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Chapter Author: John H. Ciccolo, Jr., Christopher F. Baum

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2 Changes in the Balance Sheet of the U.S. Manufacturing Sector, 1926–1977

John H. Ciccolo, Jr., and Christopher F. Baum

This paper reports the results of a research project which involves the collection and organization of income account and balance sheet data, at the individual firm level, for the years 1926–77. The primary data source for the study is *Moody's Industrial Manual*.

By working at the level of the individual firm, it is possible to obtain more accurate information on the market values of traded securities and more detailed information on the structure of firms' balance sheets than is typically available at the aggregate level. Accurate data on the income accounts and balance sheets of firms over a substantial period of time can provide researchers with a rich source of information against which specific hypotheses regarding corporate financing and investment decisions can be tested. The data collected for this study, and software necessary to manage them efficiently, are available from the authors in either IBM or VAX formats at a nominal fee. An NBER Technical Paper is also available which describes the dataset and software in detail.

Section 2.1 briefly describes the manner in which the data were collected and organized. A more detailed presentation of the characteristics of the dataset and accompanying computer software can be found in the Appendix. Section 2.2 considers the aggregate characteristics of the sample. In particular, firm average data on the sources and uses of funds, market valuations, and rates of return are presented for the 1926–77 period. Section 2.3 reports on the results of utilizing some firm-level data to estimate a simple portfolio model which attempts to explain changes in balance sheet flows.

John H. Ciccolo, Jr., is an economist with the Capital Market Group at Citibank Corporation and a research affiliate of the NBER. Christopher F. Baum is associate professor of economics at Boston College.

2.1 Collection and Organization of the Data

Our primary goal in this research project was to construct a micro dataset covering a substantial period of time for use in testing specific hypotheses regarding firm financing and investment decisions and the financial markets' valuations of these activities. A secondary goal was to organize and present the data in a manner that would allow other researchers conveniently to access, verify, and extend the basic dataset. To that end, the project also involved the creation of computer software to provide easy access to and retrieval of the data.

The sample of firms for the period 1926–77 is actually composed of nine separate subsamples, drawn periodically from various issues of *Moody's Industrial Manual*. The composition of these subsamples is outlined in table 2.1. The goal was to obtain nine overlapping subsamples of 50 subject firms each. Subject to restrictions on fiscal year, degree of consolidation, decipherability of complex transactions, and natural resource intensiveness, 52 firms were initially selected using a set of random numbers spanning the number of pages in each *Moody's* edition. Referring to table 2.1, 28 firms in subsamples 1–7 were deleted ex post because closer examination revealed inconsistencies with the initial selection criteria. For subsamples 8 and 9, only 77 of the 104 firms initially selected survived, due primarily to changes in accounting policies (typically resulting from acquisitions) which could not be reconciled without resort to additional data sources such as annual reports or form 10-K's.

For each firm in a subsample, the values for 52 data items are recorded annually. These items are listed and described in the Appendix. About thirty of the data items can be transcribed directly from the income account and balance sheet tables of the *Moody's* volume corresponding to the subsample (see the third column of table 2.1). For most of the remaining data items, it was generally necessary to read the additional

Table 2.1 **Sample Characteristics**

Subsample Number	Panel Number	Volume of *Moody's* (Data Source)	Number of Firms in Subsample	Years of Coverage
1	31	1931	48	5 (1926–30)
2	36	1936	46	6 (1930–35)
3	42	1942	48	7 (1935–41)
4	48	1948	47	7 (1941–47)
5	54	1954	50	7 (1947–53)
6	60	1960	50	7 (1953–59)
7	66	1966	47	7 (1959–65)
8	72	1972	37	7 (1965–71)
9	78	1978	40	7 (1971–77)

information provided in *Moody's* and to employ issues of the *Manual* from several years of the subsample. For instance, multiple issues of the *Manual* were necessarily referenced when firms retired a debt or preferred stock issue during the subsample interval. In cases where information on the outstanding amounts of individual debt issues for particular years were missing, the sinking fund terms were used to interpolate for the missing values.

The replacement value figures reported for firms' inventories (data item 45) are generally available for the firms of subsample 9 from footnotes in *Moody's* for the years 1976 and 1977. Also, a substantial fraction of firms increased the amount of inventories carried on a LIFO basis in 1974 and also reported the replacement values. To fill in data for missing years, 20 industry-level price indices were used to construct estimates in the manner suggested by Lindenberg and Ross (1981). For subsamples 7 and 8, book values of inventories were converted to replacement values using indices for the aggregate manufacturing sector. For all subsamples, book values of plant and equipment were converted to replacement values using Census Bureau deflators for the manufacturing sector. One way in which the quality of these data clearly could be improved would be to gather replacement values from form 10-K's for recent years and use industry deflators computed by other researchers for earlier years. The existing software would allow these new deflators to be integrated easily into the main body of data.

2.2 Aggregate Characteristics of the Sample

Several aspects of the recent performance of U.S. nonfinancial corporations have attracted widespread attention. Since the mid-1960s there has been a dramatic decline in the securities markets' valuations of these firms relative to the replacement costs of their assets and also relative to the returns generated by these assets (Brainard et al. 1980; Feldstein 1980). At the same time, nonfinancial corporate businesses have become more reliant on debt securities in financing their growth (Friedman 1980, pp. 21–26). The inflationary environment of the past 15 years has provided a powerful incentive for those with taxable incomes to increase their indebtedness. Additionally, as Friedman (1980) points out, the postwar trend away from internal sources of funds toward debt financing represents, at least partially, an adjustment toward more normal pre-Depression debt levels.

To place these issues in perspective, this section documents the sources and uses of funds, market valuations, and rates of return for the 1926–77 period using our sample of manufacturing firms. To present the general characteristics of the sample, a substantial amount of aggregation is performed. The balance sheets of the sample firms are consolidated as

Table 2.2 Typical Firm's Balance Sheet

Net Assets	Liabilities
Cash Items	Short-term debt
Accounts Receivable	Traded long-term debt
Inventories (replacement)	Nontraded long-term debt
Net Property (replacement)	Preferred stock
− Current Liabilities (excluding short-term debt, including accounts payable)	Common stockholder's equity
Miscellaneous items (net)	

described in table 2.2. For each firm, variables of interest—such as new debt or equity issues—are measured relative to net assets. Then firm data are averaged for each year to provide a time series for a hypothetical firm with the mean characteristics of its subsample. Table 2.3 shows the results of performing such calculations on the components of net assets for the overlapping years of the subsamples, as well as the years 1926–27 and the years 1976–77.

An interesting feature of the results presented in table 2.3 is the rather dramatic decline in the cash items variable, which is composed primarily of cash and short-term marketable securities. Considered in conjunction with the recent increase in the role of debt in corporate capital structures, the decline is even more striking. Closer inspection reveals that, at least since the mid-1960s, the fall in the share of cash items in net assets has been accompanied by an increase in the share of physical capital. The

Table 2.3 Composition of Net Assets, Selected Years

	Cash Items	Accounts Receivable	Inventories	Net Property	Current Liabilities & Accounts Payable	Miscellaneous
1926–27	15.3	14.4	25.4	47.7	−7.4	4.8
1930	18.1	11.3	22.0	48.0	−5.9	6.5
1935	22.6	11.0	22.3	42.7	−7.3	9.2
1941	22.8	16.2	31.3	42.7	−20.5	7.7
1947	22.0	16.4	32.7	45.6	−21.3	6.0
1953	24.5	16.0	33.6	47.5	−26.0	4.3
1959	16.9	17.5	31.8	48.0	−19.1	5.5
1965	14.8	20.1	33.2	47.0	−21.9	6.6
1971	10.1	20.6	31.6	49.5	−19.2	7.1
1976–77	9.1	19.4	31.4	53.7	−19.3	5.5

Note: Column entries are percentages of net assets. Rows may not sum to 100% because of rounding.

drastic increase in current liabilities in 1941 was due primarily to increased corporate taxation.

2.2.1 Sources and Uses of Funds

Figure 2.1 illustrates the relative importance of internal and external funds in financing the "average" firm, while figure 2.2 depicts the role of debt among external sources of finance. In both figures, the large spikes appearing above the years 1937, 1941, 1947, 1951, 1956, and 1974 coin-

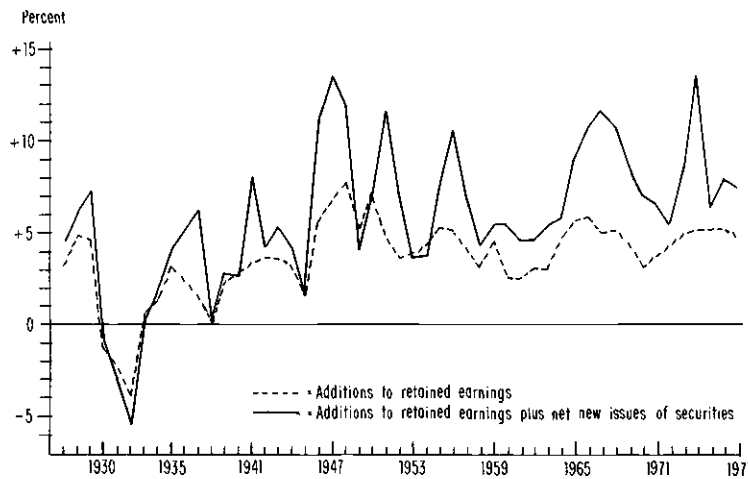

Fig. 2.1 Sources of funds as a percentage of net assets, 1927–77.

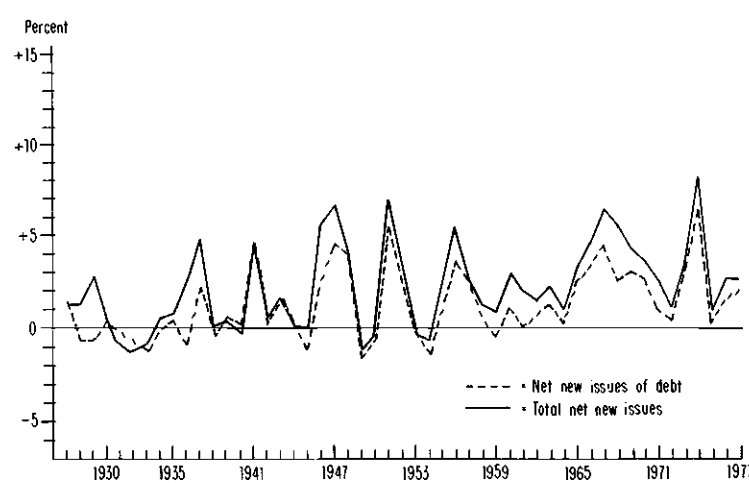

Fig. 2.2 Sources of external funds as a percentage of net assets, 1927–77.

cide with periods of unusual inventory accumulation and apparently represent a demand for external funds to finance unplanned inventories. However, this is not true for the broad spike that appears above the years 1965–68. During this period there was an unusually large demand for funds for capital expenditures and for takeovers.[1]

To highlight the longer-run trends, data on sources and uses of funds have been averaged over the individual years of the subsamples, and the results are presented in table 2.4. According to these results, net issues of debt securities remained quite constant from the 1936–41 period through the mid-1960s, when a large shift toward external sources of funds occurred. In fact, the percentage of total sources accounted for by net debt issues since 1965 is about 20, slightly more than double that in the pre-1965 period. The results of table 2.4 also clearly illustrate the increased demand for funds to finance nonfinancial activities that has occurred since the mid-1960s. Virtually all of the increase in total uses is

Table 2.4 **Sources and Uses of Funds as a Percentage of Net Assets**

	Sources						
	Total Sources	Debt Issues	Debt Retire.	Stock Issues[a]	Stock Retire.	Undistributed Profits	CCA
1927–30	7.3	2.4	−2.3	2.1	−.8	2.8	3.1
1931–35	2.6	.9	−1.5	.9	−.9	−.1	3.3
1936–41	7.5	2.4	−1.4	1.6	−.6	2.2	3.3
1942–47	10.3	2.8	−1.5	2.0	−.7	4.1	3.6
1948–53	11.0	2.9	−1.2	.7	−.7	5.4	3.5
1954–59	10.6	2.4	−1.4	1.5	−.5	4.4	4.2
1960–65	10.6	2.6	−1.5	1.6	−.4	3.6	4.7
1966–71	13.9	4.5	−1.5	2.1	−.3	4.6	4.6
1972–77	12.5	4.8	−2.4	1.5	−.6	4.9	4.3
	Uses						
	Total Uses	Plant/ Equipment	Cash Items	Inventories	Receivables	Miscellaneous (Net)	Current Liabilities
1927–30	6.4	5.2	1.0	−.2	−.6	.7	.3
1931–35	2.5	2.5	.3	.1	−.1	.0	−.3
1936–41	7.2	4.7	1.0	2.9	1.6	.1	−3.1
1942–47	10.6	7.8	2.6	3.2	.9	−1.8	−2.1
1948–53	10.9	7.4	2.1	2.7	1.3	−.1	−2.5
1054–59	10.4	7.1	.6	1.8	1.6	.2	−.9
1960–65	10.4	7.6	.7	1.8	1.7	.4	−1.8
1966–71	13.7	8.7	.7	3.2	2.1	1.0	−2.0
1972–77	12.7	8.6	1.4	3.1	2.4	.2	−3.0

[a]Both preferred and common shares.

accounted for by increased expenditures on physical assets. The gradual trend toward external (relative to internal) sources of funds during the earlier postwar years reflects primarily a decline in undistributed profits relative to net assets.

Several features of the 1927–30 and 1931–35 periods require comment. First, during 1927–30 there were virtually no retirements of common stock, and the −0.8 figure under stock retirements is due solely to retirements of preferred stock. Net issues of common equity were negligible except for the years 1928 and 1929. Furthermore, the plant/equipment data for the years prior to 1935 were estimated as depreciation allowances plus the change in net property account and are thus not comparable with the figures presented for later years. This latter feature accounts for the relatively large discrepancy between total uses and total sources for 1927–30. Also, the relatively low figure for undistributed profits for the 1927–30 period, 2.8% of net assets, is not indicative of low profitability, as 70% of funds available for common stock were paid out as dividends during this period.

2.2.2 Market Valuations

Securities markets provide a continuing valuation of corporations and their earnings streams and therefore, indirectly of their net assets. The ratio of market value, as determined in financial markets, to the replacement value of tangible assets has been dubbed Tobin's q, and this section investigates how q has behaved over the 1926–77 period.

Figure 2.3 plots q for the average firm in each of the nine overlapping

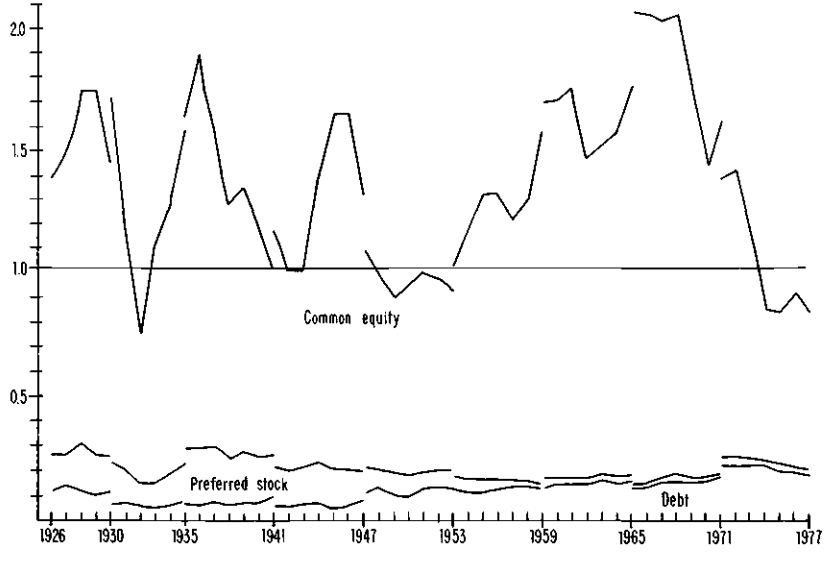

Fig. 2.3 Market value of securities, relative to net assets, 1926–77.

subsamples and also indicates the composition of the ratio as between debt, equity, and preferred stock components. For instance, the distance between the horizontal axis and the first broken line represents the market valuation of debt securities relative to net assets. To assist in interpreting the figure, table 2.5 provides the average values for the overlapping years of the subsamples, as well as for 1926–27 and 1976–77.[2] A complete listing of the data used to construct figure 2.3 appears as table 2.6.

Both table 2.5 and figure 2.3 clearly indicate the increasing importance of debt in the capital structure of the "average" corporation. It is somewhat surprising that the sum of debt and preferred stock, relative to net assets, has remained virtually constant over the entire 50-year period, suggesting that the increase in debt has come primarily at the expense of preferred stock. Another feature of figure 2.3 that clearly stands out is the sharp fall and subsequent rapid recovery of the common equity component of the ratio during the 1930–34 period. This is even more dramatic when one considers that capital goods prices were falling and thus reducing net assets and moving the ratio in the opposite direction. The figure also shows plainly the substantial decline of equity values that began in 1968. This slide in the ratio of the market value of equity relative to net assets is steeper and more prolonged than any previous decline illustrated in the diagram.

Because of significant sampling differences between the subsamples, figure 2.3 has several substantial jumps which hinder interpretation. This is especially true for the most recent years. Figure 2.4 and table 2.7 present data on q for the period 1965–77 which have been spliced to eliminate the discrete jump for 1971. The numbers for the period 1965–71 preserve their percentage changes over time but are constrained to meet

Table 2.5 **Market Value of Securities Relative to Net Assets**

	Debt	Pre-ferred	Common	Total	Debt Relative to Preferred + Common
1926–27	.120	.146	1.195	1.46	.089
1930	.089	.153	1.353	1.59	.059
1935	.068	.194	1.351	1.61	.044
1941	.076	.170	.853	1.10	.074
1947	.099	.110	1.001	1.21	.089
1953	.131	.057	.793	.98	.154
1959	.138	.026	1.474	1.64	.092
1965	.156	.015	1.775	1.95	.087
1971	.202	.028	1.275	1.51	.155
1976–77	.213	.014	.615	.84	.339

Table 2.6 **Tobin's q and Its Components, 1926–77**

Year	Debt Ratio	Preferred Ratio	Common Ratio	Tobin's q
1977	.211	.012	.566	.789
1976	.215	.015	.664	.894
1975	.219	.017	.597	.833
1974	.234	.025	.584	.843
1973	.230	.036	.860	1.125
1972	.225	.043	1.121	1.389
1971	.225	.044	1.076	1.345
1971	.178	.011	1.474	1.663
1970	.169	.011	1.276	1.456
1969	.165	.013	1.606	1.784
1968	.169	.017	1.793	1.978
1967	.170	.009	1.780	1.959
1966	.153	.011	1.816	1.980
1965	.144	.015	1.944	2.103
1965	.167	.016	1.606	1.789
1964	.162	.020	1.414	1.596
1963	.166	.022	1.352	1.540
1962	.161	.022	1.311	1.493
1961	.161	.022	1.601	1.784
1960	.159	.025	1.540	1.725
1959	.154	.027	1.543	1.724
1959	.122	.025	1.404	1.550
1958	.137	.030	1.125	1.291
1957	.133	.031	1.036	1.200
1956	.129	.036	1.157	1.322
1955	.114	.050	1.150	1.314
1954	.116	.048	1.003	1.166
1953	.128	.049	.857	1.033
1953	.134	.064	.730	.928
1952	.144	.066	.769	.978
1951	.128	.071	.814	1.012
1950	.098	.077	.784	.959
1949	.111	.081	.718	.910
1948	.129	.085	.776	.990
1947	.115	.103	.871	1.089
1947	.083	.116	1.132	1.330
1946	.062	.148	1.465	1.675
1945	.052	.162	1.456	1.671
1944	.066	.159	1.170	1.394
1943	.066	.150	1.033	1.250
1942	.055	.143	.821	1.018
1941	.061	.158	.965	1.185
1941	.091	.181	.744	1.015
1940	.065	.188	.960	1.212

Table 2.6 (continued)

Year	Debt Ratio	Preferred Ratio	Common Ratio	Tobin's q
1939	.069	.204	1.088	1.361
1938	.061	.197	1.028	1.286
1937	.071	.215	1.315	1.601
1936	.059	.231	1.624	1.913
1935	.071	.220	1.350	1.642
1935	.065	.168	1.353	1.587
1934	.057	.134	1.089	1.280
1933	.049	.104	.958	1.111
1932	.055	.099	.608	.762
1931	.065	.131	1.004	1.201
1930	.071	.159	1.488	1.718
1930	.107	.147	1.219	1.473
1929	.100	.157	1.514	1.771
1928	.113	.192	1.463	1.769
1927	.126	.140	1.245	1.511
1926	.114	.152	1.146	1.412

the 1971 values of the 1971–77 subsample. These adjusted results indicate that the ratio of the market value of debt to the replacement value of net assets increased moderately over the 1965–77 period.

Finally, this spliced series on q is compared, in table 2.8, with alternative estimates reported in the literature.

2.2.3 Rates of Return

This subsection presents calculations of several measures of the returns experienced by firms in the sample. Figure 2.5 compares the rate of

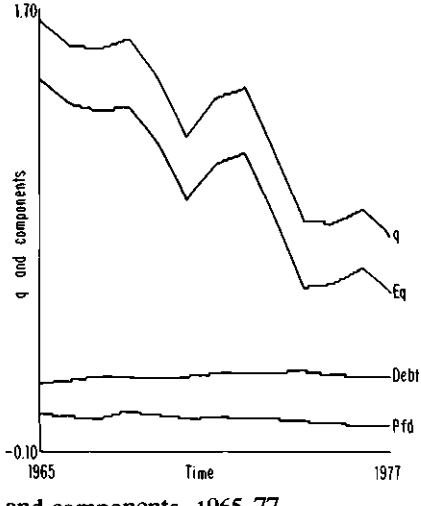

Fig. 2.4 q and components, 1965–77.

return on common stockholders' equity with the total rate of return on net assets, both rates of return measured on a replacement-cost basis. In computing both rates, an adjustment is made to place depreciation charges on a replacement-cost basis. Stockholders' equity is defined as net assets (replacement) minus the market values of debt and preferred

Table 2.7 **Tobin's *q* and Its Components, 1965–77**

Year	Debt Ratio	Preferred Ratio	Common Ratio	Tobin's *q*
1965	.060	.182	1.419	1.661
1966	.045	.193	1.326	1.564
1967	.035	.215	1.299	1.549
1968	.069	.213	1.309	1.591
1969	.054	.209	1.172	1.435
1970	.043	.214	.931	1.188
1971	.044	.225	1.076	1.345
1972	.043	.225	1.121	1.389
1973	.036	.230	.860	1.126
1974	.026	.234	.584	.844
1975	.017	.219	.597	.833
1976	.015	.215	.664	.894
1977	.012	.211	.566	.789

Table 2.8 **Alternative Estimates of Tobin's *q*, 1965–77**

Year	Ciccolo-Baum	Brainard-Shoven-Weiss	Economic Report of the President	Lind-enberg & Ross
1965	1.661	1.740	1.360	1.960
1966	1.564	1.390	1.210	1.620
1967	1.549	1.580	1.220	1.820
1968	1.591	1.560	1.260	1.840
1969	1.435	1.300	1.120	1.610
1970	1.188	1.200	.910	1.480
1971	1.345	1.260	1.000	1.580
1972	1.389	1.370	1.080	1.630
1973	1.126	1.070	1.020	1.280
1974	.844	.690	.760	.960
1975	.833	.740	.730	1.000
1976	.894	.830	.830	.980
1977	.789	.720	.770	.880

Sources: Ciccolo-Baum: Calculations by the authors based on a sample of firms from the PANEL database; Brainard-Shoven-Weiss: *Brookings Papers on Economic Activity* 2 (1980): 466; Economic Report of the President: January 1979, table 30, p. 128; Lindenberg-Ross: in "Tobin's *Q* Rates and Industrial Organization," *Journal of Business* 54:1–32.

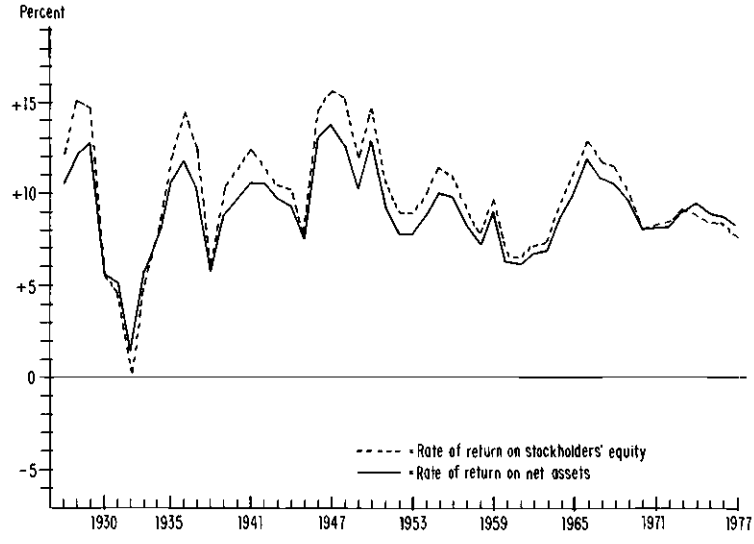

Fig. 2.5 Net rates of return, 1927–77.

stock; analogous calculations using book values yield similar figures. An inventory valuation adjustment (IVA) was not included in the figure 2.5 data because the database at present does not contain the information necessary to compute IVA prior to 1960. However, an IVA is presented in table 2.9, which compares various rates of return for the 1961–70 and 1971–77 periods. Coupled with the information presented in figure 2.3 and table 2.5, these results confirm the significant decline which has recently occurred in the securities markets' valuation of assets relative to the returns generated by those assets. When we consider the differences in sampling procedures, the rates of return (inclusive of IVA) presented in this study are close to those reported by Brainard et al. (1980, table 1, p. 463). Their estimates for the rate of return on net assets are 7.8% and 6.9% for the 1961–70 and 1971–77 periods, respectively, compared with the estimates of 8.7% and 7.5% presented in table 2.9.

The rates of return reported in table 2.9 ignore the effects of both actual and expected inflation upon the real value of the firms' financial

Table 2.9 **Rates of Return (%)**

	Rates of Return on Stockholders' Equity		Rates of Return on Net Assets	
	With IVA	Without IVA	With IVA	Without IVA
1961–70	9.3	9.7	8.7	9.1
1971–77	6.3	8.6	7.5	9.0

assets and liabilities. In particular, the component of the rate of return on net assets which reflects the tax deductibility of the inflation premium contained in nominal interest rates is not included in the calculations. Also, no allowance is made for the distributional effects of realized inflation versus anticipated inflation between creditors and stockholders. However, because the difference between paper assets and paper liabilities, relative to total net assets, is only +0.02 for 1961–70 and −0.055 for 1971–77, one would expect these effects to be small.

2.2.4 Conclusion

This section has presented some of the aggregate characteristics of the sample of manufacturing firms for the years 1926–77. The results, as regards the postwar period, are broadly consistent with those obtained by other researchers. That is, the data illustrate the increasing importance of external financing—particularly debt—as a source of funds for firms' real investment expenditures. The results also illustrate the dramatic decline that has occurred in the past 15 years in the securities markets' valuation of net assets relative to replacement values, and also relative to rates of return.

2.3 Balance Sheet Flows, 1966–77 and 1927–35

This section of the paper presents a simple portfolio model explaining the responses of nine balance sheet items to changes in firms' net cash flow, defined as additions to retained earnings plus depreciation allowances, and Tobin's q. The idea underlying the model is that firms face different constraints, and behave differently, when attempting to increase their stock of physical capital than when trying to reduce it. The framework for the investment model is the familiar flexible accelerator model of investment behavior which relates investment to the discrepancy between a desired and actual capital stock.

In the special case where the elasticity of the marginal product of capital with respect to the desired stock is unity, the market value of the existing capital stock provides an estimate of the desired stock. This is the rationale for relating the ratio of fixed investment to capital stock to Tobin's q. However, fixed investment expenditures represent only one use of a firm's resources, and thus only one part of the portfolio decision. The flows of other assets and liabilities must be considered simultaneously, if for no other reason than that the investment expenditures must be financed. The approach taken here is that firms simultaneously determine all asset and liability flows given a desired firm size—as represented by q—and given their cash flow, which is assumed exogenous to the portfolio decision.

The final feature to be incorporated into the model is an allowance for

asymmetric behavior in expansionary and contractionary regimes. For the simplest case of a firm for which the speed of capital accumulation is limited by variable adjustment costs and for which decumulation is limited by the rate of physical depreciation, the structural parameters of the investment function would reflect the adjustment costs when net investment is positive and would be zero otherwise. Again, if there is an asymmetric response of investment to changes in the independent variables depending on whether further investment is profitable or not, then there must be an asymmetric response in at least one other balance sheet flow. To estimate such a model, then, it is necessary to classify firm observations into these two regimes. An effective way to jointly classify the observations and estimate the model's parameters is by means of a switching regression (Day 1969). We now outline this procedure.

For the two-variable case, the estimation procedure can be described as follows. Given T observations on a dependent variable y_t and an independent variable x_t, we desire to estimate for each observation the probability, p_t, that the observation is generated by one regime or the other. Let

$$\text{Regime I} \qquad y_t p_t^{1/2} = \beta_1 x_t p_t^{1/2} + \epsilon_{1t} p_t^{1/2}$$

$$\text{Regime II} \qquad y_t(1-p_t)^{1/2} = \beta_1 x_t(1-p_t)^{1/2} + \epsilon_{2t}(1-p_t)^{1/2}, \; t = 1, \ldots, T,$$

$$E(\epsilon_{jt}) = 0, \; E(\epsilon_{jt}^2) = \sigma^2, \; j = 1, 2.$$

If we assume that a fixed proportion of the population, λ, is generated by Regime I, the likelihood of an observation can be expressed as

$$L(\beta_1, \beta_2, \lambda, \sigma^2) = \lambda L_1(\beta_1, \sigma^2) + (1-\lambda) L_2(\beta_2, \sigma^2).$$

Further assuming the ϵ_{jt} to be normal and independently distributed, the likelihood of a sample is

$$L(\beta_1, \beta_2, \lambda, \sigma^2) = \left(\frac{1}{2\pi\sigma^2}\right)^{T/2} \prod_{t=1}^{T} \Big\{ \lambda \exp[-(y_t - \beta_1 x_t)^2/2\sigma^2] + (1-\lambda) \exp[-(y_t - \beta_2 x_t)^2/2\sigma^2] \Big\}.$$

Maximizing the logarithm of this latter expression with respect to its four arguments,

$$\hat{\beta}_1 = \frac{\Sigma y_t x_t \hat{p}_t}{\Sigma x_t^2 \hat{p}_t}, \; \hat{\beta}_2 = \frac{\Sigma y_t x_t (1-\hat{p}_t)}{\Sigma (1-\hat{p}_t) x_t^2}, \; \hat{\lambda} = \frac{1}{T} \Sigma \hat{p}_t,$$

$$\hat{\sigma}^2 = \frac{1}{T} \Sigma [(y_t - \hat{\beta}_1 x_t)^2 \hat{p}_t + (y_t - \hat{\beta}_2 x_t)^2 (1-\hat{p}_t)].$$

Let $\text{pr}(I, y_t) = \hat{\lambda} \exp[(y_t - \hat{\beta}_1 x_t)^2/2\hat{\sigma}^2]$, the joint probability of Regime I and y_t, $\text{pr}(y_t) = \text{pr}(I, y_t) + (1-\hat{\lambda}) \exp[(y_t - \hat{\beta}_2 x_t)^2/2\sigma^2]$, the marginal

probability of y_t; then $\hat{p}_t = \text{pr}(I, y_t)/\text{pr}(y_t)$, the conditional probability of Regime I given y_t.

To obtain the empirical results presented below, a switching regression relating investment to q and net cash flow is estimated iterating on the four first-order conditions as described by Kiefer (1980). Given these estimated parameters, the $\hat{p}_t$ are computed and used to weight the observations in the regressions which explain changes in other balance sheet items.

2.3.1 Data

To apply the procedure outlined above, data from the first two panels, 1931 and 1936, and the last two panels, 1972 and 1978, were combined to give 9 annual observations (1927–35) for the earlier period and 12 (1966–77) for the later period. To make the data in two neighboring panels more compatible, information on firms that overlap was used to adjust the means of the nonoverlapping firms in each separate period. This is done assuming, for each variable, that had a nonoverlapping firm been represented in both panels, its mean would have changed between panels in the same way as for the average overlapping firm. For the earlier period there are 12 overlapping firms, and 11 in the later period.

Tobin's q is adjusted and redefined for each firm as the ratio of observed q to the mean value of q over the particular sample period. This is done to correct for persistent deviations of q above unity due to the capitalization of monopoly rents. The q variable enters the regressions with a lag of 1 year, while the net cash flow variable enters contemporaneously. All variables are measured as deviations around firm means.

2.3.2 Balance Sheet Flow Definitions

The nine dependent variables of interest, measured in current period prices, are

1. Investment: additions at cost.
2. Δcash assets: Δ[total current assets minus inventories minus accounts receivable].
3. Δinventories: Δ[FIFO inventories] minus capital gains (estimated residually for 1927–35).
4. Δnet accounts receivable: [accounts receivable minus accounts payable].
5. Δother long-term assets: Δ[book value of plant and equipment minus additions at cost plus excess of cost over book value of acquisitions] (estimated residually for 1966–77).
6. Δshort-term debt: Δ[debt due in less than one year].
7. Δlong-term debt: long-term debt issues minus retirements.
8. Δcommon equity: [equity issues minus equity retirements].
9. Δother short-term liabilities: Δ[total current liabilities minus accounts payable].

These variables are all measured relative to total net assets, lagged 1 period. Due to the balance sheet constraint, an unit increase in cash flow will result in a unit increase in the difference between the sum of the asset flows and the sum of the liability flows, whereas a unit increase in q will leave this difference unchanged.

2.3.3 Results for 1966–77

The results of estimating the investment switching regression, computing the regime probabilities, and employing them in estimating equations for the other eight balance sheet flow items for the 1966–77 period appear in table 2.10. The estimate of the mixing parameter, λ, is 0.302, which indicates that about 30% of the observations are classified into Regime I (expansion) and about 70% into Regime II (contraction). The parameter estimates indicate substantial differences in balance sheet flows, resulting from changes in both q and cash flow (CF), between regimes. With the exception of net accounts receivable, the Regime I coefficients for q are larger for all flow items than those for Regime II, and, with the exception of cash assets, the same is true for the CF coefficients.

The Regime I results indicate that substantial portfolio reallocations take place in response to increases in q and CF. On the asset side of the balance sheet, the largest responses to changes in both q and CF are in

Table 2.10 **Balance Sheet Flows Due to Unit Increase in q or Net Cash Flow (CF) (Manufacturing Firms, 1966–77)**

	Assets			Liabilities	
Flows	q	CF	Flows	q	CF
A. Regime I (λ = .302):					
Investment	.038	1.75	Δshort-term debt	.035	.386
Δcash assets	−.006	−.015	Δlong-term debt	.098	1.44
Δinventories	.028	.840	Δcommon equity	.024	.779
Δnet accounts receivable	.009	.170	Δother short term	.001	.324
Δother long term	.083	1.19			
Sums	.152	3.93	Sums	.158	2.92
B. Regime II ([1 − λ] = .698):					
Investment	.019	.237	Δshort-term debt	.017	.018
Δcash assets	−.014	.204	Δlong-term debt	.061	.203
Δinventories	.017	.494	Δcommon equity	.001	.177
Δnet accounts receivable	.012	.138	Δother short term	−.007	.284
Δother long term	.036	.574			
Sums	.070	1.65	Sums	.072	.682

Note: The difference between asset and liability column sums may not add to zero or one due to rounding.

real assets: plant and equipment, inventories, and other long-term assets. Recalling that other long-term assets primarily represent acquisitions, it is not surprising that its q coefficient is larger than that reported for investment expenditures. On the liability side, this increase in fixed assets is accompanied primarily by increases in long-term debt and common equity.

Contrary to prior expectations, cash flow is a more important variable in classifying observations between regimes than q, the respective standard deviations of CF and q being 0.02 and 0.30.

Figures 2.6–2.9 plot the results of aggregating the variables of the investment equation across firms, by regime, using the estimated classification probabilities as weights. That is, the label p^*q is $\Sigma_i \hat{p}_{it} q_{it}$. Given the underlying model, the appropriate variables to include in equations explaining aggregate balance sheet flow variables would be P^*q, $(1 - P)^*q$, P^*CF, and $(1 - P)^*$CF. This procedure would account for the changing distribution of firms by regime.

For example, it can be seen from figure 2.8 that while aggregate q was falling during 1973, the proportion of firms classified into Regime I increased dramatically, actually increasing P^*q. This provides a possible explanation for the fact that investment was increasing during a period when aggregate q was falling.

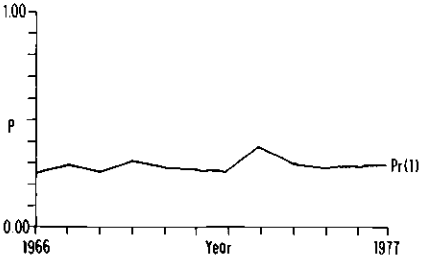

Fig. 2.6 Regime proportions, 1966–77.

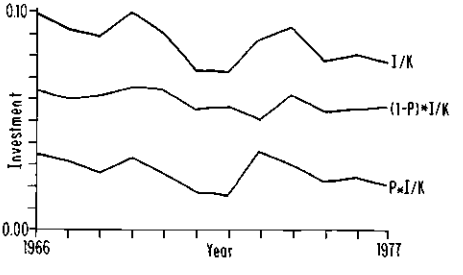

Fig. 2.7 Investment/assets, 1966–77.

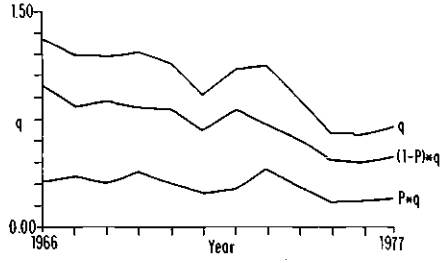

Fig. 2.8 q and its components, 1966–77.

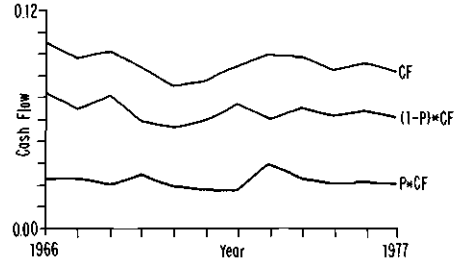

Fig. 2.9 Cash flow/assets, 1966–77.

2.3.4 Results for 1927–35

The same set of regression equations was estimated for the years 1927–35, but for this earlier period the sample is split into durable-goods and nondurable-goods firms. For the 1966–77 period the difference in results due to this disaggregation was sufficiently minor to warrant pooling the firms. For the earlier period, there are significant timing differences in the peaks and troughs of many of the variables. The 1927–35 results appear in table 2.11 (durables) and table 2.12 (nondurables). Figures 2.10–2.17 plot the results of aggregating the variables of the investment equation across firms, by regimes, using the estimated classification probabilities as weights.

For both durable and nondurable goods samples the observations are about evenly divided between regimes. Qualitatively, the results for the durable-goods sample are very similar to the results reported for 1966–77, but quantitatively unit changes in q and CF do not induce such large portfolio reallocations. This can be explained, at least in part, by firms' greater reliance on internal sources of funds in the earlier period.

On the other hand, the results for the nondurable-goods sample indicate that the data are inconsistent with our underlying model. While there is some difference in the coefficient estimates across regimes, these

Table 2.11 **Balance Sheet Flows Due to Unit Increase in q or Net Cash Flow (CF) (Durable-Goods Firms, 1927–35)**

	Assets			Liabilities	
Flows	q	CF	Flows	q	CF
A. Regime I (λ = .487):					
Investment	.038	.388	Δshort-term debt	.003	.038
Δcash assets	−.013	.131	Δlong-term debt	.009	.079
Δinventories	.003	.641	Δcommon equity	.011	.093
Δnet accounts receivable	−.008	.164	Δother short term	−.014	.092
Δother long term	−.004	−.006			
Sums	.016	1.31	Sums	.009	.303
B. Regime II ([1 − λ] = .513):					
Investment	.018	.085	Δshort-term debt	.008	.007
Δcash assets	−.026	.186	Δlong-term debt	.008	−.065
Δinventories	.026	.663	Δcommon equity	.009	.032
Δnet accounts receivable	−.006	.067	Δother short term	−.014	.055
Δother long term	−.002	.028			
Sums	.010	1.03	Sums	.011	.029

Note: The difference between asset and liability column sums may not add to zero or one due to rounding.

Table 2.12 **Balance Sheet Flows Due to Unit Increase in q or Net Cash Flow (CF) (Nondurable-Goods Firms, 1927–35)**

	Assets			Liabilities	
Flows	q	CF	Flows	q	CF
A. Regime I (λ = .546):					
Investment	.016	.238	Δshort-term debt	−.008	.067
Δcash assets	−.014	.068	Δlong-term debt	−.002	.088
Δinventories	−.043	.984	Δcommon equity	−.008	.185
Δnet accounts receivable	−.004	.111	Δother short term	−.018	.069
Δother long term	.010	.021			
Sums	−.035	1.42	Sums	−.036	.409
B. Regime II ([1 − λ] = .454):					
Investment	.017	.032	Δshort-term debt	−.008	.041
Δcash assets	−.023	.142	Δlong-term debt	.003	−.054
Δinventories	−.038	.931	Δcommon equity	−.011	.216
Δnet accounts receivable	−.002	.101	Δother short term	−.016	.061
Δother long term	.008	.057			
Sums	−.038	1.26	Sums	−.032	.264

Note: The difference between asset and liability column sums may not add to zero or one due to rounding.

differences do not provide much discriminatory power because of relatively large standard errors of estimate.

Examining the figures which plot the aggregate variables for the 1927–35 period, one can see that the timing, at turning points, between our independent variables and investment is not very supportive of the underlying model. Figures 2.12, 2.13, and 2.14 clearly show, for instance, that investment started its long decline at least one year before q and CF. Also, investment bottomed out in 1932, while q reached its minimum in 1933.

2.4 Summary and Conclusions

This paper has reported the results of a research project which involved collecting and organizing income account and balance sheet data, at the firm level, for the years 1926–77. Aggregate characteristics of the sample, including sources and uses of funds, financial market valuations, and rates of return, were presented and discussed. Another section of the paper presented the results of estimating a simple portfolio model, explaining a number of balance sheet flows using the firm-level data.

The dataset should provide other researchers with a rich source of information against which specific hypotheses regarding corporate financing and investment decisions can be tested.

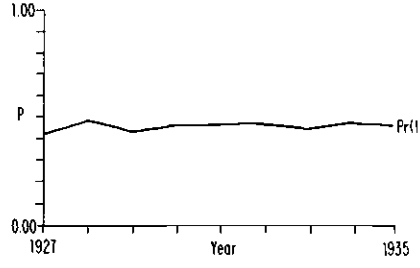

Fig. 2.10 Regime proportions, durables.

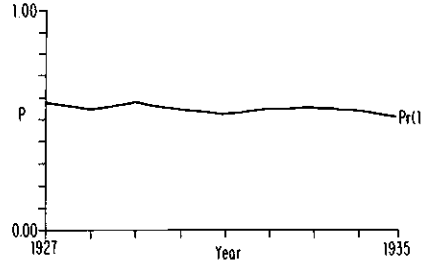

Fig. 2.11 Regime proportions, nondurables.

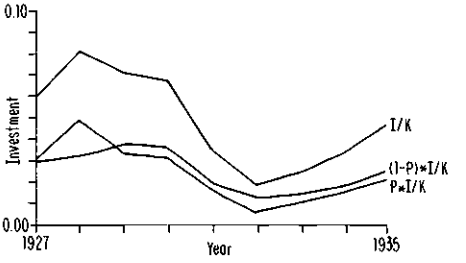

Fig. 2.12 Investment/assets, durables.

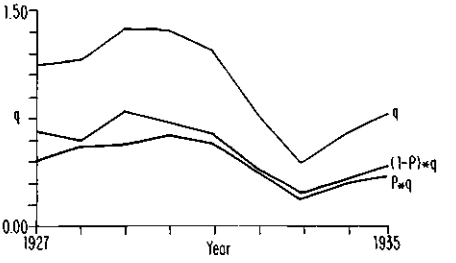

Fig. 2.13 q and its components, durables.

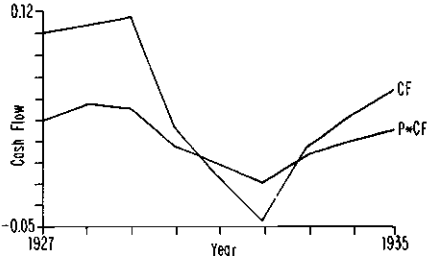

Fig. 2.14a Regime I, cash flow/assets, durables.

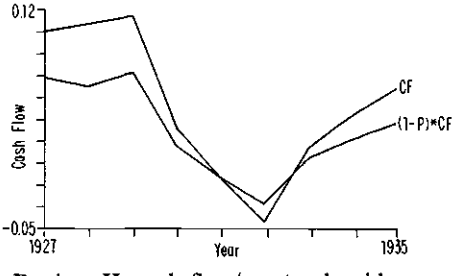

Fig. 2.14b Regime II, cash flow/assets, durables.

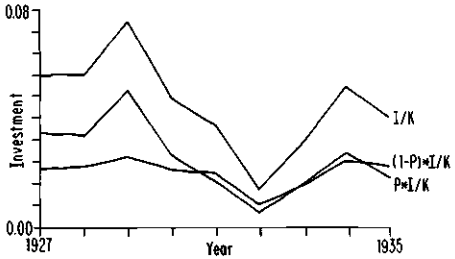

Fig. 2.15 Investment/assets, nondurables.

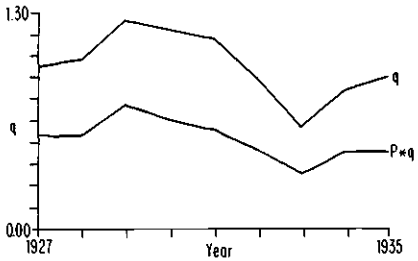

Fig. 2.16a Regime I, q and its components, nondurables.

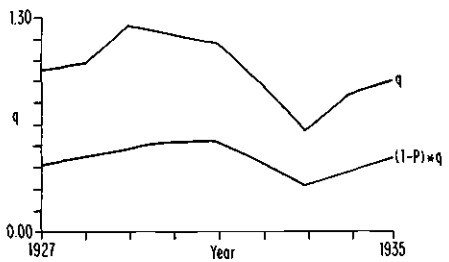

Fig. 2.16b Regime II, q and its components, nondurables.

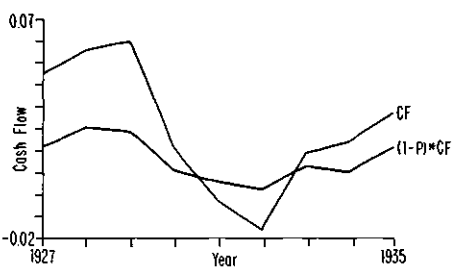

Fig. 2.17a Regime I, cash flow/assets, nondurables.

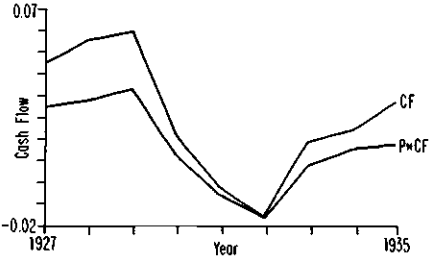

Fig. 2.17b Regime II, cash flow/assets, nondurables.

Appendix

Description of the PANEL Data Set

The PANEL Data System provides income and balance sheet data on a sample of manufacturing firms for the years 1926–77. The sample of firms is actually composed of nine separate subsamples (panels) drawn periodically from various editions of *Moody's Industrial Manual*. The general composition of the sample is outlined in table 2.1.

The goal was to obtain randomly drawn subsamples of size 50, but this was not possible for all panels given our requirements regarding accounting procedures. These criteria involve fiscal year, degree of consolidation, and, in the cases of firms purchasing other firms, accounting based on a pooling of interest. Also, natural-resource-intensive firms are excluded.

The large quantity and several dimensions of these data necessitate a second component of the PANEL Data System—an integrated set of computer programs which enable the user to access the data in each of several modes and manipulate it for research purposes.

This section of the Appendix describes the data available in each of the nine panels. Section A.1 describes the original, or raw, data and section A.2 describes the transformations that are currently contained in the PANEL Data System.

A.1 Raw Data

Fifty-two items of raw data are available for each firm in each panel. The first line is a firm header card giving the year of the panel (e.g., 1972), an eight-letter firm identification code, the firm's name, a durable/nondurable classification, the bond rating of the most recently issued debt security, and the page number from *Moody's* from which the firm's data was generated. The bond rating symbol NR indicates that the firm's debt is unrated. An example of a header card from the 1954 panel of data is

PANEL 1954 BRISTOL-MYERS CO. [n A p. 1362.]

Following each header card, there are 51 lines of raw numerical data. For instance, the line following the header card listed above is

01 55462,56611,61617,52266,42778,45308,44655.

Item 01 is sales and the data are in thousands of dollars, for years 1953, 1952, . . . , 1947. Thus, in 1953 Bristol-Myers had sales of $55,462,000. In 1947, sales were $44,655,000.

Section A.3 of the Appendix lists the variable symbols as they appear on printed output, along with a brief description of each of the 52 data items.

Most of the 52 raw data items listed are self-explanatory. However, some of the data items require additional explanation, and this is done below. Also, some of the data items are not available for each of the nine panels. These exceptions are also discussed below.

Data Item 23, SPLIT V.

This variable records information on the stock splits and stock dividends. For a firm which splits its stock two for one, SPLIT V would equal two. If the firm pays a 10% stock dividend, this V variable would take on the value 1.10. The main use of SPLIT V is in allowing one to distinguish between issues and retirements of common equity, on the one hand, and splits and stock dividends on the other. Thus, this variable must be used in computing new issues and retirements of equity.

Data Item 24, PF NONT.

PF NONT is the amount of preferred dividends associated with a firm's nontraded preferred stock. To value nontraded preferred stock, PF NONT is capitalized by a preferred dividend-price ratio which is user supplied. Currently, the PANEL Data System contains a preferred dividend price ratio corresponding to *Moody's* "medium grade industrials."

Data Items 38 and 42.

These items give the coupon, maturity date, date of issue, date on which sinking fund begins, amount authorized, and amount outstanding for the traded debt issues number 1 and 2, respectively.

Data Item 45.

This data item gives an estimate of the replacement value of a firm's inventories. The estimates in many cases are actually provided by the firms themselves in footnotes to the *Moody's* tables. When the only information available is the proportion of inventories in LIFO and the

length of time LIFO has been used, one of 20 available price indices is used to estimate the replacement value of LIFO inventories. FIFO inventories are assumed to equal replacement value.

Data Item 46.

This variable is the reported proportion of a firm's inventories that is under the LIFO accounting method.

Data Item 47.

This is the price index associated with a firm's FIFO inventories. It is used to compute an IVA. It is not necessarily the same price index that is used in constructing a replacement estimate for the LIFO portion of inventories.

Availability of Data Items.

All 52 data items are not available for all panels. Items 45–51 are available only for the 1978 panel (years 1971–77). Item 19, additions at cost, and item 1, sales, are not reported for the 1931 and 1936 panels. Data item 1 for the 1931 and 1936 panels is replaced with the variable "income taxes."

A.2 Variable Transformations

The PANEL Data System permits the user to define up to 76 variable transformations. The current version of subroutine AGGREG contains 53 transformations. In performing transformations the user can introduce external data via the data file AGGREG. Currently, a capital stock deflator (DEFL), preferred stock dividend-price ratio (PDIV), inventory deflator (PIN), and bond price index (BONDP) are present in the AGGREG file. DEFL is used to convert firms' capital stock (data item 14), which is measured on a historical cost basis, to a replacement cost basis; PIN serves a similar function for inventories. PDIV is the (medium-grade industrial) preferred dividend-price ratio used to capitalize the dividends paid on the nontraded preferred stock. BONDP is a bond price index.

The transformations currently programmed are listed in section 4 of the Appendix.

The PANEL data system software provides access to the data, computation of various averages, and regression of PANEL variables. The PANEL software and data set is available from the authors in either an IBM 370 or VAX 11/780 format for a nominal fee.

A.3 Listing of the PANEL Data Items

# 1 : SALES	Net sales
# 2 : OPER INC	Income from operations
# 3 : TOT PFT	Total income before interest and taxes
# 4 : INT EXP	Interest expense
# 5 : DEPREC	Depreciation (as reported in property acc'ts.)
# 6 : NET INC	Net income (avail. for pref/common dividends)
# 7 : PREF DIV	Preferred dividends
# 8 : COMM DIV	Common dividends
# 9 : MAINT	Expenditures for Maintenance and repairs
# 10 : ACC RECV	Accounts receivable
# 11 : INVENTRY	Inventory, book value
# 12 : TOT C.A.	Total current assets
# 13 : GROS PLT	Gross property account, book value
# 14 : NET PLT	Net property account, book value
# 15 : TOT ASST	Total assets (excluding intangibles)
# 16 : 1YR LIAB	Short-term debt and debt due in one year
# 17 : ACC PAY	Accounts payable
# 18 : TOT C.L.	Total current liabilities
# 19 : ADD COST	Additions at cost (gross P+E expenditures)
# 20 : HI PRICE	High price of common stock for year
# 21 : LO PRICE	Low price of common stock for year
# 22 : NR COMMN	Number of common shares at year end
# 23 : SPLIT V	Variable to adjust for stock splits, dividends
# 24 : PF NONT	Dividends on nontraded preferred stock
# 25 : PFD 1 HI	High price, first traded preferred stock issue
# 26 : PFD 1 LO	Low price, first traded preferred stock issue
# 27 : NR PFD 1	Number of shares, first traded preferred issue
# 28 : PFD 2 HI	High price, second traded preferred issue
# 29 : PFD 2 LO	Low price, second traded preferred issue
# 30 : NR PFD 2	Number of shares, second traded preferred issue
# 31 : CV NONT	Nontraded convertible debt, book value
# 32 : CV TRAD	Traded convertible debt, book value
# 33 : CV 1 HI	High price of traded convertible debt
# 34 : CV 1 LO	Low price of traded convertible debt
# 35 : DET 1 HI	High price, first traded debt issue
# 36 : DET 1 LO	Low price, first traded debt issue
# 37 : DET VAL	Book value, first traded debt issue
# 38 : ITEM 38	(See text)
# 39 : DET 2 HI	High price, second traded debt issue
# 40 : DET 2 LO	Low price, second traded debt issue
# 41 : ITEM 41	Book value, second traded debt issue

# 42 : ITEM 42	(See text)
# 43 : NT LDEBT	Book value, nontraded debt
# 44 : TOT LTD	Total book value of all long-term debt
# 45 : ITEM 45	Inventory at replacement value
# 46 : ITEM 46	Proportion of inventories in LIFO
# 47 : ITEM 47	Price index for FIFO portion of inventories
# 48 : ITEM 48	Deferred taxes
# 49 : ITEM 49	Deferred compensation (incl. unfunded pensions)
# 50 : ITEM 50	Minority interest
# 51 : ITEM 51	Other long-term liabilities
# 52 : Durable	Durable/nondurable indictor

A.4 Listing of the PANEL Transformations

# 1 (Firmavg # 53) : TOT NASS	Total net assets (TA)
# 2 (Firmavg # 54) : MV DEBTR	Mkt. value debt/TA
# 3 (Firmavg # 55) : MV PREFR	Mkt. value preferred/TA
# 4 (Firmavg # 56) : MV EqtyR	Mkt. value equity/TA
# 5 (Firmavg # 57) : Q	Tobin's q (#1 + #2 + #3)
# 6 (Firmavg # 58) : CASH R	Cash assets/TA
# 7 (Firmavg # 59) : MISC R	Misc. net assets/TA
# 8 (Firmavg # 60) : INVT R	Inventories/TA
# 9 (Firmavg # 61) : Liab R	S.T. liabilities/TA
# 10 (Firmavg # 62) : RECV R	Net receivables/TA
# 11 (Firmavg # 63) : REPL R	Plt. + equip.(repl.)/TA
# 12 (Firmavg # 64) : INV/CAP	Inventory(book)/TA
# 13 (Firmavg # 65) : DEF TAX	Deferred taxes/TA
# 14 (Firmavg # 66) : Oth Liab	Other liabilities/TA
# 15 (Firmavg # 67) : MIN INT	Minority interest/TA
# 16 (Firmavg # 68) : CFLO R	(Internal use)
# 17 (Firmavg # 69) : PF ISSUE	Value new pref. issues/TA
# 18 (Firmavg # 70) : PF RETIR	Cost retirements, pref./TA
# 19 (Firmavg # 71) : Eq Issue	Value new equity issues/TA
# 20 (Firmavg # 72) : EQ RETIR	Cost retirements, equity/TA
# 21 (Firmavg # 73) : DET NEW	Value new debt issues/TA
# 22 (Firmavg # 74) : DET RETR	Cost retirements, debt/TA
# 23 (Firmavg # 75) : RE	Add. to retained earnings/TA
# 24 (Firmavg # 76) : CF	Cash flow/TA
# 25 (Firmavg # 77) : GG	(Internal use)
# 26 (Firmavg # 78) : GN	(Internal use)
# 27 (Firmavg # 79) : IG	Additions to plant + equipment/TA
# 28 (Firmavg # 80) : DEPR	Depreciation/TA
# 29 (Firmavg # 81) : ACQ	(Internal use)

# 30 (Firmavg # 82) : IGA	(Internal use)
# 31 (Firmavg # 83) : DC	Change in cash assets/TA
# 32 (Firmavg # 84) : DM	Change in misc. assets/TA
# 33 (Firmavg # 85) : DINV	Change in inventory/TA
# 34 (Firmavg # 86) : DCL	Change in current liabs./TA
# 35 (Firmavg # 87) : DREC	Change in net. acct.recv./TA
# 36 (Firmavg # 88) : XGG	(Internal use)
# 37 (Firmavg # 89) : YGG	(Internal use)
# 38 (Firmavg # 90) : DVR	Dividend/price ratio, common
# 39 (Firmavg # 91) : CG	Capital gain on common share
# 40 (Firmavg # 92) : DK	Common dividends/TA
# 41 (Firmavg # 93) : PFK	Preferred dividends/TA
# 42 (Firmavg # 94) : INK	Interest payments/TA
# 43 (Firmavg # 95) : FG1	(Internal use)
# 44 (Firmavg # 96) : NtDt Rat	Nontraded debt/TA
# 45 (Firmavg # 97) : ZGG	(Internal use)
# 46 (Firmavg # 98) : STDT RAT	Short-term debt/TA
# 47 (Firmavg # 99) : BOND IND	Bond index
# 48 (Firmavg # 100) : FIFO PR	Proportion of inventories FIFO
# 49 (Firmavg # 101) : I V A	Inventory valuation adjustment
# 50 (Firmavg # 102) : Aggr 50	(Internal use)
# 51 (Firmavg # 103) : Aggr 51	(Internal use)
# 52 (Firmavg # 104) : Aggr 52	(Internal use)
# 53 (Firmavg # 105) : Aggr 53	(Internal use)

Notes

1. Takeovers show up on the balance sheet in miscellaneous items as this variable contains the difference between the actual cost of an acquisition and its book value. Generally, acquisitions exceeding 10% of the purchasing firm's net assets disqualified the firm from the sample.

2. Debt due in less than 1 year is valued at book. Nontraded long-term debt is valued using a bond price index generated for each year for each subsample.

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Comment

Franco Modigliani

In this paper, Ciccolo and Baum report on their endeavor to collect income accounts and balance sheet data for a sample of industrial firms over the span from 1926 to 1977. They also give a number of results based on the analysis of these data. I will first comment briefly on their sampling procedure and their method of estimating various components of the balance sheet and of the income statement. The rest of my comments will deal with section 2.2, in which they report information on the structure of the balance sheet and its changes over the period, and on the composition of the sources and uses of funds and its changes. I will focus particularly on their discussion of the changing structure of the liability side.

The essence of Ciccolo and Baum's approach is to collect the basic data for each firm with utmost care. But given limited resources, in order to achieve this goal, they had to confine themselves to a rather modest sample of firms. Their target was a sample of 52 firms, but some of the firms had to be discarded for various reasons, and that left them with samples mostly just below 50.

Given the smallness of the sample, one might have expected that Ciccolo and Baum would have tried to oversample large firms—for instance, by sampling dollar of sales or dollar of assets, rather than firms. However, one gathers that in effect they sampled pages of *Moody's*. This procedure would give, presumably, more chance to larger firms to appear in the sample, but only to the extent that larger firms usually occupy more space in *Moody's*. On the whole, one has a feeling that their sample may be somewhat thin in the sense of being subject to significant sampling fluctuations.

Ciccolo and Baum's sampling design makes it possible to throw some light on this conjecture. In fact, their procedure consists in changing the

Franco Modigliani is Institute Professor and professor of economics and finance at the Massachusetts Institute of Technology.

sample of firms every 5 years, but with 1-year overlap. For instance, the first sample covers the years 1926–30, while the second covers the years 1930–35. Thus, for the year 1930, for 1935, and for every seventh year thereafter, we have information available from two different samples. In figure 2.3, one can compare some statistics for the outgoing and incoming samples. The top graph exhibits the ratio of the market value of all securities to the value of net of assets, at reproduction cost (basically, Tobin's q). In the two lower graphs, the numerator of the ratio is, respectively, debt plus preferred stock and debt only. It is apparent that there are nonnegligible differences in the value of these ratios at points of overlap. This fact raises some questions about the reliability of the statistics computed from the sample and creates further problems on appropriate methods of "splicing" the various samples. The authors seem generally to handle this problem by using, for every year of overlap, the mean of the two samples. Unfortunately, this procedure is very questionable, and possibly very misleading, raising serious problems in the interpretation of the results, as I shall point out shortly.

In table 2.2, the authors analyze the structure of the assets for the years of overlap (where the sample is roughly twice as large as in other years), plus the end points. I would like to remark on the classification of assets and liabilities in the table. Specifically, I have some qualms about the treatment of net current liabilities (except short-term debts) as a deduction from assets (a negative use) rather than as a source of funds. This practice is appealing in the sense that it leaves, on the sources side, only market instruments: debt, preferred stock, and equity. However, this procedure does tend to produce a distorted picture of the importance of individual assets and its change in time, at least when, as in the case of table 2.2, the share of "net current liabilities" has almost tripled early in the period. I note that many of the apparent movements in asset composition in table 2.2—some of them stressed by the authors—largely disappear when the shares are corrected by excluding "current liabilities." This holds for the overall trend of net property and much of the trend in net receivables. Even the large rise and fall in the cash items share is considerably flattened, though the decline over the postwar period as a whole remains impressive. This trend may, at least partly, reflect more efficient cash management induced by higher interest rates and computer technology. A part of this decline shows up as a rise in the net property share, but only in the last decade; over the entire period, on the other hand, this share has changed remarkably little.

Let me now come to the issue of leverage and its behavior during the recent period of rising inflation. This is an issue that is central both to the Ciccolo and Baum and the Taggart papers. The former cite Friedman's statement (1980) as an undisputed fact that since the mid-1960s "nonfinancial corporate businesses have become more reliant on debt secur-

ities in financing their growth" and that the "inflationary environment of the past 15 years has provided a powerful incentive for those with taxable incomes to increase their indebtedness." Similarly, Taggart states that "corporations' use of debt has undeniably increased in the post–World War II"—although both sets of authors do mention that current leverage is not out of line—and indeed may be low—in comparison with prewar and, more particularly, pre-Depression periods.

Now, I completely agree with the authors that all models of rational behavior, except possibly the recent model of Miller, do suggest that, under the present structure of the corporate and personal tax system, inflation gives a strong incentive to increase leverage if management is concerned with maximizing the market value of the firm and if at the same time markets behave rationally. In my view, however, markets have not behaved rationally during the last inflationary decade; they have tended to underestimate the profitability of levered corporations by failing to adjust profits adequately for the inflationary premium incorporated in nominal interest rates (see Modigliani and Richard Cohn 1979). As a result, levered firms have tended, on the whole, to be undervalued in the market, and that has counteracted the tax incentives to leverage. I would not, therefore, be surprised to find that, despite the inflation-induced increases in the gain, leverage has not appreciably increased over the last decade. Previous contributions have suggested that the evidence is consistent with this view (see e.g., references in the above paper). What I would like to argue is that, despite Ciccolo and Baum's statements, neither their evidence nor Taggart's supports the conclusion that leverage has significantly increased in the course of the inflation which began in the mid-1960s.

In the case of both papers, the evidence is of two kinds: stocks and flows. With respect to stocks, they measure the proportion of total financing that takes the form of debt, or debt plus preferred stock. With respect to flows, they examine the share of total sources of funds which consists of net new issues of debt instruments.

In the case of the stock analysis, one faces the issue of what is the aggregate amount to be financed against which the outstanding debt should be compared. As is well known, the three alternative measures are the book value of assets, the market value of assets as measured by the market value of the liabilities, and the reproduction costs of assets. These three measures would coincide in an ideal world of no inflation, no significant technological change, and no significant oligopolistic profits. Taggart actually gives all three measures even though the book value measure is, in my view, totally worthless and misleading in an economy which has experienced inflation as high, and for as long, as the American economy. It is certain to underestimate, on the average, the true value of assets as measured by any sensible economic measure, and to do so more

and more as inflation increases. It is therefore not surprising, but also totally uninformative, that when one uses this measure, one finds that the ratio of debt to the book value of assets has risen during the recent inflation.

The relevant choice, therefore, is between reproduction cost and market valuation. In the long run, of course, these two measures should tend to coincide—that is, Tobin's q (or at least marginal q) should tend to unity. But the problem with reproduction cost, aside from the difficulties of estimating it, lies in the fact that assets may, to some extent, be obsolete and that, therefore, no one would want to reproduce them—that is, their true economic value falls below reproduction costs. One might expect that this true value would tend to be captured by market valuation, and in this sense, the ratio of debt to market valuation may appear to be the most effective way of measuring leverage. On the other hand, what we are interested in measuring is leverage policy, or the desired financial structure which, one hopes, is only changing slowly over time. It is questionable that this desired structure can be reflected adequately in the ratio of debt to market valuation, which is swayed by the volatile market valuation of equity. On the other hand, the ratio of debt to reproduction cost should provide relevant information on leverage policy in the sense that current financial decisions must bear on the composition of funds needed to finance the current acquisition of assets which, clearly, must be at (re)production cost. So, insofar as firms do tend to have a consistent and stable policy with respect to financing of assets, then that ought to be reflected in the balance sheet at reproduction cost. To be sure, the reproduction cost measure will also be subject to a certain noise. But there is no reason to suppose that it will be systematically biased as a measure of target leverage—at least when this measure is more stable than the ratio based on market value.

Ciccolo and Baum's data are set forth in table 2.5, which gives the ratios of debt preferred and common stock at market value to the reproduction cost of net assets. The first impression that one may gather from this table (which is reinforced by the authors' comments) is that the debt ratio rose steadily from a low point in 1935 up to 1965—more than doubling—and that, since 1965, it has risen further, by another third, in the course of the recent inflation, to reach a peak in 1976–77.

One must first note that there are many features of their table that appear quite puzzling. One is the behavior of Tobin's q given in column 4. It would appear that the ratio of market value to reproduction cost was higher in both 1930 and 1935 than it was in 1926 and 1927, as well as in just about every other year except 1965 and marginally in 1959. Another puzzle is that the debt ratio in column 1 is a good deal lower, at least through 1959, than is suggested by other data, such as those reported by Taggart in his table 1.3. On the other hand, the preferred stock ratio is

amazingly high, at least until 1953. On the whole, the sum of debt and preferred appears to behave more reasonably than either of its components and also is a good deal more stable. But, even if one confines oneself to the behavior of the debt ratio, one can see, by comparing table 2.4 and figure 2.3, that the systematic rise in leverage, beginning with 1965, which is exhibited in the first column of table 2.4, is largely the result of the doubtful procedure adopted in splicing together overlapping samples. Specifically, the higher ratio reported for 1971 and 1976–77 over 1965 reflects the shift in 1971 to a new sample which had a larger debt ratio (as well as a very much larger preferred stock ratio). To be sure, the 1965 sample does indicate a modest rise in leverage until 1971. But then the 1971 sample shows a roughly equal decrease between 1971 and 1977. For the sum of preferred and debt, the stability of the share is even greater; it was roughly the same at the end of the period as it was in 1965 on the basis of the 1959 sample. On the whole, there does seem to be a substantial rise in leverage between the war period and 1965, that is, during the period of relative price stability. This rise could be accounted for by a gradual return toward the pre-Depression target leverage which had been greatly reduced by the fiscal and financial policies of the war period. But, from that time on, there is no more systematic growth in leverage through 1976. This picture is supported by Taggart's data on the ratio of debt to assets at replacement cost reported in his table 1.3. The figures of columns 2 and 3 show that the debt ratio did rise somewhat from the low point at the end of the war through the 1950s and the first half of the 1960s. To be sure, his data do show a rise in the last 2 years, but, since that estimate comes from another source which is available for just 2 years, I would hesitate to make much of this small rise.

The picture is rather different if we look at the ratio of debt to market value. Taggart's estimates in table 1.2 reveal a rather substantial rise from 1965 through the late 1970s, especially if for the First War period one relies on the von Furstenberg's estimates in columns 2 and 3. Similar results were reported by Ciccolo and Baum in a table which has been dropped from the final version.

However, as pointed out earlier, the ratio of debt to the market value of the firm can not be regarded as a reliable measure of target leverage because it is largely swayed by movements in the market value of equity. This is particularly true for the more recent period since 1965. In particular, comparing the leverage measured at market value with the leverage measured at production cost suggests that the rise in the market value measure reflects to a large extent the depressing effect of inflation on the stock market, which by now is well documented, even if there still may be some disagreement as to the best way of explaining it.

When one comes to the evidence provided by the source of fund flows, the situation is very different. Taggart's table 1.4 shows an enormous rise,

roughly a doubling, in the ratio of total debt to total sources from the war years to the 1950s, and another 50% rise from the 1950s to 1970s. Ciccolo and Baum's figures in table 2.4 also show a very substantial rise in net issues of debt, at least since the mid-1960s. But I was amazed to discover that both sets of figures are meaningless because they are not adjusted for inflation. We know, in fact, that with rational markets (and nondistorting taxes) Fisher's law holds, increasing the interest bill by pD. Hence, the after-interest cash flow goes down by pD, which amount, in turn, represents a compensation to lenders, because the real debt decreases to that extent. Thus, in order to maintain the initial flow of (real) investment, and dividends, and an *unchanged* real debt and leverage, firms have to increase their debt by pD more than without inflation. Or, equivalently, to find out whether leverage is changing, one has to adjust the change in nominal debt by subtracting pD, which amount must, at the same time, be added back to measured gross internal funds, because true profits, and hence retained profits, are underestimated by pD. (The same result should roughly hold, even under the current [distorting] American tax system, except that Fisher's law has to be replaced by a generalization sometimes labeled "Super Fisher's" law).

The size of the bias in relative share of debt financing generated by failure to make the proper inflation corection depends on the rate of inflation, the size of leverage, and the rate of real growth. While I have not attempted to make that correction, rough calculation sugests that both for Taggart and for Ciccolo and Baum, much of the apparent growth in the share of debt financing since 1965 would disappear with the proper adjustment.

I conclude, therefore, that there is no convincing evidence that target leverage has changed appreciably since the beginning of inflation in the second half of the 1960s, even though most theories would suggest that inflation does increase the tax avoidance benefits that can be reaped from leverage. As I suggested earlier, one possible explanation for the discrepancy between what one should expect and what happened could be inflation fallacies, in the guise of confusion between nominal and real interest rates. To be sure, Miller's model could also be consistent with this evidence since, in that model, leverage would presumably have no value, in equilibrium, independently of the rate of inflation. But I find that model unacceptable in terms of explaining observed facts. For, if the total market value of firms were, in fact, independent of leverage, then investors in low tax brackets would have an advantage in acquiring more levered firms and unlevering them on personal account, which is inconsistent with the value of firms being unaffected by leverage.

It is less clear how Taggart's eclectic model would be affected by growing inflation. But, one would presume that even, in his view, given

the current tax structure, a rise in inflation should produce some increase in demand and, hence, presumably, induce a higher supply of leverage.

Let me finally conclude by noting that the empirical data on the behavior of financial structure of both the Ciccolo and Baum and Taggart papers are taken entirely from the history of the U.S. corporate sector. There is, however, another set of data which could be very useful in assessing the explanatory power of alternative theories. It consists of data bearing on the financial structure prevailing in other industrial countries. Anyone who has had an opportunity to look at the experience of foreign countries cannot fail to be impressed by the fact that, almost everywhere in the rest of the world, leverage is far greater than in this country, and is frequently of a size that would be considered here absolutely unsound, no matter what kind of firm one is dealing with. The only exception I know is Canada, presumably because of the contagion from the United States. But high leverage seems to prevail in most of Europe, from France and Italy to Germany, England, Sweden, and the other Scandinavian countries, and it probably is even greater in the case of Japan. These countries differ from each other and from the United States in many important ways, such as in terms of the structure of taxes, the structure of intermediation, the nature of the relation between banks and industry, and also in the structure of wealth holding, and perhaps in its concentration; also, in attitudes toward risk, and in the extent of credence placed on information provided by corporate accounting. It would be fascinating to see which, if any, of the models which have been developed to account for leverage in the United States could explain differences between countries.

Reference

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