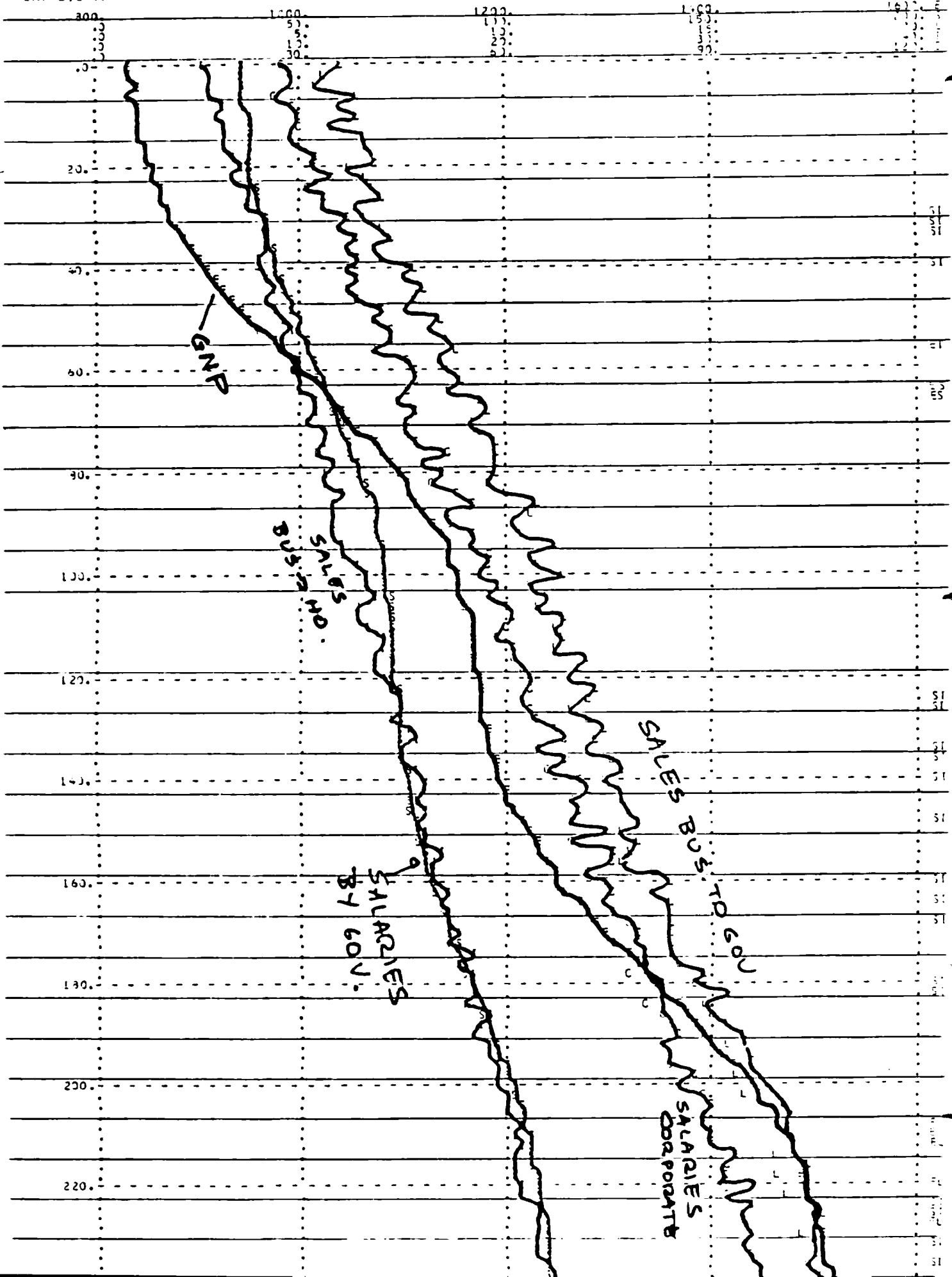
GPHEMO=M, GPHEBL=B, DEBTGO=0, SECUR=S



INDCO=I, DECC=C, TAXCO=T, TAXDIR=M



GNP=E, SALES=S, SAL EBG=L, SAL AGI=I, SAL AGO=C



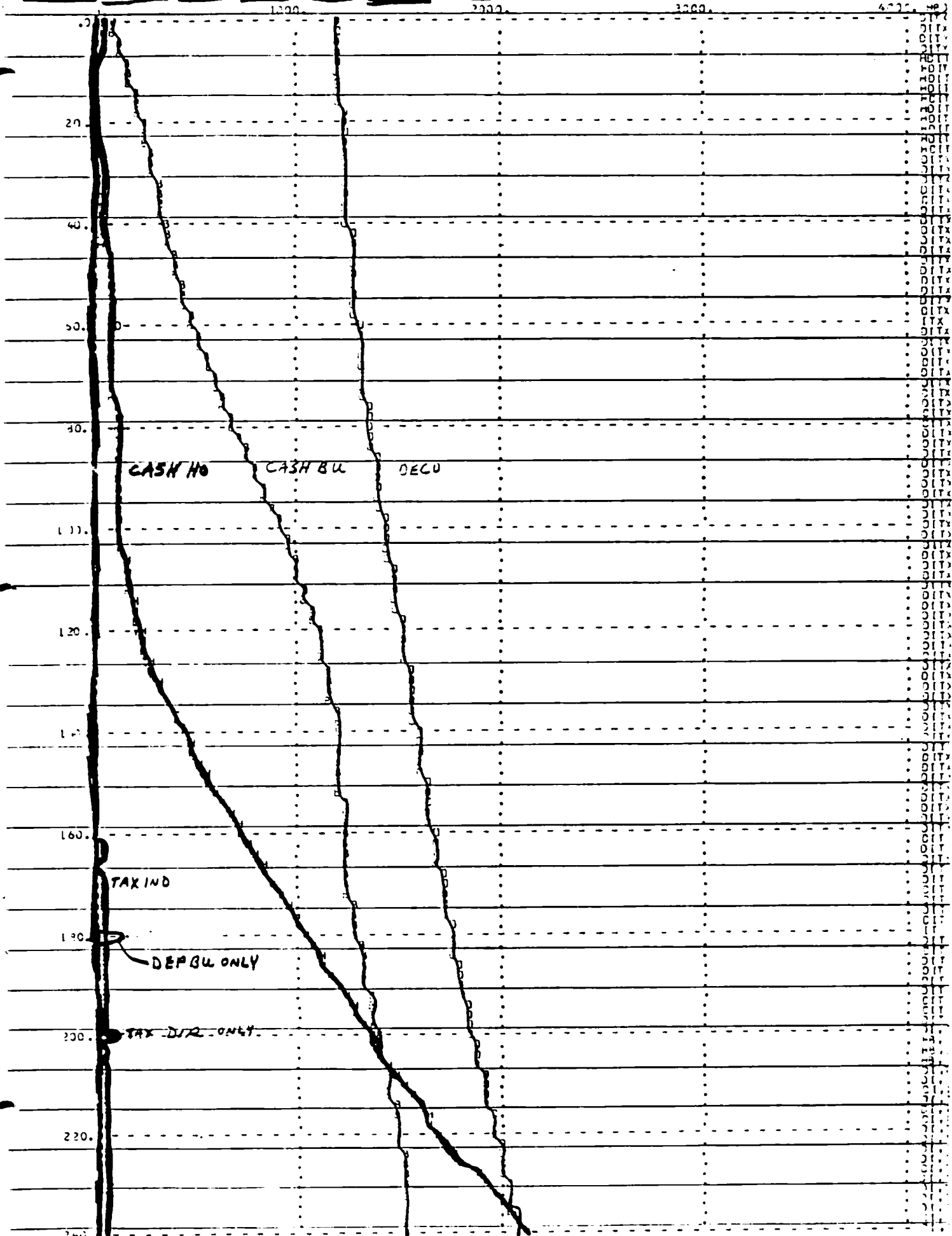
CASHM0=M, CASHB0=B, DEPR0=D, INCCO=I, DECO=O, TAXDIR=T, TAXIND=J

1000

2000

3000

4000



INCCO=1, DEPR=0, TAXCO=1, BLKR=B, SAV=S

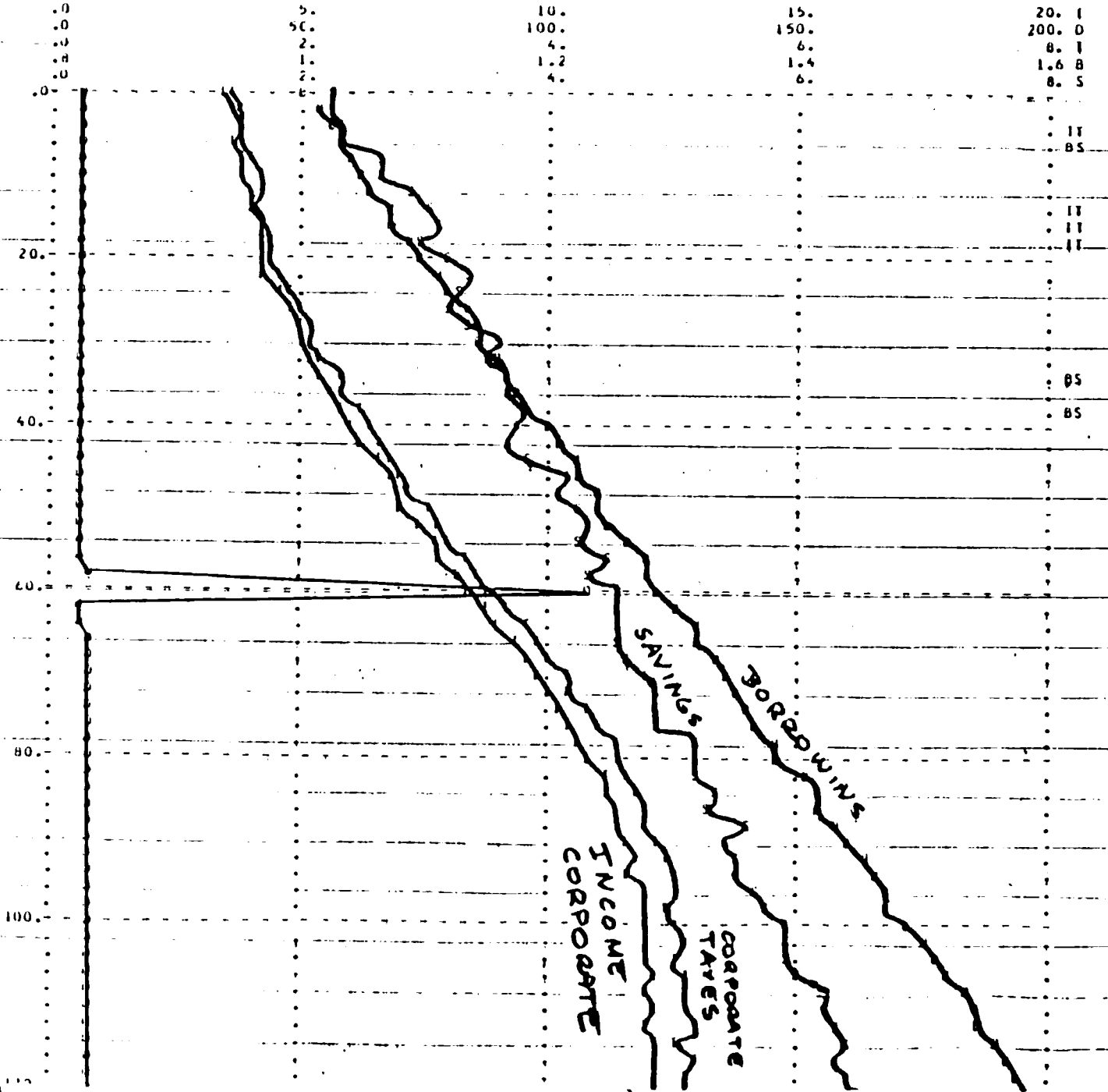


Chart 8

GNP=E, SALEBH=S, SALEBG=L, SALAGI=L, SALACO=C

