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A CLASSIFICATION AND RETRIEVAL SYSTEM
FOR ECONOMIC DATA

Richard Schmalensee

Number 28 - October 1968

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Introduction

This paper describes a system designed to facilitate the use of large bodies of economic data in a time-shared environment. The general idea is that a library of commonly used data should be available to users of a time-shared economic research system. Such a library may consist of many thousands of data files (individual series or groups of series). Some means must be provided to enable the user to retrieve files of interest when their precise designation is unknown. The analogy with a card catalog in an ordinary library is quite close.

The approach described here is being implemented within the TROLL system, though the classification scheme employed is by no means restricted to TROLL. It will enable users to find data in the system libraries, each of which can contain up to two thousand different files. The TROLL manual discusses in detail the mechanics of retrieval. This paper is intended to complement that presentation by explaining the concepts employed and exhibiting the filing system used.

The author can take full credit only for the filing system. The retrieval instructions were programmed by Orville Dodson, who also participated in the design of the system under discussion. In addition, Mr. Dodson assisted in the writing of some sections of this paper. Blame for any errors still rests with the author, of course.

The basic concepts are those of category and keyword. We will first explain them and describe how they are used to label each data file in a system library. We will then go over how they are combined to form logical

expressions and how these are used to search for files and sets of files. The remainder of the paper will detail and explain the particular categories and keywords in the TROLL system.

One important point should be made clear before we go any further. Each file in a TROLL system library has a name. If you want to use quarterly GNP data, for instance, and you know that the file containing this series is called YGNP, you do not need to use the system described in this paper. The file YGNP can be easily extracted from a system library with a single command. If, on the other hand, you want the wholesale price index for raw silk, you will most likely need to use the system described here to find the name of the corresponding file. In an ordinary library, if you know the call number of a book, you need only employ a librarian to get it. A card catalog is required only when the call number is unknown.

Concepts

Categories are essentially groups of descriptors. Suppose, for instance, that one were designing a system to classify and retrieve playing cards. One category in such a system might be "suit", and another might be "number". To specify the card one wanted, it would be necessary to supply information on each category. The sorts of things one can say about each category, the elements of the group of descriptors, are called keywords.

A logical set of keywords under the category "suit" would be "clubs", "diamonds", "hearts", and "spades". If one gave this imaginary retrieval system the keyword suit (spades), it would return all the spades. If, in

addition, the user were to specify number (seven) as another keyword, only the seven of spades would be returned.

One might want to be able to get all red or black cards of a certain denomination or all club face cards. The system can be extended to permit this by the use of classes and sub-classes. Category "suit" could have classes "red" and "black", for instance, with class "red" having sub-classes "diamonds" and "hearts", and class "black" having sub-classes "clubs" and "spades". A keyword in category "suit" could then specify either just a class or a class and a sub-class. Using suit (red) would indicate a red card was desired, and suit (red.heart) would tell the system that a heart was being requested.

The TROLL system follows this outline rather closely. There are a set of nine categories, and each data file in a system library may be labeled with one or more keywords from each category. (Economic data are often harder to classify than playing cards.) The only difference is that when the user gives the retrieval system a keyword, two-letter mnemonics are used for the category, class, and sub-class involved. For instance, suit (red.heart) might become SU(RE.HE), and a request for any red card would be SU(RE).

In general, each keyword used in the TROLL retrieval system is of the following form:

AA(BB.CC)

The letters "AA" indicate the category being considered. "BB" is a mnemonic for the class within the category to which the file must belong,

and "CC" indicates the sub-class, if any, which must be associated with the file. A keyword of the form AA(BB) indicates that the file sought is adequately described by any sub-class in class BB, category AA.

Combining Keywords: Logical Expressions

This section will discuss the concepts and notation for logical and-ing and or-ing. Using these, we will be able to combine keywords to form complex retrieval requests.

We have already seen an example of implicit or-ing: a keyword of the form AA(BB) will match and retrieve files described by any of the sub-classes of class BB. Explicit or-ing can be accomplished by the use of a comma as a divider. Thus we can form such logical expressions as

AA(BB.CC, BB.DD)

AA(BB.CC, FF)

The first of these is a request for a file described by either sub-class CC or sub-class DD of class BB. A file will be retrieved by this command if and only if one of these descriptors is associated with it. The second example indicates that either sub-class CC of class BB or class FF must be associated with a file for it to be retrieved. Note that, by implicit or-ing, any file described by a sub-class of class FF will also be returned.

We have also seen implicit and-ing. In our example of a retrieval system for playing cards, whenever we used two keywords from two categories,

we required that the first and the second be present. Similarly, explicit and-ing can be expressed by using the ampersand (&) as a divider. Thus we can form such logical expressions as

AA(BB.CC&BB.DD)

AA(BB.CC&FF)

The first of these indicates a request for a file with which both sub-classes CC and DD of class BB are associated. Only files with both these sub-classes will be retrieved. The second indicates that both sub-class CC of class BB and class FF must be associated with the file desired. Again, implicit or-ing ensures that any file described by a sub-class of class FF will be returned.

Finally, or-ing and and-ing may be used together to form more complex logical expressions. The general form of a logical expression that can be read by the retrieval system is thus

AA(BB&CC&DD,EE&FF,GG,HH&II&JJ,KK,LL,MM,...)

Two examples of valid logical expressions are

AA(BB.CC&BB.DD,GG)

AA(BB&CC,EE&FF.GG)

The first of these indicates that both sub-classes CC and DD (of class BB) must be associated with a file, or that class GG (or any of its sub-classes) must be associated with a file for it to be retrieved. The

second expression indicates that both classes BB and CC must be associated with a file, or that class EE and sub-class GG of class FF must be associated with a file for it to match. It should be clear from these examples that and-ing takes precedence in complex expressions.

Searching

Two points should be made before we plunge into a discussion of the retrieval procedure. First, the description here is intended to complement rather than substitute for that in the TROLL manual. It is here chiefly for the purpose of logically completing this paper. Second, if you know the name of the data file you want from the system library, there is no need to use this procedure. This should be clear from the TROLL manual.

To begin the search procedure, one must type

```
RETRVE "archive class name"
```

in the library phase. "Archive class name" is the name of the system library to be searched. The next command is typically

```
SEARCH LIBRARY "list of 1 to 9 logical expressions"
```

There may be a maximum of one logical expression per category. This command will cause the system to place in a work space all data files whose keywords match those you have specified. The console will respond with the number of files found that match your description.

One can then do a further search on the items just retrieved, extract copies of them from the library, name the set of files, list the

set, or just about anything else the situation may dictate. For a description of all the available commands and options, consult the TROLL manual.

The rest of this paper will list the specific categories, classes, and sub-classes available in the TROLL system.

Categories

The nine categories in the TROLL system and their mnemonics are as follows:

<u>Category</u>	<u>Mnemonic</u>
1. Variable Type	VT
2. GNP Accounts	GP
3. To Sector	TS
4. From Sector	FS
5. Unit of Measurement	UM
6. Timeunit	TU
7. Region	RE
8. Seasonality	SE
9. Population Classification Scheme	PC

Category VT is the most basic. All economic variables can be considered as either stocks, flows, or attributes. The classes and sub-classes in category VT consist of the most commonly encountered stocks, flows, and attributes. There are also residual classes, to ensure that every variable can be filed somewhere.

One of the classes in category VT is GNP flow (GP), and another is GNP-Type flow (GT). GNP flows are Department of Commerce series. A GNP-Type flow is one which can be described as either an alternative estimate of a GNP flow or as a non-Commerce breakdown of such a flow. Most of the classes and sub-classes in category GP are the elements of the GNP accounting system; they are used to further describe files having either of these variable types.

Categories TS and FS may also be used to describe GNP data. They are used for most other types of files as well. The general rules for stocks and flows are as follows:

<u>To Sector</u>	<u>From Sector</u>
receives physical flows	sends physical flows
sends financial flows	receives financial flows
has liabilities	holds assets

The basic idea is that to every buyer there corresponds a seller, and to every asset on someone's books there often corresponds a liability on someone else's. The To Sector is thus the purchaser and the From Sector the seller when dealing with flows, and the To Sector is the borrower and the From Sector the lender when dealing with balance-sheet stocks. If, of course, the purchaser is unknown, only the seller need be specified. Also, in the case of fixed assets only the From Sector can be specified, as there is (usually) no directly corresponding liability held by another sector.

To keep the relation between the To and From Sectors straight, it may be helpful to think of the mechanics of a credit sale. The purchaser

receives a physical flow and incurs a liability, so it is indicated under the To Sector. It eventually sends a financial flow to the seller, who is thus shown as the From Sector.

Occasionally, attributes will refer to sectors. In this case, the convention is that the To Sector is the one being described and the From Sector is not used. In the discussion of categories VT and GP, we will elaborate these rules.

Categories UM and RE are pretty much self-explanatory. Category SE is used to indicate whether the file contains time-series or cross-section data and to describe the seasonal adjustment procedure (if any) used on time-series data.

Category TU results from a convention in the TROLL system. All data files are treated as if they contained time-series information, and the timeunit associated with them is the number of observations per year. Cross-section information will also have a timeunit associated with it. This number can then either be interpreted as the number of rows or columns in the data matrix. The number of years in the file then corresponds to the other dimension. For instance, a file of cross-section data with timeunit 4 and 20 years could either contain four observations on 20 variables or 20 observations on four variables. The comment associated with the file will make it clear which is the case.

If one wanted to retrieve a file containing four observations on 20 variables, he would not ordinarily know which way the file was stored. The obvious approach is to or the timeunits. Thus the logical expression used in the SEARCH command would be TU(QT,OB).

Category PC is a rather important list of descriptors, especially with cross-section or demographic data. Any item of data describes the actions, status, or characteristics of certain actors--who may be firms, individuals, labor unions, governments, states, etc. Compilers of cross-section or demographic data typically use two sorts of population classification schemes. The first type includes individuals in the sample only if they pass certain tests. The other sort of classification scheme is to split the sample into groups of actors according to some test or standard.

An example of the use of the first type of population classification scheme would be data on the population between the ages of 5 and 27.4. An example of the second would be a matrix giving consumption of figs by various age groups. In both cases, age was used to classify the population.

The file label can be thought of as containing one keyword for each such scheme employed in constructing the data. By specifying only the general sort of scheme used, we save having to build the details of all possible schemes (e.g. age brackets) into the system. When searching for cross-section or demographic data, one would normally and all classification schemes used in the construction of the data.

The remainder of this paper will list and discuss the classes and subclasses that may be used in forming keywords under each of these categories.

Category Variable Type (VT)

Classes 1-11 refer to flows, 12-18 to stocks, and 19-28 to attributes. To give an example, the key word that indicates that a file contains demographic data on firms (such as number or concentration ratio) is VT(DD.FI). The footnotes at the end of the table will explain the use of other categories with the various VT classes and sub-classes.

<u>Class (Mnemonic)</u>	<u>Sub-classes (Mnemonics)</u>
1. GNP Flow (GP)	-
2. GNP-type Flow (GT)	-
3. Other Purchase or Sale (PS) ¹	-
4. Hours Worked (HW) ²	Total - All (TA)
	Total - Straight Time (TS)
	Total - Overtime (TO)
	Average - All (AA)
	Average - Straight Time (AS)
	Average - Overtime (AO)
5. New Orders (NO) ³	-
6. Production (PN) ³	-
7. Capital Flow (Trade) (CF)	Total (TO)
	Reserve Transaction (RT)
	Short-term (ST)
	Long-term (LT)
	Government (GV)
	Private (PV)

8. Change in a Stock (CS) ⁴	Financial - Short-term (FS)
	Financial - Long-term (FL)
	Net Worth (NW)
	Inventories (IN)
	Fixed Asset (FA)
	Other (OT)
9. Expected or Desired Flow (EF) ⁵	GNP Flow or GNP-Type Flow (GP)
	Other Purchase or Sale (PS)
	Hours Worked (HW)
	New Orders (NO)
	Production (PN)
	Capital Flow (CF)
	Change in a Stock (CS)
	Other Flow (OF)
10. Intra-Sector Transfers (NT) ⁶	Between Governments (BG)
	Between Businesses (BB)
	Between Households (BH)
11. Other Flow (OF)	-

12. Balance-sheet Stock (BS)	Financial - Short-term (FS)
	Financial - Long-term (FL)
	Net Worth (NW)
	Inventories (IN)
	Fixed Asset (FA)
	Other (OT)

13. Employment (EM) ²	Total (TO)
	Production (PN)
	Non-production (NP)
	Other (OT)
14. Labor Force (LF)	-
15. Population (PO)	-
16. Unfilled Orders (UO) ³	-
17. Expected or Desired Stock (ES) ⁵	Financial - Short-term (FS)
	Financial - Long-term (FL)
	Net Worth (NW)
	Inventories (IN)
	Fixed Asset (FA)
	Other (OT)
18. Other Stock (OS)	-

19. Wholesale Price Index (WP) ⁷	-
20. Consumer Price Index (CP) ⁸	-
21. GNP Deflator (GD) ⁹	-
22. Other Price (OP) ¹⁰	Stock (ST)
	Flow (FL)
23. Wage Rate (WR) ²	Hourly - Straight Time (HS)
	Hourly - Average (HA)
	Hourly - Compensation per Employee (HC)
	Hourly - Other (HO)
	Other - Straight Time (OS)

- Other - Average (OA)
- Other - Compensation per Employee (OC)
- Other - Other (OO)
- 24. Interest Rate (IR)¹¹
 - Long-term (LT)
 - Short-term (ST)
- 25. Demographic Data (DD)
 - Firms (FI)
 - Households (HO)
 - Individuals (PE)
 - Governments (GV)
- 26. Policy Variable (PV)
 - Tax Rate (TR)
 - Reserve Ratio (RR)
 - Discount Rate (DR)
 - Other (OT)
- 27. Expected or Desired Attribute (EA)⁵
 - Price (PR)
 - Interest Rate (IR)
 - Wage Rate (WR)
 - Other Attribute - Flow (FL)
 - Other Attribute - Stock (ST)
 - Other Attribute - Sector (SE)
- 28. Other Attribute (OA)
 - Stock (ST)
 - Flow (FL)
 - Sector (SE)

Notes

1. The purchasing sector is described by a keyword in category TS and the seller in category FS. Inter-industry flows and input-output coefficients go here; the latter are indicated as ratios in category UM.
2. The employing sector is specified under FS.
3. The sector principally involved (doing the producing, receiving the orders, etc.) is specified under FS.
4. The sectors involved in the stock whose change is measured are specified under TS and FS. (The From Sector holds the stock as an asset.) The number of firms or households is considered an attribute of a sector, and changes in such quantities must be requested by class 11 (Other Flow).
5. The sectors involved in the desired or expected stock or flow--or the stock or flow whose attribute is desired or expected--are described under TS and FS as per the conventions established above. The sector whose attribute is desired or expected is given under TS.
6. Recall that TS is used to specify the sector sending the funds.
7. The sector whose price level is being measured is given under FS.
8. The consumption category whose price is being measured is specified under category GP.

9. The GNP component involved is specified under category GP.
10. The sectors involved in the stock or flow being priced are given under TS and FS, following the usual conventions for describing stocks and flows.
11. Sectors involved in the stock whose yield is being measured are specified under TS and RS, following the usual conventions. The Federal Reserve discount rate goes under VT(PV.DR).

Category GNP Accounts (GP)

The really relevant items here are the sub-classes, which are taken from Table A, p. xii, The National Income and Product Accounts of the United States, 1966, GPO, Washington. The classes are intended primarily to aid in locating the sub-class of interest; they may or may not be of much use in that capacity.

The unit of government and/or the private sector or sectors involved in any transaction are specified under TS and FS as per the conventions established above. The sector whose gross product is measured (under GP(MA.PO)) is given under TS--it is viewed as a purchaser of factors.

Class (Mnemonic)

Sub-classes (Mnemonics)

1. Major Aggregates (MA)

Gross National Product (GP)

Gross Product Originating (PO)

Net National Product (NP)

	National Income (NI)
	Personal Income (PI)
	Disposable Income (DI)
2. Personal Taxes, Outlays, and Savings (PA)	Personal Tax and Non-Tax Payments (PT)
	Personal Outlays, Total (PO)
	Personal Consumption Exp., Total (CT)
	Personal Consumption Exp., Durables (CD)
	Personal Consumption Exp., Non-Durables (CN)
	Personal Consumption Exp., Services (CS)
	Interest Paid by Consumers (CI)
	Personal Saving (PS)
3. Personal Income (PI)	Compensation of Employees (CE)
	Wage and Salary Disbursements (WS)
	Supplements to Wages and Salaries (SW)
	Other Labor Income (OL)
	Proprietors' Income (PI)
	Rental Income of Persons (RI)
	Personal Interest Income (II)
	Net Interest (Business) (NI)
	Transfer Payments to Persons, Total (TT)
	Transfer Payments to Persons, From Business (BT)
	Transfer Payments to Persons, From Government (GT)

4. Foreign Transactions Account (FA)	Exports of Goods and Services (EX)
	Imports of Goods and Services (IM)
	Government Transfer Payments To Foreigners (GT)
	Personal Transfer Payments To Foreigners (PT)
	Net Foreign Investment (FI)
5. Gross Private Domestic Investment (GI)	Total (TO)
	Change in Business Inventories (IN)
	Fixed Investment, Total (FI)
	Residential Structures (RS)
	Non-Residential Structures (NS)
	Producers' Durable Equipment (DE)
	Total Non-Residential Fixed Investment (TN)
6. Business Accounts and Misc. (BA)	Corporate Profits and IVA (CI)
	Corporate Profits Before Tax (CB)
	Corporate Profits Tax Liability (CT)
	Corporate Profits After Tax (CA)
	Dividends (DI)
	Undistributed Profits (RE)
	Inventory Valuation Adjustment (IV)
	Wage Accruals less Disbursements (AD)
	Capital Consumption Allowances (CC)
	Statistical Discrepancy (SD)

7. Government Outlays (GO)

Purchases of Goods and Services
Total (GT)

National Defense (GD)

Non-Defense (GN)

Compensation of Employees (GE)

Wages and Salaries (GW)

Goods and Services other than GE (GO)

Transfer Payments, Total (TT)

Net Interest Paid (GI)

Subsidies less Surplus of Government
Enterprises (SL)

Surplus or Deficit (SD)

8. Government Receipts (GR)

Indirect Business Tax and Non-Tax
Liability (IB)

Total Contributions for Social
Insurance (ST)

Employer Contributions for Social
Insurance (SE)

Personal Contributions for Social
Insurance (SP)

Categories To Sector and From Sector (TS and FS)

The same classes and sub-classes can be used to form keywords in both categories. For instance, the keywords VT(NO) and FS(MN.DF) would indicate a file of new orders received by the Primary Metals industry. On the other hand, VT(BS.NW) and TS(MN.DF) would indicate a file containing data on net worth for that industry.

<u>Class (Mnemonic)</u>	<u>Sub-classes (Mnemonics)</u>
1. Government (GO)	Total (TO) Federal (FE) State (ST) Local (LO) Government Enterprises (EN) Federal Reserve (FR)
2. Households and Institutions (HI)	Total (TO) Households (HO) Institutions (IN)
3. Private Sector (PS)	Total (TO) Farm (AG) Non-Farm (NA) Financial (FI) Non-Financial (NF) Corporate (CO) Non-Corporate (NC)

4. Foreign Sector (FS)

The Rest of the World (RW)

A Particular Country (PC)

A Particular Group of Countries (PG)

5. Manufacturing (MN)

Total (TO)

Durables (MD)

Non-Durables (MN)

Food and Kindred Products -
SIC 20 (NA)

Tobacco Manufactures -
SIC 21 (NB)

Textile Mill Products -
SIC 22 (NC)

Apparel and Related -
SIC 23 (ND)

Paper and Allied Products -
SIC 26 (NE)

Printing, Publishing, and Allied -
SIC 27 (NF)

Chemicals and Allied Products -
SIC 28 (NG)

Petroleum Refining and Related -
SIC 29 (NH)

Rubber and Misc. Plastics -
SIC 30 (NI)

Leather and Leather Products -
SIC 31 (DA)

Ordinance - SIC 19 (DB)

Lumber and Wood, Except Furniture -
SIC 24 (DC)

Furniture and Fixtures -
SIC 25 (DD)

Stone, Clay, and Glass -
SIC 32 (DE)

Primary Metal Industries -
SIC 33 (DF)

Fabricated Metal Products -
SIC 34 (DG)

Machinery, Except Electrical -
SIC 35 (DH)

Electrical Machinery -
SIC 36 (DI)

Transportation Equipment -
SIC 37 (DJ)

Instruments - SIC 38 (DK)

Misc. Manufacturing Industries -
SIC 39 (MM)

6. Non-Manufacturing Business (NB)

Agriculture, Forestry, and Fisheries,
Except Farming (AO)

Farming (AF)

Mining (OM)

Contract Construction (CC)

Transportation (TR)

Telephone and Telegraph (TC)

Radio and Television (RC)

Electric, Gas, and Sanitary Services (EG)

Wholesale Trade (WT)

Retail Trade (RT)

Commercial Banks (CB)

All Other Finance, Insurance, and
Real Estate (OF)

Services (SE)

Category Unit of Measurement (UM)

The sub-classes listed are allowable for all ten classes. For instance, UM(CU.AR) indicates a variable measured in current dollars at annual rates, and UM(CN.MR) indicates a variable measured in constant dollars at monthly rates.

<u>Class (Mnemonic)</u>	<u>Sub-classes (Mnemonics)</u>
1. Current Dollars (or other currency) (CU)	No Rate (NR)
2. Constant Dollars (or other currency) (CN)	Annual Rates (AR)
3. Physical Units (such as number) (PH)	Semi-Annual Rates (SR)
4. Rate of Change (RC)	Quarterly Rates (QR)
5. Average (AV)	Monthly Rates (MR)
6. Percentage (PC)	Other Rates (OR)
7. Ratio (RA)	
8. Index (IN)	
9. Deflator (DF)	
10. Other (OT)	

Category Timeunit (TU)

This category is used to indicate the number of observations per (real or fictitious) year, as explained above. For example, TU(QT) can mean that the file requested contains quarterly data, or that it contains four pieces of data for each of a set of observations, or that it has four observations on each of a set of variables. The distinction between time-series and cross-section files is made in category SE.

Class (Mnemonic)

1. Annual (1) (AN)
2. Semi-Annual (2) (SA)
3. Quarterly (4) (QT)
4. Monthly (12) (MO)
5. Semi-Monthly (24) (SM)
6. Weekly (52) (WE)
7. Other, Less than or Equal to 10 (OA)
8. Other, Greater than 10, Less than or Equal to 20 (OB)
9. Other, Greater than 20, Less than or Equal to 50 (OC)
10. Other, Greater than 50 (OD)

Category Region (RE)

This category is used to indicate the region to which a particular file refers. It permits specification of population classification schemes that are geographic.

Class (Mnemonic)

1. United States (US)
2. The Rest of the World (RW)
3. A Group of Foreign Countries (GF)
4. An Individual Foreign Country (IF)
5. A Group of States (GS)
6. An Individual State (IS)
7. A Group of SMSA's (GM)
8. An Individual SMSA (IM)
9. A Group of Local Political Units (GL)
10. An Individual Local Political Unit (IL)
11. A Group of Federal Reserve Districts (GD)
12. An Individual Federal Reserve District (ID)
13. Reserve City - Federal Reserve (RC)
14. Country - Federal Reserve (CO)
15. Other (OT)

Category Seasonality (SE)

The sub-classes under class SA are used to indicate who did the adjusting. Sub-class TR is included in anticipation of a seasonal adjustment capability in TROLL. Note that NS(CS) indicates cross-section data.

<u>Class (Mnemonic)</u>	<u>Sub-classes (Mnemonics)</u>
1. Not Seasonally Adjusted (NS)	Time Series (TS) Cross-Section (CS)
2. Seasonally Adjusted (SA)	Commerce (CO) Census (CE) BLS (LA) TROLL (TR) Other (OT) Unknown (UN)

Category Population Classification Scheme (PC)

This category was explained in detail above.

Class (Mnemonic)

1. Market Share (MS)
2. Family Size (FS)
3. Other Size (OS)
4. Earnings (EA)
5. Taxes Paid (TP)
6. Net Worth (NW)
7. Race (RA)
8. Age (AG)
9. Sex (SX)
10. Occupation (OC)
11. Labor Force Status (LF)
12. Marital Status (MS)
13. Skill (SK)
14. Education (ED)
15. Industry Employing (IE)
16. Place of Employment (LE)
17. Place of Residence (LR)
18. Union Membership (UA)
19. Other Affiliation (OA)
20. Geographic Origin (GO)

21. Other Household or Individual Characteristics (OH)
22. Other Firm or Industry Characteristics (OB)
23. Other Government or Regional Characteristics (OG)
24. Any Other Characteristics (OT)

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