3 1293 00561 2134 12202666

THESIS

LIBRARY
Michigan State
University

This is to certify that the

dissertation entitled

A Microeconomic Model of the Banking Firm
and the Pricing of New Automobile Loans
at Commercial Banks

presented by

Mark Arlington White

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Business Administration

Major professor

Date April 18, 1989

MSU is an Affirmative Action/Equal Opportunity Institution

O-12771

MSU
LIBRARIES

RETURNING MATERIALS:
Place in book drop to remove this checkout from your record. FINES will be charged if book is returned after the date stamped below.

NOV 14
325

JUN 19 19

OCT 05 1999

A MICROECONOMIC MODEL OF THE BANKING FIRM AND THE PRICING OF NEW AUTOMOBILE LOANS AT COMMERCIAL BANKS

By

Mark Arlington White

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Finance and Insurance

1989

X-11,795

ABSTRACT

A MICROECONOMIC MODEL OF THE BANKING FIRM AND THE PRICING OF NEW AUTOMOBILE LOANS AT COMMERCIAL BANKS

By

Mark Arlington White

Consumer debt accounts for a large and growing portion of the financial liabilities of the United states. Many observers see the increased willingness of households to incur debt as a sign of weakness and the imminent collapse of the financial system. The growth in non-residential debt financing, or instalment credit, is viewed as a particular worry because much of it is used to fund investment in nondurable goods. At the same time, commercial banks are eager to expand their presence in the consumer lending arena to offset decreased demand for commercial and international loans. These factors contribute to the growing interest in consumer loan pricing at commercial banks.

This dissertation develops a microeconomic model of the banking firm in the theory-of-the-firm tradition of Klein (1971). It extends Slovin and Sushka's (1983) work on the pricing of commercial loans by introducing an alternative outlet for bank funds (consumer loans) and subjecting the resultant predictions of the theoretical model to empirical verification. There are three primary differences between the work at hand and previous studies: 1) It introduces a

more comprehensive model of bank loan portfolio behavior, 2) The implications of the model are tested using the appropriate *microeconomic* data and 3) It is the first study to investigate the behavior of consumer loan rates vís-a-vís commercial loan and competitors' rates over time.

This paper provides tentative evidence that the automobile loan market is highly competitive with respect to automobile loan rates; these findings should be pursued with a longer and more comprehensive data series.

ACKNOWLEDGEMENTS

I am grateful to my dissertation chairman, Professor Alan Grunewald, the members of my dissertation committee, Professor Richard Simonds and Professor Robert Rasche, and Professor John O'Donnell for their guidance and advice throughout this undertaking. Don Mann of the Michigan Department of Commerce and Gary Meyers of Meyers and Associates graciously allowed access to data collected by their respective organizations. I thank Manjit Virdi for his assistance with the computer analyses and wish to acknowledge the support and helpful comments of my comrades-in-arms, Maurice Tse, Rick Osborne and Marcus Chung. Finally, I am deeply indebted to my parents, Harry and Nancy White, and my beautiful bride-to-be, Susie Reid, for their encouragement, patience and love.

TABLE OF CONTENTS

I. Introduction 1

Problem Identification 4

Research Objectives 5

Contributions and Significance 5

II. Literature Review 7

Consumer Credit Markets 7

Types and Characteristics of Consumer Credit 9

History of Automotive Finance 21

Regulation of Consumer Lending 34

Consumer Credit Knowledge 38

Models of the Banking Firm 41

Why Do Banks Exist? 42

Portfolio Management Models 46

Theory-of-the-Firm Models 48

Credit Rationing Models 49

Determinants of Bank Loan Rates 50

Cost Factors 52

Competitive Factors 54

Empirical Studies 57

Determinants of Bank Deposit Rates 62

III. A Model of the Consumer Loan Rate 65
Assumptions and Objective Function 66
First Order Conditions 69
Second Order Conditions 70
Solution and Predictions 70
IV. Methodology 72
Sources of Data 72
Consumer Loan and Deposit Rate Data 72
Security Rates 76
Other Variables 78
Econometric Analysis 78
V. Results and Discussion 81
Hypotheses 81
Regression Results 83
Automobile Loan Rates 83
Deposit Rates 97
Discussion 103
Is the Model Wrong? 104
Is the Data Suspicious? 105
Is the World Different from Theory? 106
VI. Summary and Conclusions 108
The Theoretical Model 109
Empirical Results 110
Implications 113
Areas for Future Research 115

Appendix A: A Mathematical Model of the Banking Firm 116
Appendix B1: Characteristics of Financial Institutions 125
Appendix B2: Financial Institutions Ranked by Size 129
Appendix C1: Auto Loan Rates (Descriptive Statistics) 130
Appendix C2: Deposit Rates (Descriptive Statistics) 131
References 132

LIST OF TABLES

Table 1. 1986 Credit Market Borrowing By Sectors 9
Table 2. Outstanding Consumer Installment Credit 14
Table 3. Consumer Debt by Family Characteristics 18
Table 4. Federal Consumer Credit Legislation 35
Table 5. Development of the Theory of the Banking Firm 45
Table 6. Loan Portfolios of Insured Commercial Banks 50
Table 7. Costs of Installment Lending in 1985 52
Table 8. Functional Cost Analysis of Bank Lending 53
Table 9. Empirical Models of Bank Loan Rates 58
Table 10. Correlation Matrix of Security Rates 77
Table 11. Hypothesis Testing 82
Table 12. Automobile Loan Rate Regressions 84
Table 13. Signed Coefficients of Loan Rate Regressions 88
Table 14. Automobile Loan Rates vs. Competitors' Rates 91
Table 15. Institutions Classified by Market Structure 94
Table 16. Intraregional Variation of Auto Loan Rates 96
Table 17. Intra-Size Class Variation of Loan Rates 97
Table 18. Deposit Rate Regressions 98
Table 19. Signed Coefficients of Deposit Regressions 102
Table 20. Summary of Empirical Testing Results 111

LIST OF FIGURES

Figure 1. U.S. Credit Market Debt Outstanding 8

Figure 2. Major Types of Consumer Installment Credit 11

Figure 3. Major Holders of Consumer Installment Credit 16

Figure 4. Outstanding Household Debt 20

Figure 5. Average New-Auto Finance Rates, 1924-1962 25

Figure 6. GMAC's Six Percent Plan 27

Figure 7. The Effects of Binding Usury Ceilings 35

I. INTRODUCTION

Commercial banks have historically concentrated their lending activities in three areas: business loans, international loans and consumer loans. Consumer lending has grown more attractive in recent years as developments in the commercial and international loan markets have curtailed lending opportunities. At the same time, deregulation of the financial services industry has increased the uncertainty of profits derived from the extension of consumer credit. These and other factors have contributed to a renewed interest in consumer lending and the determinants of consumer loan rates.

Commercial loan demand has fallen off for two primary reasons. First, large corporations always have had the alternative to finance their short-term needs by issuing commercial paper. The explosive growth in money market mutual funds has increased the demand for these securities leading to 1) More attractive terms for the established market participants and 2) The issuance of paper by less well-established or more risky firms. Second, the growth of the junk bond market has increased the access of smaller firms to the capital markets and decreased their reliance on bank financing. International lending by commercial banks has followed a similar course. The weak U.S. dollar and unattractive levels of perceived default risk have limited banks' foreign lending opportunities.

Before the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Garn-St. Germain Depository Institutions Act of 1982, non-bank financial institutions were relatively restricted in the scope of their lending activities, while commercial banks were similarly restricted in their investment opportunities. A wave of unprecedented high interest rates and the widespread availability of computer technologies, coupled with a strong pro-business Presidential administration led to the collapse of many barriers to entry throughout the industry. In addition to their traditional competitors among the other depository institutions (savings and loans, credit unions, and mutual savings banks), banks must now defend their loan markets against intrusion from brokerage houses, automotive finance companies, and retailers. Each of these institutions brings a particular strength to the consumer credit market, and it is not yet clear who the victors will be. If the retailing industry's recent experience may be taken as an example, one might anticipate a few large and growing chains of discount financial centers, in which price is the main competitive weapon, e.g. Wal-Mart and K-Mart. Specialty financial intermediaries might also prosper in well-defined niches, competing primarily on quality and service.

On a macroeconomic level, the availability of consumer credit is an important factor in determining the level of consumer spending. Recovery from the 1973-75 and 1980-81 recessions was speeded by the ability of consumers to defer

payment of goods purchased. On the other hand, the burgeoning debt held by consumers has significant implications for governmental and monetary policy-making. Population demographics are such that record numbers of younger married couples are entering the economy. Traditionally, these households have been the primary users of consumer credit and these same individuals appear less reticent about taking on higher debt levels than earlier generations have been.

Consumer loan rates are of special interest for one last reason. Since biblical times, usury regulations, or limitations on the rate of interest one may charge on loans, have been a part of many cultures' moral and legal codes. The recent bout of high interest rates and the consequent effects of many state usury laws has generated some debate regarding the desirability of interest rate ceilings and their benefit to the consumer.

The importance of consumer credit in the American economy and commercial banks' willingness and ability to provide credit at a fair price will have an important impact on our financial markets. An article in *Fortune* on Citicorp, the nation's largest commercial bank, notes:

> "For the past five years consumer revenues have been growing at 30% a year, three times as fast as the wholesale banking side, which lends to corporations and governments. If the trend continues, virtually all Citicorp's revenues will come from consumer banking within 15 years. Retail banking ... is rapidly becoming the only job that matters ... " (Norton, 1987).

PROBLEM IDENTIFICATION

Despite the increased interest in consumer lending shown by commercial banks and the importance of consumer credit in determining consumer spending patterns, little theoretical work has been done in the area of consumer loan pricing. Most of the literature on the theory of the banking firm fails to differentiate between the different types of loans present in a bank's portfolio, although significant differences in size, risk, and market characteristics clearly exist. In fact, very few studies directly address loan pricing at all. Slovin and Sushka (1983) derived a model of the commercial loan rate which was applied (incorrectly) to the behavior of consumer loan rates in a recent working paper by Sullivan and Fain (1984). Other empirical investigations of bank loan rates have generally concentrated on geographic and competitive differences with mixed conclusions.

The lack of a substantive theoretical base presents difficulties for bank managements wishing to maximize the value of their firms. The recent wave of bank deregulation has led to the entry of many new competitors in the financial services arena. Now more than ever, it is imperative that a bank have a thorough understanding of the characteristics underlying the supply and demand of its various product offerings. As banks' monopoly power decreases, lower margins of error in the pricing of bank services will be allowed.

RESEARCH OBJECTIVES

The objective of this dissertation is to develop a microeconomic model of the banking firm with explicit attention given to the pricing of consumer loans. The model will be tested with microeconomic cross-sectional time-series data from depository financial institutions in six metropolitan areas of the United States. An important goal of this research is to identify the influence of competitors' offerings on consumer loan rates charged by commercial banks; this information may be useful in the formulation of strategic policies by bank managements.

CONTRIBUTIONS AND SIGNIFICANCE

The results of this research will make several theoretical and practical contributions. As previously noted, no formal model of the consumer loan rate has been proposed in the academic literature. Moreover, the microeconomic model proposed in this dissertation will be tested with micro-, rather than macro-, economic data, which has NOT been the case in other examinations of loan rate behavior (Slovin and Sushka, 1983; Sullivan and Fain, 1984; Lee, 1985). The development and testing of this model should add to our understanding of the the behavior of consumer loan rates at depository financial institutions.

Bank managements should find the results of this dissertation useful in establishing a framework for consumer loan pricing. High loan rates may affect shareholder wealth

by discouraging profitable loans to good customers. Low loan rates may affect shareholder wealth through lost profit opportunities.

Automobile finance companies may gain insight into their competitors' behavior by a reading of this paper. Although the model is intended as a general approach to consumer lending, its testing is limited to the rates charged on automobile loans, which comprise the largest category of installment lending in the United States. The recent use of incentive financing plans to bolster automobile sales suggests that the automobile finance companies may have a keen interest in commercial banks' reactions to their pricing policies.

Finally, consumers may benefit from the results presented in this dissertation if they are in a position to shop for lower-cost financing. Alternative sources of consumer credit generally increase market efficiency, and knowledge of the loan pricing decision may increase one's ability to negotiate or choose better loan terms.

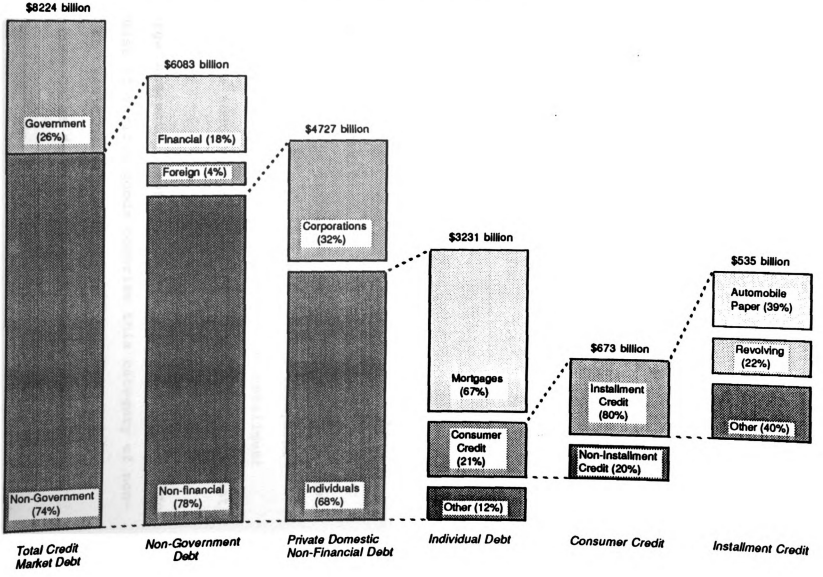
II. LITERATURE REVIEW

This review is developed in sections. First a general overview of consumer credit markets is presented, with especial attention to the history of automobile finance, regulation of consumer lending, and consumer credit knowledge. Second, the academic literature on the theory of the banking firm is reviewed and characterized. Third, previous work on the determinants of bank loan and deposit rates is discussed.

CONSUMER CREDIT MARKETS

The Board of Governors of the Federal Reserve defines consumer credit as including all short- and intermediate-term credit extended through regular business channels to finance the purchase of commodities and services for personal consumption, or to refinance debts incurred for such purposes (Chapman, 1967). A significant portion of the nation's outstanding credit market debt is held in this form. In 1985, consumers were responsible for $1066 billion of nonmortgage debt, or about 33 percent of the total debt held by individuals (Figure 1).

Figure 1. 1986 Credit Market Debt Outstanding



Households borrowed $291 billion in 1986, making them the largest single sector in net credit market borrowings (Table 1). Approximately one-fourth of these funds were raised in consumer credit markets.

Table 1. 1986 Net Credit Market Borrowing By Sectors[1]

SECTOR	AMOUNT	PERCENT
Households	$291.2 billion	27.2 %
Nonfinancial Business	262.2 billion	24.5
US Government	214.3 billion	20.0
Government Agencies	171.1 billion	16.0
State/Local Governments	60.0 billion	5.6

TYPES AND CHARACTERISTICS OF CONSUMER CREDIT

Non-Installment Credit

Consumer credit is classified as installment (multiple repayment periods) or non-installment (single repayment period). There are three major types of non-installment credit: charge accounts, service credit, and single-payment loans.

Charge Accounts Unpaid balances owed to retailers for the purchase of various goods comprise this category of non-installment credit market debt. Some travel and entertainment cards debts, e.g. American Express, are

[1]Board of Governors of the Federal Reserve System, *Flow of Funds Accounts* (March 1987)

included in this category. This type of credit is declining in popularity as VISA and MasterCharge accounts gain ever-wider usage.

Service Credit These are accounts owed to service professionals and institutions, such as doctors, lawyers and utility companies.

Single-payment Loans Also called 'bullet loans', this category refers to loans which are repaid in a single payment. Rates are usually low because most of these loans are heavily collateralized. Security and policy loans on one's life insurance are examples of this type of credit.

Installment Credit

Installment credit is the more important form of consumer credit and is the focus of this dissertation. Eighty percent of consumer credit is in this form. There are four major categories of installment debt: Automobile Credit, Revolving Credit, Mobile Home Credit and Other. The volume of outstanding consumer installment credit has increased tremendously in recent years (Figure 2).

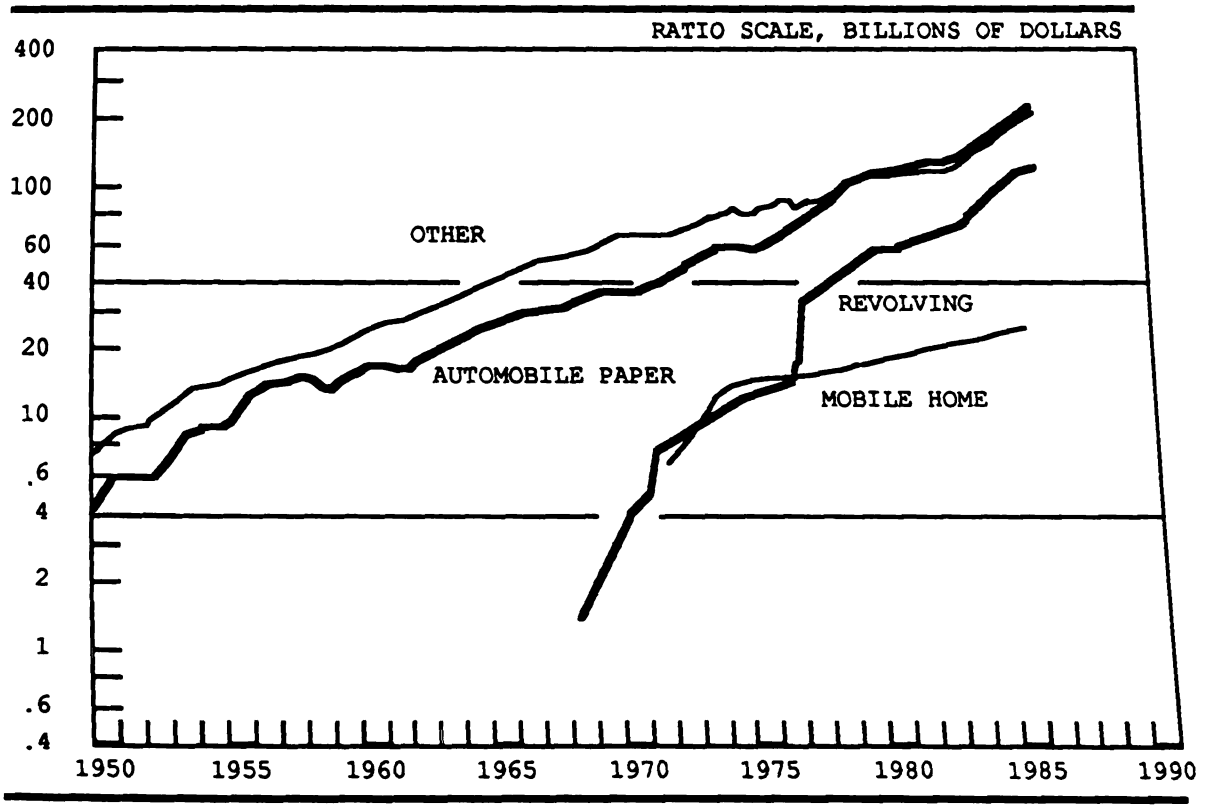


Figure 2. Major Types of Consumer Installment Credit[2]

Automobile Credit This is the largest category of consumer installment credit, with over $240 billion outstanding. The importance of the automobile in American culture is well-documented; most purchases are made with borrowed funds. In addition to the volume of extensions and outstandings, the Federal Reserve reports the average interest rate, maturity, loan size, and loan-to-value ratio for new and used cars in the *Monthly Bulletin*. Automobile

[2]Board of Governors of the Federal Reserve System, *Historical Chart Book* (1986)

loan rates will be used to test the consumer loan rate model developed later in this dissertation.

Revolving Credit Credit card debts comprise the majority of revolving consumer credit. Nearly one trillion of these instruments are in estimated use worldwide (Rose, 1986). Revolving credit refers to the existence of a prearranged line of credit where the timing of both extensions and repayments are at the option of the creditor. Another form of revolving credit is the overdraft loan available at many depository institutions.

Mobile Home Credit This type of credit facilitates the purchase of mobile homes by consumers.

Other The final category of consumer installment credit encompasses loans made for a variety of purposes. Household expenses, debt consolidation, vacations, and purchases of durable goods other than automobiles are included in this lending miscellany.

Installment Credit Terms

In an installment loan contract, the issuer agrees to lend a specified sum for a specified period of time at a specified rate of interest. The loan itself is to be repaid according to a payment schedule, which determines the amount and timing of these payments. Each of these terms affects the amount of credit lenders are willing to supply and the amount demanded by consumers. From the lender's perspective, increasing loan size decreases per-dollar loan costs, as

origination costs are generally fixed. Increasing the term of the loan exposes the lender to greater default risk and to greater interest rate risk if the loan rate is fixed. The response of borrowers to installment credit terms will be reviewed in a later section.

Lenders appear to specialize in the types and terms of loans offered. Interest rates on loans obtained from finance companies usually are higher than those on loans obtained from commercial banks. This difference can be explained in part by lower individual loan sizes and the greater risk of borrowers at finance companies (Boczar, 1975, 1978). A trend towards longer maturities has developed in recent years, particularly in automotive lending. Higher automobile prices and borrowers' desires for low monthly payments have contributed to this pattern (Luckett, 1986).

Suppliers of Consumer Credit

Consumer debt obligations are held by a number of financial institutions. Commercial banks, finance companies, credit unions and thrift institutions (mutual savings banks and savings and loans) are the major suppliers of installment credit. Retailers and gasoline companies are net suppliers of revolving and charge card credit. The relative amounts and types of installment credit supplied by these intermediaries is in Table 2.

Table 2. Outstanding Consumer Installment Credit

	Commercial Banks	Finance Companies	Credit Unions	Thrifts	Retailers	Gasoline Cos.	Total
Automobile	$118.1	$ 98.9	$ 47.1	$ 18.8	-	-	$282.8
Revolving	109.6	-	8.4	15.5	$ 37.7	$ 3.7	174.9
Mobile Home	8.9	7.4	-	9.5	-	-	25.9
Other	65.5	37.5	30.0	24.4	6.0	-	163.4
Total	$302.0	$143.8	$ 85.6	$ 68.2	$ 443.6	$ 3.7	$646.9

Source: *Federal Reserve Bulletin*, (November 1988), Table 1.55. Figures in millions of dollars.

Commercial Banks Commercial banks make short and intermediate-term loans to individuals for the purchase of automobiles, home improvements, education and a variety of other goods and services. At the end of April 1987, banks held $263 billion, or about 45% of total installment credit outstanding, making them the largest direct participants in the consumer credit markets. Banks provide indirect consumer financing as well through loans and loan commitments to finance companies and retailers.

Finance Companies Finance companies extend credit to consumers in the form of personal loans and automobile paper. Formerly, a distinction was made between companies which made direct cash loans to consumers (personal finance companies) and companies which purchased installment sales contracts from dealers or retailers (sales finance companies). Presently, a more useful dichotomy might be made between the captive finance companies and independent finance companies. Captive finance companies such as General Motors Acceptance

Corporation (GMAC), IBM Credit Corporation and Sears Roebuck Acceptance Corporation provide financing to facilitate the sale of their parent company's products. Independent finance companies specialize in the provision of short-term cash loans to higher risk individuals. C.I.T. Group Holdings, Associates Corporation of North America and Household Financial Services Corporation are among the largest independent finance companies in the United States (Cacace, 1987).

Credit Unions Credit unions specialize in the granting of credit to persons sharing a common bond. Members utilize these funds to purchase automobiles, homes and to fund nondurable items like education and vacations. They are the most rapidly-growing market participants.

Thrift Institutions The recently-deregulated thrift institutions (savings and loans, mutual savings banks) are a growing presence in the increasingly-competitive consumer credit arena offering automobile and personal loans to individuals in more-or-less restricted geographical areas.

Consumer installment credit experienced rapid and widespread growth in the post-World War II years. The total outstanding rose from $4.4 billion in 1946 to $577.8 billion in 1986, an annual rate of increase of 13.3 percent per year. Population growth, rising incomes, and the increased availability and widespread use of health and unemployment insurance have been cited as important factors in this growth

(Chapman, 1967). Figure 3 presents information on the growth of consumer debt held by financial intermediaries.

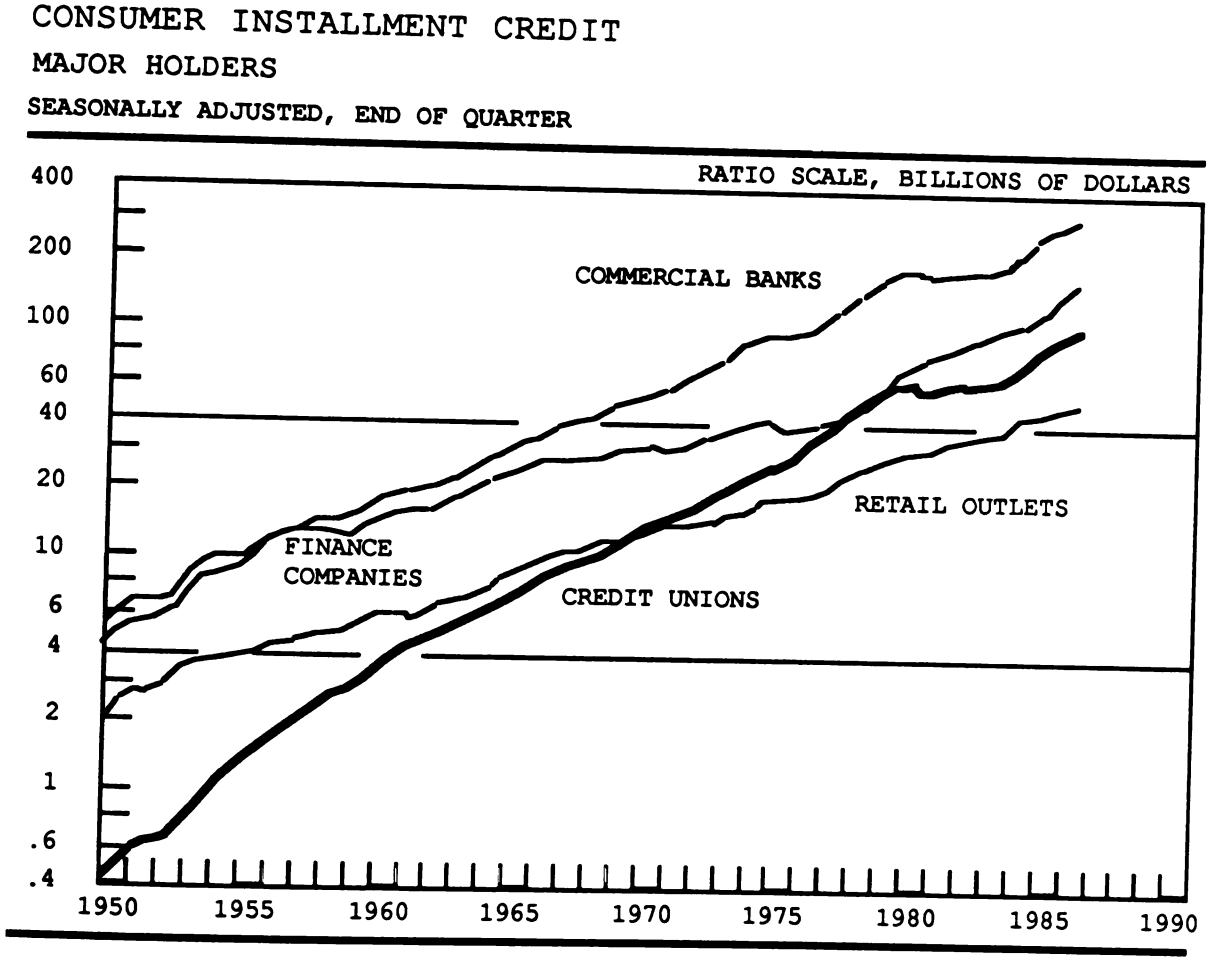


Figure 3. Major Holders of Consumer Credit[3]

Consumer Credit Demand

The demand for consumer credit has been investigated using annual surveys of consumer attitudes towards various loan characteristics and repayment policies. From 1947 through 1970 these were conducted by the Survey Research

[3]Board of Governors of the Federal Reserve System, *Historical Chart Book* (1986)

Center at the University of Michigan (Katona, Mandell and Schmiedeskamp, 1970). In the late 1970s, balance-sheet data were collected as part of a consumer credit sponsored by the Federal Reserve Board (Durkin and Elliehausen, 1977). The 1983 Survey of Consumer Finances is the most recent comprehensive study generally available (Avery et al.; 1984a, 1984b). Each of these surveys used personal interviews to determine the distribution of assets and liabilities among families with various characteristics (Table 3).

Table 3. Consumer Debt by Family Characteristics

	PERCENT OF FAMILIES	MEAN (dollars)	MEDIAN (dollars)
Family Income (dollars)			
Less than 5000	33	2834	677
5000 - 7499	40	1919	573
7500 - 9999	48	4152	1006
10000 - 14999	54	3452	1451
15000 - 19999	66	4295	1639
20000 - 24999	72	4149	2336
25000 - 29999	72	4632	2929
30000 - 39999	77	5138	3594
40000 - 49999	80	7079	4365
50000 or more	75	12,772	5529
Age of Family Head (years)			
Under 25	64	3584	2263
25 - 34	77	4781	2265
35 - 44	79	6673	3030
45 - 54	71	5780	3152
55 - 64	57	6325	1700
65 - 74	31	3567	943
75 and over	15	1117	308
Race of Family Head			
Caucasian	63	5577	2503
Nonwhite and Hispanic	60	4578	1830
Life-Cycle State of Family Head			
Under 45 years			
Unmarried, no children	64	4864	1900
Married, no children	86	4877	2949
Married, with children	83	5922	3076
45 years and over			
Head in labor force	66	6403	2949
Head retired	27	2967	677
All ages			
Unmarried, with children	65	4433	1135
All Families	62	5400	2382

Source: Avery et al., (1984b)

Up to an income of $20,000 to $24,999, the greater the income, the larger the proportion of families that owe consumer debt. Above that level of income the proportion remains relatively stable, although as incomes rise the mean and median amounts of consumer debt outstanding increase. Outstanding debt increases with the age of the family head

until 44, when it begins to decline. Married couples are more likely to use consumer credit than unmarried persons.

Peterson and Peterson (1981) investigated the relationship between borrower characteristics, downpayments and defaults. They conclude that the default rate on new car loans decreases as downpayments rise and that occupations are significantly related to default rates. It appears that workers most vulnerable to layoffs are more likely to default. The most useful predictor of default risk, however, is age. Younger borrowers (< 30 years) are more than three times more likely to default than older borrowers (> 30 years).

Borrower segmentation of the consumer loan market was analyzed in a paper by Johnson and Sullivan (1981). They found that consumers were aware of differences in rates between banks and finance companies and that finance companies were patronized by choice, rather than necessity. They report,

> "... very little of the market segmentation of banks and finance company customers appears to be a supply-side phenomenon. Many - perhaps three-fourths - of the customers of finance companies were sufficiently creditworthy to warrant loans from commercial banks. Instead, most of the market segmentation apparently stemmed from consumers demands."

Consumer Debt Burdens

The record levels of household indebtedness have given rise to concerns ranging from economic recession through slowed future spending to a nationwide depression arising out

of borrower defaults (Kaufman, 1986; Malabre, 1987). Although the "debt burden", or ratio of consumer installment credit to disposable income has increased steadily since World War II, it has taken a sharp upward turn in recent months (Figure 4).

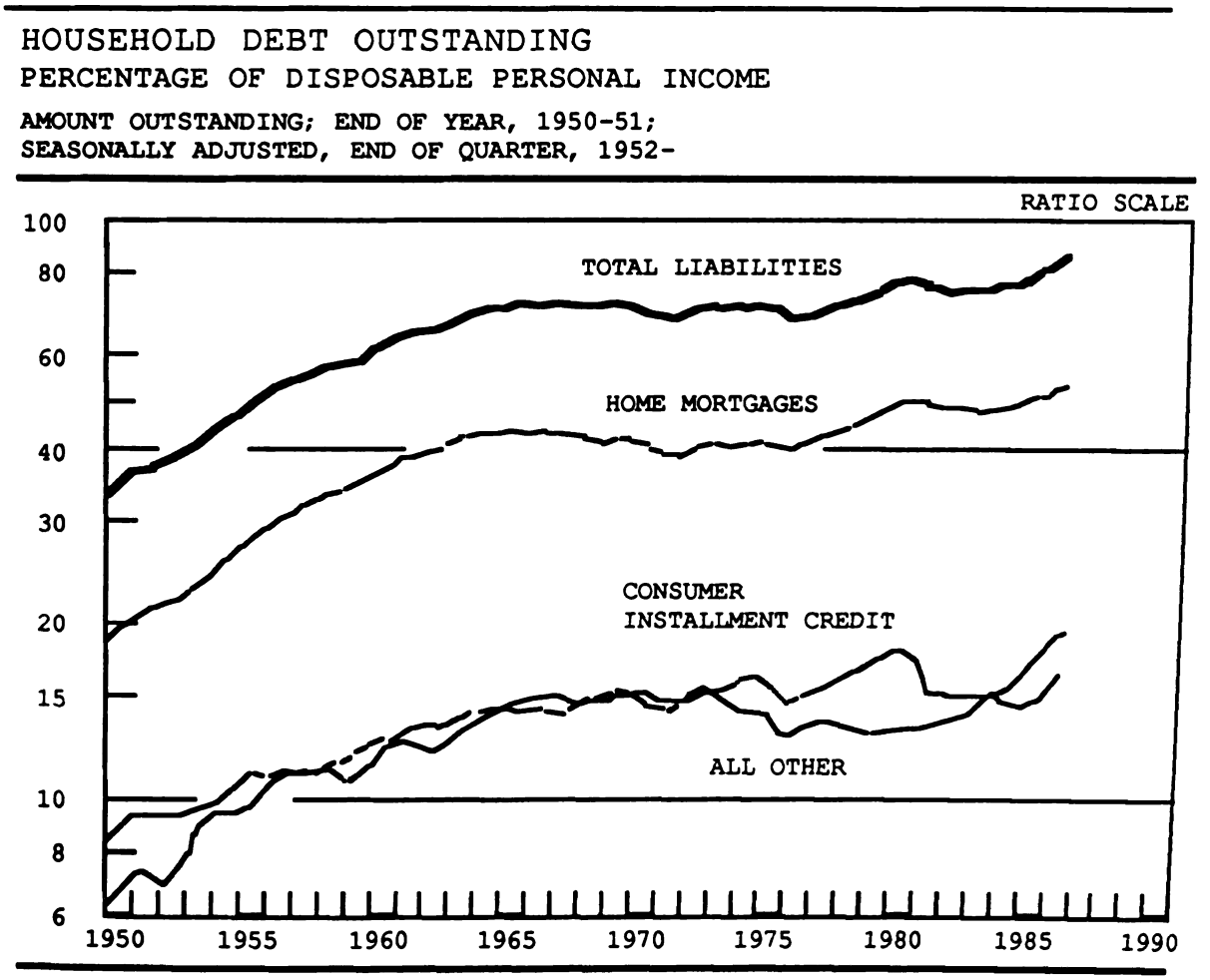


Figure 4. Outstanding Household Debt[4]

[4]Board of Governors of the Federal Reserve System, *Historical Chart Book* (1986)

Factors contributing to credit growth include the relaxation of binding usury ceilings, greater usage of adjustable-rate financing and increased lending involvement by savings and loans. Other influences, such as the growing use of credit for convenience purposes, the lengthening of maturities on new consumer loans, and changing demographics towards the 25-34 and 35-44 year old age categories (traditionally heavy users of consumer credit) inflate outstanding credit without suggesting any seriously negative impact. Moreover, when outstanding debt (a stock) is measured as a percent of total assets (a stock), rather than as a percent of income (a flow), the spectre of financial collapse appears less imminent (Luckett and August, 1985; Pearce, 1985).

HISTORY OF AUTOMOTIVE FINANCE

A review of the history of automotive finance is of interest for three reasons. First, automobile credit is the single largest component of consumer installment credit, which is the item of primary interest in this dissertation. Second, the development of automobile credit markets are responsible in large part for the market structure we observe today. Third, this study uses automobile loan data to test its model of the consumer loan rate.

The history of automobile finance is necessarily tied to the invention and development of the automobile market. Henry Ford's 1909 landmark decision to concentrate production

on the affordable Model T is credited as the cornerstone of the American automobile industry. Installment selling of cars was rare before World War I, although by the mid-twenties nearly three-quarters of all cars were sold in this manner. Michelman (1970) writes,

> "Not only was the old American morality concerning buying on time about to crumble in the face of such a convenience, but generations of young couples were handed a suitable locale for various degrees of misconduct."

Shay's (1964) article reviews the history of automobile finance through 1962. He identified four stages through which automobile financing had passed to that point in time.

The Experimental Period (1915-1922)

Seligman (1927) has suggested that consumers were financing automobile purchases through Morris Plan Banks as early as 1910. By 1913, L. F. Weaver, a San Francisco automobile dealer, had established an organization to finance the installment sales of his cars (Phelps, 1952). The Guaranty Securities Company of Toledo was formed in 1915 to facilitate the sale of Willys-Overland cars but soon expanded to provide credit for the purchase of competing makes. In 1916 the Commercial Credit Company and the Commercial Investment Trust (C.I.T.) Corporation were established; these firms continue in existence today. At the close of 1917 nearly forty firms had devoted themselves to the financing of automobile purchases (Phelps, 1952).

In the early days of the automobile, most purchasers either paid cash or obtained credit from a sales finance company with whom the dealer had a 'preferred' relationship. In 1919, General Motors established the General Motors Acceptance Corporation (GMAC) to better service the credit needs of its automobile customers. That same year, the Industrial Finance Corporation (IFC) signed an exclusive agreement with the Studebaker Corporation to finance the sales of its cars. The involvement of auto manufacturers in automobile sales financing was to have an important impact on the development of this new market.

A variety of methods developed for the setting and quoting of finance charges, due in part to the different backgrounds of the respective credit companies. Interest charges, service charges and insurance fees were manipulated to produce an often-confusing panoply of rates. The recession of 1920-21 sharply restricted automobile financing as sales dropped and interest rates rose. Shay (1964) estimated annual interest rates over the period 1919-22 at approximately 14 percent.

The Stage of Manufacturer Participation (1922-1935)

Following the recession, agreements between automobile manufacturers and large sales finance companies emerged providing mutually-advantageous subsidies. Dealers began to share in finance charge income, although reserve agreements (wherein manufacturers withheld a portion of the purchase

price of the automobile paper as a contingency against losses) encouraged them to maintain the quality of their loans. This subsidy system encouraged credit purchases and held rates at lower levels than would otherwise have been the case. The number of independent companies grew as well - Seligman (1927) reports nearly 1600 in operation as of 1925! By 1932, increases in reserves increased the rates charged purchasers as loan losses mounted during the Depression.

Chrysler Corporation signed a financing agreement with Commercial Credit Corporation in 1926. The Hudson Motor Car Company affiliated itself with C.I.T. during this period as well. In 1928, Ford Motor Company formed the Universal Credit Corporation to finance the sale of its automobiles, which it operated until its sale to C.I.T. Corporation in 1933. Finance charges fluctuated rather extensively over the period 1922-35 (Figure 5).

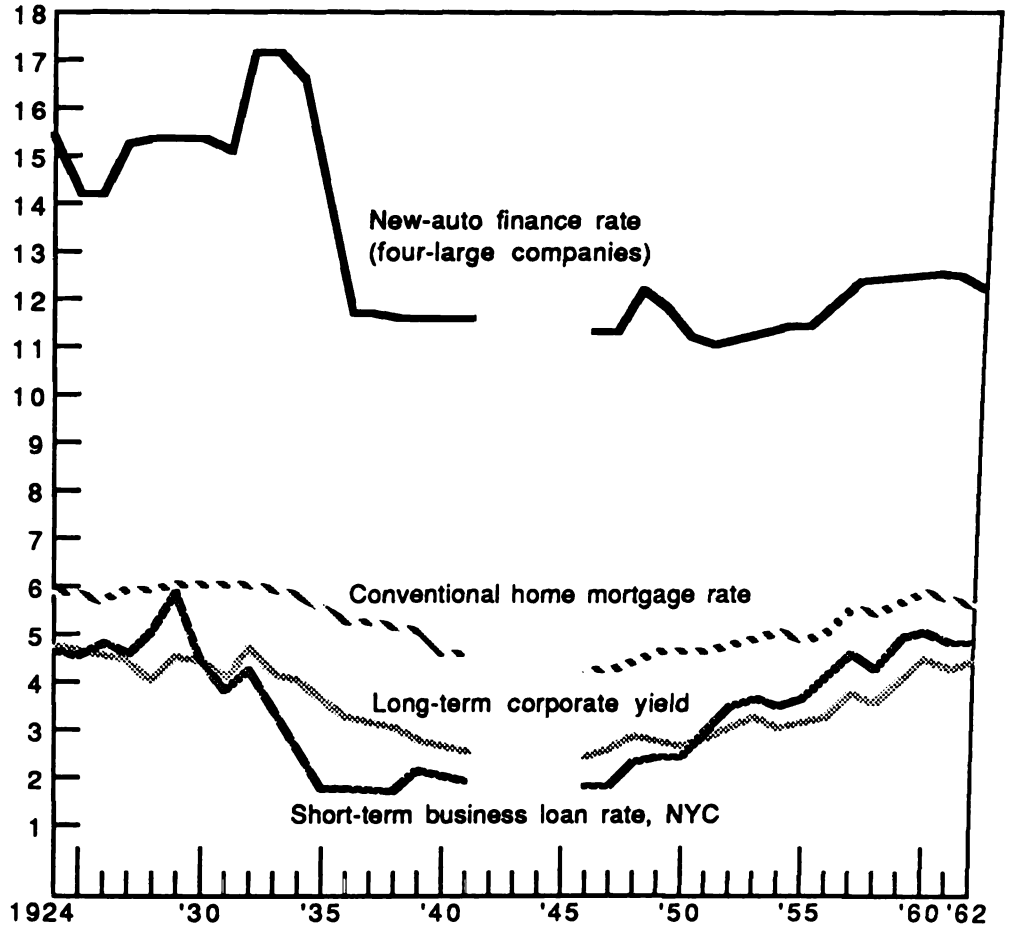


Figure 5. Average New-Auto Finance rates, 1924-1962[5]

Prior to 1930, banks were not significantly involved in consumer lending. A generally-conservative banking profession had strong predjudices against lending to consumers for the purpose of purchasing household goods or luxuries. Business loan demand was more than adequate for the placement of deposit funds. Operational problems, perceptions of high risk and an unwillingness to try something new and different prevented banks from immediately embracing these new opportunities. A number of observers

[5]Shay (1964), p. 213.

viewed consumer lending as morally reprehensible. Phelps (1952) reports,

> "The use of credit, and particularly the installment type, by consumers was characterized as 'an economic sin,' as 'enervating the character because it leads straight to serfdom,' as setting 'utterly false standards of living,' causing judgement to become 'hopelessly distorted,' and tending to 'break down credit morale.' It was attacked as 'marking the breakdown of traditional habits of thrift,' as tending to 'weaken the moral fiber of the Nation,' and as dangerous to the economy of the United States.
>
> It was accused of 'breaking down character and resistance to temptations, to extravagance, and to living beyond one's means, breeding dishonesty,' causing 'many young people to get their first experience of being deadbeats through yielding to temptations that are placed before them,' and 'creating a new type of criminal or causing professional deadbeats to shift to this new and highly lucrative opportunity."

By the mid-1930s, a more tolerant attitude towards consumer borrowing had developed. Changing mores and weak business loan demand led banks to enter the consumer loan market during the Great Depression.

The Period of Anti-Trust Activity (1935-1952)

An abundance of funds and active commercial bank participation brought increased competition to the growing automobile credit market, causing a decline in loan rates. Federal anti-trust authorities became concerned over the long-term direction of the industry, and many states passed legislation designed to protect dealer and consumer interests. The first recorded incentive financing plan debuted in 1935. Known as the "Six Percent Plan", it was introduced by GMAC and quickly copied by the other large

sales finance companies. Although created as a competitive weapon, it also sought to increase the public's knowledge of finance rates. Figure 6 presents a facsimile of an advertisement of that era.

GMAC

General Motors Acceptance Corporation Reduces Time Payment Costs

on New Cars with a New 6% Plan

Simple as A, B, C

A - Take your Unpaid Balance

B - Add Cost of Insurance

C* - Multiply by 6% - 12 month's plan (One-half of one per cent per month for periods more or less than 12 months). That's your whole financing cost. No extras. No service fees. No other charges.

*In some states a small legal documentary is required.

Figure 6. GMAC's Six Percent Plan[6]

The Federal Trade Comission (FTC) charged GM with misleading and deceptive advertising in 1936, arguing purchasers might misinterpret the offering as a 6 percent annual interest rate on the unpaid balance. General Motors and its subsidiaries were ordered to cease and desist in 1939 (Plummer and Young, 1940).

The Department of Justice instituted anti-trust proceedings against General Motors, Ford and Chrysler in 1937, leading the latter two firms to divest their finance subsidiaries through consent decrees in 1939. GM contested

---

[6]Shay (1964), p. 214.

its indictment, and after a lengthy court battle, was finally allowed to maintain ownership of GMAC in 1952. It was prohibited from extending factory preferential treatment to dealers utilizing GMAC services, however.

During the war, new car production decreased as production efforts were shifted to war materiel and armaments. Government controls on interest rates (Regulation W) and relatively high disposable incomes maintained rates at generally low levels.

The Era of Inter-Agency Competition, (1952-present)

By 1952, commercial banks held a 42% share of the auto credit market, up from 28% in 1939. They became the largest holder of automotive credit in 1958. Ford Motor Credit Company began operations in 1959 after GM's consent decree was extended to the other automakers. Consumers have benefited from rate decreases engendered by increased competition. Shay (1964) writes,

> "The growth of competing credit agencies, particularly commercial banks and credit unions, has tended to replace the four large sales finance companies as low-cost credit sources in the new-auto installment credit market … the major result of such competition has been the secular decline in the cost to consumers of obtaining larger amounts of credit for progressively longer periods of time."

Outstanding automobile credit grew with automobile sales during the late 1970s, contracting somewhat during the early 1980s and rapidly expanding during 1984 and 1985. Commercial banks in particular cut back on consumer lending in the 1980-

82 period, reducing their share of the automobile credit market to 45 percent from 58 percent. Manufacturers stepped in to fill the void, offering below-market rates in 1981 on certain slow-selling models. Over the three-year period ending in 1982, finance companies had increased their automobile credit holding by more than 80 percent.

The strong resurgence of the American economy beginning in 1983 has had a dramatic impact on new car sales and automobile financing. Banks flush with funds began expanding once more into consumer lending, attracted by 'sticky' rates that dropped more slowly than general market rates. In late 1982 the captive finance companies briefly attempted to stimulate sales with reduced-rate or incentive financing programs, while at the same time reducing their investment in outstanding automobile receivables. Commercial banks and the newly-deregulated savings and loans eagerly stepped in the fill unmet consumer needs. In 1985, the automotive finance companies entered the market once more with an aggressive round of financing incentives that remains with us today. Banks, savings and loans and credit unions are concerned about the future competitive structure of the industry.

Recent Developments in Automobile Financing

Luckett (1986) identified three topics of especial importance in his review of recent developments in automobile finance.

Leasing Leasing is becoming more attractive to consumers as car prices increase and the interest expense deduction is eliminated by the Tax Reform Act of 1986. It offers an alternative to customers wishing to obtain the use of an automobile without the risk of ownership. The initial outlay on a lease agreement is generally smaller that that required for purchase; payments may be greater or less than those of the purchase option. A survey sponsored by the Consumer Bankers Association (1986) reports the industry is growing more competitive and that profit margins at commercial banks are being squeezed. Note that the same Act which sparked consumer interest in leases also eroded lender profits by removing the investment tax credit and accelerated depreciation benefits. Consumer pressure to disclose leasing terms may impact banks' willingness to supply funds to this market in the future.

Securitization Until recently, the issuance of asset-backed securities was largely confined to the repackaging and sale of mortgage loans. In 1970, the Government National Mortgage Association (GNMA) developed the Ginnie Mae pass-through as a method of selling participation in single-family FHA and VA mortgages. With over $2 trillion outstanding, mortgage loans account for the majority of loans securitized.

In early 1985, Salomon Brothers underwrote a $10 million debt issue secured by auto loans on behalf of Lloyd Andersen, a large West Coast finance company. Salomon titled these

instruments "CARS", for Certificates of Automotive Receivables. Shortly thereafter, Marine Midland Bank and Valley National Bank of Phoenix issued similar packages. GMAC became the first captive finance company to issue securities backed by auto loans in December 1985 with a $525 million issue. Since that time, GMAC has dominated the market. Its most recent issue was a record-breaking $4 billion. Chrysler Corporation and Nissan Motors have sold similar securities.

Issuers of asset-backed securities are attracted by opportunities to improve capital ratios and rid themselves of unwanted assets. Investors appreciate the relatively high yields and apparently low risk levels. Investor risk on auto-backed securities appears moderate due to historically low delinquency rates and low inclinations of consumers to pre-pay their loans when rates decline. In addition, most issues have limited repayment guarantees attached. As the market expands, however, it is likely that lesser-quality loans will be pledged, increasing the risk to investors. Standard and Poor's and Moody's have not yet issued definitive ratings for these instruments.

The development of a secondary market in consumer receivables could lead to lower rates for consumers as lenders compete more aggressively for auto loans to repackage and sell. The general decline in mortgage rates sparked by the movement of mortgage bankers into the once savings and

loan-dominated mortgage market can be cited as an example of this phenomenon (Monroe, 1985).

Incentive Financing Reduced rate financing (subvention financing) by the automotive finance companies has significantly impacted the structure of automobile credit markets. Periodic offerings of cut-rate financing were first used in 1982 to boost sales of cars left over from the previous model year. Initially, these programs were limited in scope and offered rates not significantly less than those available at banks and other depository institutions. More recently, incentive rates have dipped deeply below market rates. Prior to its aquisition by Chrysler Corporation, American Motors offered 0.0% financing on new cars.

Through subvention financing, the auto finance companies have established control over the new automobile finance market (Consumer Bankers Association, 1987). The National Credit Union Administration filed a complaint with the Federal Trade Commission in 1986 charging the finance companies with antitrust and consumer protection violations, although those allegations were recently found to be without merit (Luipo, 1987). The promotion of finance charges as a reason to purchase a particular type of automobile at a particular time has had some negative effects for the automakers as well. First, price is the easiest variable in the marketing mix for competitors to duplicate (Kotler, 1986). Second, limited-duration promotions may lead consumers to postpone purchases until more favorable terms

are available. Third, the monies necessary to fund below-market loans by GMAC and the other captives are transferred from the parent operating corporation. The consolidated impact on the consumer of higher car prices financed at lower costs has not yet been determined.

The ability to sell joint products such as credit life insurance and extended protection plans suggest it is unlikely that the auto finance companies will quickly relinquish their gains in market share. The National Automobile Dealer's Association (NADA) estimates that finance and insurance income has come to account for approximately 15 percent of the combined new and used vehicle departments' gross profits (Lukasiak, 1987).

The impact of automobile incentive financing plans on commercial bank loan portfolios and loan rates has not yet been established. Respondents to an annual financing survey sponsored by the Consumer Banker's Association reported a 17 percent increase from 1985 to 1986 with average loan size increasing slightly from $7140 to $7260 (Consumer Banker's Association, 1987). Loan delinquency data do not support the contention that banks are lending to more risky borrowers, however. The major impact of subvention financing on commercial banks appears to be in a lengthening of the average loan portfolios. Most of the incentives offered by the captive finance companies apply to relatively short-term loans, i.e. 24- and 36-months. Opportunities exist for loans

of longer maturities or for models not covered by incentives, e.g. foreign makes.

REGULATION OF CONSUMER LENDING

Most consumer legislation was passed in response to the rapid growth of consumer credit in the 1960s and 1970s. The Consumer Credit Protection Act of 1968, or Truth-in-Lending, was a major step in ensuring that consumers received accurate information about credit costs in order to facilitate comparison shopping. Discrimination in the granting of consumer credit was a concern of the civil rights movement of the mid-1960s and led to the passage of legislation prohibiting these practices. The Fair Housing Act of 1968 and the Equal Credit Opportunity Act of 1974 forbid discrimination based on sex, age, race, marital status, color, religion and national origin. Abuses in the extension, collection and reporting of consumer credit are addressed by a variety of more specific federal laws. Table 4 chronicles the major events in consumer credit legislation.

Table 4. Federal Consumer Credit Legislation

YEAR	LEGISLATION	DESCRIPTION
1968	Truth-in-Lending Act [Regulation Z]	Requires uniform disclosure of credit charges and established method of reporting charges as the 'annual percentage rate'
1968	Fair Housing Act	Prohibits discrimination in any part of a credit transaction involving housing
1970	Fair Credit Reporting Act	Set requirements for consumer credit reporting agencies and users of credit information to prevent innaccurate or inappropriate information disclosure
1974	Real Estate Settlement Procedures Act (RESPA) [Regulation X]	Requires lenders to inform potential homebuyers in writing of settlement charges to prohibit kickbacks and limits use of escrow accounts
1974	Equal Credit Opportunity Act [Regulation B]	Prohibits discrimination in personal and commercial credit transactions
1975	Home Mortgage Disclosure Act [Regulation C]	Requires depository institutions to disclose home loan information; intended to prevent redlining'
1975	Federal Trade Commission Improvement Act	Establishes procedures for investigating consumer complaints against financial institutions
1976	Consumer Leasing Act [Regulation M]	Requires meaningful, accurate disclosures of the terms of personal property leases and established procedures for resolving disputes over the terminal liability
1977	Fair Debt Collection Practices Act	Designed to eliminate abusive and deceptive debt collection practices
1977	Community Reinvestment Act (CRA)	Intended to encourage depository institutions to help meet the credit needs of their community
1978	Right to Financial Privacy Act	Requires a Federal agency to obtain either the customer's authorization, subpoena or search warrant to obtain access to financial records
1978	Electronic Funds Transfer Act [Regulation E]	Focuses on the unsolicited issuance of access devices, liability for unauthorized use, error resolution and transfer documentation

Adapted from Spong (1985) and Rose (1986)

The Bankruptcy Reform Act of 1978 impacted consumer credit markets during the early 1980s by subsituting

relatively lenient Federal bankruptcy conditions for more onerous state regulations. Personal bankruptcies soared, causing lenders to set higher standards for loan approvals. The Bankruptcy Amendment and Federal Judgeship Act of 1984 addressed these problems and provided for improved monitoring systems and judicial relief in cases of abuse.

Usury Laws

Prohibitions on the maximum rate of interest that may be charged on a loan have a long history (Tauesch, 1942). They originated from the belief that unsophisticated borrowers required protection from unscrupulous lenders. During the early part of this century, loan sharks were a particular concern in the not-well-developed personal loan market, and many states adopted 'small loan laws' designed to prevent usurious rates of interest (Michelman, 1970). Today, most states have ceilings on the rate of interest that may be charged for certain types of consumer loans. In Michigan, the interest rate on new automobile loans may not exceed 16.5 percent.

When rate ceilings are non-binding, they generate little interest. During the late 1970s and early 1980s when interest rates rose to record levels, usury ceilings prevented lenders from earning normal profits and led to a decrease in the amount of credit supplied. This can be shown in a loanable funds framework (Figure 7).

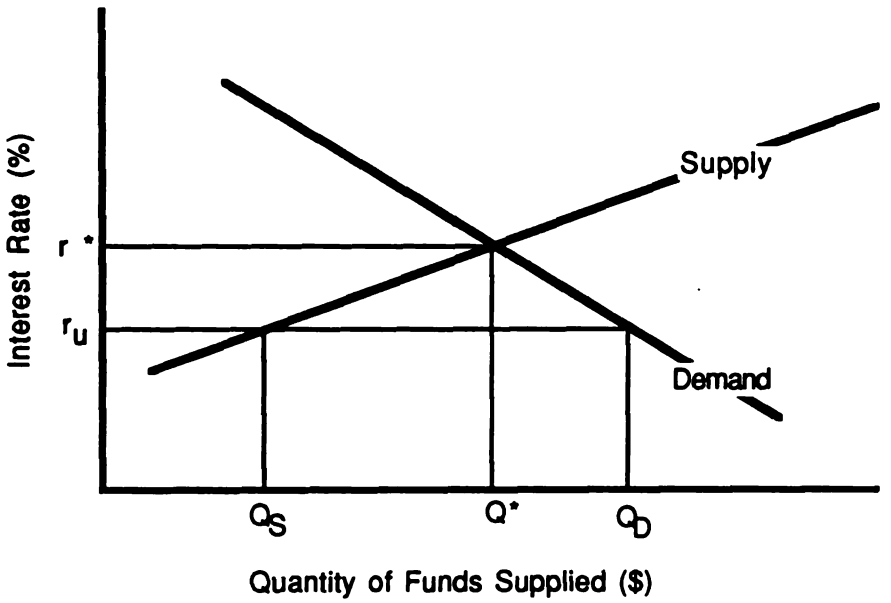


Figure 7. The Effects of Binding Usury Ceilings[7]

This situation illustrates the negative aspects of usury legislation. First, they affect the efficiency of financial markets. Lenders may require larger downpayments, shorter maturities or up-front processing fees in order to obtain required returns. Second, binding usury ceilings result in credit rationing. High risk borrowers are passed over in favor of less risky applicants. Ironically, this has the potential of harming the very individuals the laws were intended to protect, as the less well-informed or low-income consumers are frequently higher risks. Empirical studies of usury ceilings support the notion that loan supplies decline, noninterest compensation is increased, and borrowing by

[7]Adapted from Vandenbrink (1982)

higher-risk individuals is restricted (Goudzewaard, 1968; Greer, 1974, 1975; Shay, 1970, 1975).

Competition in consumer loan markets has been partially explained by restrictive rate ceilings (Sullivan, 1984). Binding interest rates reduce the intensity of competition between banks and finance companies for customers of similar risks.

Recent Legislation

The passage of the Depository Institutions Deregulation and Monetary Control Act (DIDMCA) brought about a number of developments in the consumer credit markets. Title IV of this Act allowed Federally chartered savings and loans to invest in consumer loans and issue credit cards. Title V preempted state usury ceilings on residential mortgage loans and Title VI revised the Truth-in-Lending Act to make it easier for lenders to comply with disclosure requirements. Title III of the Garn-St. Germain Depository Institutions Act of 1982 increased the permissible percentage of consumer loans at Federal thrift institutions from 20 to 30 percent of total assets.

CONSUMER CREDIT KNOWLEDGE

Consumer knowledge and sensitivity to credit terms is a matter of substantial historical interest. Early work by Due (1955) established that American families were relatively unaware of carrying charges or interest rates and

characterized consumer credit markets as imperfectly competitive. Families were found to be less concerned with credit costs than with their ability to meet monthly payments. Juster and Shay (1964) confirmed Due's conclusions in a comprehensive survey of consumer borrowers. They reported that although consumers appear to have "institutional" knowledge of credit terms, i.e. some kinds of credit cost more than others, this did not guarantee they would seek the lowest cost alternative.

Congress passed the Consumer Credit Protection Act, or Truth-in-Lending in July 1969. Its purpose is found in Section 102,

> "The informed use of credit results from an awareness of the cost thereof by consumers. It is the purpose of this title to assure a meaningful disclosure of terms so that the consumer will be able to compare more readily the various credit terms available to him and avoid the uninformed use of credit."

The efficacy of Truth-in-Lending has been controversial. Mandell (1971, 1973) reported that although consumers who borrowed after Truth-in-Lending were more aware of the true rate of interest than consumers who borrowed before, there were still significant gaps in their knowledge. Education and income were the key determinants of consumer credit knowledge and understanding. Other reports from the mid-1970s substantiated and extended Mandell's findings (Day and Brandt, 1974; Parker and Shay, 1974; Brandt, Day and Deutscher, 1975; Durkin, 1975; Shay and Schober, 1975b; Kinsey and McAlister, 1981).

By 1981, Durkin estimated that 54 percent of consumers could be classified as aware of annual percentage rates, compared with 14 percent before Truth-in-Lending's implementation. Awareness of interest rate charges was still lowest among less-educated and low-income groups, although awareness of the *dollar* amount of finance charges was greater for this population as compared to persons with more education and income. It is apparent from these studies that Truth-in-Lending's main purpose has been accomplished. Significantly more consumers are aware of credit terms than before the laws passage. Although total awareness has not yet been achieved, it is perhaps not necessary for market efficiency. A relatively small number of well-informed borrowers may suffice to 'police' the market and prevent gross abuses.

Recent work in this area has focused on consumers' choice of loan contract terms. Peterson and Black (1982) analyzed the results from surveys of 3,572 consumers in Purdue University's 1979 Consumer Financial Survey. The most frequently cited factors in their choice of credit sources were interest rates, finance charges and monthly payments. Slightly over twenty percent of the consumers who had obtained credit in the past year actively shopped around for the best terms, mostly at commercial banks. According to the authors, "... differences in non-rate payment terms appeared to have little influence on the selection of a borrowing source."

Sullivan (1985) evaluated consumers' choice of adjustable versus fixed-rate automobile loans. Consumers attracted to adjustable-rate loans have higher credit risk and higher monthly payment burdens than those choosing the fixed-payment option, suggesting that lenders who offer adjustable-rate loans may be substituting default risk for interest rate risk in their loan portfolios.

In Worden and Sullivan's (1987) recent study of consumer credit shopping, consumers were asked to state the most important factor on a credit contract. Almost 40 percent mentioned the interest rate, while another 40 percent mentioned the monthly payment size. They found that consumers' propensity to shop for credit 1) Increases with education, income and liquid asset holdings, 2) Is less for consumers with previous borrowing relationships, 3) Is less for consumers with past credit rejections, 4) Is higher for young, single persons with no children, and 5) Is lower for residents of rural areas and states with restrictive interest rate ceilings.

Models of the Banking Firm

The theory of the banking firm is still in its developmental stages. Although a substantial literature exists, "... this literature, however, is still unsettled and rather heterogeneous. There exist a number of rival models and approaches which have not yet been forged together to form a coherent, unified and generally accepted theory of

bank behaviour" (Baltensperger, 1980). Some of this dissonance arises from conflicting notions on what a bank should be optimizing, while a further source of confusion stems from the multiple functions served by banking firms. Before reviewing the attempts which have been made in this area, it is useful to identify the main functions of financial intermediaries.

WHY DO BANKS EXIST?

Financial intermediaries contribute to the efficient functioning of a financial system through a variety of products and services. Commercial banks specialize in a subset of these activities. Gurley and Shaw (1960) and Goldsmith (1969) have discussed the basic reasons for bank existence.

Asset Transformation

Banks perform a useful function by facilitating the transformation of small, highly liquid assets (bank deposits) into larger denomination, less liquid ones (loans and investments). Kane and Buser (1979) argue that divisibility problems favor the use of financial institutions.

Risk Transformation

Banks also provide a valuable service in the form of risk transformation. Deposit interest is paid from the earnings of a bank's loan and investment portfolio.

Diversification among a variety of investments reduces the risk of default and unrealized expectations. Klein (1973) suggests that financial firms offer a risk-return combination that dominates households' constrained opportunity set.

Brokerage

Banks enjoy cost and informational advantages in the evaluation of credit market applicants allowing them to profitably intermediate between 'sellers' (borrowers) and 'buyers' (depositors). Benston and Smith (1976) argue that banks' role in minimizing transaction costs justifies economic profits earned from the exploitation of depositors' constrained opportunity sets. The role of imperfect information in financial intermediation is a subject of substantial recent interest (Leland and Pyle, 1977; Campbell and Kracaw, 1980).

Transactions Services

The importance of commercial banks in administering the payments mechanism is well-established (Laidler, 1977). Demand deposits, wire transfers and credit cards are the primary means of making payment in the United States. In fact, maintaining a stable payments system is one of the major reasons for the proliferation of bank regulations (Spong, 1985).

Miscellaneous Services

Commercial banks provide safekeeping services for business and consumer wealth, aided by Federal deposit insurance, which significantly lessens the probability of bank default. Banks often act in a fiduciary capacity and supply trust services to their customers. Convenience functions, e.g. foreign exchange, loan guarantees, securities brokerage and insurance are also performed by banks.

Two fundamental approaches have been used to model the banking firm. The portfolio management approach assumes banks behave as risk-averse investors and allocates resources among asset categories to maximize expected returns for a given level of risk. The chief alternative to this approach views banks as microeconomic profit-maximizing firms intent on increasing short-term profits or net worth. A related literature in economics attempts to capture the effects of unmet loan demand (credit rationing) and its impact on the monetary system. Table 5 summarizes the major contributions of the first two approaches to the theory of the banking firm.

Table 5. Development of the Theory of the Banking Firm

AUTHOR	YEAR	SOURCE	DESCRIPTION
Shull	1963	Banking & Mon Studies	A monopoly model that presents commercial banks as multiple-product price-discriminating firms.
Kane and Malkiel	1965	Qrtly J Econ	A portfolio-management model with deposit variability.
Pesek	1970	Can J Econ	A real-resource model focusing upon the role and behavior of banks and the financial system.
Klein	1971	JMCB	A monopoly model that determines bank size and portfolio structure.
Pyle	1971	JF	A model based upon modern portfolio theory with hedging and quantity-setting behavior.
Hart & Jaffee	1974	Rev Econ Stat	A portfolio-theory approach in which the intermediary is a quantity-setter facing random deposit rates.
Towey	1974	JMCB	A real-resource model in the traditional theory-of-the-firm framework.
Pringle	1974	JMCB	An imperfect-markets and risk-aversion model focusing upon capital decisions in banks.
Edwards	1977	JPE	An expense-preference model applied to banking.
Sealey & Lindley	1977	JF	A neoclassical model based upon production and cost theory.
Fama	1980	JME	A general equilibrium look at banking in the theory of finance.
Baltensperger	1980	JME	A survey of alternative approaches to the theory of the banking firm with emphasis on 'partial' vs. 'complete' models.
Sealey	1980	JF	A model of the banking firm with analysis of deposit rate-setting, risk aversion, market conditions and resource costs.
O'Hara	1983	JF	A dynamic theory of the banking firm incorporating the bank's roles as an intermediary, managed firm and regulated enterprise.
Prisman, Slovin & Sushka	1986	JME	A stochastic programming model of the banking firm incorporating uncertainty and a liquidity constraint.

Modified from Sinkey (1983). JMCB = Journal of Money, Credit and Banking, JF = Journal of Finance, JPE = Journal of Political Economy, JME = Journal of Monetary Economics

The following sections briefly discuss the three major approaches which have been taken in modelling the banking firm. A more detailed review may be found in Santomero (1984).

PORTFOLIO MANAGEMENT MODELS

The chief advantage of the portfolio management models is their explicit treatment of uncertainty. They have been used most extensively to solve problems in bank reserve and liquidity management. Edgeworth's research in the late 1800s serves as the basis for much of this work (Santomero, 1984). Under this framework bank managements struggle to maintain adequate stocks of liquidity in the face of stochastic deposit demand while maximizing return on earning assets. Reserve requirements act to constrain bank behavior. Different solutions to this problem are obtained depending on the assumptions of market structure (Orr and Mellon, 1961; Poole, 1968; Hester and Pierce, 1975).

Parkin (1970), Pyle (1971) and Hart and Jaffee (1974) applied modern portfolio theory techniques to the problem of asset choice. Price-taking in loan and deposit markets leads to optimal portfolio choice in the quantity of various earning asset categories. In Pyle's model an intermediary must choose between three securities: a risk-free asset, risky loans and risky deposits. Intermediation, i.e. the transformation of deposits into loans is found to occur only with the existence of positive risk premia. Hart and Jaffee

verified Tobin's (1958) separation theorem for financial intermediaries constrained by institutional and market factors without assuming that intermediaries can borrow or lend at the risk-free rate.

In a recent paper O'Hara (1983) assumed the novel objective function of maximizing the utility of a bank manager's share of bank profits. She used stochastic dynamic programming to solve a multiperiod model incorporating uncertain loan and deposit rates. Although perfect competition is still assumed in both asset and deposit markets, O'Hara makes a significant contribution through her attempt to incorporate risk, capital adequacy and resource costs within a general model.

Portfolio management models have been criticized for their assumptions of perfect competition, failure to incorporate real resource costs and 'stand-alone' nature. Baltensperger (1980) refers to them as 'partial' rather than 'complete' models, since they typically treat but a portion of the balance sheet. A serious shortcoming of the portfolio approach is its general failure to include the effects of deposit uncertainty. In most models banks are assumed to be quantity-setting price-takers with respect to deposit supplies, while the reverse situation is a more likely description of the actual state of affairs (Sinkey, 1983). Sealey and Lindley (1977) note that a major flaw in portfolio models of the banking firm is their neglect of the effects of firm size.

THEORY-OF-THE-FIRM MODELS

Banks generally possess significant monopoly power owing to informational advantages, the local nature of their major product, loans, and restrictive entry and exit regulations (Havrilesky, 1985). Shull (1963) and Klein (1971) were among the first to develop this notion as an explanation of bank behavior. Shull applied Clemens' multiple-product price-discriminating model to the analysis of bank competition. In Klein's model a bank may choose among three assets: cash reserves, government securities and loans. Liabilities consist of demand deposits, time deposits and bank capital, although no special role is assigned to the latter. Asset markets are characterized by imperfect competition for loans and price-taking for government securities. The bank is a price-setter in unconstrained deposit markets. Klein obtained the surprising result that a bank's optimal loan policy was independent of the rate paid on its deposits.

Critics of Klein's model targeted key assumptions of 1) Risk neutrality, 2) Imperfectly competitive deposit markets, 3) Single-period planning horizon and 4) Neglect of real resource costs (Pringle, 1973; Sealey and Lindley, 1977; Sealey, 1980; Baltensperger, 1980; Slovin and Sushka, 1983; O'Hara, 1983; Prisman, Slovin and Sushka, 1986). Most of these writers have developed models of their own designed to "correct" these deficiencies.

Klein's model viewed deposit interest as the sole cost factor in the determination of bank profit. In the

traditional theory of the firm, production costs are an important factor in determining firm output and pricing. Applications of this approach to financial intermediaries have been made by Pesek (1970), Towey (1974), Sealey and Lindley (1977) and Sealey (1980). These models have a particular advantage in explaining firm size, although the related empirical literature on bank economies of scale does not seem to have been fully developed. Sealey's (1980) model makes an important contribution in its simultaneous incorporation of production costs, risk, deposit rate-setting, and liquidity effects. Baltensperger (1980) strongly advocates the theory-of-the-firm approach to bank behavior, alluding to its ability to include joint determinations of asset structure, liability structure and firm scale.

CREDIT RATIONING MODELS

The traditional credit-rationing literature identified and offered solutions to the problem of legal or social constraints on the availability of credit. If lenders are able to discriminate between borrowers of different risk classes, they may be in a position to allocate funds in a manner which, while profitable to an individual firm, is inconsistent with increased efficiency of the financial system. Freimer and Gordon (1965), Kane and Malkiel (1965) and Jaffee and Modigliani (1969) offer explanations for this behavior. A more thorough exposition of this problem is

provided in Jaffee (1971); Baltensperger (1978) and Blackwell and Santomero (1982) offer critiques.

DETERMINANTS OF BANK LOAN RATES

The majority of a bank's income is derived from its loan portfolio. Commercial bank lending falls into four major classes: Commercial and Industrial, Real Estate, Consumer and Agricultural. The remainder is comprised of loans to foreign governments, state and local governments, and other financial institutions. Table 6 provides information on the loan portfolio of insured commercial banks.

Table 6. Loan Portfolios of Insured Commercial Banks

LOAN TYPE	1975		1980		1983	
Commercial/Industrial	$176	35 %	$283	34 %	$404	36 %
Real Estate	136	27	263	31	328	29
Consumer	107	21	182	22	218	19
Financial Institutions	39	8	47	6	77	7
Agricultural	20	4	32	4	39	3
Other	24	5	33	4	60	5

Source: *FDIC Annual Reports, Table 109.* All dollar figures are in billions.

A bank must make several decisions regarding its loan portfolio. First, the total size of the portfolio as a percentage of bank assets must be decided upon. This is primarily a function of loan demand and market structure. Second, choices must be made regarding the loan mix. This

decision is affected by the institution's expertise and operating environment. Third, the average maturity of the loan portfolio must be determined. Average deposit and liability maturities are of crucial importance in this decision.

After a bank has established its overall portfolio structure goals, emphasis shifts to a consideration of loan pricing. (These events are not temporally independent; it's quite possible, for instance, for a bank to first establish its pricing policies and then adjust its portfolio accordingly. The theoretical model developed in this dissertation assumes this to be the case). Many factors are involved in the pricing of consumer loans, and there is no set of variables which is universally agreed-upon as determining loan rates. However, most influences on the consumer loan rate may be classified as originating from 1) Cost, 2) Competition, 3) Risk and 4) Regulation.

Of these four influences, only cost and competitive factors will be addressed in this dissertation. If it is assumed that banks practice perfect credit scoring, then loans are granted only to customers who repay their loans in the agreed-upon fashion. Default risk and collection risk are thus nonexistent. Alternatively, loan losses may be treated as a cost of lending to be subtracted from the rate of interest charged. In any case, loans are assumed to be priced correctly for their risk characteristics.

Despite the significant current interest in the effects of regulation on consumer lending, this aspect of bank loan rate determination will not be covered in depth. A number of recent books discuss the probable impacts of the DIDMC and Garn-St. Germain Acts of 1980 and 1982 on the financial services industry (Fraser and Kolari, 1985; Cooper and Fraser, 1986). The markets are still in too great a state of flux to achieve concrete conclusions.

COST FACTORS

The most comprehensive source of cost data is found in the Functional Cost Analysis prepared annually by the Federal Reserve. Information on the cost of installment lending at commercial banks during 1985 is shown in Table 7.

Table 7. Costs of Installment Lending in 1985

	DEPOSITS		
	LESS THAN $50 MILLION	BTWN $50 AND $200 MILLION	OVER $200 MILLION
Origination cost (per loan)	$81.20	$84.41	$85.67
Collection cost (per payment)	$ 5.47	$ 5.69	$ 5.67
Loss rate (5-yr. avg., based on avg. loan size)	$27.43	$18.45	$13.27
Average loan size	$3,424	$3,852	$4,439
Percent accepted	80.74%	81.71%	72.84%

Source: Board of Governors of the Federal Reserve System, *Functional Cost Analysis* (1985)

The administrative and operating expenses of lending vary significantly with the type of loan activity. Consumer lending functions, e.g. credit card and installment loans, are the most expensive to administer. Consumer loan rates must be higher than commercial or real estate loan rates to compensate the bank for increased administrative and default costs. Table 8 compares the costs of various loan categories.

Table 8. Functional Cost Analysis of Bank Lending

TYPE OF LOAN	CREDIT CARD	INSTALLMENT	COMMERCIAL	REAL ESTATE	SECURITIES
Gross Yield	23.65 %	15.21 %	12.44 %	11.51 %	11.20 %
- Cost of Funds	(7.95)	(8.01)	(7.93)	(8.06)	(7.97)
Interest Spread	15.70	7.20	4.51	3.45	3.23
- Oper. Expense	(11.64)	(3.64)	(1.82)	(1.01)	(0.16)
- Loan Losses	(2.12)	(0.58)	(1.05)	(0.15)	(0.00)
Net Return	1.94 %	2.98 %	1.64 %	2.29 %	3.07 %

Source: Board of Governors of the Federal Reserve System, *Functional Cost Analysis* (1983)

Economies of Scale

There is a rich literature on scale economies in banking. Bell and Murphy's (1968) seminal monograph and the works of George Benston (1965a, 1965b, 1972) are of particular interest for their broad scope and attention to detail. The study of bank economies of scale is important to at least three groups of people. Regulators are interested

in estimating the cost consequences of merger decisions. Bank managements may use comparative cost data to improve firm efficiency. Financial economists rely on empirical estimates of cost functions in the development of theoretical models.

Most early studies assumed a Cobb-Douglas production function and measured output as the number of accounts or loans serviced over a given period of time. In general, significant economies of scale were found for most banking functions, including installment lending. A recent paper by Benston, Hanweck and Humphrey (1982) criticizes the early work for its failure to address the optimal scale of bank operations either due to lack of data or the assumed form of the production function. They propose a more general translog function in which bank output is measured by a Divisia index. Their main conclusions are: 1) Average operating costs for both unit and branch state banks are U-shaped or upward-sloping for three different measures of bank output (including total costs or deposits), 2) An optimal size of bank office exists from $10 million to $25 million in deposits and 3) Both branch and unit state banks experience significant operating cost scale diseconomies on a "plant" level.

COMPETITIVE FACTORS

Some of the most widely discussed issues in American banking over the past twenty years revolve around the topics

of bank structure and competition. Regulators believe bank structure (the number and distribution of banks operating within a particular area) affects the degree of competition within a market, which in turn affects loan rates, deposit rates and the price of bank services. One goal of regulation is to determine the optimal bank structure leading to lower prices for bank outputs without the undue sacrifice of market diversity and/or bank failures. A voluminous literature has arisen to provide information on the effects of bank mergers on competition and cost structures. Several literature surveys have been published (Benston, 1973; Rhoades, 1977, 1982), the most recent of which is by Gilbert (1984). Regulation of market structure is effected by legislation governing the entry and exit of banking firms from a particular market, limitations on bank merger activity and branching restrictions.

Structure-Conduct-Performance Hypothesis

The traditional method of inquiry into bank competition begins with the structure-conduct-performance (S-C-P) hypothesis drawn from the industrial organization literature. According to this hypothesis, a high concentration of sellers fosters collusion among oligopolistic competitors and increases firm performance. The S-C-P hypothesis has received strong support from studies of the behavior of manufacturing firms, but has not been unanimously accepted as a description of the commercial banking industry. Gilbert

(1984) reviews 56 studies of bank structure and competition and finds support for the hypothesis in only 27 of them. Smirlock (1985) argues that this is because there is no relationship between concentration and profitability, but rather between market share and profitability. He follows Demsetz (1973) in this latter point, claiming increased market share results from superior efficiency rather than market power.

Consumer credit markets have long been recognized as imperfectly competitive, that is, markets in which supply and demand are not equated solely on the basis of price (Yntema, 1938; Phelps, 1944). According to a recent textbook author, "the simple truth, however, is that the market for consumer loans is not nearly as competitive as for commercial loans. Banks have successfully found individuals to be full-service customers of single institutions" (Koch, 1987). Hancock (1986) tested commercial banks' price-taking behavior in loan and deposit markets and concluded that "competitive markets are the exception rather than the rule." Recent work by Smirlock and Brown (1986) challenge this assertion of bank monopoly power. These authors support Smirlock's earlier contention that increased market concentration is the result of superior efficiencies, and present evidence that leading firms act as price-setters while secondary firms act as price-takers.

EMPIRICAL STUDIES

A limited number of studies have addressed the empirical behavior of bank loan rates over time. Consumer loan rate behavior has been examined only once, in Sullivan and Fain's (1984) working paper. Most other studies have used commercial loan rates or the prime rate in their investigations. The next few paragraphs review the empirical results from four of the more relevant attempts.

Slovin and Sushka (1983) used aggregate data from the Federal Reserve to test their theoretical model of the bank loan rate. For the period 1952-1980, current commercial paper and mortgage rates were found to be significant in explaining the behavior of the aggregate rate charged on commercial loans on a quarterly basis. A one-quarter lagged commercial paper rate was significant, although a two-quarter lag was not. Additional regressions led them to conclude "... the commercial loan rate is primarily a function of open market interest rates and that under normal conditions the setting of the loan rate is dichotomized from conditions in deposit markets." Table 9 presents the simplest of Slovin and Sushka's regression results.

Table 9. Empirical Models of Bank Loan Rates

AUTHOR	MODEL	PERIOD
Slovin and Sushka (1983)	$RCL = -.31 + .26RCP + .44RCP_{-1} - .06RCP_{-2} + .56RM$ (-.94) (4.39) (5.61) (-.96) (6.73)	1952-1980 (quarterly)
Goldberg (1984)	$RCL = .51 + .41RCD + .57RCD_{-1} - .12RCD_{-2} + \ldots$ (.97) (7.19) (9.41) (3.36)	1972-1981 (monthly)
Lee (1985)	$RCL = -3.4 + .45FF + .39FF_{-1} + .43RP + .03IV + \ldots$ (-2.96) (13.07) (11.46) (2.46) (1.77)	1960-1983 (quarterly)
Sullivan and Fain (1984)	$RAL = 3.71 + .17RTB_{-1} + .19RTB_{-2} + .53RM$ (10.02) (1.89) (2.71) (4.08)	1972-1983 (quarterly)

*Student *t*-statistics in parentheses. RCL = commercial loan rate, RCD = CD rate, RCP = commercial paper rate, RM = mortgage rate, FF = Federal funds rate, RP = risk premium on AAA corporate bonds, IV = average nonfarm inventory investment, RAL = auto loan rate, RTB = Treasury bond rate. Subscripts indicate lagged variables.

Two subsequent tests of Slovin and Sushka's model have been conducted. Lee (1985) reexamined their results using the Federal funds rate to proxy both open market rates and signalling effects. He also incorporated business loan demand, interest rate expectations, risk, and asset/liability relationships in his empirical model. Unlike Slovin and Sushka (who also examined these factors), Lee found significant relationships for each of these variables, suggesting that commercial loan rates are significantly influenced by factors other than open market interest rates. Lee's sample period was both shorter and more recent than Slovin and Sushka's; according to his research, the commercial loan rate has grown more responsive to the Federal funds rate and the market risk premium.

Sullivan and Fain (1984) used Slovin and Sushka's model to investigate the behavior of consumer loan rates. Their

work represents the sole application of time series techniques to consumer loan rate behavior. They regressed aggregate automobile loan and personal loan rates against the rates on constant-maturity Treasury bonds and mortgages. They found lagged quarterly Treasury bond rates and contemporaneous mortgage rates useful in explaining the movements of automobile loan rates. Their best results are shown in Table 9.

Goldberg (1984) has argued that the prime rate (the rate charged by commercial banks on loans to their most creditworthy customers) is principally determined by the average cost of a bank's currently- and previously-issued liabilities. He regressed monthly averages of the prime rate charged by large money center banks (as reported in the Federal Reserve Bulletin) against contemporaneous and lagged values of the average rate paid on large certificates of deposit for the period 1972-1981. For the period as a whole, both current and lagged CD rates are useful in describing the behavior of commercial loan rates (Table 9). Over shorter sub-periods, however, only lagged values are significant. Goldberg interprets these results as evidence the prime rate is "... stable relative to money market rates but responsive to 'fundamental' changes in the bank's cost of purchased liabilities."

In summary, the recent empirical literature is divided on exactly what factors are important in determining the behavior of loan rates offered by commercial banks. Slovin

and Sushka's model hinges on the substitutability of open market securities for a bank's loan portfolio. Lee sacrificed theoretical rigor for empirical results, and concluded that many factors (albeit with different weights) explain the movement of commercial loan rates. Sullivan and Fain found long-term lagged rates useful in explaining the behavior or automobile loan rates. Goldberg's model, based on bank funding costs, finds commercial loan rates to be functions of lagged but not contemporaneous market rates.

Automobile Loan Rates

Previous sections have discussed general issues surrounding the pricing of consumer loans at commercial banks. The final paragraphs of this review will summarize the relatively few studies that have directly addressed automobile lending by commercial banks.

Early research by Shay (1963, 1964) laid the cornerstone for work in this area. His careful analysis of the historical determinants of new automobile financing led others to more in-depth examinations. Greer and Shay (1975) and Greer and Nagata (1975) developed an elaborate macroeconomic model of the new automobile credit market for the National Commission on Consumer Finance in the early 1970s.

Stafford and Dunkelberg (1969) used data gathered from the 1966 Survey of Consumer Finances to characterize borrowers for new and used cars. Finance charges paid by

borrowers decreased with age and education but increased with disposable income. Credit charges decreased with loan size and increased with loan maturity. Regional variations were found in loan rates, with banks in the southern United States charging the highest rates.

Heggestad and Mingo (1976) included automobile loan rates as a performance measure in their study of competition in commercial banking. They reported a significant increase (79 basis points) in new car loan rates from the least concentrated to the most concentrated markets in their study, suggesting that commercial banks at that time wielded measurable market power.

A more thorough investigation of commercial bank auto loan rates was conducted by Peterson and Ginsberg (1981). Using data from approximately 320 banks in all but one state, they examined the effects of government regulations, geographic location, market structure and bank size on 36-month direct loan rates. They found rates to be reduced by rate ceilings and creditor restrictions on the collection of delinquent debts. While smaller banks were found to charge lower loan rates than larger banks, rates offered by rural banks were higher than those of their urban counterparts. Regional geographic differences were found to exist, although they were not consistent with those reported by Shay (1963) or Stafford and Dunkelberg (1969).

In Sullivan and Fain's (1984) working paper the 'most common' automobile loan rate was determined to follow

movements in home mortgage rates and constant-maturity Treasury securities over the period 1972-1983. They reported that automobile loan rates appear to lag Treasury bill rates by several quarters while mortgage rates move concurrently in the same direction as auto rates. Regressions using a 'bank willingness index' to measure the impact of restrictive rate ceilings on auto loan rates were not significant. Sullivan and Fain based their empirical work on Slovin and Sushka's (1983) theoretical model of the commercial loan rate. Like the latter authors, they used macroeconomic data to test microeconomic phenomenona. Thus, their results are open to further interpretation.

Determinants of Bank Deposit Rates

A number of different approaches have been taken in attempts to describe the behavior of bank deposit rates. This section discusses the major theoretical contributions in this area and reviews the supporting empirical evidence.

The theory-of-the-firm approach exemplified by Klein (1971) underlies much of the the theoretical work on the determination of deposit rates at banking firms. Klein's model assumed banks to be price-setters in both loan and deposit markets and showed that deposit rates were unrelated to the returns on a bank's loan portfolio. Rather, deposit rates were found to be functions of the (exogenously-determined) rate on government securities. Klein and Murphy (1971) made further refinements to this model and applied it

specifically to the pricing of demand and time deposits, with similar conclusions.

Baltensperger (1972) and Sealey and Lindley (1977) incorporated production costs into the bank's profit function and found optimality conditions in which marginal revenue did not always equal marginal cost. The latter authors' work appears to rest on their peculiar view of bank output, which they defined as " … total services provided to debtor institutions … " and measured by the total dollar volume of earning assets. The tendancy for changes in changes in demand deposit rates to lag behind time deposit rate changes was explained by Flannery (1982) using a quasi-fixed production function. He noted that deposit rates have specific investment costs associated with them and that banks might be more likely to pay "excessive" rates in the short run to preserve valuable customer relationships.

The trade-off between explicit and implicit payments of interest on deposit accounts has been analyzed by Barro and Santomero (1972), Santomero (1979) and Mitchell (1979). Each of these authors notes that binding interest rate ceilings encourage banks to recompense depositors with nonmonetary returns. Check clearing at prices below cost is the perhaps the most important example. Mitchell (1979) developed a theoretical model in which an increase in explicit interest rates actually reduces the fees charged on check clearing; his results assume that savings accounts are not subject to

binding ceilings and that consumers view checking and savings accounts as close subsitutes.

The relationship of deposit rates to market interest rates has not received extensive treatment in the theoretical literature, most probably due to the existence of Regulation Q ceilings up until 1982. Weber (1966) demonstrated that deposit rates tend to be sluggish whenever the rates on an institution's earning assets adjust slowly to market innovations. Goldfeld and Jaffee (1970) and Stigum (1976) elaborated on this observation and noted that when mortgage rates decline, deposit rates will not fall below some minimum feasible rate; however, when rates increase, the deposit rate may stay constant or even fall. The most recent theoretical paper of note in this area is Sealey (1980). He develops a portfolio model of the banking firm incorporating market conditions, cost considerations, and deposit rate-setting behavior. Sealey's work is important because it demonstrates how risk, resource costs and liquidity constraints interact in the determining optimal bank behavior.

III. A MODEL OF THE CONSUMER LOAN RATE

This dissertation develops a theoretical model of the banking firm emphasizing the pricing of consumer loans and empirically tests it with monthly loan and deposit data gathered from individual banks across the United States. Myron Slovin and Marie Sushka's 1983 article in *The Journal of Finance* entitled, "A Model of the Commercial Loan Rate," provided the foundation for this endeavor.

In Slovin and Sushka's paper, banks are assumed to maximize short-term profits under conditions of monopolistic competition. Banks may hold assets in either of two forms: open-market securities and "loans." Three kinds of deposits - demand deposits, time deposits and negotiable certificates of deposit (CDs) - constitute claims on bank assets. Each deposit type is subject to its own reserve requirements. As demand deposits pay no interest and savings account rates are constrained by regulatory influences, the bank's decision variables are the CD rate, r_{CD}, and the loan rate, r_L, which Slovin and Sushka construe to be the rate on *commercial loans* (hence the title of their paper).

Slovin and Sushka expend some effort in deriving their model under conditions of both nonbinding and binding liquidity constraints. While their results are interesting, it is not clear that banks actually experience liquidity crises of the sort imagined by Slovin and Sushka, or that banks would continue to maximize profits if such situations

arose. Further, characterizing the return on a bank's entire loan portfolio with a single number (the the rate charged on commercial loans) raises a number of interesting questions regarding the behavior of individual loan types. As discussed in Chapter II, Slovin and Sushka test their model with aggregate quarterly interest rate data from the Federal Reserve.

My work improves on Slovin and Sushka's theoretical model in three ways. First, I allow for *two* kinds of loans in bank portfolios: business loans and consumer loans. Second, I explicitly consider the influence of competitors' rates in determining the rates paid on consumer loans. Third, I provide solutions for the optimal determination of deposit rates, which are not presented in Slovin and Sushka's original work. Most importantly, however, my model provides the only theoretical explanation for the behavior of *consumer* loan rates yet to appear in the literature.

ASSUMPTIONS AND OBJECTIVE FUNCTION

The bank's assets are assumed to consist of two types of loans (business and consumer), securities, and required reserves. Deposits consitute the sole claim on bank assets. Following Sealey (1980) and Slovin and Sushka (1983), bank capital is omitted. In a review of Sealey's model, Sinkey (1983) notes,

> "... if it disturbs you that the model ignores bank capital, think of the banking firm in his framework as a going concern. Bank capital becomes important mainly in crisis situations. Moreover, ... the

adequacy of a bank's capital is determined primarily by its profitability and liquidity."

The bank's balance sheet takes the form

$$B + C + S + qD = D \tag{1}$$

where

B = business loan volume

C = consumer loan volume

S = securities

qD = required reserves

D = deposits

The bank is assumed to maximize the single-period profit function

$$\pi = r_C C + r_B B + r_S[(1 - q)D - C - B] - r_D D - \chi_C(C) - \chi_B(B) - \chi_D(D) \tag{2}$$

where:

r_B = business loan rate

r_C = consumer loan rate

r_S = marketable securities rate

r_D = deposit rate

q = percentage of deposits held for reserve and liquidity requirements

$\chi_B(B)$ = cost function of originating and servicing the business loan portfolio

$\chi_C(C)$ = cost function of originating and servicing the consumer loan portfolio

$\chi_D(D)$ = cost function of supplying deposit services

Business loan rates are exogenous and set by competitive forces beyond an individual bank's immediate control. Consumer loan rates are determined in an imperfect market and are a function of bank preferences and competitors' offerings. From the balance sheet constraint, $S = (1 - q)D - B - C$ and can be substituted into the profit equation. The following assumptions are made regarding the behavior of certain variables and functions:

$C = C(r_C, r_X)$ (consumer loan volume is a function of the loan rates offered and competitors' rates)

$B = B(r_B, r_C)$ (business loan volume is a function of the business loan rate and the rate paid on consumer loans)

$D = D(r_D)$ (demand for deposit balances is a function of deposit rates)

$\frac{\partial B}{\partial r_B} > 0$ (increases in business loan rates increase business loan supply)

$\frac{\partial B}{\partial r_C} < 0$ (increases in consumer rates decrease business loan supply)

$\frac{\partial C}{\partial r_C} < 0$ (decreases in consumer rates increase consumer loan demand)

$\frac{\partial C}{\partial r_X} > 0$ (increases in competitors' rates increase consumer loan demand)

$\frac{\partial D}{\partial r_D} > 0$ (increases in deposit rates increase deposit demand)

$\chi'_C(C) > 0$ (marginal costs increase as loan and deposit volumes increase)

$\chi'_B(B) > 0$

$\chi'_D(D) > 0$

$\chi''_C(C) > 0$ (marginal costs are non-diminishing)

$\chi''_B(B) > 0$

$\chi''_D(D) > 0$

FIRST ORDER CONDITIONS

The bank's decision variables are the consumer loan rate and the deposit rate. The profit-maximizing levels of consumer and business loans follow from their choices, as do deposit and securities volumes. Following Klein (1971), Tobin (1982), and Slovin and Sushka (1983), the bank is assumed to be risk-neutral with respect to profit maximization. Differentiating the objective function with respect to the choice variables gives two first-order conditions:

$$\frac{\partial \pi}{\partial r_C} = \frac{\partial C}{\partial r_C}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial B}{\partial r_C}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) + C = 0 \qquad (3)$$

$$\frac{\partial \pi}{\partial r_D} = \frac{\partial D}{\partial r_D}\left(r_S(1 - q) - r_D - \frac{\partial \chi_D}{\partial D}\right) - D = 0 \qquad (4)$$

SECOND ORDER CONDITIONS

The second-order conditions (5) and (6) must be negative for the bank to obtain a profit maximum.

$$\frac{\partial^2 \pi}{\partial r_C^2} = \frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) + 2\,\frac{\partial C}{r_C} < 0 \quad (5)$$

$$\frac{\partial^2 \pi}{\partial r_D^2} = \frac{\partial^2 D}{\partial r_D^2}\left(r_S(1 - q) - r_D - \frac{\partial \chi_D}{\partial D}\right) - 2\,\frac{\partial D}{\partial r_D} < 0 \quad (6)$$

SOLUTION AND PREDICTIONS

Since the loan and deposit functions are only generally specified, it is not possible to achieve a closed-form solution to this model. However, testable hypotheses of the model's behavior may be derived from the comparative statics of the first-order conditions.[1] Equations (7) and (8) show the response of consumer loan rates and deposit rates to changes in the exogenous variables r_S, r_B and r_X.

$$dr_C^* = K\left(\left|-\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right)\right| dr_S + \left(\frac{\partial B}{\partial r_C}\right) dr_B + \left(\frac{\partial C}{\partial r_X}\right) dr_X\right) \quad (7)$$

$$dr_D^* = L\left(\frac{\partial D}{\partial r_D}(1 - q)\right) dr_S \quad (8)$$

where K and L reflect constraints imposed by the second-order conditions. Without explicit specifying the supply, demand and cost functions, the magnitudes of the coefficients cannot

---

[1]See Appendix A for further explanation.

be determined. Their signs, however, provide information on the predicted **direction** of loan and deposit rate movements. If the second-order conditions are met, the coefficients may be unambiguously signed as follows:

$$\frac{\partial r_C}{\partial r_S} > 0 \qquad \frac{\partial r_C}{\partial r_B} < 0 \qquad \frac{\partial r_C}{\partial r_X} > 0 \tag{9}$$

$$\frac{\partial r_D}{\partial r_S} > 0 \qquad \frac{\partial r_D}{\partial r_B} = 0 \qquad \frac{\partial r_D}{\partial r_X} = 0 \tag{10}$$

The model predicts that the interest rate charged on consumer loans increases as interest rates on securities rise, reflecting increased opportunity costs on the consumer loan portfolio. Consumer loan rates should decrease as the prime, or business loan rate increases, as resources are directed towards more profitable business loans. Financial institutions should increase consumer loan rates in response to competitor's offerings. Increases in security rates should increase the rate paid on deposits at financial institutions, while business loan and competitor's rates should have no effect. These predicted relationships will be examined empirically in Chapters IV and V.

IV. METHODOLOGY

The solution to the theoretical model implies a bank's consumer loan rate should *increase* as security rates and competitor's rates increase and *decrease* with increases in the business loan rate. Its deposit rate should increase with increasing security rates and not respond to changes in the business loan rate or competitor's rates. This section outlines the methodology used to test the theoretical model's predictions and presents the results of these tests.

SOURCES OF DATA

Empirical data for testing the theoretical model were obtained from a number of sources. Because the inputs to the theoretical model were specified only in general terms, reasonable effort was expended to find a data set which was representative and which added positive marginal informativeness. The quality and comparability of the data set was also an important consideration.

CONSUMER LOAN AND DEPOSIT RATE DATA

The primary data source for this dissertation was obtained from Gary Meyers and Associates, a Chicago consulting firm. This company publishes a weekly report, *The Meyers Report,* of interest rates and terms on consumer financial products at over 200 depository institutions

throughout the country. The firm surveys each of its reporting institutions by telephone each week on Monday and Tuesday. Usually, the institution's contact person is telephoned by the same Meyers employee week after week. Information is collected on the current rate structure and terms on consumer mortgages, installment loans and deposit accounts. An attempt is made to gather data on "standard" products, e.g. 48-month fixed-rate new automobile loans. Where this is not possible, data is collected for the closest approximation to this standard. The data is organized and collated on Wednesday and Thursday and the report is mailed to subscribers on Friday. Care is taken to verify the data before is printed; employees are required to cross-check each other's work.

The *Meyers* data is particularly valuable because it reports the rates and terms on individual products at individual banks. Previous empirical studies on the determinants of bank loan rates used composite figures generated from hundreds of reporting banks. It is quite possible for microeconomic relationships to differ from their macroeconomic aggregates. Unfortunately, comparative microeconomic analyses tend to yield less clear-cut results. It is not the intention of this dissertation to claim that the theoretical model applies to ALL depository institutions, however, it should provide insight into the behaviors of particular subsets.

The Meyers Report offers a unique data set for research, but its shortcomings should also be recognized. First, the data set exists only on paper. The data is originally entered into a microcomputer spreadsheet, but after it is printed, new data is written over the old and the printed hardcopy is the only remaining evidence of its existence. Second, although the firm has been collecting and reporting data in more-or-less the same way since 1984, its portfolio of reporting financial institutions has changed over time, severely restricting the number and length of usable time series. Third, not all institutions within a given market are represented. Some banks do not choose to report their loan and deposit rates. A related, and hopefully very minor problem, is the the possibility that the institution might report inaccurate or misleading information. Finally, Meyers' hardcopy archives are incomplete. Certain issues are missing pages and/or no longer obtainable. This creates gaps in the data set which may or may not be significant.

Consumer loan information is collected for New Car Loans, Unsecured Personal Installment Loans, Home Improvement/Equity Loans, and New RV/Marine Loans. Not all of the reporting institutions offer all of these loans all of the time, and thus certain time series are nonexistent or interrupted. Automobile loan rates provide the most consistent and complete set of consumer loan rates for empirical testing. They are the largest component of consumer credit, have the most closely-comparable terms and

have the most homogenous purpose and risk characteristics of the available loan categories. The majority of these rates were quoted for 48-month, fixed-rate new automobile loans. Four kinds of deposit rates were reported: Money Market Accounts, NOW Accounts, IRAs and Certificates of Deposit with maturities from three months to ten years. Again, the most consistent and comprehensive series, Money Market Account rates, was chosen as a proxy for deposit rates.

The theoretical model is tested with a *monthly* data set. *The Meyers Report* is published weekly, but two conditions led to the choice of monthly periods. First, automobile loan rates do not vary all that much. Generally, they are changed only through the action of a loan committee, which may meet on a biweekly or monthly basis. A weekly series might obscure more fundamental responses. Second, the problem of missing issues in the data set would perhaps be worsened by weekly observations. The data for this study was taken from issues of the *Meyers Report* published between July 1986 and July 1988. In all but two cases, data came from the first week of each month. In the remaining cases, data was taken from the second week of each month. Loan rate data was manually entered into a computer database; deposit data was scanned with an optical character reader and further manipulated by computer. Spot checks were conducted in both cases to verify the accuracy of the database.

Forty-five institutions from New York City, Chicago, California, Boston, Detroit and Cincinnati were included for

a total of 25 weeks x 45 banks x 2 interest rates = 2250 observations. Appendix B provides additional information on the institutions used in this study and descriptive statistics for the consumer loan and deposit rate series.

SECURITY RATES

The theoretical model developed earlier presupposes a bank holds "securities" in its asset portfolio for invesment and liquidity reasons. Including the rates on all possible securities in an empirical regression equation is not a good idea, as it creates multicollinearity problems and may hide even more fundamental results. Thus, a single, commonly-held security should be chosen as a proxy for 'SEC,' the security rate.

Four security rates were taken from the Federal Reserve Bulletin and considered as possible proxies for the security rate. Three of these (Treasury bills, federal funds and certificates of deposit) were money market rates and one (3-year constant maturity Treasury bonds) was a capital market rate. Their correlation with each other and the average prime rate is shown in Table 10.

Table 10. Correlation Matrix of Security Rates

Security	FFR	CD	TBL	TBD	BUS
Federal Funds (FFR):	1.000				
Certificates of Deposit (CD):	0.703	1.000			
U.S. Treasury Bills (TBL):	0.721	0.779	1.000		
U.S. Treasury Bonds (TBD):	0.648	0.953	0.777	1.000	
Prime Rate (BUS):	0.673	0.935	0.798	0.924	1.000

Monthly observations corresponding to the first week of each month from July 1986 through July 1988. FFR = federal funds rate, CD= secondary market rates on 3-month certificates of deposit, TBL = secondary market rates on 3-month U.S. Treasury bills, TBD = rate on 3-year constant maturity U.S. Treasury bonds, BUS = average rate charged by banks on short-term business loans. Data from the *Federal Reserve Bulletin*.

Much preliminary analysis was conducted to determine the appropriate proxy rate. Federal funds and certificate of deposit rates were dismissed fairly early on, citing the volatility of the former and the aggregate nature of the latter. Treasury bills and three-year constant maturity Treasury bonds were considered in a number of forms, including lags of up to four weeks prior. Treasury bonds provided slightly better results in both loan and deposit rate regressions. The loan rate results may arise from the similar maturities between the bonds and the automobile loans. The results of the deposit rate regressions were more surprising - money market account rates are better explained by Treasury *bond,* rather than Treasury *bill,* rates! Thus, three-year constant maturity Treasury bond rates were chosen to proxy the 'SEC' rate in the empirical regressions.

OTHER VARIABLES

The Federal Reserve Board reports the prime rate charged by banks on short-term business as a monthly average. This figure was used to proxy the rate on a bank's business loan portfolio. Competitors' rates were proxied by an arithmetic average of the rates charged by all other banks in the regional sample for a given date. Differences due to geographical location and bank size were investigated through the use of dummy variables.

ECONOMETRIC ANALYSIS

In the previous chapter, a theoretical model of the banking firm was developed in which rates on consumer loans and customer deposits were hypothesized to be functions of security rates, business loan rates and competitors' rates. In testing this model, it is important to keep in mind the model's assumptions and the nature of the available data. This section briefly describes the econometric techniques used to test the theoretical model. Essentially, two types of tests will be conducted: F-tests, which measure the degree of explanatory power of the regression *equation*, and t-tests, which measure the explanatory power of a particular regression *coefficient*.

The classical linear regression (CLR) model using the ordinary least squares (OLS) estimator is, "… probably the most popular estimator among researchers doing empirical work" (Kennedy, 1985). For many econometric problems, this

model has very desirable properties and is computationally efficient. In the CLR, a set of independent variables (regressors) is used to describe the behavior of a dependent variable. The OLS estimator obtains values for the intercept and regression coefficients by minimizing the sum of squared residual disturbances. The applicability of this technique depends in large part on the nature of the data; the CLR model makes five assumptions about the way in which the data is generated.

Assumptions of the CLR Model

As its name implies, the classical linear regression model assumes the dependent variable can be expressed as a *linear* function of a set of independent variables plus an error term. The coefficients of this function are assumed to be constants. *Specification errors* arise when these assumptions are not met. Perhaps the wrong independent variables are included in the regression, or the correct ones are left out. Maybe the regression relationship is nonlinear. Or, the coefficients may be non-stationary over the sample period.

The second assumption of the CLR model is that the expected value of the disturbance term equals zero. If it does not, the regression may have a *biased intercept.* Third, the disturbance terms are assumed to have the same variance across time (homoskedasticity) and to be uncorrelated with

one another. *Heteroskedasticity* and *autocorrelation* are problems associated with the violation of this assumption.

The fourth assumption is that the observations on the independent variables can be considered fixed in repeated samples. If they are not, *autocorrelation, errors in variables, or simultaneous equation estimation* problems may occur. The final assumption of the CLR model is that no linear relationships exist between the independent variables and the number of independent variables is less than the number of observations. Violating this assumption causes problems of *multicollinearity.*

If its assumptions are met, the ordinary least squares estimator has a number of desirable properties. Is is optimal on the least squares, highest R^2, unbiasedness and asymptotic criteria considered most important by econometricians (Kennedy, 1985). However, different methods of estimation may be appropriate when these assumptions are not met.

V. RESULTS AND DISCUSSION

This chapter describes the hypotheses arising from the theoretical model and the results of the empirical testing procedures. It concludes with discussion and interpretation of the results.

HYPOTHESES

Initial hypothesis testing was conducted using classical linear regression techiques to estimate the parameters of the equations

$$AUT_{it} = \alpha_0 + \alpha_1 SEC_t + \alpha_2 BUS_t + \alpha_3 AUTX_t + \varepsilon_t \quad (11)$$

$$MMA_{it} = \beta_0 + \beta_1 SEC_t + \beta_2 BUS_t + \beta_3 AUTX_t + \varepsilon_t \quad (12)$$

where AUT_{it} = bank i's automobile loan rate at time t

MMA_{it} = bank i's money market account rate at time t

SEC_t = security rate at time t

BUS_t = business loan rate at time t

$AUTX_t$ = competitors' rate at time t

As explained earlier, the general nature of the loan and deposit rate functions underlying the solution to the theoretical model only predicts the *signs* of the coefficients, and not their magnitudes. Eight hypotheses associated with the model's predictions (Table 11).

Table 11. Hypothesis Testing

NULL HYPOTHESIS	THEORETICAL MODEL PREDICTS ...
Test of Regression Equation	
1. H_O: $\alpha_1 = \alpha_2 = \alpha_3 = 0$	REJECT null hypothesis; r_C is a function of r_S, r_B, and r_X
Test of Regression Coefficients	
2. H_O: $\alpha_1 \leq 0$	REJECT null hypothesis; $\frac{\partial r_C}{\partial r_S} > 0$
3. H_O: $\alpha_2 \geq 0$	REJECT null hypothesis; $\frac{\partial r_C}{\partial r_B} < 0$
4. H_O: $\alpha_3 \leq 0$	REJECT null hypothesis; $\frac{\partial r_C}{\partial r_X} > 0$
Test of Regression Equation	
5. H_O: $\beta_2 = \beta_3 = 0$	ACCEPT null hypothesis; r_D is NOT a function of r_B and r_X
Test of Regression Coefficients	
6. H_O: $\beta_1 \leq 0$	REJECT null hypothesis; $\frac{\partial r_D}{\partial r_S} > 0$
7. H_O: $\beta_2 = 0$	ACCEPT null hypothesis; $\frac{\partial r_D}{\partial r_B} = 0$
8. H_O: $\beta_3 = 0$	ACCEPT null hypothesis; $\frac{\partial r_D}{\partial r_X} = 0$

REGRESSION RESULTS

Ordinary least-squares and first-order autoregressive procedures were run on the data set described earlier. The SAS statistical software package running on Michigan State University's IBM 3090 mainframe computer was used for these analyses. Only the 'best' results corresponding to Equations 11 and 12 are reported.[1]

AUTOMOBILE LOAN RATES

Table 12 shows the results of the regression model specified in Equation 11. Data from Bank 28 was excluded because its automobile loan rate did not vary over the sample period.

---

[1]For instance, each of the reqression equations was estimated using levels as well as first differences; the latter was generally not useful in explaining the behavior of automobile loan or deposit rates.

Table 12. Automobile Loan Rate Regressions

$$AUT = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
1	6.05	-0.58	0.88	0.09	0.041	0.50	8.69	1.74	n=24
	(1.00)	(0.14)	(0.19)	(0.10)					
2	4.46	0.18	-0.48	0.84	0.127	0.47	7.63	2.20	n=23
	(1.80)	(0.26)	(0.47)	(0.25)					
3	-8.70	1.94	-3.64	3.23	0.241	0.84	41.76	1.49	n=24
	(2.82)	(0.33)	(0.53)	(0.37)					
4	-1.90	0.20	-0.41	1.33	0.013	0.97	19.38	1.52	n=24
	(0.62)	(0.08)	(0.11)	(0.07)					
5	-8.38	-0.21	1.51	0.91	0.255	0.80	31.71	1.37	n=24
	(2.90)	(0.34)	(0.47)	(0.29)					
6	5.26	-0.37	0.88	0.04	0.027	0.73	21.45	1.84	n=24
	(0.81)	(0.11)	(0.16)	(0.08)					
7	-3.20	0.15	-0.12	1.31	0.168	0.73	21.39	1.05	n=24
	(2.23)	(0.27)	(0.40)	(0.25)					
8	7.38	-0.54	0.44	0.38	0.115	0.20	2.93	1.13	n=24
	(1.66)	(0.23)	(0.33)	(0.18)					
9	-2.11	0.27	-1.09	1.81	0.085	0.80	27.20	1.58	n=21
	(2.17)	(0.28)	(0.44)	(0.26)					
10	1.28	-0.37	-0.23	1.18	0.127	0.67	16.88	1.40	n=25
	(2.49)	(0.28)	(0.41)	(0.28)					
11	8.56	0.05	0.68	-0.24	0.061	0.76	26.44	1.19	n=25
	(1.60)	(0.20)	(0.27)	(0.16)					
12	5.74	0.21	-0.15	0.50	0.057	0.28	4.18	1.10	n=25
	(1.58)	(0.19)	(0.27)	(0.17)					
13	-1.76	-0.96	1.72	0.49	0.133	0.64	14.98	1.54	n=25
	(2.66)	(0.28)	(0.38)	(0.26)					
14	1.38	0.63	-1.32	1.42	0.091	0.63	14.46	1.19	n=25
	(2.10)	(0.25)	(0.37)	(0.25)					
15	1.83	0.49	-0.56	0.95	0.205	0.19	2.82	1.54	n=25
	(3.19)	(0.38)	(0.53)	(0.35)					
16	1.51	-0.23	.43	0.64	0.232	0.61			n=25
	(5.41)	(0.42)	(0.64)	(0.50)					
17	-0.21	-0.16	0.18	1.02	0.043	0.77	28.50	2.28	n=25
	(1.51)	(0.15)	(0.20)	(0.13)					
18	8.18	0.40	-0.37	0.30	0.086	0.10	1.76	0.93	n=21
	(2.87)	(0.22)	(0.31)	(0.28)					
19	0.03	-0.29	0.41	0.86	0.101	0.31	3.99	1.14	n=21
	(3.50)	(0.23)	(0.32)	(0.33)					

Table 12. (contd.).

$$AUT = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
20	1.51	0.09	-0.30	1.04	0.118	0.53	9.92	2.09	n=25
	(2.49)	(0.26)	(0.35)	(0.22)					
21	6.77	-0.27	-0.09	0.58	0.126	0.44	6.60	1.19	n=22
	(2.41)	(0.26)	(0.36)	(0.22)					
22	0.94	-0.72	1.26	0.49	0.086	0.61	13.30	1.33	n=25
	(2.09)	(0.21)	(0.28)	(0.17)					
23	-4.22	0.55	-0.42	1.30	0.107	0.61	13.64	1.75	n=25
	(2.47)	(0.25)	(0.33)	(0.21)					
24	2.29	0.45	-0.15	0.63	0.317	0.14	2.32	1.35	n=25
	(4.32)	(0.41)	(0.55)	(0.37)					
25	4.46	0.06	0.25	0.42	0.227	0.10	1.90	2.79	n=25
	(3.54)	(0.34)	(0.46)	(0.30)					
26	-7.34	-1.05	1.07	1.52	0.239	0.59	12.37	1.38	n=25
	(4.15)	(0.33)	(0.46)	(0.36)					
27	1.11	-0.63	0.86	0.57	0.142	0.35	5.32	1.32	n=25
	(2.90)	(0.26)	(0.36)	(0.24)					
29	0.31	-0.23	0.34	0.90	0.041	0.70	20.03	2.67	n=25
	(1.57)	(0.14)	(0.20)	(0.14)					
30	1.31	0.73	-1.61	1.52	0.328	0.40	6.43	1.53	n=25
	(4.45)	(0.42)	(0.60)	(0.43)					
31	-7.19	-0.23	0.66	1.14	0.039	0.86	47.28	1.60	n=23
	(1.71)	(0.17)	(0.23)	(0.16)					
32	12.81	-0.44	-0.10	0.23	0.055	0.78	27.67	1.70	n=23
	(2.05)	(0.21)	(0.28)	(0.19)					
33	-0.45	-0.39	0.78	0.59	0.047	0.70	18.25	1.06	n=23
	(1.90)	(0.19)	(0.26)	(0.17)					
34	4.97	0.37	-1.17	1.03	0.127	0.67	16.04	1.19	n=23
	(3.11)	(0.32)	(0.42)	(0.28)					
35	-8.68	0.08	0.38	1.28	0.087	0.83			n=23
	(3.65)	(0.30)	(0.43)	(0.32)					
36	-5.31	0.53	-0.60	1.40	0.038	0.81	32.51	2.01	n=23
	(1.70)	(0.17)	(0.23)	(0.15)					
37	-2.70	0.90	-1.41	1.53	0.109	0.64	13.88	1.45	n=23
	(2.88)	(0.29)	(0.39)	(0.26)					
38	7.80	-0.42	.80	-0.11	0.030	0.77			n=23
	(2.03)	(0.17)	(0.25)	(0.18)					
39	1.51	0.53	-1.19	1.27	0.097	0.62	9.27	1.44	n=16
	(2.11)	(0.27)	(0.46)	(0.27)					

Table 12. (contd.).

$$AUT = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
40	5.52	-1.13	2.23	-0.32	1.192	0.05	1.35	1.53	n=22
	(4.06)	(0.73)	(1.11)	(0.37)					
41	7.27	-0.69	0.97	0.10	0.068	0.48	7.68	1.77	n=23
	(1.20)	(0.19)	(0.28)	(0.10)					
42	1.86	0.39	-0.32	0.66	0.205	0.42	6.34	2.08	n=23
	(2.19)	(0.36)	(0.55)	(0.22)					
43	-0.69	-0.45	0.92	0.57	0.046	0.86	45.87	1.50	n=23
	(1.04)	(0.17)	(0.26)	(0.10)					
44	0.11	-0.27	0.89	0.43	0.024	0.92	82.36	1.65	n=23
	(0.75)	(0.12)	(0.19)	(0.08)					
45	2.07	-0.45	1.15	0.19	0.375	0.28	3.85	1.31	n=23
	(2.97)	(0.48)	(0.75)	(0.30)					

Regressions computed using ordinary least squares (OLS) unless F-ratio and DW are not shown, when first-order autoregression (AR1) techniques were used. SE = standard error of the regression, R^2 is adjusted except in the AR1 regressions, F-rat.= F-statistic of the regression, DW = Durbin-Watson statistic.

Hypothesis 1: *Consumer Loan Rates React to Innovations in Security Rates, Business Loan Rates and Competitors' Rates*

The theoretical model postulates that changes in the consumer loan rate are associated with changes in open-market security rates, the business loan rate, and competitors' rates. For this to be true, the coefficients in Equation 11 must be non-zero. The F-statistics shown in Table 12 show this generally to be the case. Only seven banks (Marine Midland, First Chicago, Northern Trust, First Interstate, First National Bank of Monterey, Bank of Boston and Bank of New England) have F-ratios less than the required critical value,and cannot reject the null hypothesis with a 95% level of confidence. The F-statistics by themselves, however, are

not enough to support the theoretical model. Hypotheses 2, 3 and 4 must also be rejected for its confirmation.

Hypothesis 2: *Consumer Loan Rates Increase with Increases in Security Rates*

The significance of individual regression coefficients is determined with t-tests. If an individual t-statistic (calculated by dividing the coefficient in question by its standard error) is greater than a predetermined critical value, the null hypothesis must be rejected. A one-tailed test is appropriate for testing coefficient signs. Table 13 shows the results of t-tests on the coefficients in each of the regression equations shown in Table 12. The results are applicable at the 95% confidence interval.

Table 13. Signed Coefficients of Loan Rate Regressions

$$AUT = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

α_1	α_2	α_3	α_0	BANK	NAME
+	0	+	0	23	Wells Fargo Bank
+	0	0	+	18	First Interstate Bank
+	-	+	0	14	La Salle National Bank
+	-	+	0	30	Union Warren Savings Bank
+	-	+	0	37	National Bank of Detroit
+	-	+	0	39	Ameritrust
+	-	+	-	3	Chase Manhattan
+	-	+	-	4	Chemical Bank
+	-	+	-	36	Manufacturers National Bank
0	+	+	0	29	State Street Bank
0	+	+	-	5	Citibank
0	+	+	-	31	Comerica
0	+	0	+	11	Exchange National Bank
0	+	0	0	40	Bank One
0	0	+	+	2	Bowery Savings
0	0	+	+	12	First Chicago
0	0	+	+	21	Home Federal Savings and Loan
0	0	+	0	7	Manufacturer's Hannover
0	0	+	0	10	Continental Illinois
0	0	+	0	15	Northern Trust Bank
0	0	+	0	17	Bank of America
0	0	+	0	19	First National Bank - Monterey
0	0	+	0	20	Great Western Savings
0	0	+	0	42	Fifth Third Bank
0	0	+	-	35	Great Lakes Savings Bank
0	0	0	0	16	Talman Home Savings and Loan
0	0	0	0	24	Bank of Boston
0	0	0	0	25	Bank of New England
0	0	0	0	45	Society Bank
0	-	+	0	9	Ben Franklin Savings and Loan
0	-	+	0	34	First Federal Savings Bank
-	+	+	0	13	Harris Trust and Savings Bank
-	+	+	0	22	Sears Savings Bank
-	+	+	0	27	First Mutual of Boston
-	+	+	0	33	First of America
-	+	+	0	43	First National Bank
-	+	+	0	44	Provident Bank
-	+	+	-	26	Boston Five Cents Savings Bank
-	+	0	+	1	Anchor Savings
-	+	0	+	6	First American Bank
-	+	0	+	38	Standard Federal
-	+	0	+	41	Central Trust
-	0	+	+	8	Marine Midland Bank
-	0	0	+	32	Empire of America

Entries represent coefficients significantly different from zero at a 95% confidence level. '+' indicates the coefficient is significantly greater than zero, '-' indicates the coefficient is significantly less than zero, and '0' indicates the coefficient does not differ significantly from zero.

It is generally not possible to reject Hypothesis 2 at the 95% level of significance, implying that consumer loan rates are not very sensitive to changes in the security rate (as proxied by the interest rate on 3-year constant maturity Treasury bonds). Of the banks which show a positive relationship, most are strong regional institutions and two (Chase Manhattan and Chemical Bank) must be considered 'money-center' banks.

***Hypothesis 3**: Consumer Loan Rates Decrease with Increases in the Business Loan Rate*

As shown in Table 13, Hypothesis 3 is not well-supported. For most banks, the rate offered on new automobile loans is not negatively related to the prime rate.

***Hypothesis 4**: Consumer Loan Rates Increase with Increases in Competitors' Rates*

With few exceptions, Hypothesis 4 can be rejected at a 95% confidence level, indicating interbank competition is very important in setting consumer loan rates. These results support the prediction of the theoretical model and suggest the new automobile loan market is imperfectly competitive, a claim which runs counter to some published research but which supports observations made by practioners.

The strong influence of competitors' rates suggests that they alone might be useful in explaining the behavior of automobile loan rates over time. Table 14 presents the results of regression analyses performed using just an

intercept and competitors' rates charged on consumer loans as explanatory variables.

Table 14. Automobile Loan Rates vs. Competitors' Rates

$$AUT = \alpha_0 + \alpha_1(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	SE	R^2	F-rat.	DW	
1	8.30	0.15	0.077	0.10	2.38	1.16	n=24
	(1.17)	(0.10)					
2	4.13	0.64	0.122	0.52	22.61	1.86	n=23
	(1.55)	(0.13)					
3	-10.49	2.01	0.405	0.76			n=24
	(5.57)	(0.49)					
4	-2.41	1.21	0.020	0.95	24.43	1.38	n=24
	(0.68)	(0.06)					
5	-3.29	1.43	0.374	0.73			n=24
	(4.81)	(0.43)					
6	7.74	0.21	0.059	0.45			n=24
	(1.46)	(0.12)					
7	-3.84	1.38	0.156	0.76	68.65	1.20	n=24
	(1.91)	(0.17)					
8	7.88	0.31	0.112	0.29			n=24
	(2.27)	(0.20)					
9	-1.26	1.09	0.093	0.80			n=21
	(3.83)	(0.35)					
10	2.85	0.61	0.114	0.73			n=25
	(4.07)	(0.37)					
11	12.16	-0.01	0.046	0.83			n=25
	(2.47)	(0.23)					
12	4.47	0.65	0.042	0.52			n=25
	(1.97)	(0.19)					
13	4.16	0.60	0.105	0.74			n=25
	(3.81)	(0.35)					
14	1.83	0.80	0.054	0.80			n=25
	(2.84)	(0.26)					
15	3.61	0.70	0.205	0.22	6.45	1.30	n=25
	(2.90)	(0.27)					
16	3.74	0.60	0.204	0.63			n=25
	(5.16)	(0.48)					
17	-0.62	1.08	0.041	0.79	87.15	2.33	n=25
	(1.30)	(0.12)					
18	9.47	0.17	0.043	0.60			n=21
	(3.28)	(0.30)					
19	3.23	0.68	0.073	0.55			n=21
	(4.18)	(0.37)					

Table 14. (contd.).

$$AUT = \alpha_0 + \alpha_1(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	SE	R^2	F-rat.	DW	
20	-0.03	1.02	0.120	0.54	26.97	1.82	n=25
	(2.20)	(0.20)					
21	4.35	0.56	0.101	0.59			n=22
	(2.91)	(0.26)					
22	4.95	0.58	0.101	0.58			n=25
	(3.20)	(0.28)					
23	-0.15	1.00	0.123	0.59			n=25
	(3.17)	(0.28)					
24	8.32	0.28	0.287	0.29			n=25
	(4.96)	(0.44)					
25	7.66	0.36	0.247	0.06	1.55	2.39	n=25
	(3.30)	(0.29)					
26	3.07	0.70	0.142	0.78			n=25
	(3.86)	(0.34)					
27	1.54	0.73	0.168	0.27	8.40	1.24	n=25
	(2.93)	(0.25)					
29	0.61	0.97	0.043	0.70	54.56	2.41	n=25
	(1.49)	(0.13)					
30	5.12	0.50	0.332	0.45			n=25
	(5.73)	(0.50)					
31	-6.69	1.41	0.053	0.83			n=23
	(2.74)	(0.23)					
32	6.24	0.43	0.110	0.61			n=23
	(4.23)	(0.35)					
33	0.28	0.82	0.067	0.62			n=23
	(2.45)	(0.20)					
34	3.19	0.61	0.109	0.74			n=23
	(4.34)	(0.36)					
35	-5.64	1.34	0.091	0.80			n=23
	(3.97)	(0.32)					
36	-2.40	1.08	0.054	0.74	61.22	1.41	n=23
	(1.67)	(0.14)					
37	-1.59	1.02	0.153	0.54			n=23
	(3.74)	(0.31)					
38	7.71	0.19	0.022	0.81			n=23
	(2.07)	(0.17)					
39	3.02	0.70	0.074	0.75			n=16
	(3.16)	(0.24)					

Table 14. (contd.).

$$AUT = \alpha_0 + \alpha_1(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	SE	R^2	F-rat.	DW	
40	10.08 (3.71)	0.11 (0.29)	1.217	0.12			n=22
41	7.97 (1.35)	0.27 (0.10)	0.103	0.24	6.67	1.48	n=23
42	2.35 (2.21)	0.65 (0.17)	0.214	0.42	15.39	1.73	n=23
43	-0.14 (1.31)	0.85 (0.10)	0.076	0.78	73.56	1.50	n=23
44	3.42 (1.62)	0.58 (0.12)	0.066	0.79			n=23
45	5.97 (3.52)	0.36 (0.26)	0.312	0.46			n=23

Regressions computed using ordinary least squares (OLS) unless DW and F-ratios are not shown, when first-order autoregression (AR1) techniques were used. SE = standard error of the regression, R^2 is adjusted except in the AR1 regressions, F-rat.= F-statistic of the regression, DW = Durbin-Watson statistic.

The sample institutions may be separated into four groups according to the results of t-tests performed on the slope coefficient (Table 15). For a bank to behave as a pure monopoly, α_1 should be equal to 0. Pure competition implies $\alpha_1 = 1$. The third group consists of "imperfectly competitive" institutions, in which neither of these hypotheses can be rejected. The fourth (and smallest) category is composed of institutions in which both Hypothesis 1 and 2 are rejected; these results are unexplainable under this framework.

Table 15. Institutions Classified by Market Structure

$$AUT = \alpha_0 + \alpha_1(AUTX)$$

Hypothesis 1: $\alpha_1 = 0$ FAILURE TO REJECT implies monopolistic behavior

Hypothesis 2: $\alpha_1 = 1$ FAILURE TO REJECT implies competitive behavior

FAIL TO REJECT H1: $\alpha_1 = 0$
REJECT H2: $\alpha_1 \neq 1$

"Monopolistic" Banks

1 Anchor Savings Bank
6 First American Bank
8 Marine Midland Bank
11 Exchange National Bank
18 First Interstate Bank
25 Bank of New England
38 Standard Federal Bank
40 Bank One
45 Society Bank

REJECT H1: $\alpha_1 \neq 0$
FAIL TO REJECT H2: $\alpha_1 = 1$

"Competitive" Banks

3 Chase Manhattan
5 Citibank
9 Ben Franklin Savings & Loan
12 First Chicago
14 LaSalle National Bank
15 Northern Trust Bank
17 Bank of America
20 Great Western Bank
21 Home Federal Savings & Loan
22 Sears Savings Bank
23 Wells Fargo Bank
27 First Mutual of Boston
29 State Street Bank and Trust
31 Comerica
33 First of America
35 Great Lakes Savings Bank
36 Manufacturers National Bank
37 National Bank of Detroit
39 AmeriTrust
42 Fifth Third Bank
43 First National Bank

REJECT H1: $\alpha_1 \neq 0$
REJECT H2: $\alpha_1 \neq 1$

"Imperfectly Competitive" Banks

2 Bowery Savings Bank
4 Chemical Bank
7 Manufacturers Hanover
41 Central Trust
44 Provident Bank

FAIL TO REJECT H1: $\alpha_1 = 0$
FAIL TO REJECT H2: $\alpha_1 = 1$

"Unclassified" Banks

10 Continental Illinois
13 Harris Trust & Savings Bank
16 Talman Home Savings & Loan
19 First Nat'l Bank Monterey
24 Bank of Boston
26 Boston Five Cents Bank
30 Union Warren Savings Bank
32 Empire of America
34 First Federal of Michigan

Decisions to accept or reject the stated hypotheses based on a two-tailed test at a 95% significance interval.

Automobile loan rates at seven of the nine banks classified as "Monopolistic" appear to follow the movements of the prime rate and suggest a simple form of markup pricing. The remaining two banks, First Interstate and Bank of New England, have near-insignificant coefficients on any of the explanatory variables. Twenty-one of the 44 banks in the sample have automobile loan rates which behave in accordance with a competitive market. These banks are fairly evenly dispersed across geographic regions and among size classes, demonstrating that competition is more widespread than suggested by earlier authors. A cautionary note: this is a small sample (44 out an estimated 14,000 banks in the United States) examined over a rather short period (25 months).

Of the five banks in the third group, only Banks 2, 41 and 44 have coefficients on the competitive variable between 0 and 1 and can properly be labelled "Imperfectly Competitive". Chemical Bank and Manufacturers Hanover do not fit this classification, as their coefficients on the competitive variable are significantly greater than 1. The final group of banks designated "Unclassified," are a mystery. A third are from Chicago, and a third are from Boston, but no other distinguishing characteristics are apparent. In summary, the empirical evidence shows that the automobile loan market is better characterized by a competitive model with respect to automobile loan rate behavior.

Attempts to investigate the influence of institutional location and size were thwarted by the heterogeneity of behaviors within a given classification. As indicated by the high F-ratios in Tables 16 and 17, intraregional and intra-size class variation was too great to allow continued examination of interregional or inter-size class differences.

Table 16. Intraregional Variation of Auto Loan Rates

Unrestricted: $AUT = \Sigma \alpha_k DB_k + \beta_1(TBD) + \beta_2(BUS) + \beta_3(AUTX) + \varepsilon_i$

Restricted: $AUT = \alpha_0 + \beta_1(TBD) + \beta_2(BUS) + \beta_3(AUTX) + \varepsilon_i$

Hypothesis: All banks within a given region behave in sufficiently the same manner as to allow "pooling" of the data

Region	Number of Institutions	F-ratio	Decision
New York City	8	69.13	REJECT
Chicago	8	61.83	REJECT
California	7	26.18	REJECT
Boston	6	75.90	REJECT
Detroit	8	27.74	REJECT
Cincinnati	7	13.14	REJECT

Table 17. Intra-Size Class Variation of Auto Loan Rates

Unrestricted: $AUT = \Sigma\alpha_k DB_k + \beta_1(TBD) + \beta_2(BUS) + \beta_3(AUTX) + \varepsilon_i$

Restricted: $AUT = \alpha_0 + \beta_1(TBD) + \beta_2(BUS) + \beta_3(AUTX) + \varepsilon_i$

Hypothesis: All banks within a given size class behave in sufficiently the same manner as to allow "pooling" of the data

Size Class	Assets ($)	Number of Institutions	F-ratio	Decision
5	$ 45 to 100 billion	4	20.77	REJECT
4	25 to 50 billion	5	60.86	REJECT
3	10 to 25 billion	7	29.56	REJECT
2	5 to 10 billion	11	70.46	REJECT
1	1 to 5 billion	13	26.55	REJECT

DEPOSIT RATES

The response of an institution's deposit rate to changes in the security rate, business rate and competitors' rates is shown in Table 18. Banks 18 and 19 did not offer money market accounts during the sample period and were excluded from the study.

Table 18. Deposit Rate Regressions

$$MMA = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
1	3.01	-0.33	0.53	0.07	0.041	0.56	0.74		n=23
	(1.44)	(0.17)	(0.24)	(0.13)					
2	2.81	-0.71	1.38	-0.27	0.040	0.57	24.85	1.17	n=22
	(0.82)	(0.14)	(0.28)	(0.14)					
3	-0.99	-0.49	.95	0.20	0.047	0.75	5.19		n=24
	(2.03)	(0.19)	(0.31)	(0.21)					
4	0.97	-0.38	.86	0.03	0.030	0.80	0.08		n=24
	(1.27)	(0.14)	(0.21)	(0.13)					
5	1.13	-0.27	0.81	-0.02	0.040	0.64	4.06	1.13	n=24
	(1.14)	(0.13)	(0.19)	(0.11)					
6	1.43	-0.59	1.04	0.00	0.058	0.48	13.81	1.04	n=24
	(1.19)	(0.16)	(0.23)	(0.12)					
7	-0.82	-0.39	0.93	0.15	0.074	0.56	4.77	1.02	n=24
	(1.48)	(0.18)	(0.26)	(0.16)					
8	1.24	-0.60	1.16	-0.07	0.040	0.64	20.30	1.32	n=24
	(0.98)	(0.13)	(0.19)	(0.11)					
9	3.38	-0.21	0.35	0.08	0.012	0.72	5.55		n=25
	(0.64)	(0.09)	(0.15)	(0.05)					
10	-0.14	0.23	-0.31	0.62	0.031	0.45	2.65	1.14	n=25
	(1.23)	(0.14)	(0.21)	(0.14)					
11	-0.33	0.10	0.05	0.47	0.012	0.75	1.31	1.35	n=25
	(0.71)	(0.09)	(0.12)	(0.07)					
12	-1.26	0.26	-0.22	0.64	0.010	0.82	9.92	1.29	n=25
	(0.66)	(0.08)	(0.11)	(0.07)					
13	3.64	0.20	-0.34	0.33	0.015	0.37	4.49	1.32	n=25
	(0.89)	(0.09)	(0.13)	(0.09)					
14	-1.07	0.04	0.01	0.60	0.010	0.80	0.22	1.07	n=25
	(0.71)	(0.09)	(0.12)	(0.08)					
15	0.46	0.10	-0.01	0.43	0.014	0.61	1.02	1.39	n=25
	(0.85)	(0.10)	(0.14)	(0.09)					
16	1.76	0.04	-0.09	0.39	0.005	0.80	2.18		n=25
	(0.75)	(0.06)	(0.09)	(0.07)					
17	1.25	-0.25	0.41	0.21	0.012	0.58	9.67	1.95	n=25
	(0.81)	(0.08)	(0.11)	(0.07)					
20	1.42	-0.03	0.00	0.38	0.011	0.65	0.20	1.25	n=25
	(0.74)	(0.08)	(0.10)	(0.07)					
21	5.99	-0.10	0.00	0.02	0.023	0.56	1.05		n=25
	(0.92)	(0.12)	(0.17)	(0.03)					

Table 18. (contd.).

$$MMA = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
22	-0.75	0.00	0.08	0.50	0.007	0.85	0.00	1.16	n=21
	(0.61)	(0.07)	(0.11)	(0.06)					
23	-2.03	-0.16	0.50	0.36	0.027	0.62	1.65	2.20	n=25
	(1.24)	(0.13)	(0.17)	(0.11)					
24	-1.72	-0.06	0.86	0.13	0.053	0.79	0.13	1.27	n=25
	(1.78)	(0.17)	(0.23)	(0.15)					
25	0.12	-0.13	0.41	0.30	0.023	0.73	1.30		n=25
	(1.49)	(0.12)	(0.17)	(0.12)					
26	-0.31	-0.40	0.69	0.31	0.031	0.54	11.03	1.48	n=25
	(1.51)	(0.12)	(0.17)	(0.13)					
27	-1.86	-0.33	0.85	0.28	0.042	0.67	5.48	1.58	n=25
	(1.57)	(0.14)	(0.19)	(0.13)					
28	-1.09	-0.06	0.44	0.35	0.025	0.71	0.34	2.09	n=25
	(1.05)	(0.11)	(0.15)	(0.09)					
29	-3.39	-0.14	0.58	0.48	0.035	0.71	1.10	1.33	n=24
	(1.45)	(0.13)	(0.18)	(0.13)					
30	-4.00	-0.49	1.32	0.26	0.112	0.64	4.0	1.59	n=25
	(2.60)	(0.25)	(0.35)	(0.25)					
31	-3.35	-0.15	0.34	0.59	0.015	0.77	1.73	1.53	n=22
	(1.26)	(0.11)	(0.15)	(0.11)					
32	-0.31	0.16	-0.09	0.46	0.028	0.40	1.22	1.54	n=23
	(1.46)	(0.15)	(0.20)	(0.13)					
33	-4.19	0.00	0.04	0.77	0.026	0.74	0.00	1.99	n=23
	(1.41)	(0.14)	(0.19)	(0.13)					
34	-1.54	-0.02	0.03	0.57	0.015	0.73	0.03	1.31	n=23
	(1.08)	(0.11)	(0.15)	(0.10)					
35	-2.20	-0.08	0.00	0.68	0.016	0.81	0.46	1.38	n=23
	(1.11)	(0.11)	(0.15)	(0.10)					
36	-1.84	-0.19	0.44	0.42	0.009	0.85	5.34	1.81	n=23
	(0.80)	(0.08)	(0.11)	(0.07)					
37	-4.28	-0.56	1.22	0.34	0.031	0.83	12.98	2.22	n=23
	(1.54)	(0.16)	(0.21)	(0.14)					
38	-1.83	0.05	0.01	0.57	0.009	0.81	0.33	1.29	n=23
	(0.82)	(0.08)	(0.11)	(0.07)					
39	2.06	0.10	0.08	0.16	0.009	0.77	1.70	0.97	n=17
	(0.55)	(0.08)	(0.12)	(0.06)					
40	4.90	-0.32	0.53	-0.11	0.186	0.15	0.48	0.75	n=13
	(2.15)	(0.46)	(0.54)	(0.20)					

Table 18. (contd.).

$$MMA = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

Bank	α_0	α_1	α_2	α_3	SE	R^2	F-rat.	DW	
41	4.09 (1.27)	-0.10 (0.20)	-0.03 (0.30)	0.22 (0.10)	0.076	0.16	0.23	1.66	n=23
42	4.55 (1.89)	-0.45 (0.31)	0.86 (0.48)	-0.20 (0.19)	0.153	0.03	2.12	1.47	n=23
43	-1.74 (0.90)	-0.13 (0.15)	0.36 (0.23)	0.40 (0.09)	0.035	0.74	0.77	1.19	n=23
44	0.84 (0.74)	0.26 (0.12)	-0.11 (0.19)	0.29 (0.07)	0.023	0.71	4.50	1.37	n=23
45	2.56 (1.59)	0.01 (0.27)	-0.70 (0.41)	0.62 (0.16)	0.107	0.57	0.00	1.56	n=22

Regressions computed using ordinary least squares (OLS) unless DW is not shown, when first-order autoregression (AR1) techniques were used. SE = standard error of the regression, R^2 is adjusted except in the AR1 regressions, F-rat.= F-statistic for the hypothesis H_o: $\beta_2 = \beta_2 = 0$, DW = Durbin-Watson statistic.

***Hypothesis 5**: Deposit Rates React to Innovations in Security Rates, but NOT Business Loan Rates and Competitors' Rates*

According to the theoretical model, deposit rates should respond to changes in open market security rates and be unresponsive to changes in the prime rate or the rates charged by competitors on consumer loans. This assertion is tested with an F-statistic; if it is possible to accept the joint hypothesis $\beta_2 = \beta_3 = 0$ then further investigation of the the security rate coefficient is warranted. The results shown in Table 18 are mixed; of the 43 financial institutions examined, the null hypothesis is rejected approximately one-third of the time. The model's predictions are realized in the remaining two-thirds of the sample. There seems to be no pattern describing the group of rejecting banks.

Hypothesis 6: *Deposit Rates Increase with Increases in Security Rates*

As discussed earlier, tests of individual coefficients are conducted using t-statistics. Table 19 summarizes the signs of the significant coefficients from the deposit rate regressions. The coefficient on the security rate proxy is positive in 22 of 43 regression equations.

Hypothesis 7: *Deposit Rates are Unaffected by Changes in Business Loan Rates*

It is not possible to draw meaningful conclusions regarding Hypothesis 7, as the t-statistics indicate the null hypothesis is rejected in 24 out of the 43 regression equations and accepted in the remainder.

Hypothesis 8: *Deposit Rates are Unaffected by Changes in Consumer Loan Rates*

Hypothesis 8 is rejected for 28 of 43 banks, and unable to be rejected by 14 of 43 banks,suggesting that deposit rates are correlated with consumer loan rates at the majority of banks in the sample.

Table 19. Signed Coefficients of Deposit Rate Regressions

$$MMA = \alpha_0 + \alpha_1(TBD) + \alpha_2(BUS) + \alpha_3(AUTX) + \varepsilon_i$$

α_1	α_2	α_3	α_0	BANK	NAME
+	*0*	+	*0*	*44*	*Provident Bank*
+	-	+	+	*13*	*Harris Trust and Savings Bank*
+	-	+	-	*12*	*First Chicago*
0	+	+	0	23	Wells Fargo Bank
0	+	+	0	28	New World Bank for Savings
0	+	+	-	29	State Street Bank
0	+	+	-	31	Comerica
0	+	0	+	42	Fifth Third bank
0	+	0	0	24	Bank of Boston
0	+	0	0	25	Bank of New England
0	0	+	+	16	Talman Home Savings and Loan
0	0	+	+	20	Great Western Savings
0	0	+	+	39	Ameritrust
0	0	+	+	41	Central Trust
0	0	+	0	10	Continental Illinois
0	0	+	0	11	Exchange National Bank
0	0	+	0	14	La Salle National Bank
0	0	+	0	15	Northern Trust Bank
0	0	+	0	22	Sears Savings Bank
0	0	+	0	32	Empire of America
0	0	+	0	34	First Federal Savings Bank
0	0	+	0	45	Society Bank
0	0	+	-	33	First of America
0	0	+	-	35	Great Lakes Savings Bank
0	0	+	-	38	Standard Federal
0	0	+	-	43	First National Bank
0	0	0	+	21	Home Federal Savings and Loan
0	0	0	+	40	Bank One
-	+	+	*0*	*17*	*Bank of America*
-	+	+	*0*	*26*	*Boston Five Cents Savings Bank*
-	+	+	*0*	*27*	*First Mutual of Boston*
-	+	+	-	*36*	*Manufacturers National Bank*
-	+	+	-	*37*	*National Bank of Detroit*
-	+	0	+	1	Anchor Savings
-	+	*0*	+	*9*	*Ben Franklin Savings and Loan*
-	+	*0*	*0*	*3*	*Chase Manhattan*
-	+	0	0	4	Chemical Bank
-	+	0	0	5	Citibank
-	+	*0*	*0*	*6*	*First American Bank*
-	+	*0*	*0*	*7*	*Manufacturers Hanover*
-	+	*0*	*0*	*8*	*Marine Midland Bank*
-	+	0	0	30	Union Warren Savings Bank
-	+	-	+	*2*	*Bowery Savings*

Entries represent coefficients significantly different from zero at a 95% confidence level. '+' indicates the coefficient is significantly greater than zero, '-' indicates the coefficient is significantly less than zero, and '0' indicates the coefficient does not differ significantly from zero. Hypothesis 1 is rejected at the 95% confidence interval for banks in italics.

DISCUSSION

This section discusses the results presented in the previous chapter and attempts to resolve inconsistencies between the predictions of the theoretical model and observed behaviors. Before beginning a discussion of these topics, however, it is important to note that one of this dissertation's biggest strengths is also one of its biggest drawbacks. This statement refers to the use of *microeconomic* time series data for the empirical testing. The use of individual, rather than aggregate, bank data is justified by both theoretical and practical considerations, however, it may lead one to " ... miss the forest for the trees." Theory suggests individual firms seek to maximize profits; it is unlikely that aggregates pursue such enlightened self interest. Further, bank managements are concerned primarily with decision-making at their own institutions, and much less with the results of aggregate behaviors.

However justified, the decision to examine the behavior of individual financial institutions makes interpretation of the results rather difficult, for in every test, some banks' results agree with the theoretical predictions and others do not. Because no clear-cut answer to the working hypotheses generated in Chapter V was found, the remainder of this discussion will focus on reasons why the results might NOT support the theoretical model developed in Chapter III.

Three possible explanations will be discussed: 1) Is the model wrong? 2) Is the data suspicious? 3) Is the world different than theory?

IS THE MODEL WRONG?

If the theoretical model developed in Chapter III has been incorrectly specified or if its solution contains mathematical errors, then it would not be surprising for the empirical results to differ from the predicted theoretical responses. Operating under the belief that the model has been correctly manipulated and solved leads one to question the validity of its underlying assumptions.

A crucial assumption is that consumer loan markets are imperfectly competitive, i.e. banks have some price-setting ability. Recall that a controversy exists amongst academics and practitioners concerning bank market structures. The theoretical model assumes a bank's consumer loan volume results from the interplay of endogenous pricing decisions and competitors' offerings, although it does not specify the exact nature of this interaction. The strong positive effects of competitors' rates on a many banks' automobile loan rates suggests this market more closely approximates the pure competition model and might be better described with another approach, more similar to the portfolio theory models reviewed earlier. The results of regressions run against competitors' rates alone are indicate that the assumption of imperfect competition is untrue for most banks in the sample.

The failure of the theoretical model to explain the behavior of deposit rates was not wholly unexpected. A bank offers many types of deposit accounts, each with different characteristics, and it is naive to presume that a single account could capture the behavior of the overall aggregate. In defense of these non-results, it should be noted that the accurate description of the liability side of a bank's balance sheet was NOT a primary consideration in the formulation of the model. Other researchers have investigated questions of deposit-rate determination in much greater depth, usually by including simplifying assumptions on the asset side (Weber, 1966; Klein and Murphy, 1971; Sealey, 1980; Flannery, 1982).

IS THE DATA SUSPICIOUS?

The strengths and weaknesses of the data used to test the empirical model have already been discussed. Non-sampling errors due to inaccurate collection or transcription of the individual banks' data and the difficulties inherent in the choice of a single proxy for an institution's security portfolio were cited. Money market account rates are surely an oversimplified proxy for aggregate bank deposit rates. A few additional points might also be raised. First, the sample period is relatively short, with only twenty-five observations spanning a period only slightly longer than two years. Also, this was not a highly volatile period, and the variation in loan rates was quite small. The automobile loan

rate of one bank did not change at all during the sample period! The small sample size and low variability of the data lead to decreased confidence in the estimation of the "true" results.

The composition of the available data set is also an important issue. The sample institutions came from six *metropolitan* areas and were primarily composed of large banks. Indeed, seven of the ten largest banks in the country were included in the sample. Only a few large savings and loans or savings banks were included; credit unions were notable by their absence. It is quite possible different results would be obtained if the theoretical model were tested with data from smaller institutions in more rural markets.

IS THE WORLD DIFFERENT FROM THEORY?

The British philosopher Alfred North Whitehead is reputed to have remarked, "Seek simplicity … and distrust it." Hopefully, the theoretical model captured the essential characteristics of a bank's decision-making process while ignoring extraneous details. However, it is very likely that certain important information was excluded in the interest of maintaining the model's tractability. For instance, the model assumes bank managements are risk-neutral and attempt to maximize end-of-period profits. If these assumptions are not met in practice, the empirical tests are flawed. One result of the empirical tests has been to identify consumer

loan markets as being much farther along the continuum from monopoly to competitive markets.

Other possible ways in which the real world might differ from its theoretical construct include institutional constraints, such as time lags in the adjustment of rates. Another possible complication is associated with the variable used to proxy the consumer loan rate. Perhaps the interest rates charged on new automobile loans is not a good proxy for the consumer loan rate? The theoretical model is mum on the subject of non-interest rate compensation.

Of the three possible explanations for the divergence of the empirical results from the theoretical predictions, this last explanation, "the world is different from theory," is the most appealing. First, the theoretical model is a simplification of the real world. Financial institutions make many types of loans in addition to the two specifically examined in the model. Mortgage lending is an important outlet for many banks' funds. Second, the markets for which we have data are much more competitive then previously thought. A theory-of-the-firm model of the type used in this dissertation is perhaps not an appropriate description of bank behavior in these markets. Finally, the maximization of short-term profits may not be the relevant objective function. Other considerations, e.g. regulation, strategic policy and managerial satisfaction may be important.

VI. SUMMARY AND CONCLUSIONS

This study reviewed and examined the theoretical and practical issues surrounding the determination of consumer loan rates at commercial banks. It developed a microeconomic model of the banking firm emphasizing the consumer loan pricing decision and tested this model with time series data from individual United States banks. This chapter summarizes the major conclusions and implications of this research.

Chapter I conceptualized and defined the central research issue of this dissertation: Although lending to consumers is a rapidly expanding area of bank activities, very little theoretical or empirical work has been conducted on the pricing of consumer loans. The relevant consumer credit literature was reviewed in Chapter II and key issues were identified. It was argued that consumers are both knowledgeable and responsive regarding the interest rate charged on consumer loans. A discussion of existing models of the banking firm and empirical observations of bank loan markets led to the choice of a monopoly, or 'theory-of-the-firm' model for modelling consumer loan rates. The closing paragraphs of the literature review summarized the results of the few empirical investigations of bank loan rate behavior and briefly reviewed the relevant deposit rate literature.

THE THEORETICAL MODEL

The model developed in Chapter III extended earlier work by allowing a bank to hold more than one type of loan portfolio. Previous studies assumed banks used the monies collected from deposits to make "loans". Cost functions for administering the various loan and deposit portfolios were included as draws against bank revenue, although the requirement that the second-order conditions be met obviated their usefulness.

The bank's choice variables were the consumer loan rate and the rate paid on bank deposits, while security rates, the business loan rate, and the rate on consumer loans offered at competing institutions were taken to be exogenous and beyond the bank's immediate control. The model's solution was stated only in general term, although testable hypotheses of the predicted signs of its coefficients were generated. Consumer loan rates were predicted to respond positively to positive innovations in security rates and competitors' rates and negatively to increases in the business loan rate. The rate paid on deposits was dichotomized from lending rate decisions and predicted to increase as security rates increased. Changes in the business loan rate or the rate offered on competitive consumer loans were predicted to have no effect on deposit rates.

Empirical Results

The hypotheses generated by the theoretical model were tested with classical linear regression techniques and probit analysis, although the latter technique did not yield meaningful results. The results of the hypotheses stated in Chapter IV are summarized in Table 20.

Table 20. Results of Hypothesis Testing

HYPOTHESIS	RESULTS	REMARKS
1. Consumer loan rates are NOT impacted by innovations in security rates, business rates and competitors' rates H_o: $\alpha_1 = \alpha_2 = \alpha_3 = 0$	REJECTED by 32 of 41 institutions; consumer loan rates ARE generally affected by these variables	Null hypothesis is accepted at the two smallest banks in the study and at the larger *regional* banks
2. Consumer loan rates increase with increases in security rates H_o: $\alpha_1 \leq 0$	POSITIVE relationship at 9 of 44 banks; no relationship at 22 of 44 banks, significantly negative at 13 firms	With exception of First Interstate, 9 rejecting banks tend to have small consumer loan portfolios
3. Consumer loan rates decrease with increases in business loan rates H_o: $\alpha_2 \geq 0$	NEGATIVE relationship at 9 of 44 banks; no relationship at 19 of 44 banks, significantly positive at 16 firms	Seven of the 9 rejecting banks also rejected the prior hypothesis
4. Consumer loan rates increase with increases in competitors' rates H_o: $\alpha_3 \leq 0$	POSITIVE relationship at 32 of 44 banks; no relationship at 12 of 44 banks	Strong competitor influences; price-setting assumption may be incorrect
5. Deposit rates are NOT affected by changes in business rates or competitors' rates H_o: $\beta_2 = \beta_3 = 0$	ACCEPTED by 29 of 42 institutions; deposit rates are NOT generally affected by business or competitors' rates	Difficult to draw conclusions; rejecting banks are both small and large in varied regions

Table 20. (contd.).

HYPOTHESIS	RESULTS	REMARKS
6. Deposit rates increase with increases in security rates H_o: $\beta_1 \leq 0$	No relationship at 25 of 29 banks; significantly negative at 4 of 29 firms	Odd findings; T-bonds slightly better than T-bills at explaining changes in money market account rates
7. Deposit rates are unrelated to innovations in business loan rates H_o: $\beta_2 = 0$	NO relationship at 18 of 29 banks; significantly positive at 11 of 29 firms	Deposit rates are dichotomized from business loan rates
8. Deposit rates are unrelated to innovations in competitors' rates H_o: $\beta_3 = 0$	NO relationship at 9 of 29 banks; significantly positive at 20 of 29 firms	No explanation, unless deposit rates are correlated with own-bank consumer loan

The divergence of the consumer loan rate results from the model's predictions was suggested to be due to the strong influence of competitors' rates. An alternative approach to modelling the banking firm using concepts drawn from portfolio theory may provide a better description of the real world. The results of the deposit rate regressions did not wholly support the theoretical model and suggest there might be some empirical interplay between the loan and deposit markets, contradictory to theory.

IMPLICATIONS

There are at least three implications for future theoretical work in consumer loan pricing which have arisen from the current study. First, consumer loan markets, at least in the major metropolitan areas tested, are more competitive than previously thought. This observation contradicts the work of Hancock (1986) and Koch (1987), but lends support to Smirlock (1985) and Smirlock and Brown's (1986) contention that markets are at least imperfectly competitive. Second, incorporating the separable and admittedly restrictive cost functions into a one-period profit maximization model appears to make little difference in the model's solution. Finally, care should be taken in interpreting previously-published empirical research on the behavior of commercial and consumer loan rates. The results of this study indicate a significant amount of heterogeneity between institutions. Aggregate data tends to obscure what

appears to be important factors operating on a microeconomic level. For example, it would be entirely possible to demonstrate monopolistic behavior for the banking industry as a whole (using aggregate data) because the majority of the 15,000 or so U.S. banks are small institutions located in one- or two-bank towns. However, as this dissertation has shown, on the *microeconomic* level, larger banks exhibit a significant amount of competitive influences.

This study shows that banks apparently are taking more account of competitors' offerings when setting consumer loan rates then previously thought. Thus, a bank's strategic policies should include the expectation of rapid competitive responses. The profit-maximizing results of the theoretical model are not applicable in a perfectly competitive environment, and inasmuch as monopoly or imperfect competition pricing strategies are doomed to fail in a competitive market, bank managements are advised to consider alternative means for the pricing of their consumer loans. The generally weak support for the theoretical model also suggests that deposit rates may not be set to maximize profits, but may be a reflection of competitive interactions between individual banks. It could also be a function of the relatively simplistic specification of deposit account behavior. As deregulation of the financial markets continues to increase, it is apparent that banking (at least in the larger metropolitan markets) will grow to resemble the competitive model much more closely.

AREAS FOR FUTURE RESEARCH

Further investigation of so-called 'external' factors needs to be conducted. Regional variations and deviations attributable to differences in institutional type, size and portfolio composition should be examined. The acquisition of a new data set containing information on smaller banks in more rural settings should be a priority item. As mentioned throughout the latter half of this dissertation, a portfolio model assuming purely competitive loan and deposit returns should be considered. The anomalous results of the deposit rate regressions require further investigation, particularly in regards to their degree of correlation with the yields on various money market securities.

Perhaps most importantly, the results presented in this dissertation should be verified with a larger and more comprehensive data set. Longer time series, more institutions, and a variety of loan and deposit instruments would be instrumental in the continuing confirmation or rejection of the theoretical model.

APPENDIX A

APPENDIX A. A MATHEMATICAL MODEL OF THE BANKING FIRM

The solution to the one-period profit maximization model developed in Chapter 3 is obtained by setting the total differentials of the first-order conditions equal to zero and simultaneously solving for the two decision variables, r_C and r_D. The restrictions implied by the second-order conditions allow one to unambiguously sign the coefficients in the solution functions $r_C^* = f(r_S, r_B, r_X)$ and $r_D^* = f(r_S, r_B, r_X)$.

Recall the objective function:

$$\pi = r_C C + r_B B + r_S[(1 - q)D - C - B] - r_D D - \chi_C(C) - \chi_B(B) - \chi_D(D) \qquad (A1)$$

where:

r_C = consumer loan rate

r_B = business loan rate

r_D = deposit rate

r_S = marketable securities rate

C = volume of consumer loans

B = volume of business loans

B = volume of bank deposits

q = percentage of deposits held for reserve and liquidity requirements

$\chi_B(B)$ = cost function of originating and servicing the business loan portfolio

$\chi_C(C)$ = cost function of originating and servicing the consumer loan portfolio

$\chi_D(D)$ = cost function of supplying deposit services

and the following assumptions about bank behavior are stated explicitly:

$C = C(r_C, r_X)$	$\partial C/\partial r_C < 0$	$\partial C/\partial r_X > 0$	$\chi'_C(C) > 0$	$\chi''_C(C) > 0$
$B = B(r_B, r_C)$	$\partial B/\partial r_B > 0$	$\partial B/\partial r_C < 0$	$\chi'_B(B) > 0$	$\chi''_B(B) > 0$
$D = D(r_D)$	$\partial D/\partial r_D > 0$		$\chi'_D(D) > 0$	$\chi''_D(D) > 0.$

The bank's decision variables are the consumer loan rate and the deposit rate. The profit-maximizing levels of consumer and business loans follow from these choices, as do deposit and securities volumes. This following pages detail the steps leading to the model's solution.

The two decision variables give rise to two first-order conditions. These are:

$$\frac{\partial \pi}{\partial r_C} = C + r_C\frac{\partial C}{\partial r_C} + r_B\frac{\partial B}{\partial r_C} - r_S\frac{\partial C}{\partial r_C} - r_S\frac{\partial B}{\partial r_C} - \frac{\partial \chi_C}{\partial C}\frac{\partial C}{\partial r_C} - \frac{\partial \chi_B}{\partial B}\frac{\partial B}{\partial r_C} = 0 \qquad \text{(A2)}$$

$$\frac{\partial \pi}{\partial r_D} = r_S(1 - q)\frac{\partial D}{\partial r_D} - r_D\frac{\partial D}{\partial r_D} - D - \frac{\partial \chi_D}{\partial D}\frac{\partial D}{\partial r_D} = 0 \qquad \text{(A3)}$$

which can be rearranged to produce

$$\frac{\partial \pi}{\partial r_C} = \frac{\partial C}{\partial r_C}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial B}{\partial r_C}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) + C = 0 \qquad \text{(A4)}$$

$$\frac{\partial \pi}{\partial r_D} = \frac{\partial D}{\partial r_D}\left(r_S(1 - q) - r_D - \frac{\partial \chi_D}{\partial D}\right) - D = 0 \qquad \text{(A5)}$$

The second-order conditions (A6) and (A7) must be less than zero to ensure a profit maximum.

$$\frac{\partial^2 \pi}{\partial r_C^2} = \frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial C}{\partial r_C}\left(1 - \frac{\partial^2 \chi_C}{\partial C \partial r_C}\right) + \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) + \frac{\partial B}{\partial r_C}\left(\frac{\partial^2 \chi_B}{\partial B \partial r_C}\right) + \frac{\partial C}{r_C} < 0 \qquad \text{(A6)}$$

$$\frac{\partial^2 \pi}{\partial r_D^2} = \frac{\partial^2 D}{\partial r_D^2}\left(r_S(1 - q) - r_D - \frac{\partial \chi_D}{\partial D}\right) + \frac{\partial D}{\partial r_D}\left(-1 - \frac{\partial^2 C_D}{\partial D \partial r_D}\right) - \frac{\partial D}{\partial r_D} < 0 \qquad \text{(A7)}$$

If the cost functions are additive and separable and the cross-partials are assumed to be equal to zero, (A6) and (A7) may be rearranged and simplified to:

$$\frac{\partial^2 \pi}{\partial r_C^2} = \frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) + 2\,\frac{\partial C}{r_C} < 0 \qquad \text{(A8)}$$

$$\frac{\partial^2 \pi}{\partial r_D^2} = \frac{\partial^2 D}{\partial r_D^2}\left(r_S(1 - q) - r_D - \frac{\partial \chi_D}{\partial D}\right) - 2\,\frac{\partial D}{\partial r_D} < 0 \qquad \text{(A9)}$$

The total differentials of the first-order conditions are

$$d\frac{\partial \pi}{\partial r_C} = \frac{\partial C}{\partial r_C}\left(dr_C - dr_S - \frac{\partial^2 \chi_C}{\partial C \partial r_C}dr_C - \frac{\partial^2 \chi_C}{\partial C \partial r_X}dr_X\right) + \frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right)dr_C$$
$$+ \frac{\partial B}{\partial r_C}\left(dr_B - dr_S - \frac{\partial^2 \chi_B}{\partial B \partial r_C}dr_C - \frac{\partial^2 \chi_B}{\partial B \partial r_B}dr_B\right) + \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right)dr_C + \frac{\partial C}{\partial r_C}dr_C + \frac{\partial C}{\partial r_X}dr_X = 0 \qquad \text{(A10)}$$

$$d\frac{\partial \pi}{\partial r_D} = \frac{\partial D}{\partial r_D}\left((1 - q)dr_S - dr_D - \frac{\partial^2 \chi_D}{\partial D \partial r_D}dr_D\right) + \left((1 - q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right)\frac{\partial^2 D}{\partial r_D^2}\,dr_D - \frac{\partial D}{\partial r_D}dr_D = 0 \qquad \text{(A11)}$$

Assuming the cross partials equal zero and rearranging,

$$d\frac{\partial \pi}{\partial r_C} = \left\{\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) + \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial c_B}{\partial B}\right) + 2\frac{\partial C}{\partial r_C}\right\}dr_C + \{0\}dr_D + \left\{-\frac{\partial C}{\partial r_C} - \frac{\partial B}{\partial r_C}\right\}dr_S + \left\{\frac{\partial B}{\partial r_C}\right\}dr_B + \left\{\frac{\partial C}{\partial r_X}\right\}dr_X = 0 \quad \text{(A12)}$$

$$d\frac{\partial \pi}{\partial r_D} = \{0\}dr_C + \left\{\frac{\partial^2 D}{\partial r_D^2}\left((1 - q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) - 2\frac{\partial D}{\partial r_D}\right\}dr_D + \left\{\frac{\partial D}{\partial r_D}(1 - q)\right\}dr_S + \{0\}dr_B + \{0\}dr_X = 0 \quad \text{(A13)}$$

Expressing this equation system in matrix notation,

$$\begin{bmatrix} -\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C} & 0 \\ 0 & -\frac{\partial^2 D}{\partial r_B^2}\left((1-q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D} \end{bmatrix} \begin{bmatrix} dr_C \\ dr_D \end{bmatrix} = \begin{bmatrix} -\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right) & \frac{\partial B}{\partial r_C} & \frac{\partial C}{\partial r_X} \\ \frac{\partial D}{\partial r_D}(1-q) & 0 & 0 \end{bmatrix} \begin{bmatrix} dr_S \\ dr_B \\ dr_X \end{bmatrix}$$

Premultiplying by the inverse of the LHS coefficient matrix,

$$\begin{bmatrix} dr_C \\ dr_D \end{bmatrix} = \frac{1}{A} \begin{bmatrix} -\frac{\partial^2 D}{\partial r_B^2}\left((1-q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D} & 0 \\ 0 & -\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C} \end{bmatrix} \begin{bmatrix} -\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right) & \frac{\partial B}{\partial r_C} & \frac{\partial C}{\partial r_X} \\ \frac{\partial D}{\partial r_D}(1-q) & 0 & 0 \end{bmatrix} \begin{bmatrix} dr_S \\ dr_B \\ dr_X \end{bmatrix}$$

where $A = \left[-\frac{\partial^2 D}{\partial r_B^2}\left((1-q)r_S - r_D - \frac{\partial C_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[-\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C}\right] > 0$

Multiplying through gives

$$-\frac{1}{A}\begin{bmatrix} \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_s - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[-\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right)\right] & \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_s - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[\frac{\partial B}{\partial r_C}\right] & \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_s - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right] \\ \left[-\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_s - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_s - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C}\right]\left[\frac{\partial D}{\partial r_D}(1-q)\right] & 0 & 0 \end{bmatrix}$$

Re-writing and distributing across terms produces

$$dr_C^* = \frac{1}{A}\left\{\begin{array}{l} \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[-\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right)\right] dr_S \\ \quad + \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[\frac{\partial B}{\partial r_C}\right] dr_B \\ \quad + \left[-\frac{\partial^2 D}{\partial r_D^2}\left((1-q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}\right]\left[\frac{\partial C}{\partial r_X}\right] dr_X \end{array}\right\} \qquad \text{(A14)}$$

$$dr_D^* = \frac{1}{A}\left\{\begin{array}{l} \left[-\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C}\right]\left[\frac{\partial D}{\partial r_D}(1-q)\right] dr_S \\ \quad + [0]\, dr_B + [0]\, dr_X \end{array}\right\} \qquad \text{(A15)}$$

Simplifying and grouping terms gives the final results

$$dr_C^* = K\left\{-\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right)\right\}dr_S + \left\{\frac{\partial B}{\partial r_C}\right\}dr_B + \left\{\frac{\partial C}{\partial r_X}\right\}dr_X \qquad \text{(A16)}$$

$$dr_D^* = L\left\{\frac{\partial D}{\partial r_D}(1 - q)\right\}dr_S \qquad \text{(A17)}$$

$$\text{where } K = \frac{1}{-\frac{\partial^2 C}{\partial r_C^2}\left(r_C - r_S - \frac{\partial \chi_C}{\partial C}\right) - \frac{\partial^2 B}{\partial r_C^2}\left(r_B - r_S - \frac{\partial \chi_B}{\partial B}\right) - 2\frac{\partial C}{\partial r_C}}$$

$$\text{and } L = \frac{1}{-\frac{\partial^2 D}{\partial r_D^2}\left((1 - q)r_S - r_D - \frac{\partial \chi_D}{\partial D}\right) + 2\frac{\partial D}{\partial r_D}}$$

Expressing (A16) and (A17) in general form,

$$dr_C = \frac{\partial r_C}{\partial r_S}\,dr_S + \frac{\partial r_C}{\partial r_B}\,dr_B + \frac{\partial r_C}{\partial r_X}\,dr_X \qquad \text{(A18)}$$

$$dr_D = \frac{\partial r_D}{\partial r_S}\,dr_S + \frac{\partial r_D}{\partial r_B}\,dr_B + \frac{\partial r_D}{\partial r_X}\,dr_X \qquad \text{(A19)}$$

it is apparent that

$$\frac{\partial r_C}{\partial r_S} = -K\left(\frac{\partial C}{\partial r_C} + \frac{\partial B}{\partial r_C}\right) \qquad \frac{\partial r_C}{\partial r_B} = K\left(\frac{\partial B}{\partial r_C}\right) \qquad \frac{\partial r_C}{\partial r_X} = K\left(\frac{\partial C}{\partial r_X}\right) \tag{A20}$$

$$\frac{\partial r_D}{\partial r_S} = L\left(\frac{\partial D}{\partial r_D}(1 - q)\right) \qquad \frac{\partial r_D}{\partial r_B} = 0 \qquad \frac{\partial r_D}{\partial r_X} = 0 \tag{A21}$$

Satisfaction of the second-order conditions for a profit maximum implies K and L are positive. From the model's assumptions, $\frac{\partial C}{\partial r_C} < 0$, $\frac{\partial B}{\partial r_C} < 0$, $\frac{\partial C}{\partial r_X} > 0$, and $\frac{\partial D}{\partial r_D} > 0$. Thus consumer loan rates are expected to be a positive function of the security rate and competirors' rates and a negative function of the business loan rate. The deposit rate is a positive function of security rates and unresponsive to changes in the buisness loan rate and competitors' rates.

APPENDIX B

Appendix B1. Characteristics of Financial Institutions

	NAME	TYPE	REGION	ASSETS	DEPOSITS	BUSINESS LOANS	CONSUMER LOANS
1	Anchor Savings Bank Northport, NY	FSB	NYC	$ 7,673,815			
2	Bowery Savings Bank New York City, NY	FSB	NYC	6,513,306			
3	Chase Manhattan New York City, NY	CB	NYC	82,598,276	63,740,897	$ 10,292,016 (21%)	$ 3,159,887 (6%)
4	Chemical Bank New York City, NY	CB	NYC	59,311,000	42,242,000	13,959,000 (39%)	3,884,000 (11%)
5	Citibank New York City, NY	CB	NYC	154,574,000	104,907,000	31,875,000 (34%)	14,384,000 (15%)
6	First American Bank New York City, NY	CB	NYC	1,315,699	1,045,974	213,677 (30%)	144,037 (20%)
7	Manufacturers Hanover New York City, NY	CB	NYC	59,406,000	45,667,000	19,118,000 (46%)	4,080,000 (10%)
8	Marine Midland Bank Buffalo, NY	CB	NYC	20,971,528	16,638,545	6,021,934 (10%)	4,125,556 (24%)
9	Ben Franklin Savings & Loan Chicago, IL	SL	CHI	Unavailable			
10	Continental Illinois Chicago, IL	CB	CHI	31,825,861	19,697,101	13,383,406 (64%)	457,019 (2%)
11	Exchange National Bank Chicago, IL	CB	CHI	2,107,016	1,605,587	728,540 (59%)	90,353 (7%)
12	First Chicago Chicago, IL	CB	CHI	35,476,470	27,243,360	9,759,880 (42%)	1,937,677 (8%)

Appendix B1. (contd.).

	NAME	TYPE	REGION	ASSETS	DEPOSITS	BUSINESS LOANS	CONSUMER LOANS
13	Harris Trust & Savings Bank Chicago, IL	CB	CHI	8,721,438	6,219,856	2,403,848 (49%)	612,232 (12%)
14	La Salle National Bank Chicago, IL	CB	CHI	1,564,910	1,146,218	680,752 (65%)	81,626 (8%)
15	Northern Trust Bank Chicago, IL	CB	CHI	7,690,024	5,441,841	1,507,680 (42%)	120,502 (3%)
16	Talman Home Savings & Loan Chicago, IL	SL	CHI	6,052,257			
17	Bank of America San Francisco,CA	CB	CAL	81,314,000	70,221,000	22,258,000 (40%)	7,685,000 (14%)
18	First Interstate Bank Los Angeles, CA	CB	CAL	19,604,065	16,829,226	4,641,404 (34%)	4,050,188 (30%)
19	First National Bank of Monterey Monterey, CA	CB	CAL	149,691	137,825	27,780 (28%)	12,960 (13%)
20	Great Western Bank Beverly Hills, CA	FSB	CAL	28,526,110			
21	Home Federal Savings & Loan San Diego, CA	SL	CAL	14,109,123			
22	Sears Savings Bank Glendale, CA	FSB	CAL	5,604,724			
23	Wells Fargo Bank San Francisco, CA	CB	CAL	41,362,913	32,350,223	9,792,377 (28%)	4,397,337 (13%)
24	Bank of Boston Boston, MA	CB	BOS	25,158,248	17,043,994	10,323,797 (58%)	1,017,948 (6%)

Appendix B1. (contd.).

	NAME	TYPE	REGION	ASSETS	DEPOSITS	BUSINESS LOANS	CONSUMER LOANS
25	Bank of New England Boston, MA	CB	BOS	13,327,632	9,423,023	3,489,253 (34%)	562,874 (6%)
26	Boston Five Cents Savings Bank Boston, MA	FSB	BOS	1,927,016			
27	First Mutual of Boston Boston, MA	CB	BOS	1,272,695			
28	New World Bank For Savings Boston, MA	FSB	BOS	1,422,954			
29	State Street Bank and Trust Boston, MA	CB	BOS	7,014,109	4,540,702	771,942 (36%)	400,770 (19%)
30	Union Warren Savings Bank Boston, MA	FSB	BOS	3,657,020			
31	Comerica Detroit, MI	CB	DET	7,996,467	5,714,440	1,930,305 (40%)	1,251,361 (26%)
32	Empire of America Buffalo, NY	FSB	DET	10,855,983			
33	First of America Detroit, MI	CB	DET	1,090,926	919,509	160,514 (21%)	294,874 (38%)
34	First Federal of Michigan Detroit, MI	FSB	DET	11,882,593			
35	Great Lakes Savings Bank Ann Arbor, MI	FSB	DET	3,143,233			
36	Manufacturers National Bank Detroit, MI	CB	DET	7,710,631	6,030,732	2,189,108 (46%)	453,069 (9%)

Appendix B1. (contd.).

	NAME	TYPE	REGION	ASSETS	DEPOSITS	BUSINESS LOANS	CONSUMER LOANS
37	National Bank of Detroit Detroit, MI	CB	DET	14,881,125	10,850,031	4,197,933 (55%)	776,526 (10%)
38	Standard Federal Bank Troy, MI	FSB	DET	8,514,739			
39	AmeriTrust Cleveland, OH	CB	CIN	8,036,693	6,006,409	2,387,786 (44%)	1,099,107 (20%)
40	Bank One Columbus, OH	CB	CIN	3,470,106	2,477,588	729,143 (30%)	977,682 (41%)
41	Central Trust Cincinnati, OH	CB	CIN	3,054,975	2,216,828	636,113 (31%)	491,307 (24%)
42	Fifth Third Bank Cincinnati, OH	CB	CIN	3,053,845	2,341,505	565,665 (27%)	578,274 (27%)
43	First National Bank Cincinnati, OH	CB	CIN	2,716,868	2,037,195	574,493 (32%)	428,735 (24%)
44	Provident Bank Cincinnati, OH	CB	CIN	1,755,599	1,251,649	440,319 (40%)	263,777 (24%)
45	Society Bank Columbus, OH	CB	CIN	546,194	471,264	61,646 (16%)	139,626 (37%)

Source: *Rand McNally's Banking Handbook.* Figures are as of December 31, 1987 unless indicated otherwise. All figures in thousands of dollars. CB = Commercial bank, MSB = Mutual savings bank, SL = Savings and loan. NYC = New York City, CHI = Chicago, CAL = San Francisco/Los Angeles, BOS = Boston, DET = Detroit, CIN = Cincinnati.

Appendix B2. Financial Institutions Ranked by Size

	BANK	TYPE	REGION	TOTAL ASSETS	NUMBER
1	Citibank	CB	NYC	$ 154,574,000	5
2	Chase Manhattan	CB	NYC	82,598,276	3
3	Bank of America	CB	CAL	81,314,000	17
4	Manufacturers Hanover	CB	NYC	59,406,000	7
5	Chemical Bank	CB	NYC	59,311,000	4
6	Wells Fargo Bank	CB	CAL	41,362,913	23
7	First Chicago	CB	CHI	35,476,470	12
8	Continental Illinois	CB	CHI	31,825,861	10
9	Great Western Bank	FSB	CAL	28,526,110	20
10	Bank of Boston	CB	BOS	25,158,248	24
11	Marine Midland Bank	CB	NYC	20,971,528	8
12	First Interstate Bank	CB	CAL	19,604,065	18
13	National Bank of Detroit	CB	DET	14,881,125	37
14	Home Federal Savings & Loan	SL	CAL	14,109,123	21
15	Bank of New England	CB	BOS	13,327,632	25
16	First Federal of Michigan	FSB	DET	11,882,593	34
17	Empire of America	FSB	DET	10,855,983	32
18	Harris Trust & Savings Bank	CB	CHI	8,721,438	13
19	Standard Federal Bank	FSB	DET	8,514,739	38
20	AmeriTrust	CB	CIN	8,036,693	39
21	Comerica	CB	DET	7,996,467	31
22	Manufacturers National Bank	CB	DET	7,710,631	36
23	Northern Trust Bank	CB	CHI	7,690,024	15
24	Anchor Savings Bank	FSB	NYC	7,673,815	1
25	State Street Bank and Trust	CB	BOS	7,014,109	29
26	Bowery Savings Bank	FSB	NYC	6,513,306	2
27	Talman Home Savings & Loan	SL	CHI	6,052,257	16
28	Sears Savings Bank	FSB	CAL	5,604,724	22
29	Union Warren Savings Bank	FSB	BOS	3,657,020	30
30	Bank One	CB	CIN	3,470,106	40
31	Great Lakes Savings Bank	FSB	DET	3,143,233	35
32	Central Trust	CB	CIN	3,054,975	41
33	Fifth Third Bank	CB	CIN	3,053,845	42
34	First National Bank	CB	CIN	2,716,868	43
35	Exchange National Bank	CB	CHI	2,107,016	11
36	Boston Five Cents Savings Bank	FSB	BOS	1,927,016	26
37	Provident Bank	CB	CIN	1,755,599	44
38	La Salle National Bank	CB	CHI	1,564,910	14
39	New World Bank For Savings	FSB	BOS	1,422,954	28
40	First American Bank	CB	NYC	1,315,699	6
41	First Mutual of Boston	CB	BOS	1,272,695	27
42	First of America	CB	DET	1,090,926	33
43	Society Bank	CB	CIN	546,194	45
44	First National Bank of Monterey	CB	CAL	149,691	19
45	Ben Franklin Savings & Loan	SL	CHI	Unavailable	9

APPENDIX C

Appendix C1. Automobile Loan Rates: Statistics

BANK	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	N
1	10.10	0.29	9.90	10.50	24
2	11.50	0.49	10.90	12.25	23
3	12.55	1.23	10.50	14.50	24
4	11.53	0.63	10.50	12.40	24
5	12.85	1.13	11.00	13.90	24
6	10.20	0.31	9.75	10.75	24
7	11.96	0.78	10.90	12.90	24
8	11.42	0.38	10.56	11.90	24
9	10.32	0.65	9.90	11.75	21
10	9.43	0.62	8.50	11.00	25
11	12.06	0.51	11.50	12.50	25
12	11.29	0.28	10.50	11.90	25
13	10.52	0.60	10.00	11.25	25
14	10.33	0.49	10.00	11.75	25
15	10.98	0.50	9.50	11.90	25
16	10.20	0.71	9.40	11.40	25
17	11.49	0.44	10.50	12.50	25
18	11.46	0.31	11.00	11.75	21
19	10.85	0.38	10.25	11.50	21
20	11.39	0.50	10.75	12.75	25
21	10.61	0.48	10.25	11.75	22
22	11.50	0.47	10.25	12.25	25
23	11.14	0.53	10.00	12.00	25
24	11.47	0.61	11.00	13.40	25
25	11.76	0.50	10.50	13.50	25
26	10.99	0.76	9.95	12.50	25
27	10.01	0.47	9.00	11.50	25
28	12.75	0.00	12.75	12.75	25
29	11.60	0.37	11.25	12.50	25
30	10.90	0.74	9.90	12.50	25
31	10.30	0.53	9.75	11.50	23
32	11.48	0.51	10.25	11.95	23
33	10.17	0.40	9.90	11.50	23
34	10.58	0.62	9.75	12.00	23
35	10.59	0.65	9.75	11.50	23
36	10.63	0.45	9.90	11.50	23
37	10.82	0.55	10.00	11.90	23
38	10.02	0.32	9.75	10.75	23
39	12.32	0.51	11.50	13.00	16
40	11.39	1.12	10.20	14.35	22
41	11.46	0.36	10.90	12.00	23
42	11.00	0.60	9.90	12.25	23
43	11.10	0.57	10.20	12.00	23
44	11.11	0.54	10.50	12.00	23
45	10.77	0.72	9.75	12.00	23

Appendix C2. Bank Deposit Rates: Statistics

BANK	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	N
1	5.70	0.27	5.10	6.34	24
2	5.76	0.30	5.35	6.40	23
3	5.45	0.39	4.86	6.18	25
4	5.57	0.34	5.13	6.18	25
5	5.58	0.33	5.13	6.18	25
6	5.54	0.33	5.12	6.22	25
7	5.66	0.41	5.13	6.82	25
8	5.51	0.33	4.90	6.01	25
9	5.58	0.19	5.34	5.94	25
10	5.70	0.24	5.38	6.48	25
11	5.76	0.22	5.43	6.43	25
12	5.67	0.23	5.33	6.39	25
13	5.79	0.15	5.64	6.32	25
14	5.74	0.23	5.43	6.38	25
15	5.72	0.19	5.38	6.11	25
16	5.49	0.15	5.39	6.00	25
17	5.07	0.17	4.85	5.64	25
18	.	.	.	.	0
19	.	.	.	.	0
20	5.38	0.17	5.23	6.05	25
21	5.51	0.21	5.25	6.24	25
22	5.52	0.22	5.30	6.15	21
23	4.92	0.27	4.13	5.38	25
24	6.31	0.50	5.64	7.12	25
25	5.89	0.27	5.43	6.38	25
26	5.93	0.26	5.59	6.50	25
27	6.03	0.35	5.54	6.70	25
28	5.98	0.30	5.54	6.60	25
29	5.82	0.35	5.12	6.33	24
30	6.25	0.56	5.64	7.23	25
31	5.41	0.25	5.12	5.91	24
32	5.72	0.21	5.40	6.20	25
33	5.40	0.30	5.00	6.12	25
34	5.48	0.23	5.27	6.27	25
35	5.49	0.28	5.23	6.17	25
36	5.40	0.23	5.00	5.80	25
37	5.58	0.41	5.12	6.86	25
38	5.46	0.21	5.12	6.12	25
39	5.71	0.21	5.34	6.01	19
40	5.44	0.39	5.13	6.54	14
41	5.92	0.33	5.15	6.68	25
42	5.56	0.41	4.86	6.40	25
43	5.56	0.36	5.15	6.29	25
44	5.65	0.28	5.15	6.15	25
45	4.98	0.48	4.60	6.12	24

LIST OF REFERENCES

REFERENCES

Avery, R. B., Elliehausen, G. E., Canner, G. B. and T. A. Gustafson. "Survey of Consumer Finances, 1983," *Federal Reserve Bulletin* **70** (September 1984), pp. 679-692.

Avery, R. B., Elliehausen, G. E., Canner, G. B. and T. A. Gustafson. "Survey of Consumer Finances, 1983: A Second Report," *Federal Reserve Bulletin* **70** (December 1984), pp. 857-868.

Baltensperger, E. "Cost of Banking Activities: Interactions Between Risk and Operating Costs," *Journal of Money, Credit and Banking* **4** (August 1972), pp. 595-611.

Baltensperger, E. "Credit Rationing: Issues and Questions," *Journal of Money, Credit and Banking* **10** (May 1978), pp. 170-183.

Baltensperger, E. "Alternative Approaches to the Theory of the Banking Firm," *Journal of Monetary Economics* **6** (January 1980), pp. 1-37.

Barro, R. J. and A. M. Santomero. "Household Money Holdings and the Demand Deposit Rate," *Journal of Money, Credit and Banking* **4** (May 1972), pp. 397-413.

Bell, F. W. and N. B. Murphy. *Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation, Research Report No. 41.* (Boston: Federal Reserve Bank of Boston, 1968).

Benston, G. J. "Branch Banking and Economies of Scale," *Journal of Finance* **20** (May 1965a), pp. 312-331.

Benston, G. J. "Economies of Scale and Marginal Costs in Banking Operations," *National Banking Review* **2** (June 1965b), pp. 507-549.

Benston, G. J. "Economies of Scale in Financial Institutions," *Journal of Money, Credit and Banking* **4** (May 1972), pp. 312-341.

Benston, G. J. "The Optimal Banking Structure: Theory and Evidence," *Journal of Bank Research* **3** (Winter 1973), pp. 220-237.

Benston, G. J. and C. W. Smith. "A Transactions Cost Approach to the Theory of Financial Intermediation," *Journal of Finance* **31** (May 1976), pp. 215-231.

Benston, G. J., Hanweck, G. A. and D. B. Humphrey. "Scale Economies in Banking," *Journal of Money, Credit and Banking* **14** (November 1982), pp. 435-456.

Blackwell, N. R. and A. M. Santomero. "Bank Credit Rationing and the Customer Relation," *Journal of Monetary Economics* **9** (January 1982), pp. 121-129.

Board of Governors of the Federal Reserve System. *Annual Statistical Digest*. (Washington, DC: U.S. Government Printing Office, 1986a).

Board of Governors of the Federal Reserve System. Domestic Financial Statistics: Consumer Installment Credit, Table 1.55. *Federal Reserve Bulletin* (Washington, DC: U.S. Government Printing Office, January 1983 - November 1988).

Board of Governors of the Federal Board of Governors of the Federal Reserve System. *Functional Cost Analysis*. (Washington, DC: U.S. Government Printing Office, 1986b).

Board of Governors of the Federal Reserve System. *Historical Chart Book*. (Washington, DC: U.S. Government Printing Office, 1986c).

Board of Governors of the Federal Reserve System. *Flow of Funds Accounts*. (Washington, DC: U.S. Government Printing Office, March, 1987).

Boczar, G. E. "The Evidence on Competition Between Banks and Finance Companies," *Journal of Bank Research* **6** (Summer 1975), pp. 150-154.

Boczar, G. E. "Competition Between Banks and Finance Companies: A Cross Section Study of Personal Loan Debtors," *Journal of Finance* **33** (March 1978), pp. 245-258.

Brandt, W. K., Day, G. S., and T. Deutscher. "Information Disclosure and Consumer Credit Knowledge: A Longitudinal Analysis," *Journal of Consumer Affairs* **9** (Summer 1975), pp. 15-32.

Cacace, L. M. "Chrysler Passes Ford as No. 2 Finance Firm," *American Banker*, (10 June 1987), pp. 1, 13-14.

Campbell, T. S. and W. A. Kracaw. "Information Production, Market Signalling and the Theory of Financial Intermediation: A Reply" *Journal of Finance* **37** (September 1980), pp. 1097-1099.

Chapman, J. M. "Role of Consumer Finance Companies in a Credit Economy," in Chapman, J. M and R. P. Shay, Eds. *The Consumer Finance Industry: Its Costs and Regulation,* (New York: Columbia University Press, 1967), pp. 1-28.

Consumer Bankers Association. *1985-86 Automobile Financing and Leasing Survey* (Arlington, VA: Consumer Bankers Association, 1987), 47 pp.

Cooper, K. and D. R. Fraser. *Banking Deregulation and the New Competition in Financial Services.* (Cambridge, MA: Ballinger Publishing Company, 1986), 318 pp.

Day, G. S. and W. K. Brandt. "Consumer Research and the Evaluation of Information Disclosure Requirements: The Case of Truth In Lending," *Journal of Consumer Research* ***1*** (June 1974), pp. 21-32.

Demsetz, H. "Industry Structure, Market Rivalry, and Public Policy," *Journal of Law and Economics* ***16*** (April 1973), pp. 1-9.

Due, J. M. "Consumer Knowledge of Installment Credit Charges," *Journal of Marketing* ***30*** (October 1955), pp. 162-166.

Durkin, T. A. and G. E. Elliehausen.*1977 Consumer Credit Survey* (Washington, DC: Federal Reserve Board of Governors, 1978).

Durkin, T. A. "Consumer Awareness of Credit Terms: Review and New Evidence," *Journal of Business* ***48*** (April 1975), pp. 253-363.

Durkin, T.A. "Consumer Awareness of Installment Credit Terms: Evidence of the Impact of Truth in Lending After A Passage of Time," *Journal of Retail Banking* ***3*** (March 1981), pp. 21-32.

Edwards, F. R. "Managerial Objectives in Regulated Industries: Expense-Preference Behavior in Banking." *Journal of Political Economy* ***85*** (February 1977), pp. 147-161.

Fama, E. F. "Banking in a Theory of Finance." *Journal of Monetary Economics* ***6*** (January1980), pp. 39-57.

Federal Deposit Insurance Corporation. *Annual Report.* (Washington, DC: U.S. Government Printing Office).

Flannery, M. "Retail Bank Deposits as Quasi-Fixed Factors of Production," *American Economic Review* ***72*** (June 1982), pp. 527-536.

Fraser, D. R. and J. W. Kolari. *The Future of Small Banks in a Deregulated Environment*. (Cambridge, MA: Ballinger Publishing Company, 1985), 262 pp.

Freimer, M. and M. J. Gordon. "Why Bankers Ration Credit," *Quarterly Journal of Economics* **79** (August 1965), pp. 397-416.

Gilbert, R. A. "Bank Market Structure and Competition: A Survey," *Journal of Money, Credit and Banking* **16** (November 1984), pp. 617-644.

Goldberg, M. A. "The Sensitivity of the Prime Rate to Money Market Conditions," *Journal of Financial Research* **7** (Winter 1984), pp. 269-280.

Goldfeld, S. M. and D. M. Jaffee. "The Determinants of Deposit-Rate Setting by Savings and Loan Associations," *Journal of Finance* **25** (June 1970), pp. 615-632.

Goldsmith, R. W. *Financial Structure and Development*. (New Haven, CT: Yale University Press, 1969).

Goudzwaard, M. B. "Price Ceilings and Credit Rationing," *Journal of Finance* **23** (March 1968), pp. 177-185.

Greer, D. F. "Rate Ceilings, Market Structure, and the Supply of Finance Company Personal Loans," *Journal of Finance* **29** (December 1974), pp. 1363-1382.

Greer, D. F. "Rate Ceilings and Loan Turndowns," *Journal of Finance* **30** (December 1975), pp. 1376-1383.

Greer, D. F. and E. Nagata. "An Econometric Analysis of the New Auto Credit Market," *National Commission on Consumer Finance Technical Studies Volume IV* (Washington, DC: U.S. Government Printing Office, 1975), Chapter 4.

Greer, D. F. and R. P. Shay. "Preliminary Model Specifications for the Automobile Credit Market," *National Commission on Consumer Finance Technical Studies Volume IV* (Washington, DC: U.S. Government Printing Office, 1975), Chapter 3.

Gurley, J. G. and E. S. Shaw. *Money in a Theory of Finance*. (Washington, DC: The Brookings Institution, 1960).

Hancock, D. "Testing Price Taking in Loan and Deposit Markets by Financial Firms," *Financial Review* **21** (May 1986), pp. 239-237.

Hart, O. and D. Jaffee. "On the Application of Portfolio Theory to Depository Financial Intermediaries," *Review of Economic Studies* **41** (January 1974), pp. 129-147.

Havrilesky, T. M. "Theory-of-the-Firm Models of Bank Behavior," in *Dynamics of Banking*, T. M. Havrilesky, R. Schweitzer and J. T. Boorman, Eds. (Arlington Heights, IL: Harlan Davidson, Inc., 1985), pp. 5-26.

Heggestad, A. A. and J. J. Mingo. "Prices, Nonprices, and Concentration in Commercial Banking," *Journal of Money, Credit, and Banking* **8** (February 1976), pp. 107-117.

Hester, D. D. and J. L. Pierce. *Bank Management and Portfolio Behavior*. (New Haven, CT: Yale University Press, 1975).

Jaffee, D. *Credit Rationing and the Commercial Loan Market* (New York: John Wiley & Sons, 1971), 183 pp.

Jaffee, D. and F. Modigliani. "A Theory and Test of Credit Rationing." *American Economic Review* **59** (December 1969), pp. 850-872.

Johnson, R. W. and A. C. Sullivan. "Segmentation of the Consumer Loan Market," *Journal of Retail Banking* **3** (September 1981), pp. 1-7.

Juster, F. T. and R. P. Shay. "Consumer Sensitivity to Finance Rates: An Empirical and Analytical Investigation," *National Bureau of Economic Research Occasional Paper #88* (New York: Columbia University Press, 1964), 105 pp.

Kane, E. J. and B. G. Malkiel. "Bank Portfolio Allocation, Deposit Variability, and the Availability Doctrine." *Quarterly Journal of Economics* **79** (February 1965), pp. 113-134.

Kane, E. J. and S. A. Buser. "Portfolio Diversification at Commercial Banks." *Journal of Finance* **34** (March 1979), pp. 19-34.

Katona, G., Mandell, L. and J. Schmiedeskamp.*1970 Survey of Consumer Finances* (Ann Arbor, MI: Survey Research Center, University of Michigan, 1971), 295 pp.

Kaufman, H. *Interest Rates, the Markets, and the New Financial World* (New York: Times Books, 1986), 257 pp.

Kinsey, J. and R. McAlister. "Consumer Knowledge of the Costs of Open-End Credit," *Journal of Consumer Affairs* **15** (Winter 1981), pp. 249-270.

Klein, M. A. "A Theory of the Banking Firm," *Journal of Money, Credit, and Banking* **3** (May 1971), pp. 205-218.

Klein, M. A. "The Economics of Security Divisibility and Financial Intermediation," *Journal of Finance* **28** (September 1973), pp. 923-931.

Klein, M. A. and N. B. Murphy. "The Pricing of Bank Deposits: A Theoretical and Empirical Analysis," *Journal of Financial and Quantitative Analysis* **6** (March 1971), pp. 747-761.

Koch, G. *Bank Management*. (Chicago: Dryden Press, 1987), pp. 521-522.

Kotler, P. *Principles of Marketing, 3rd Ed.* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1986), pp. 365-387.

Laidler, D. E. *The Demand for Money: Theories and Evidence, 2nd Ed.* (New York: Dun/Donnelly Publishing Company, 1977).

Lee, B. E. "Determinants of the Commercial Loan Rate Revisited," *Quarterly Journal of Business and Economics* **24** (Autumn 1985), pp. 85-95.

Leland, H. E. and D. H. Pyle. "Informatin Asymmetries, Financial Structure and Financial Intermediation," *Journal of Finance* **32** (May 1977), pp. 371-387.

Luckett, C. A. "Recent Developments in Automobile Finance," *Federal Reserve Bulletin* **72** (June 1986), pp. 355-365.

Luckett, C. A. and J. D. August. "The Growth of Consumer Debt," *Federal Reserve Bulletin* **71** (June 1985), pp. 389-402.

Lukasiak, P. "Finance & Insurance: Cracks in the Golden Egg?" *Automotive Executive* **59** (November 1987), pp. 30-33.

Lupo, N. "Cheap Loans Are Cars' Hottest Options," *Detroit Free Press* (29 March 1987), Section D, p. 2, col. 1.

Malabre, A. L. *Beyond Our Means* (New York: Random House, 1987), 174 pp.

Mandell, L. "Consumer Perception of Incurred Interest Rates: An Empirical Test of the Efficacy of the Truth-In-Lending Law," *Journal of Finance* **26** (December 1971), pp. 1143-1153.

Mandell, L. "Consumer Knowledge and Understanding of Consumer Credit," *Journal of Consumer Affairs* **7** (Summer 1973), pp. 23-36.

Michelman, I. S. *Consumer Finance: A Case History in American Business* (New York: Augustus M. Kelly, 1970), 336 pp.

Mitchell, D. W. "Explicit and Implicit Demand Deposit Interest: Substitutes or Complements from the Bank's Point of View," *Journal of Money, Credit and Banking* **11** (May 1979), pp. 182-191.

Monroe, A. "Security Backed By Car Loans Is Part of Trend That May Lead to Lower Consumer Loan Rates," *The Wall Street Journal*, (11 February 1985).

Norton, R. E. "Citibank Wows the Consumer," *Fortune*, (8 June 1987), pp. 48-54.

O'Hara, M. "A Dynamic Theory of the Banking Firm," *Journal of Finance* **38** (March 1983), pp. 127-140.

Orr, D. and W. G. Mellon. "Stochastic Reserve Losses and Expansion of Bank Credit," *American Economic Review* **51** (September 1961), pp. 614-623.

Parker, G. G. and R. P. Shay. "Some Factors Affecting Awareness of Annual Percentage Rates in Consumer Installment Credit Transactions," *Journal of Finance* **29** (March 1974), pp. 217-225.

Parkin, M. J. "Discount House Portfolio and Debt Selection." *Review of Economic Studies* **37** (October 1970), pp. 469-497.

Pearce, D. K. "Rising Household Debt in Perspective," *Economic Review, Federal Reserve Bank of Kansas City* **70** (July/August 1985), pp. 3-17.

Pesek, B. P. "Banks' Supply Function and the Equilibrium Quantity of Money," *Canadian Journal of Economics* **3** (August 1970), pp. 357-385.

Peterson, C. M. and R. L. Peterson. "Downpayments, Borrower Characteristics, and Defaults," *Journal of Retail Banking* **3** (March 1981), pp. 1-6.

Peterson, R. L. and D. A. Black. "Consumer Credit Shopping," *Journal of Retail Banking* **4** (Fall 1982), pp. 50-61.

Peterson, R. L. and D. A. Black. "Consumer Credit Search: A Note," *Journal of Money, Credit, and Banking* **16** (1984), pp. 527-535.

Peterson, R. L. and M. D. Ginsberg. "Determinants of Commercial Bank Auto Loan Rates," *Journal of Bank Research* **12** (Spring 1981), pp. 46-55.

Phelps, C. W. "Monopolistic and Imperfect Competition in Consumer Loans," *Journal of Marketing* **4** (April 1944), pp. 382-393.

Phelps, C. W. *The Role of the Sales Finance Companies in the American Economy* (Baltimore, MD: Commercial Credit Company, 1952), 84 pp.

Plummer, W. C. and R. A. Young. "Sales Finance Companies and Their Credit Practices," *Studies in Consumer Installment Financing #2* (New York: National Bureau of Economic Research 1940), 298 pp.

Poole, W. "Commercial Bank Reserve Management in a Stochastic Model: Implications for Monetary Policy," *Journal of Finance* **23** (December 1968), pp. 769-791.

Pringle, J. J. "A Theory of the Banking Firm: A Comment," *Journal of Money, Credit, and Banking* **5** (November 1973), pp. 990-996.

Pringle, J. J. "The Imperfect Model of Commercial Bank Financial Management," *Journal of Financial and Quantitative Analysis* **9** (January 1974), pp. 69-87.

Prisman, E. Z., and Slovin, M. B., and M. E. Sushka. "A General Model of the Banking Firm Under Conditions of Monopoly, Uncertainty, and Recourse," *Journal of Monetary Economics* **17** (March 1986), pp. 293-304.

Pyle, D. H. "On The Theory of Financial Intermediation," *Journal of Finance* **26** (June 1971), pp. 737-747.

Rhoades, S. A. "Structure-Performance Studies in Banking: A Summary and Evaluation," *Staff Economic Studies No. 92* (Washington, DC: Federal Reserve Board of Governors, 1977).

Rhoades, S. A. "Structure-Performance Studies in Banking: An Updated Summary and Evaluation," *Staff Economic Studies No. 119* (Washington, DC: Federal Reserve Board of Governors, 1982).

Rose, J. T. *Money and Capital Markets, 2nd Ed.* (Plano, TX: Business Publications, Inc., 1986), pp. 477-483.

Rousseas, S. "A Markup Theory of Bank Loan Rates," *Journal of Post-Keynesian Economics* **8** (Fall 1985), pp. 135-144.

Santomero, A. M. "The Role of Transactions Costs and Rates of Return on the Demand Deposit Decision," *Journal of Monetary Economics* **5** (July 1979), pp. 343-364.

Santomero, A. M. "Modeling the Banking Firm," *Journal of Money, Credit and Banking* **16** (November 1984), pp. 576-616.

Sealey, C. "Deposit Rate-setting, Risk Aversion and the Theory of Depository Financial Intermediaries," *Journal of Finance* **35** (December 1980), pp. 1139-1154.

Sealey, C. and J. Lindley. "Inputs, Outputs, and a Theory of Production and Cost at Depository Financial Institutions," *Journal of Finance* **32** (September 1977), pp. 1251-1266.

Seligman, E. R. A. *The Economics of Installment Selling, Volume I* (New York: Harper and Brothers, 1927), 355 pp.

Shay, R. P. "New-Automobile Finance Rates, 1924-62," *Journal of Finance* **18** (September 1963), pp. 461-493.

Shay, R. P. "The Pricing Process in Consumer Credit," *Journal of Finance* **19** (May 1964), pp. 205-221.

Shay, R. P. "Factors Affecting Price, Volume and Credit Risk in the Consumer Finance Industry," *Journal of Finance* **25** (May 1970), pp. 503-515.

Shay, R. P. "The Impact of State Legal Rate Ceilings Upon the Availability and Price of Consumer Installment Credit," *National Commission on Consumer Finance Technical Studies Volume IV* (Washington, DC: U.S. Government Printing Office, 1975), Chapter 10.

Shay, R. P. and M. W. Schober. "Consumer Awareness of Annual Percentage Rates of Charge in Consumer Installment Credit: Before and After Truth-In-Lending Became Effective," *National Commission on Consumer Finance Technical Studies Volume I* (Washington, DC: U.S. Government Printing Office, 1975b), Chapter 1.

Shull, B. "Commercial Banks as Multiple-Product Price-Discriminating Firms," in *Banking and Monetary Studies*, edited by D. Carson. (Homewood, IL: Richard D. Irwin, Inc., 1963), pp. 351-368.

Silvia, J. "There Is No Consumer Debt Problem," *The Wall Street Journal* (1987).

Sinkey, J. F. *Commercial Bank Management*. (New York: MacMillan Publishing Co., 1983), pp. 464-479.

Slovin, M. B. and M. E. Sushka. "A Model of the Commercial Loan Rate," *Journal of Finance* **38** (1983), pp. 1583-1596.

Smirlock, M. "Evidence on the (Non) Relationship between Concentration and Profitability in Banking," *Journal of Money, Credit, and Banking* **17** (February 1985), pp. 69-83.

Smirlock, M. and D. Brown. "Collusion, Efficiency and Pricing Behavior: Evidence from the Banking Industry," *Economic Inquiry* ***24*** (January 1986), pp. 85-96.

Spong, K. *Banking Regulation, 2nd Ed.* (Kansas City, MO: Federal Reserve Bank of Kansas City, 1985), pp. 127-153.

Stafford, F. and W. Dunkelberg. "The Cost of Financing Automobile Purchases," *Review of Economics and Statistics* ***51*** (November 1969), pp. 459-464.

Stigum, M. L. "Some Further Implications of Profit Maximization by a Savings and Loan Association," *Journal of Finance* ***31*** (December 1976), pp. 1405-1426.

Sullivan, A. C. "Competition in the Market for Consumer Loans," *Journal of Economics and Business* ***36*** (February 1984), pp. 141-149.

Sullivan, A. C. "Consumers' Choice of Consumer Loan Contract Terms," Working Paper #51, Credit Research Center, Purdue University, (1985), 37 pp.

Sullivan, A. C. and J. R. Fain. "The Behavior of Consumer Loan Rates Charged By Commercial Banks," Working Paper #50, Credit Research Center, Purdue University, (1984), 41 pp.

Taeusch, C. F. "The Concept of 'Usury': The History of an Idea," *Journal of the History of Ideas* ***3*** (January 1942), pp. 291-318.

Tobin, J. "Liquidity Preference as Behavior Toward Risk," *Review of Economic Studies* ***25*** (February 1958), pp. 65-86.

Towey, R. E. "Money Creation and the Theory of the Banking Firm," *Journal of Finance* ***29*** (March 1974), pp. 57-72.

Vandenbrink, D. "The Effects of Usury Ceilings," *Economic Perspectives*, (Chicago: Federal Reserve Bank of Chicago, 1982), pp. 44-55.

Weber, G. I. "Interest Rates on Mortgages and Dividend Rates on Savings and Loan Shares," *Journal of Finance* ***21*** (September 1966), pp. 515-521.

Worden, D. D. and A. C. Sullivan. "Shopping For Consumer Credit: Implications For Market Efficiency," Working Paper #54, Credit Research Center, Purdue University, (1987), 36 pp.

Yntema, T. O. "The Market for Consumer Credit: A Case in 'Imperfect Competition'," *Annals of the American Academy of Political and Social Science* (March 1938), pp. 79-85.

MICHIGAN STATE UNIV. LIBRARIES
31293005612134