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CHAPTER 5 VALIDITY OF THE RISK MEASURES

The preceding two chapters focused on what data are and are not available and on the problems involved in their interpretation. Before making use of these series, we must ascertain that they do in fact measure credit risk. Thus, we now turn to the analytical tests of the validity of the data.

We have found three basic types of these series: collection difficulties, risk-related characteristics and credit ratings. The losses, foreclosures, delinquencies, etc., that comprise the first group are direct *ex post* measures of actual lending experience and, thereby, of credit risk. The time series on credit terms, borrower characteristics and credit ratings, however, are not direct measures of credit risk and require validation. Before they are used as indicators of risk, they must be shown to be related in a significant way to one or another of the measures of credit difficulty.

A number of the characteristics for which time series are available have not been directly validated; that is, no test has been made which covers that specific characteristic for that specific type of credit instrument. The evidence is broadest and deepest for consumer instalment loans and home mortgages. In cases where evidence is sparse or absent, we rely on the circumstantial evidence provided by tests of similar characteristics or tests of the same characteristic for other credit instruments.

The tests cited below were carried out by many different investigators. No attempt is made to provide complete summaries of their findings, nor to be exhaustive in terms of all the research of this type. The intention is, rather, to present a synopsis of the major evidence linking the loan and borrower characteristics that we use as indicators of risk to the measures of collection difficulties.

Ratios of Debt and Debt Payments to Income

The first general class of risk-related characteristics that will be discussed are the debt-to-income and debt-payments-to-income ratios. Table 4

summarizes the series of this class that are listed in Part II of this volume.

These ratios are of several types and they tell us different things about the risk position of the credit structure. One type, the aggregate ratios of debt outstanding to income, show what is happening to the volume of credit in a particular sector of the economy relative to the flow of income that is the primary source for its repayment. They are, therefore, a measure of the burden of the aggregate debt in that sector of the economy.

These ratios are closely related to the maturities of the credit instruments — the longer the maturities, the higher the ratio. Although the evidence is mixed, as we shall see, longer maturities are usually associated with a higher incidence of collection difficulty, suggesting a similar relationship for debt-to-income ratios. In addition, a larger debt generally means a lower equity in the item for which the credit was used and this tends to reduce the incentive for the borrower to repay the debt.

A second ratio of this type, also an aggregate measure, relates the dollar volume of debt payments — principal and interest or interest alone — to income. Despite the fact that this ratio does not pick up the quality-effect of the maturity, in the household sector at least (and perhaps elsewhere), debt payments appear to be a more appropriate numerator than debt outstanding for the ratio to disposable personal income. Since almost all present-day consumer and home mortgage debt is amortized on a regular monthly schedule and the balance outstanding is generally not callable under normal circumstances, the ratio of debt service requirements to income may be a better measure of the relative burden of household debt than the ratio of outstanding debt to income.¹

The chief disadvantage of both types of measurement lies in their aggregative nature; for example, debt repayments of all consumer debtors

TABLE 4
Measures of Credit Risk:
A. Ratios of Debt or Debt Payments to Income

| | Source ^a | No. of Series | | Source Notes, Page |
|--|-------------------------------|---------------------|-------------------|--------------------|
| | | Listed ^b | Data ^b | |
| <i>I. HOUSEHOLD SECTOR, CONSUMER INSTALMENT CREDIT</i> | | | | |
| 1. Aggregate ratios of total debt or payments to total income. | FRB, OBE, Gorman | 4 | 3 | 259 |
| 2. Ratios of debt or payments to income, debtor families. | SCF, FRB, OBE | 6 | 6 | 260, 261 |
| 3. Ratio of payments to income, small loans. | HFC | 1 | 0 | 263 |
| <i>II. HOUSEHOLD SECTOR, HOME MORTGAGES</i> | | | | |
| 1. Aggregate ratios of total home mortgage debt or payments to total income. | FHLBB, NICB, Gorman, OBE | 3 | 2 | 280 |
| 2. Ratios of home mortgage debt or payments to income, home mortgage debtors. | SCF | 4 | 2 | 281, 282 |
| 3. Ratios of home mortgage amount to income, FHA or VA borrowers. | FHA, VA | 5 | 2 | 283, 285, 286 |
| 4. Ratios of housing expense to income, FHA or VA borrowers. | FHA, VA | 14 | 3 | 283, 284, 286, 287 |
| <i>III. HOUSEHOLD SECTOR, ALL HOUSEHOLD CREDIT COMBINED</i> | | | | |
| 1. Aggregate ratios of total or payments to total income. | FRB, FHLBB, NICB, OBE | 3 | 2 | 306, 307 |
| <i>IV. BUSINESS SECTOR, GENERAL</i> | | | | |
| 1. Aggregate ratios of total cash flow to total debt or debt payments, nonfinancial or manufacturing corporations. | FTC-SEC, Statistics of Income | 3 | 2 | 309, 310 |
| 2. Aggregate times-charges-earned ratio, nonfinancial corporations. | Statistics of Income | 1 | 0 | 309 |
| <i>VI. BUSINESS SECTOR, CORPORATE BONDS</i> | | | | |
| 1. Times-charges-earned ratios, corporate bonds or direct placements. | Atkinson, Cohan | 7 | 7 | 324, 325 |
| <i>VII. BUSINESS SECTOR, MORTGAGES ON INCOME-PRODUCING PROPERTIES</i> | | | | |
| 1. Ratio of mortgage amount to rental, FHA multifamily housing mortgages. | FHA | 1 | 1 | 329 |

(continued)

TABLE 4 (concluded)

| | Source ^a | No. of Series | | Source Notes, Page |
|---|---------------------|---------------------|-------------------|--------------------|
| | | Listed ^b | Data ^b | |
| 2. Debt coverage ratio, multifamily and nonresidential mortgages of life insurance companies. | LIAA | 1 | 1 | 329 |
| <i>VIII. AGRICULTURAL SECTOR</i> | | | | |
| 1. Aggregate ratios of interest charges on farm mortgages to net income of farm operators. | USDA | 1 | 1 | 333 |
| <i>IX. STATE AND LOCAL GOVERNMENT SECTOR</i> | | | | |
| 1. Aggregate ratios of interest payments or interest plus retirements to general revenues. | Hempel | 3 | 1 | 341 |
| Total of Ratios of Debt or Payments to Income | | 57 | 33 | |

^aFor full description, see Source Notes.

^bThe column headed "listed" shows the number of series of this category listed in Part II of this book; the column headed "data" shows the number of series of this category for which the data are published in Part II.

are generally compared with the income of all consumers, both debtors and nondebtors (series HI5, HM10). A rising proportion of families using instalment debt or a rising proportion of homeowners with mortgages will, therefore, bring about an increase in the aggregate debt-payments-to-income ratio, even though those consumers with debt are on average committing no larger a share of their income to debt payments.

The higher level of the aggregate ratio resulting from a larger proportion of debt-using families does indicate a larger burden for the household sector as a whole, because the burden on new debtors has advanced from zero to some positive figure. It is important to realize, however, that the higher aggregate ratio does not necessarily indicate — though it is often interpreted to mean — an increased average burden for debtor families or a higher proportion of heavily burden borrowers.²

Several measures of this latter type are available in the *Survey of Consumer Finances* made each year by the Survey Research Center, e.g., the ratio of instalment payments to *debtor* income (series HI7). Unlike the aggregate payments-to-income ratios, the ratios compiled from data on debtors alone do not move in part as a function of the rising incidence of instalment credit usage and homeownership. They indicate, more precisely, the extent of the payment burden that debtors carry.

The extent to which a rising ratio of debt service to debtor income represents increasing risk is difficult to estimate. One aspect of this question is the use of the borrowed funds. In some cases, the debt will simply add to the borrower's total commitments, which increases the danger that he will overburden himself. In other cases, however, the debt will merely replace one type of payment

with another; mortgage repayments substituting for rent, for example, appliance loan payments substituting for maid service or laundry service, or auto loan payments substituting for commuter fare. The substitution is not necessarily an equal one and the borrower can still overextend himself, but when the purpose of the debt involves a substitution of this sort, there is somewhat less chance that the repayment burden will overwhelm the debtor than when the loan simply adds to the borrower's total commitments with no reduction of expenses. Further, where second-hand markets are well developed, as in the case of autos and housing, the borrower who finds himself in economic difficulties has an opportunity to sell the asset that is the collateral for the loan, and thereby repay all or most of his remaining debt obligation.

A related question is whether disposable personal income is the most appropriate base against which to compare the debt service requirements. Should the denominator of the payments-to-income ratio be disposable personal income or some other measure of income? As the economy grows and incomes rise, the basic necessities of life require a smaller share of the consumer's income. Kisselgoff found that changes in consumer credit were associated especially with income "over and above the amount necessary to meet essential living costs."³ Thus the consumer's debt-carrying capacity probably rises more rapidly than his spendable income, and discretionary income would be a better base than disposable income for the ratio of debt payments to income. Although this appears valid, no wholly satisfactory measure of discretionary income is available; hence all of the consumer debt-service-to-income ratios in this paper are calculated with disposable personal income as the denominator.⁴

In addition to the *Survey of Consumer Finances* data cited above, there are available also time series on the ratio of housing expense (mortgage payments, real estate taxes, repairs and utilities) to income of new borrowers on FHA-insured and VA-guaranteed home mortgages. The relationship between these ratios of debt payments to borrower income and credit performance has been established in several analyses. A Housing and

Home Finance Agency sample study of foreclosures in 1961-62 on one- to four-family owner-occupied homes showed a significant relationship between foreclosures and the ratio of housing expense to the borrower's income.⁵ Another sample, provided by a large New York bank, showed a strong relationship between delinquencies on Title I repair and modernization loans and the ratio of fixed charges to borrower income. Plummer and Young reported that the repossession rate on appliance loans of the Electric Home and Farm Authority were strongly related to the ratio of monthly payment to income.⁶

In one test the payment-to-income ratio did not prove to be related to collection difficulty; this was the regression analysis of home mortgage default and foreclosure risk recently completed by Herzog and Earley.⁷ This is a particularly noteworthy test since, unlike most others, it simultaneously examined eleven different loan, property and borrower characteristics. After allowing for these other variables, "payment-to-income ratios did not appear to be at all related to default risk." Their data strongly suggested, however, that "It may be that this is simply because lenders watch this ratio very carefully and reject loan applications in which some fairly conservative critical limit is exceeded."

In addition to this evidence, there is a considerable history — going back to 1938 — of tests that have established a relationship between loan experience and borrower's income per se, that is, without regard to the debt-to-income ratio. Perhaps the most comprehensive are a series of tests by Moore and Klein on data from a survey of new car loans made by National Analysts, Inc., in 1954-55. This study shows, as did the earlier tests, a clear inverse relationship between borrower's income and both repossession and delinquency rates.⁸

More recent evidence is found in a preliminary report on a study that the Federal Reserve System is now undertaking. "... average incomes for borrowers that defaulted were much less than for other borrowers. As expected, ... borrowers with low incomes (less than \$2,000) had relatively poor repayment records." Interestingly, they also reported, "However, further analyses showed that

borrowers with household incomes of \$10,000 or more also had relatively poor repayment records," and went on to note that many high-income households "had more than one source of income, primarily a working spouse. . . . Combining the two average level incomes may add to the family's ability and desire to incur debt, but the additional income may not always be fully available for retiring debt. Thus, the income variable alone is perhaps not sufficient information on which to base credit quality."⁹

A later report on this Federal Reserve study noted that "... 12 per cent of all auto loans charged off were made to borrowers already heavily in debt (those with more than 20 per cent of their income already committed) when they applied for the loan. In contrast, only 3 per cent of the paid-off loans were to such borrowers."¹⁰

Another type of debt-payments-to-income ratio is used in the business sector.¹¹ These are the times-charges-earned calculations used for corporate bonds and the aggregate ratios of cash flow to debt and to debt payments.¹² These ratios relate the earnings or cash flow of the indebted corporation (before taxes and interest expense) to the amount of interest charges or debt-payment requirements or both. Thus they are measures of the protection that the creditors enjoy. Hickman found the times-charges-earned measure to be a very efficient indicator of the risk of default. The default rate of those corporations that covered their fixed charges by the smallest margin (those with the lowest times-charges-earned ratio) was seventeen times as large as the default rate of the group of corporations with the highest earnings coverage.¹³

Two more recent studies have confirmed this evidence. Beaver, in an extensive analysis of the ability of various financial ratios to predict business failure, reported that "The ability to predict failure is strongest in the cash-flow-to-total-debt ratio."¹⁴ Altman, in a multivariate test (multiple discriminant analysis), found that the ratio of earnings before interest and taxes to total assets made the largest contribution of the five ratios in his final discriminant function, i.e., the five ratios selected as doing the best over-all job

together in the prediction of corporate bankruptcy.¹⁵

Ratios of Debt and Debt Payments to Assets

Another type of comparison commonly used to judge the soundness of credit is the relationship between debt outstanding or debt payments and either (1) the value of the assets which back up the debt or (2) some measure of the net worth of the borrower. Unlike the debt-to-income ratios where the focus is on the income flow as the basis for repayment, these ratios to assets focus on the margin of equity that the borrower holds, on the value of the collateral for recourse should the borrower get into financial difficulty, and on the value of other assets, generally liquid assets, owned by the borrower. Table 5 summarizes the credit quality series of this class that are listed in Part II of this volume.

Probably the single most useful of these ratios, certainly the most common, is the loan-to-value or downpayment ratio. These ratios compare the amount of the loan or the downpayment to the purchase price or some other measure of the value of the item on which the loan is made.¹⁶ The two forms are complementary: 100 per cent minus the loan-to-value ratio equals the downpayment ratio. The loan-to-value ratio is almost always used for mortgages. The downpayment ratio is the more common form for consumer instalment credit, although since the mid-1950's the dealer-cost ratio¹⁷ has generally replaced the downpayment ratio for automobile contracts.

Other things equal, a higher loan-to-value ratio makes for a larger monthly payment burden and a smaller borrower's equity. Two studies by government agencies demonstrated the importance of equity to the risk of credit difficulty. The Federal Housing Administration found that over half of their home mortgages in default had been outstanding only three or four years, and 80-90 per cent of the properties they acquired had been insured within that time span. They concluded that "the accumulation of equity with the passage of time reduces the probability of property acquisitions."¹⁸ Similarly, the Veterans Administration

TABLE 5
Measures of Credit Risk:
B. Ratios of Debt or Debt Payments to Assets

| | Source ^a | No. of Series | | Source Notes, Page |
|---|---|---------------------|-------------------|-----------------------------|
| | | Listed ^b | Data ^b | |
| <i>I. HOUSEHOLD SECTOR, CONSUMER INSTALMENT CREDIT</i> | | | | |
| 1. Dealer-cost or downpayment ratios on auto loans. | FRB, ABA, FNBChi, NASFCo | 14 | 6 | 263, 265, 266, 268, 269 |
| 2. Downpayment ratios on instalment loans on appliances and other durables. | ABA | 5 | 1 | 265 |
| 3. Aggregate ratios of total debt outstanding to value of the stock of consumer durables. | Juster | 2 | 2 | 259 |
| 4. Aggregate ratios of total debt or payments to total liquid assets of households. | Gorman, FRB, National Balance Sheet | 4 | 2 | 259 |
| <i>II. HOUSEHOLD SECTOR, HOME MORTGAGES</i> | | | | |
| 1. Loan-to-value ratios on home mortgages. | FHLBB, FHA, VA, USSLL, Guttentag | 53 | 12 | 283, 284, 286-290, 293, 294 |
| 2. Aggregate ratio of home mortgage debt to value of housing. | Juster | 1 | 1 | 280 |
| 3. Aggregate ratios of total home mortgage debt or payments to total liquid assets of households. | FHLBB, NICB, Gorman, FRB | 3 | 2 | 280 |
| 4. Ratios of mortgage amount to liquid assets, VA borrowers, | VA | 3 | 1 | 286, 287 |
| 5. Ratios of housing expense to liquid assets, VA borrowers. | VA | 3 | 1 | 286, 287 |
| <i>III. HOUSEHOLD SECTOR, ALL HOUSEHOLD CREDIT COMBINED</i> | | | | |
| 1. Aggregate ratios of total debt outstanding to value of assets or to equities. | Juster, National Balance Sheet | 2 | 1 | 307 |
| 2. Aggregate ratios of total debt or payments to total liquid assets of households. | FRB, National Balance Sheet, Gorman, NICB | 3 | 2 | 307 |
| <i>IV. BUSINESS SECTOR, GENERAL</i> | | | | |
| 1. Ratios of net worth to debt, non-financial or manufacturing corporations. | FTC-SEC, Statistics of Income, National Balance Sheet | 3 | 1 | 309, 310, 312 |

(continued)

TABLE 5 (concluded)

| | Source ^a | No. of Series | | Source Notes, Page |
|---|--|---------------------|-------------------|--------------------|
| | | Listed ^b | Data ^b | |
| 2. Liquidity ratios, nonfinancial or manufacturing corporations. | SEC, FTC-SEC, Statistics of Income, National Balance Sheet . | 9 | 3 | 309-313 |
| <i>VI. BUSINESS SECTOR, CORPORATE BONDS</i> | | | | |
| 1. Ratios of debt to assets, industrial firms or public utilities making direct placements. | Cohan | 2 | 0 | 325 |
| <i>VII. BUSINESS SECTOR, MORTGAGES ON INCOME-PRODUCING PROPERTIES</i> | | | | |
| 1. Loan-to-value ratios on multifamily and nonresidential mortgages. | LIAA, FHA, Morton | 4 | 4 | 329, 330 |
| <i>VIII. AGRICULTURAL SECTOR</i> | | | | |
| 1. Loan-to-value ratios on farm mortgages. | USDA, Brinegar | 3 | 2 | 334, 335 |
| 2. Aggregate ratio of total farm mortgage debt to total value of farmland. | USDA | 1 | 1 | 334 |
| 3. Aggregate ratios of total debt to equities, agricultural sector. | USDA, National Balance Sheet | 2 | 1 | 335 |
| <i>IX. STATE AND LOCAL GOVERNMENT SECTOR</i> | | | | |
| 1. Aggregate ratios of debt outstanding to property values or to equities. | Hempel, National Balance Sheet | 2 | 1 | 341, 342 |
| <i>X. OTHER SERIES</i> | | | | |
| 1. Ratios of collateral value to stock market debt. | NYSE | 2 | 0 | 345 |
| 2. Ratios of total debt to equities. | National Balance Sheet | 2 | 0 | |
| Total of Ratios of Debt or Payments to Assets | | 123 | 44 | 345, 346 |

^aFor full description, see Source Notes.^bThe column headed "listed" shows the number of series of this category listed in Part II of this book; the column headed "data" shows the number of series of this category for which the data are published in Part II.

found that the proportion of defaults processed which resulted in claims filed on GI home loans declined sharply as the borrowers' equity increased.¹⁹

The evidence relating loan-to-value and downpayment ratios to credit performance exhibits a pronounced correlation. Since the 1920's, empirical studies have consistently shown collection difficulties to be positively related to loan-to-value ratios on home mortgages, and negatively related to downpayment ratios on new and used cars and on appliance loans.²⁰

Strong evidence is also available from the agricultural sector. Brinegar and Fetting uncovered a marked relationship between the incidence of foreclosure on farm mortgage loans made by the Springfield Land Bank of the Farm Credit Administration during the period 1917-58 and the ratio of the loan amount to the market value or to the "normal agricultural value" of the farm.²¹ Jones and Durand concluded that "an abundance of statistical information confirms the importance of the loan-to-value ratio. Both foreclosure rates and loss rates tend to be high when the debt burden is high. This tendency was found in all seven of the studies that covered the subject."²²

Turning to those ratios of debt to the liquid assets of the borrower, we find a number of tests establishing their usefulness as indicators of credit risk. In the consumer sector, Durand found that the ownership of bank accounts and insurance was closely associated with loan quality. This evidence was corroborated in Moore and Klein's analysis of the 1954-55 survey of new car purchases, in which both the net worth and liquid asset holdings of borrowers were found to be strongly correlated with loan performance. In the 1954-55 data, relating liquid asset holdings to delinquencies and repossessions brought quite striking results; about one-third of the borrowers had liquid assets of less than \$200, but they accounted for three-fourths of all repossessions and delinquencies.²³

Although these appear to be very useful relationships for watching consumer credit quality, there is, unfortunately, little time series information of this sort available. The Veterans Administration has series relating home mortgage debt to liquid assets (HM84-HM89). The Survey Research

Center published data in 1960 and 1962 on the liquid asset holdings of instalment debtors, but these tables are not available for subsequent years.²⁴ In the absence of other data, and although they are certainly not as good substitutes as we would like, we have included computed ratios of total consumer debt, instalment debt and home mortgage debt outstanding, and debt payments to the liquid assets held by all consumer units. As in the aggregate ratio of debt payments to income these series are deficient because there is no basis for knowing to what degree the debtor families are also holders of liquid assets or how their holdings have changed over time.

Other series included here are the debt-to-equity ratio for the consumer sector and the ratios of home mortgage and instalment debt to the value of major durables held by consumers. These series have the advantage of being based on the estimated current market value of the assets, so that the relationships are not distorted by price changes. At the same time, they have the serious disadvantage of not being available on a current and continuing basis.

In the business sector, there are a number of balance-sheet ratios relating assets to debt that have long been used as indicators of the financial strength and solvency of business firms. These are the worth-to-debt ratio and the liquidity ratios: the working-capital ratio, the current ratio and the quick ratio. The quick ratio is the ratio of cash plus government securities to current liabilities. It is a measure of the ability of a business firm to meet its short-term liabilities from its quickly liquid assets. It thus defines the minimum financial strength of the company.

The current ratio relates total current assets (the "quick" assets plus inventories and receivables) to total current liabilities. To the extent that inventories and receivables are salable to their full value, the current ratio is a more accurate measure of a firm's financial strength than the quick ratio. Since inventories and receivables often cannot be turned into cash readily and without loss (especially when the need to do so is greatest, as in a recession), the current ratio is likely to be an overstatement of the financial strength of the firm. The current ratio, therefore, measures the

TABLE 6
Measures of Credit Risk:
C. Maturities

| | Source ^a | No. of Series | | Source Notes, Page |
|---|---|---------------------|-------------------|----------------------------|
| | | Listed ^b | Data ^b | |
| <i>I. HOUSEHOLD SECTOR, CONSUMER INSTALMENT CREDIT</i> | | | | |
| 1. Computed average duration of consumer instalment credit outstanding. | FRB, FNBChi | 10 | 6 | 267, 268 |
| 2. Maturities (time to maturity) of auto mobile loans held by sales finance companies. | FNBChi | 2 | 1 | 268, 269 |
| 3. Maturities of loans made on auto-mobiles. | ABA, FRB, NBER, Juster, Holthausen, NASFCo | 35 | 6 | 263, 265-267, 269-271 |
| 4. Maturities of loans made on durable goods other than autos or for property improvements. | ABA, FHA | 8 | 2 | 265, 266, 271 |
| <i>II. HOUSEHOLD SECTOR, HOME MORTGAGES</i> | | | | |
| 1. Maturities of home mortgages made by five types of lenders. | FHLBB, VA, USSLL, FHA, Morton, Guttentag | 47 | 8 | 283, 284, 286-291, 293-295 |
| <i>IV. BUSINESS SECTOR, GENERAL</i> | | | | |
| 1. Proportion of debt in long-term form, nonfinancial or manufacturing corporations. | FTC-SEC, Statistics of Income, National Balance Sheet | 3 | 0 | 309, 311, 312 |
| <i>V. BUSINESS SECTOR, BANK LOANS</i> | | | | |
| 1. Proportion of bank loans to manufacturers with maturity of more than 1 year. | FTC-SEC | 1 | 0 | 320 |
| <i>VI. BUSINESS SECTOR, CORPORATE BONDS</i> | | | | |
| 1. Maturities of direct placements. | Cohan | 4 | 0 | 326 |
| <i>VII. BUSINESS SECTOR, MORTGAGES ON INCOME-PRODUCING PROPERTIES</i> | | | | |
| 1. Maturities of multifamily and non-residential mortgages. | LIAA, Morton | 3 | 3 | 330 |

(continued)

TABLE 6 (concluded)

| | Source ^a | No. of Series | | Source Notes, Page |
|--|---------------------|---------------------|-------------------|--------------------|
| | | Listed ^b | Data ^b | |
| <i>VIII. AGRICULTURAL SECTOR</i> | | | | |
| 1. Maturity on farm mortgages recorded. | USDA | 8 | 1 | 335, 336 |
| <i>IX. STATE AND LOCAL GOVERNMENT SECTOR</i> | | | | |
| 1. Maturities of state and local government bonds. | Hempel | 9 | 0 | 342 |
| Total of Series on Maturities | | 130 | 27 | |

^aFor full description, see Source Notes.

^bThe column headed "listed" shows the number of series of this category listed in Part II of this book; the column headed "data" shows the number of series of this category for which the data are published in Part II.

TABLE 7
Measures of Credit Risk:
D. Debt Composition

| | Source ^a | No. of Series | | Source Notes, Page |
|---|--|---------------------|-------------------|--------------------|
| | | Listed ^b | Data ^b | |
| <i>IV. BUSINESS SECTOR, GENERAL</i> | | | | |
| 1. Composition of business debt by industry of borrower. | Statistics of Income | 6 | 0 | 309, 310 |
| 2. Ratios of trade credit to total liabilities or sales. | FTC-SEC, CRF, Statistics of Income, National Balance Sheet | 8 | 2 | 310-314 |
| <i>V. BUSINESS SECTOR, BANK LOANS</i> | | | | |
| 1. Composition of bank loans by industry of borrower. | FRB | 9 | 0 | 321, 322 |
| <i>IX. STATE AND LOCAL GOVERNMENT SECTOR</i> | | | | |
| 1. Ratios of revenue bonds to all state and local government bonds. | Hempel | 2 | 2 | 343 |
| Total of Debt Composition Series | | 25 | 4 | |

^aFor full description, see Source Notes.

^bThe column headed "listed" shows the number of series of this category listed in Part II of this book; the column headed "data" shows the number of series of this category for which the data are published in Part II.

maximum internal liquidity of a business firm.

The working-capital ratio is the ratio of net working capital, i.e., current assets minus current liabilities, to total assets. This ratio is similar to the current ratio except that it uses total assets as the base against which to measure working-capital needs.

The worth-to-debt ratio compares the net worth of a firm to the total of its debt obligations. It is a measure of the protection that the firm's creditors have in the form of the equity capital invested in the business, and is the most fundamental of the financial ratios from a long-range credit quality standpoint.²⁵

Several studies of successful and unsuccessful business firms in the 1920's and 1930's found these four ratios to be generally reliable — though by no means infallible — indicators of business failure. Groups of unsuccessful firms consistently showed lower levels of these ratios than did successful firms. Moreover, for unsuccessful firms these ratios began to show persistent declines as much as four - six years before failure. The working-capital ratio was the most useful of the four indicators in this regard.²⁶

In another examination of this topic, Saulnier, Halcrow and Jacoby investigated defaults, foreclosures and losses on business loans made by the Reconstruction Finance Corporation during 1934-51 relative to the current ratios and net-worth-to-debt ratios of the borrowing firms. This study indicated that loans to firms with poorer financial ratios are more prone to encounter credit difficulty.²⁷

A more recent study of the effectiveness of these ratios was carried out by the Bank of Israel in a study of bankrupt companies in that country during 1956-60. Their results confirmed the earlier studies. Specifically they found the quick ratio, the current ratio and the worth-to-debt ratio to be significantly lower in the year before bankruptcy for unsuccessful firms than for all firms. Interestingly, the Bank of Israel study went one step further than previous analyses, and calculated an index of the risk of bankruptcy. For each firm this is a composite measure based on the worth-to-debt and current ratios, the trend of profits, the inventory-to-sales ratio, the receivables-to-sales ratio

and the working-capital ratio. To test this composite risk index, a sample of 130 firms was taken from among all industrial companies operating in Israel in 1958. Of the 21 firms with the lowest scores, 11 went bankrupt between 1958 and 1960, but of the 109 businesses with higher scores only 5 went bankrupt.²⁸

Two studies here in the United States provide confirming evidence on several of these ratios. Beaver's study showed the debt-to-assets, working-capital and current ratios all to have significant ability to predict business failure. And Altman's multivariate analysis designed to predict corporate bankruptcy included the working-capital and net-worth-to-debt ratios in the final discriminant function. However, Altman used the market value of the equity rather than the book value in his net-worth-to-debt ratio, reporting that the former appeared to be the more effective predictor of bankruptcy.

The time series presented in Part II of this book for these four financial ratios are calculated from the manufacturing data published by the FTC-SEC, and from data for all nonfinancial corporations put out by the SEC, the Internal Revenue Service and in *Studies in the National Balance Sheet of the United States*.²⁹ The FTC-SEC and SEC data provide up-to-date quarterly figures, while the other two provide valuable longer perspective.

Additional data on these ratios by industry and size of firm, not presented here, are available from several sources. The FTC-SEC release contains income and balance sheet figures for twenty manufacturing industries and nine size classifications (not cross-classified, however). The Industry Studies Department of Dun & Bradstreet, Inc., each year publishes fourteen financial ratios for 125 different lines of business in the retail, wholesale, manufacturing and construction sectors.³⁰ Finally, Robert Morris Associates provide a wealth of data for 190 different lines of business — manufacturers, wholesalers, retailers and nine service lines — classified into three size groups.³¹

Maturities

Another characteristic that is frequently related to credit risk is the length of the contract. Table 6

summarizes the time series on loan maturity that are listed in Part II of this volume.

The relation between loan maturity and repayment experience is a complicated one with several different factors working in opposite directions. On the one hand, for a given loan amount, the longer its maturity, the smaller are the borrower's monthly payments, and thus the lighter is his current payment burden, i.e., the lower his payment-to-income ratio, which would tend to reduce the risk of credit difficulties. On the other hand, a longer contract means a longer period of time during which the income and financial position of the borrower can change, thus increasing the possibility of credit trouble over the life of the loan. Total payments from this debt obligation are also larger, because of the interest charges. Another influence operating in this direction on instalment and home mortgage loans is the fact that longer maturities result in a slower accumulation of equity on the part of the borrower, making his stake in fulfilling the loan obligation correspondingly smaller at any given time.

Although the evidence is mixed, longer maturities are for the most part associated with a greater risk of poor credit performance. Moore and Klein found that longer contracts were typically associated with poor repossession and loss experience on new car contracts (several studies) and on appliance loans. On personal loans, however, the evidence was inconclusive, and on used car contracts shorter maturities appeared to have the higher risk of delinquency. This latter relationship may have occurred because the short-maturity loans on used cars are generally on the oldest and cheapest autos, which are usually purchased by the poorest credit risks.³² Another contradictory piece of evidence is reported by the Federal Reserve Bank of Atlanta. Their study of nonauto consumer loans showed that defaulted contracts had, on the average, slightly shorter maturities than did the loans that were repaid.

In home mortgage lending, a number of studies found the length of the contract to be positively related to the prospect of default or foreclosure.³³ Herzog and Earley's evidence is inconclusive, however. Their multivariate analysis showed the term to maturity to be positively correlated with fore-

closure risk, but inversely related to the risk of delinquency. Similarly, Knight's multiple regression produced an ambiguous result on the maturity variable.

More often than not, therefore, the burden of these studies points to a positive relationship between maturities and collection difficulties. The exceptions, however, are sufficiently numerous to raise some doubts and to keep us from drawing any firm conclusion. Here, obviously, there is need for simultaneous analysis of all credit characteristics to try to determine the direction and amount of influence, if any, maturity has on credit performance.

Debt Composition

Because the riskiness of debt differs substantially according to the industry of the borrower and the type of debt, the quality of credit may vary through time according to its changing composition.³⁴ When an increasing proportion of total debt is from relatively high-risk industries and debt types, a decline in aggregate credit quality is suggested. When high-risk debt becomes smaller, an improvement in quality is indicated. We thus include in our listing of credit quality information several time series that show the percentage distribution of certain business, bank, and state and local government credit by major industry group or by type. Table 7 provides a summary of these series. In addition, credit ratings and failure statistics by industry are included.

Several of the NBER Quality of Credit Studies found differences in credit quality among industrial sectors. Summarizing these studies, Earley concluded that retail trade and durable-goods manufacturing were generally high-risk industries; wholesale trade, services, utilities, transport and communications were of relatively low risk; and nondurable-goods manufacturing, mining and construction were intermediate or ambiguous in relative credit riskiness.³⁵ The quality standings of the various industries were not entirely consistent in all of the comparisons by which they were judged, however, and the matter deserves further attention.

Trade credit is one of the largest types of business credit. It is also one of the riskiest credit

sectors. In 1961, bad debt losses in four major business sectors were 1.2 per cent of the volume of trade credit outstanding. By contrast, in that year the loss rate on bank loans was .2 per cent and the loss rate on consumer automobile credit written by commercial banks was .3 per cent. Thus the trade credit series warrant close attention.

The volume of trade credit has traditionally been measured relative to the volume of sales (rather than as a per cent of total business debt). The ratios of trade receivables and trade payables to sales volume are influenced by three factors: (1) the relative amount of trade credit offered or incurred, (2) the terms (i.e., the maturities) under which trade credit is granted, and (3) the difficulty of collecting trade credit. The ratio of receivables to sales, expressed as number of days sales outstanding, is sometimes called the trade-credit collection period.³⁶ We avoid that term here, because it implies that the ratio is solely a measure of collection difficulty. A rise in the ratio of trade receivables to sales, however, can also mean that (1) business firms that did not do so previously are offering trade credit to their customers, (2) firms are offering trade credit to a larger proportion of their customers, (3) more customers are taking advantage of trade credit, or (4) trade credit is being offered or incurred on longer terms than before. Part, perhaps a large part, of the postwar rise in trade-credit ratios may reflect these factors, as well as an increase in collection difficulties.³⁷

Two trends that have contributed to the increase in the ratio have been the general shift by businesses from item billing to lot billing (e.g., on a regular monthly cycle), and the shift away from cash discounts offered for prompt payment (e.g., "2/10, net/30" has in many cases become just "net/30"). Both of these trends would increase the relative volume of trade credit outstanding and the trade-credit collection period irrespective of the ease or difficulty encountered in collecting trade credit.

Nevertheless, increases in the ratio of receivables or payables to sales may still indicate an increase in the degree of credit risk because of (1) a longer average maturity, which in other types of credit is generally associated with poorer credit performance, and (2) a larger relative volume of

credit outstanding in a sector that has long experienced higher than average loss rates.

A third measure of debt composition included in this compendium is the proportion of state and local government debt in the form of revenue bonds. As Hempel has pointed out, revenue bonds historically have been much more prone to default than general-obligation bonds. The latter are backed by the full faith and credit standing of the local government body and its full taxing power, while revenue bonds are normally repayed solely from the earnings of the facility (e.g., toll road) for which the funds were borrowed.

Credit Ratings

Credit ratings are the judgments of experts about the credit worthiness of borrowers and the degree of risk encompassed in their debt obligations. In large part, these evaluations are based on the risk-related loan, borrower and instrument characteristics of the sort discussed in the previous sections of this chapter. In addition, they include a subjective element reflecting credit factors for which no statistical data are available.

The credit ratings presented in Part II of this volume are summarized in Table 8. They are of two types: agency ratings, which are the judgments of organizations whose business it is to make and publish ratings of business firms and of bonds; and examiner ratings, which are the judgments of governmental examining agents about the loans or mortgages held by financial institutions over which they have regulatory responsibility.

Agency Ratings

Agency ratings are regularly published for business firms and for corporate and municipal bonds. Dun & Bradstreet, Inc., maintains credit ratings on approximately three million business firms. These ratings are based on the history and experience of management, on the firm's financial position and accomplishments, on the record of credit payments, and on other characteristics of the firm. The ratings are designed for, and primarily used by, mercantile concerns that grant trade credit.

The statistical validity of these Dun & Bradstreet credit ratings has been clearly demonstrated

TABLE 8
Measures of Credit Risk:
E. Credit Ratings

| | Source ^a | No. of Series | | Source Notes, Page |
|---|------------------------------------|---------------------|-------------------|-----------------------|
| | | Listed ^b | Data ^b | |
| <i>II. HOUSEHOLD SECTOR, HOME MORTGAGES</i> | | | | |
| 1. FHA ratings on insured home mortgages. | FHA | 3 | 0 | 295 |
| <i>IV. BUSINESS SECTOR, GENERAL</i> | | | | |
| 1. Dun & Bradstreet credit ratings of business firms. | D & B | 19 | 6 | 314, 315 |
| <i>V. BUSINESS SECTOR, BANK LOANS</i> | | | | |
| 1. Examiner criticism rates on bank loans. | FRB Boston, Wojnilower, FDIC | 3 | 3 | 322 |
| <i>VI. BUSINESS SECTOR, CORPORATE BONDS</i> | | | | |
| 1. Credit ratings on publicly offered corporate bonds. | Atkinson | 4 | 1 | 326, 327 |
| 2. Credit ratings on corporate debt directly placed. | Atkinson | 5 | 0 | 327 |
| <i>VIII. AGRICULTURAL SECTOR</i> | | | | |
| 1. Examiner ratings on farm mortgages or Production Credit Association loans. | Brinegar and Fettig | 3 | 0 | 336 |
| <i>IX. STATE AND LOCAL GOVERNMENT SECTOR</i> | | | | |
| 1. Credit ratings on state and local government bonds issued or outstanding. | IBA, Moody's, Hempel | 6 | 6 | 343, 344 |
| Total of Credit Ratings | | 43 | 16 | |

^aFor full description, see Source Notes.

^bThe column headed "listed" shows the number of series of this category listed in Part II of this book; the column headed "data" shows the number of series of this category for which the data are published in Part II.

a number of times. One of the most telling pieces of evidence is the business experience of the American Credit Indemnity Company, which uses Dun & Bradstreet's credit ratings, along with firm size, as a basis for its premiums for insuring trade-credit losses. ACI data on the trade-credit performance of its customers show a strong relationship between credit losses and credit ratings: over the period 1952-57, loss rates for firms rated "high" were .09 per cent, while they were .50 per cent for firms rated "good" and 1.84 per cent for firms rated only "fair" or "limited." Direct business loans of the Reconstruction Finance Corporation from 1934 through 1951 also showed a pronounced relationship between default and loss rates and the Dun & Bradstreet credit ratings of the borrowing firms.³⁸

Credit ratings on corporate and municipal bond issues are made by Moody's, Standard and Poor's, and Dun & Bradstreet. Hickman has demonstrated that the record of agency ratings on corporate bonds, both publicly issued bonds and direct placements, based on cross-section tests, was remarkably good for the period 1900-43. For example, on all large issues offered during the period, only 11 per cent of the dollar volume of bonds rated "investment quality" (i.e., in the first four grades) went into default in those years, compared to 42 per cent defaulting of those rated "predominantly speculative" (below the first four grades).³⁹

Examiner Ratings

Although there are several examiner-ratings series available for past periods, none is published currently. This is unfortunate, as studies made of these ratings strongly suggest that they can be a valuable source of information on credit quality.

In his small sample of examiner reports on commercial banks, Wojnilower found that loan criticism rates were positively related to credit performance. His principal test compared the examiner criticism rates with loss rates on a bank-by-bank basis. The criticism rates were also found to be statistically and logically related to credit ratings and financial ratios.⁴⁰ Similarly, Hsiu-Kwang Wu concluded from his study of national banks in New England "that bank

examiner criticisms on business loans are reasonably accurate. They are good *ex ante* measures of loan quality, and therefore they should be extremely useful as financial indicators in economic forecasting."⁴¹

Farm lending is another credit area in which examiner ratings proved valid. Brinegar and Fetting's studies of production loans indicated that charge-off rates differed significantly between loans graded "high" and "low" by Farm Credit Administration examiners. Likewise, home mortgage "risk ratings" employed by the Federal Housing Administration to determine the acceptability of loans offered for insurance appear to be related to the probability of loss.⁴² Later, however, the FHA ceased publication of these ratings because of concern that they might be misleading.

Thus, both the agency ratings and examiner ratings have substantial evidence of their validity as indicators of credit risk, and deserve a full share of attention when the risk position of the nation's credit is being assessed.

Other Loan and Borrower Characteristics

In addition to the many credit quality series described above, there are a number of loan and borrower characteristics that at one time or another in the past have been found to be associated with credit collection difficulties, but for which no time series is included in this compendium. One of these, interest rate differentials, was discussed in Chapter 3.

In the household sector, these characteristics are the presence or absence of junior financing (second mortgages), the existence of previous debt, the purpose of the loan, the borrower's occupation, age, marital status, family size, time on present job and time in current residence.⁴³ In each case, these borrower characteristics are not included in this report because time series data are not available for them.

In the business sector, there are two series that have been used in other studies of the quality of credit but are not included here. One is the proportion of corporate bonds that are secured by a lien on the assets of the borrowing company. Presumably, a bond secured in this way is of higher

quality than an unsecured bond, other things equal. The evidence linking this characteristic with the risk of default, however, suggests that the opposite is true: that unsecured bonds have a better repayment record than secured bonds.⁴⁴ The reason may be that other things are not equal, that is, the secured bonds may be weaker in other respects. In any event, because the evidence is contradictory to the presumed relationship, this series is not included in the present volume.

The second of these indicators of business credit risk is the composition of business debt by size of borrower. Borrower size has been demonstrated in many studies to be closely related to credit performance: the smaller the firm, the higher the risk of collection difficulties.⁴⁵ Thus a time series of the proportion of all business debt outstanding owed by the smaller firms would show whether debt was tending toward or away from the weaker sectors of the economy. In addition, financial ratios and credit ratings by borrower size group would indicate risk movements within the weaker and stronger sectors.

A substantial quantity of data is available showing the composition of business debt by size of firm, and financial ratios and credit ratings could also be shown by size breakdown.⁴⁶ There is, however, reason to question the usefulness of such time series as they are likely to be biased over time. All of the available data define the size groups according to a fixed absolute dollar value, usually of assets. The smallest category in the FTC-SEC data, for example, consists of firms with assets of less than \$250,000. Over time, however, with the growth of the economy and inflation, the proportion of business firms that fall into the various size categories undergoes a marked shift, with the "center of gravity" of the distribution of total assets tending to move up the scale of size categories, leaving relatively fewer assets in the smaller categories. Consequently, if every firm maintained its ratio of debt to assets at a constant level, a time series of the proportion of debt accounted for by the smallest firms (based on fixed size groupings) would show a downward trend, and would thereby give an erroneous impression of decreasing credit risk.

Also, since there is a typical pattern for finan-

cial ratios and credit ratings by size of borrower, with the smaller companies having the weakest ratios, there would be within each size category a downward bias in the time series of these risk-related characteristics. The series would thus tend to give an erroneous picture of increasing credit risk. It is difficult to judge how important such distortions would be relative to the "real" movements of these series; but in the absence of evidence that such bias is not of significant proportions, it seems prudent to be wary of them. Consequently, with the exception of three Dun & Bradstreet credit ratings series, no quality measures based on size of firm are included in this book.

¹The debt payments figures on consumer instalment credit, however, contain a statistical blemish arising from the fact that the repayments data (and credit extensions) reported by the Federal Reserve include the large repayments that are made when an existing instalment loan is refinanced. In terms of the burden of consumers' regular monthly debt payments (e.g., series H15), therefore, the reported statistics overstate the true ratio. (Ernst Dauer has estimated that "The resulting overstatement [of repayments] can run as high as 1/3 of the published estimates in any one month." See his "Consumer Credit Outlook - Basic Factors," presented to Columbia University Consumer Credit Management Program, Harriman, New York, June 12, 1967, mimeograph, p. 3.) It is uncertain, however, to what extent the trend or cyclical movements of the aggregate payments-to-income ratios may be affected.

²For another discussion of the burden of consumer instalment debt, see Warren L. Smith, "Is the Growth of Private Debt a Cause for Concern," in George Horwich, ed., *Monetary Process and Policy*, Homewood, Ill., 1967, pp. 73-98.

³Avram Kisselgoff, "The Quantitative Analysis of the Demand for Instalment Sales Credit," *University of Illinois Bulletin*, Vol. 48, No. 76, June 1951, p. 143. See also his *Factors Affecting the Demand for Consumer Instalment Sales Credit*.

⁴For a still broader concept of how the repayments-to-income ratio might be formulated, see the *Economic Report of the President*, Washington, D.C., January 1966, p. 48.

⁵Housing and Home Finance Agency, *Mortgage Foreclosures in Six Metropolitan Areas*, Washington, D.C., June 1963.

⁶Wilbur C. Plummer and Ralph A. Young, *Sales Finance Companies and Their Credit Practices*, New York, NBER, 1940, Table 46.

⁷Herzog and Earley, *Home Mortgage Delinquency and Foreclosure*.

⁸For a conspectus of the earlier evidence and a report on the 1954-55 survey, see Moore and Klein, *The Quality of Consumer Instalment Credit*, Chapter 4.

⁹"Consumer Credit Quality - A Search for an Answer," *Monthly Review*, Federal Reserve Bank of Atlanta, November 1966.

¹⁰Board of Governors of the Federal Reserve System, "Consumer Instalment Credit," *Federal Reserve Bulletin*, June 1968, p. 463.

¹¹Note, however, that here they are in inverted form, i.e., income-to-debt-payment ratios rather than the other way around. We shall find this to be the case for most ratios in the business sector, except in some instances for mortgages on income-producing properties where their form often follows that used for home mortgages.

¹²The cash-flow-to-debt-payments ratio was used by James S. Earley in "Problems in the Measurement of the Quality of Credit," pp. 202-217. Alternatively, see his *The Quality of Credit in the United States: A Summary Volume*.

¹³W. Braddock Hickman, *Corporate Bond Quality and Investor Experience*, p. 11.

¹⁴William H. Beaver, "Financial Ratios as Predictors of Failure," *Empirical Research in Accounting: Selected Studies, 1966*, Chicago, Ill., 1967, p. 85.

¹⁵Edward I. Altman, "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy."

¹⁶Note, however, that ratios of loan-to-value apply only to the loan made and do not reflect the presence of any "junior financing" that may accompany the transaction.

¹⁷For new cars, the dealer-cost ratio is the amount of the loan (excluding finance and insurance charges) as a percentage of the car's cost to the dealer; for used cars, it is the loan as a percentage of the wholesale value of the car determined from official guidebooks published at regular intervals. The use of dealer cost or wholesale value avoids the nominal inflation of the retail price that is made possible by an inflated trade-in value.

¹⁸Housing and Home Finance Agency, *FHA Experience with Mortgage Foreclosures and Property Acquisitions*, Washington, D.C., January 1963.

¹⁹Study made by the Office of Appraisals and Department of Veterans Benefits of the Veterans Administration, "FHA Mortgage Foreclosures," *Hearings* before subcommittee, Committee on Banking and Currency, United States Senate, 88th Cong., 2nd Sess., January 27-28, 1964, pp. 123-209.

²⁰For home mortgages see Herzog and Earley; Earley, *The Quality of Credit*; . . . Housing and Home Finance Agency, p. 4 and *FHA Experience with Mortgage Foreclosures and Property Acquisitions*, pp. 32-36; Veterans Administration, *ibid.*; Leon T. Kendall, *Anatomy of the Residential Mortgage*, United States Savings and Loan League, Chicago, Ill., 1964, pp. 19-20; Robert E. Knight, "The Quality of Mortgage Credit: Part II." For consumer instalment credit see Moore and Klein, Chapter 3.

²¹Brinegar and Fettig, *Some Measures of the Quality of Agricultural Credit*, pp. 44-51.

²²Lawrence A. Jones and David Durand, *Mortgage Lending Experience in Agriculture*, Princeton for NBER, 1954, p. 139.

²³David Durand, *Risk Elements in Consumer Instalment Financing*, New York, NBER, 1941; and Moore and Klein, pp. 106-111. There is a qualification to the later evidence, however. As Moore and Klein point out, "the implications of these relationships are not as clear-cut as they might be, because the net worth and liquid asset holdings were recorded as of the time the car buyer was interviewed in the survey, rather than as of the date the loan was originated. Hence the results do not necessarily mean that low net worth or a weak liquid asset position at the time of borrowing leads to repayment difficulty, though they may mean that."

²⁴1960 *Survey of Consumer Finances*, p. 162; 1962 *Survey of Consumer Finances*, p. 70.

²⁵For a fuller discussion of the meaning of these ratios in terms of credit quality, see Earley, "Problems in the Measurement of the Quality of Credit," and *The Quality of Credit*, . . . ; and Martin H. Seiden, *The Quality of Trade Credit*, Occasional Paper 87, New York, NBER, 1964, pp. 51-53, and 59-62.

²⁶Raymond F. Smith, *A Test Analysis of Unsuccessful Industrial Companies*, Bureau of Business Research, Bulletin No. 31, Urbana, Ill., 1930; Raymond F. Smith and Arthur H. Winakor, *Changes in the Financial Structure of Unsuccessful Industrial Corporations*, Bureau of Business Research, Bulletin No. 51, Urbana, Ill., 1935; and Charles L. Merwin, *Financing Small Corporations in Five Manufacturing Industries*, New York, NBER, 1942. For a summary of these three studies, see Seiden, *ibid.*, pp. 51-53.

²⁷Raymond J. Saulnier, Harold G. Halcrow and Neil H. Jacoby, *Federal Lending and Loan Insurance*, Princeton for NBER, 1958, Tables B-16, B-22, B-29, and B-35.

²⁸M. Tamari, "Financial Ratios as a Means of Forecasting Bankruptcy," *Bank of Israel Bulletin No. 21*, Jerusalem, April 1964.

²⁹Federal Trade Commission-Securities and Exchange Commission, *Quarterly Financial Reports for Manufacturing Corporations*; Securities and Exchange Commission, *Working Capital of U.S. Corporations*; U.S. Treasury Department, Internal Revenue Service, *Statistics of Income*; and Raymond W. Goldsmith, Robert E. Lipsey and Morris Mendelson, *Studies in the National Balance Sheet of the United States*, Vol. II, Princeton for NBER, 1963.

³⁰Dun & Bradstreet, Inc., *Key Business Ratios*.

³¹Robert Morris Associates, *Annual Statement Studies*, Philadelphia, Pa.

³²Moore and Klein, Chapter 3.

³³Subcommittee on Housing, Committee on Banking and Currency, U.S. Senate, *Study of Mortgage Credit*, March 28, 1961, pp. 200-201; Veterans Administration, p. 57; Housing and Home Finance Agency, *FHA Experi-*

ence with *Mortgage Foreclosures and Property Acquisitions*, p. 39 and Appendix A; and Housing and Home Finance Agency, *Mortgage Foreclosures in Six Metropolitan Areas*.

³⁴Any change in the risk-related characteristics of credit outstanding represents, in a sense, a change in *composition*. For example, an increasing proportion of home mortgages with high loan-to-value ratios represents a change, other things equal, toward a higher risk *composition* of home mortgage credit. Earley uses this broader concept of *composition* in his paper, "Problems in the Measurement of Quality of Credit." In this book, however, the term *composition* refers only to the distribution of the volume of credit among industries or types known historically to differ significantly in their incidence of credit difficulty.

³⁵Earley, *The Quality of Credit*

³⁶See, for example, Seiden, Chapter 4.

³⁷See series BG54 on trade-credit delinquencies.

³⁸Seiden, pp. 71-78; Saulnier, Halcrow and Jacoby, Table B-16, p. 458; and Moore, Atkinson and Kilberg, *Report to the Committees on Banking and Currency* . . . , pp. 59-61. For additional discussion of the Dun & Bradstreet ratings as indicators of credit quality, see Wojnilower, *The Quality of Bank Loans*, pp. 32-38; Earley, *The Quality of Credit* . . . ; and Zarnowitz,

"Credit Ratings of Business Concerns," in *The Study of Economic Growth*, Thirty-ninth Annual Report of the NBER, May 1959, pp. 59-62.

³⁹Atkinson, *Trends in Corporate Bond Quality*, pp. 50-51; Hickman, pp. 141-142, 144 and 176. For a discussion of the validity of ratings on municipal bonds, see Hempel, "The Postwar Quality of State and Local Debt."

⁴⁰Wojnilower, *The Quality of Bank Loans*.

⁴¹Hsiu-Kwang Wu, "Bank Examiner Criticism, Bank Loan Defaults, and Bank Loan Quality," *Journal of Finance*, September 1969, pp. 697-705.

⁴²Housing and Home Finance Agency Report in U.S. Senate Committee on Banking and Currency, Subcommittee on Housing, *Study of Mortgage Credit*, Washington, D.C., 1961, pp. 202-203.

⁴³See Moore and Klein; Herzog and Earley; Federal Reserve Bank of Atlanta; Paul Smith, "Measuring Risk on Instalment Credit" in Cohen and Hammer, *Analytical Methods in Banking*, pp. 136-151.

⁴⁴See Atkinson, *Trends in Corporate Bond Quality*, Chapter 6.

⁴⁵See, for example, Earley, *The Quality of Credit* . . . ; and Moore, Atkinson and Kilberg.

⁴⁶Federal Trade Commission-Securities and Exchange Commission; Dun & Bradstreet, Inc.; and Robert Morris Associates.

