BANKS AND INFLATION

by

Nozar Hashemzadeh

Dissertation submitted to the Graduate Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Economics

APPROVED:

Vittorio Bonomo, Chairman

Wilson E. Schmidt

Gordon Tullock

Robert M. Spann

Robert J. Mackay

June, 1974

Blacksburg, Virginia

To Vic, who made it possible.

ACKNOWLEDGMENTS

I owe heartfelt gratitude to my dissertation director and friend, Vittorio Bonomo, who so kindly devoted his time and effort to my training in economics. My debt to this gentleman scholar is beyond what I am able to acknowledge. Never have I benefitted so much from the advice and continuous guidance of a single teacher.

I would also like to thank Gordon Tullock, Robert Spann, Robert Mackay and Wilson Schmidt, who kindly served on my Graduate Committee and who gave me all the help and assistance I could use in writing my dissertation. I am deeply indebted to all these gentlemen.

I would also like to thank the Public Choice Center and the Esacife Foundation for giving me a fellowship during my tenure as a graduate student at Virginia Polytechnic Institute and State University. My thanks should also go to the librarians of VPI & SU and of Clinch Valley College of the University of Virginia for their continuous assistance. I feel especially obliged to Miss Agnes Davis of the Carol M. Newman library for the many hours she so kindly spent on finding the materials that I needed to carry out my research.

Finally, I would like to thank my friends Lawrence Shepherd and Mrs. Jo Hill for reading and typing the manuscript.

TABLE OF CONTENTS

Page

LIST OF TABLES

List of Tables -- Continued

LIST OF FIGURES

List of Figures -- Continued

If successful prediction were the sole criterion of the merit of a science, economics should long since have ceased to exist as a serious intellectual pursuit. The real strength of the discipline lies in another direction -- namely, in its apparently limitless capacity to rationalize events after they happen. This helps explain the indifference of most economic theorists to "the lessons of history"; men to whom all things are possible have little to learn from experiments conducted in the laboratory of time. It also helps explain the indifference of most economic historians to abstract theory; what have they to learn from a subject that "yields no predictions, summarizes no empirical generalizations, provides no useful frameowrk of analysis?"

Robert Clower

Journal of Economic History

CHAPTER I

INTRODUCTION

The analysis of the effects of inflation on commercial banks has been the subject matter of two journal articles in recent years. The first of these, by Martin Bailey, analyzes the effects of inflation on banks along lines suggested by Quantity Theorists. In this approach, inflation is viewed as a tax imposed on holdings of real cash balances, with the tax rate being equal to the rate of increase of the nominal stock of money. This approach holds that commercial banks, as suppliers of a portion of the money stock, are able to share some of the revenues of the inflation tax with the governments.

The second study, by Armen Alchian and Reuben Kessel, investigates the impact of inflation on banks using the traditional debtor-creditor approach. The basic postulate of this approach is that inflation, because of lack of foresight and other market imperfections, redistributes income from lenders to borrowers. In the context of this approach, if banks are net monetary debtors, they will gain from inflation; if they are net monetary creditors, they will lose. Alchian and Kessel have argued that such gains and losses would be reflected in the stock prices of commercial banks.

Notwithstanding their importance, both of these studies are macro-oriented and attempt to make predictions about the behavior of individual banks from an analysis of the behavior of all banks taken in the aggregate. The role played by individual banks is only remotely considered and the structure of banking markets has not been adequately examined. In view of this, I felt justified in considering the subject matter at a micro-economic level to see whether predictions derived from a micro model differ significantly from those inferred from macro models. A discussion of the shortcomings of macro models of banking behavior is reserved for Chapters III and IV.

In this study I first trace the evolution of the credit theory of inflation. This theory, which was quite popular until the 1930s, holds that an excess issue of credit causes inflation. Credit inflation can occur either through modifications in the reserve requirements of commercial banks, through an expansion of the monetary base and/or an unwarranted expansion of credit by bankers themselves. The credit theory of inflation views commercial banks as actively contributing to the inflationary process.

In the third chapter, a micro-economic analysis of bank behavior in an inflationary environment is developed. The analysis is supplemented by an empirical study of the performance of Chilean commercial banks over the inflationary period 1936-1950.

The fourth chapter considers the portfolio responses of commercial banks to changes in prices and interest rates. In the final chapter, I present a summary of findings and examine some of the avenues for further research in the areas discussed earlier in the thesis.

CHAPTER II

AN OVERVIEW

The Credit Structure

Monetary economists have usefully distinguished four different, though closely related, types of credit that may exist in an economy. These include fiat money (or high-powered money), central bank credit, commercial bank credit and business credit outside banks. It is well known that monetary authorities are usually able to exercise effective control over the quantity of the first two types of credit, cash and central bank credit. With regard to the degree of control that can be exercised upon commercial bank credit there have been widespread differences of opinion among economists. To a great extent these differences lie in the way in which the money stock, inclusive of bank credit, is presumed to affect the rate of spending. If one believes that changes in the money supply directly influence the rate of spending and, by implication, the movement of prices and business cycles, then one has to agree that inflationary and deflationary processes are caused primarily by changes in the supply of money. However, if it is held that the money stock responds primarily to changes in the rate of spending and price level, then one has to concede that inflationary and deflationary developments are real phenomena rather than monetary phenomena. The general implications of these alternative views with regard to the involvement of commercial banks in the inflationary or deflationary process are clear. In the context of the former view, commercial banks function as vehicles for carrying the inflationary or deflationary forces set in motion primarily by the monetary authority. Banks feed these forces and, furthermore, generate secondary forces that lengthen the inflationary or deflationary periods. The latter view predicates no causal role for commercial banks in inflationary or deflationary processes. The spirit of over-trading and a bullish psychology give rise to inflationary expectations. Banks, like all the other economic agents, respond to these expectations by changing the quantity and composition of their earning assets.

The controversy between authors who place the responsibility of inflationary developments on the central and commercial banks and those who attribute rising prices to other circumstances has had a long and interesting history. Many of the theoretical issues which are the subject of the contemporary debate between the "Monetarists" and the adherents of the "New View" were argued for almost seventy years during the late eighteenth and first half of the nineteenth centuries. It is hardly an exaggeration to assert that the foundations of contemporary monetary theory were laid by the writers who discussed the issues of English monetary and banking policy from the Restriction Act of 1797 to the gold inflation of the 1850s.[1]

---

[1]See Joseph A. Schumpeter, History of Economic Analysis (New York: Oxford University Press, Inc., 1959), p. 688.

Monetary Theory of Credit

Modern textbooks in money and banking portray the credit structure of an economy as an inverted pyramid which has four components: fiat money, central bank credit, commercial bank credit and credit outside the banks. The cornerstone of this analysis of the money supply process is the belief that fiat money, the base of the pyramid, controls the whole credit structure. The student is repeatedly reminded that means of payment other than fiat money are "near moneys" or money "substitutes" and that the pyramid of credit is founded upon legal tender money. In other words, fiat money is conceived of as being the independent variable and near moneys as the dependent variable of the credit system. This theory of the money supply process will be referred to as the "monetary theory of credit."

The first systematic theory of the money supply process which fits the models presented in modern-day textbooks was synthesized by Henry Dunning Macleod (1821-1902).[1] Macleod, who had the reputation of being the least elegant of economists, was not able to convince the profession to accept his theory. What he managed to do instead was to discredit the monetary theory of credit for quite some time. Macleod's theory was later restated by a number of authors, most notably Wicksell, H. J. Davenport, W. G. L. Taylor and C. A. Phillips.[2] The

---

[1] Henry Dunning Macleod, Theory and Practice of Banking (1855-1856); The Theory of Credit (1889-1891).

[2] Knut Wicksell, Lectures on Political Economy (1901-1906); H. J. Davenport, Value and Distribution (1908); W. G. L. Taylor, The Credit System (1913); Chester Arthur Phillips, Bank Credit (1920).

various aspects of the theory were not, however, fully explored until 1924, when Albert Hahn published his book on money and banking.[1] Hahn's work was not an immediate success. According to Schumpeter, the main reason for the slow acceptance of Hahn's views was the fact that the theory of money and banking which he presented was "wedded to certain highly optimistic views about the possibility of achieving permanent prosperity, which prejudiced some economists against its essential achievement."[2]

Economic historians in general, and writers of money and banking textbooks in particular, have often alleged that the slow acceptance of the monetary theory of credit was due to the fact that most economists could not be convinced of the process of deposit creation by the banks. C. A. Phillips, who gives the reader the impression of being the founder of the new theory, criticized his precursors for failing to distinguish between the possibilities available to a single bank and those open to the banking system as a whole.[3] Although some confusion with regard to the process of deposit exapnsion by the banking system persisted as late as the 1930s, there is evidence testifying to the contrary. In his History of Economic Analysis Schumpeter points out that the process of deposit creation was recognized as early as 1855. He credits Simon Newcomb with being one of the first economists

---

[1] Schumpeter, op. cit., p. 1116.

[2] Ibid.

[3] C. A. Phillips, op. cit.

to explain the process by which deposits are created through lending.[1] Schumpeter is not, however, completely accurate.

Credit creation, whether in terms of deposits or banknotes by the banking system, was well known to a considerable number of monetary economists who wrote during the late eighteenth century and the early nineteenth century. These writers were not, however, concerned with the arithmetic of the process of deposit or banknote expansion. Their basic concern lay somewhere else -- in ascertaining the possible impact of credit in general and bank credit in particular upon prices and exchange rates. In so doing, they also provided the backbone of the modern theory of the money supply process.

The Pre-Smithians

Among the first writers who addressed themselves to the economics of money and banking were David Hume in England and Richard Cantillon in France. Both acknowledged the possibility of multiple expansion of bank notes, but they held diametrically opposing views with regard to the possible inflationary effects of this phenomenon. Writing around the 1750s, Hume warned that "paper credit multiplies money, and more than a certain quantity of money is unnecessary."[2] In his "Essay of the Balance of Trade," published in 1752, Hume praised the banks for facilitating trade and industry in Scotland, but

---

[1] Schumpeter, <u>op. cit</u>., p. 1115.

[2] David Hume, <u>Essay of the Balance of Trade</u>, World Library of Standard Books, p. 191. See also <u>Essays, Moral, Political and Literary</u>, Volume I (London: Longmans' Green, 1898), pp. 330-41, 343-5.

at the same time warned that Scotland was menaced by an over-extension of what he termed "counterfeit money" -- bank notes. Hume believed that an excess issue of bank notes would lead to rising prices and the impoverishment of the community through a drain of gold. He therefore recommended that banks issue notes to equal the amount of bullion they held in reserve. He thought that if banks violated the policy of 100 percent reserves the stock of money in circulation was indeterminate. Hume believed that convertibility by itself was not an adequate check upon the amount of notes that could be issued by banks. Hume's well-known sympathizer, Joseph Harris (1702-1764)[1] theorized in 1757 that issuing more banknotes than there was bullion to back them was likely to be inflationary.[2]

Although Richard Cantillon agreed in principle with Hume, that banks had the potential to extend their note-issues beyond the quantity of gold and other precious metals entrusted to them, he argued that such expansionary practices could not be continued for an extended period of time. Cantillon theorized that there existed an automatic mechanism which limited the maximum amount of bank notes that could be kept in circulation in any particular area: the total volume of bank money outstanding was determined and regulated by the habits and customs of the commercial population rather than by bank authorities. This point is best illustrated in Cantillon's "Essay on the Nature of Commerce," which he wrote sometime between 1720 and 1730. In his

---

[1]Joseph Harris, "Essay on Money and Coin," 1755.

[2]<u>Ibid</u>., p. 101.

discussion of the Bank of Venice he observes:

> It is found that the sellers and buyers of the bank money are regularly equal when the total of all the credits of inscriptions on the books of the Bank do not exceed the value of 8000,000 ounces of silver and thereabouts.[1]

Cantillon, a former banker, argued that if banks issue notes in excess of their reserves, bank money will fall in value and will be returned to banks to be exchanged for gold and silver. This process, he believed, will continue until the amount of notes outstanding and the amount of reserves is again equal. According to Cantillon, the basic function performed by banks is to increase the velocity of circulation of that part of the money supply held by "economical gentlemen who put by every year money from their savings," and who deposit these savings at the banks "to avoid the trouble of keeping this money in their houses and the thefts which might be made of it."[2]

Cantillon argued that inflationary spirals could be set in motion in two ways. The first is through changes in what we may call the monetary base, that is, gold. If the production of gold is increased, then mine owners and mine workers will increase their expenditures on food, clothing, and other goods. The added expenditures by these people, he argued, will give employment to artisans (tailors, manufacturers, etc.), who in turn will increase their expenditures. Thus,

---

[1] Richard Cantillon, Essai sur la Nature du Commerce, trans. by Henry Higgs (London: Macmillan, 1931), pp. 309-310.

[2] Ibid., p. 299.

Cantillon believed that increases in the monetary base set in motion multiple rounds of expenditure and employment increases. But he also observed that during this process prices begin to rise, thus inflicting hardship upon fixed-income recipients and those who did not participate in the initial round of income and employment increases.[1]

The second cause of inflation, Cantillon argued, is a continuous trade surplus. A trade surplus implies that, in net, the economy's money stock (gold and silver) will increase. The increased money income will result in an increased demand for domestically produced goods and, hence, domestic prices will rise. But this analysis is only partially correct. With domestic prices increasing relative to the prices of imported goods, there will be an increased demand for imports which would induce an outflow of gold and silver, thus reversing the process.

Cantillon's ideas were refined and restated by one of Hume's contemporaries. In his "Essay of Banks and Paper Credit," published in 1768, Reverend Robert Wallace argued that the credit worthiness of bank borrowers was the automatic mechanism which prevented the banks from overexpanding their credits. Credit, Wallace emphasized, "can never be given without end." He said that no one would give credit but to "men either of substance or integrity and activity ....

---

[1]Richard Cantillon, "On the Nature of Commerce in General," in Early Economic Thought, ed. by Arthur E. Monroe (Cambridge: Harvard University Press, 1924), p. 265.

Here there are natural checks and limits, beyond which credit will not be expanded."[1]

A few years later, Sir James Steuart, in an apparent defense of Cantillon and his British followers, most notably William Petty, challenged Hume's analysis of monetary matters and argued that he did not envision any danger in expansion of credit as long as "loans were issued for suitable purposes and proper security." "For loans to be secured," he noted, "they must be based upon land or securities rather than upon public and mercantile credit."[2] Steuart maintained that the stock of money was positively related to the volume of trade. If trade is increased, advances on securities are enlarged and so there is an increase in the quantity of money.[3] Steuart agreed with Hume that an excess issue of paper money may lead to an adverse balance of trade and result in an outflow of gold from the economy. However, Steuart's policy recommendations were just the opposite of Hume's. Banks should increase the volume of their credit knowing that "the extra paper money is necessary for purposes of maintaining an unchanged volume of trade, and would therefore, not be cashed in." He believed that if bankers confined their advances to the "needs of trade," the quantity of

---

[1]Robert Wallace, "Essays on Banks and Paper Credit," 1768, as quoted in Papers in English Monetary History, ed. by T. S. Ashton and R. S. Sayers (London: Oxford University Press, 1964), p. 4.

[2]Sir James Steuart, "An Inquiry into the Principles of Political Economy," p. 171.

[3]*Ibid.*, p. 231.

money circulating would automatically adjust itself to the optimum amount.[1]

The idea of an "elastic money supply" as set forth by Wallace and Steuart gained substantial prominence in the nineteenth and the early twentieth centuries. Although later writers such as David Ricardo, Henry Thornton and Thomas Tooke made serious efforts to show the fallacies inherent in the theory espoused by Hume and Steuart, the commercial loan theory (more commonly known as the "real bills doctrine") was an immediate success. By 1900 the theory was so popular that it was accepted, without much reservation, by the writers of the Federal Reserve Act of 1913. This issue will be taken up below.

Adam Smith's Monetary Theory

The pre-Smithians made some headway towards building a theory of money. They realized the possibility of multiple expansion of credit by the banking system, recognized the positive relationship between the quantity of nominal income and prices, and made some genuine efforts to construct a credit theory of money. But their ideas, influential and widespread as they were, were doomed to be completely overshadowed by Adam Smith's doctrines for at least two decades. This is hardly surprising when we recall that between 1770 and 1797, the years in which the Bank of England was ordered to suspend cash payments, England did not experience any major monetary crisis

---

[1] Steuart, op. cit., p. 176.

necessitating an all-out inquiry. The Wealth of Nations was written in an atmosphere of stability and England was not "...confronted with the inconvenience of monetary redundancy on the one hand, nor exposed to the evils of monetary scarcity [on the other].[1]

Besides synthesizing the thought processes of his predecessors, Adam Smith contributed very little to monetary theory. He acknowledged the contributions made by Hume, Cantillon and Steuart but he was neither convinced by Hume nor converted by Steuart. He confirmed most of the principles set forth by Cantillon and believed, as Cantillon had, that banks could not grant credit in excess of the sum deposited by the public.

Adam Smith had a thorough understanding of the monetary arrangements of his time. He distinguished clearly the difference between the effects of non-convertible paper money and convertible paper money. Smith supported substitution of a less expensive resource -- paper -- for comparatively much more expensive resources -- silver and gold.[2] But he emphasized that essential safeguards should be adopted to limit the circulation of paper money within some boundaries.[3] According to Smith, sound banking policy required that note issues of any particular bank should not exceed that parts of its customers' capital "which they would otherwise be obliged to keep ... unemployed, and in ready money

---

[1]Jacob Hollander, "The Development of the Theory of Money from Adam Smith to David Ricardo," Quarterly Journal of Economics, XXV (May, 1911), 439-40.

[2]Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, ed. by Edwin Cannan, p. 275.

[3]Ibid., p. 276.

for answering occasional demands."[1] Citing examples from Spain and Portugal, Smith advanced the view that the failures of the Bank of England and the banks of Scotland and Portugal were mainly due to chronic loss of bullion.[2] On the basis of these observations he placed great emphasis on the significance of instant convertibility and maintained that so long as the banks honored the instant repurchase clause, their paper issues would not depreciate in value.

> A paper money consisting of bank notes, issued by people of undoubted credit, payable upon demand without any condition, and in fact readily paid as soon as presented, is in every respect, equal in value to gold and silver money.[3]

In the concluding paragraph of the chapter on money in The Wealth of Nations, Smith recommended that the state should not interfere with banks beyond requiring them to honor the instant repurchase clause. He advocated a competitive banking system and asserted that competition among banks prevented them from overexpanding their issues of notes. He seems to have been the first economist to explicitly take this position.

> ... the late multiplication of banking companies in both parts of the united kingdom, an event by which many people have been much alarmed, instead of diminishing, increases the security of the public. It obliges all of them to be more circumspect in their conduct, and, by not extending their currency beyond its due proportion to their cash, to guard themselves against those malicious runs, which the rivalship of so many competitors is always ready to bring

---

[1] Smith, op. cit., p. 288.

[2] Ibid., pp. 280-90.

[3] Ibid., p. 307.

> upon them. It restrains the circulation of each particular company within a narrower circle, and reduces their circulating notes to a smaller number. By dividing the whole circulation into a greater number of parts, the failure of any one company, an accident which, in the course of things, must sometimes happen, becomes of less consequence to the public. This free competition too obliges all bankers to be more liberal in their dealings with their customers, lest their rivals should carry them away. In general, if any branch of trade, or any division of labor, be advantageous to the public, the freer and more general the competition, it will always be more so.[1]

On the surface, Smith's reasoning of the curtailing power of competition seems convincing. There is, however, a major flaw in his argument. Although it is true that an excess issue of notes by one single bank will be detected by rival banks and the offending bank will be required to redeem its excess issues in correncY (gold, silver, etc.), this analysis does not hold if all banks increase their note issues in proportion. The clearing process will check an over-issue of notes by one bank, but not by all banks.

Constant Velocity

Unlike Cantillon, Smith did not perceive that bank credit could make the existing stock of currency circulate more rapidly. His conviction that the bank note was merely a cheap substitute for metallic currency led him to assert that the "... whole paper money of every kind, which can easily circulate in any country, never can exceed the value of the gold and silver of which it supplies the place, or which (the commerce being the same) would circulate there, if there was no

---

[1]Smith, op. cit., p. 313.

paper money."[1] This passage implies that Smith believed that paper money could neither increase nor decrease the velocity of circulation of currency. This idea was later challenged by Henry Thornton, who convincingly argued that different means of payments usually have different velocities of circulation. Nowhere in his book did Smith bring out the question of velocity and its effect upon the formation of the price level. To him the quantity of money, rather than its speed of circulation, was the most important factor in the formation of prices of labor, land and commodities.

The Restriction Act

Between the publication of The Wealth of Nations and the close of the eighteenth century, the British monetary system underwent some important changes. Among these changes were the establishment of a "clearing house" in London, a sharp increase in the number of country banks and the substitution of checks for banknotes. During this period the Bank of England officially became the bankers' bank or the "dernier resort," as Sir Francis Baring has called it, where "... in emergency everybody expected to obtain ready money [from it]."[2] The ramifications of these developments were not apprehended by the British economists of the time. For at least two decades they failed to make any major contribution to money and banking theory. This situation did not last long, however. The suspension of specie payment by the Bank of

---

[1] Smith, op. cit., p. 283.

[2] Sir Francis Baring, "Observations on the Establishment of the Bank of England," (1797).

England in February, 1779, triggered by the Napoleonic Wars, came as a great surprise to both the economists and the public alike. Jacob Hollander has vividly portrayed the aftermath of that momentous event:

> The ink had barely dried upon the Order in Council suspending the further issue of bullion, before the issues involved had become matters of active discussion in Parliament, and within two decades a controversial literature of extraordinary extent and intensity had developed.[1]

Although the Order in Council applied only to the Bank of England, British country banks also refused to redeem their own notes in gold and silver. Following the suspension, these banks redeemed their notes only in Bank of England notes. At first the notes issued by these country banks were not considered legal tender, but in 1811 the British Parliament issued a proclamation making paper money issued by all banks legal tender. This was a great victory for the British banks and the beginning of the era of a forced paper currency in England. Bank notes ceased to be a substitute for metallic money but were purchasing power created directly by the banks and no longer closely linked to the existing quantity of metallic money. These developments gave rise to a whole set of new issues which could not have been anticipated by economists writing prior to 1779.

The Restriction Act automatically divided the monetary economists of the time into two opposing camps: the "bullionists," who criticized the government for suspending cash payments; and the "anti-bullionists," who supported the government and the Bank of England.[2]

---

[1]Hollander, op. cit., p. 441.

[2]For an excellent discussion of the bullionist controversy, see Jacob Viner, Studies in the Theory of International Trade (New York: Harper & Brothers, 1937), pp. 119-217.

The bullionists believed that the suspension of cash payments by the Bank of England and the refusal of country banks to redeem their notes in specie was responsible for the depreciation of the value of paper money and the fall in foreign exchanges.

The bullionists were divided among themselves as to the proper criterion for measuring the value of paper money. Some bullionists like Walter Boyd maintained that the "... premium on bullion, the low rate of exchange, and the high prices of commodities in general" were symptoms and effects of superabundance of paper.[1] Other bullionists, most motably Ricardo, argued that the existence of a premium on bullion was not merely evidence, but prima facie proof of the existence of depreciation and excess issue.[2] Jacob Viner has pointed out that measurement of the extent of depreciation was not, however, the major concern of the bullionists. Most bullionists were satisfied when they had demonstrated its existence.[3]

The anti-bullionists rejected the idea that the rise in bullion prices and the fall in foreign exchanges was a monetary phenomenon caused by the expansionary policies of the Bank of England and the country banks. They claimed that bank credits were given on sound security and were not inflationary. According to John Pearse, the deputy governor of the Bank of England, discounts based on "... bills

---

[1] Walter Boyd, A Letter to the Right Honorable William Pitt on the Influence of the Stoppage of Issues in Specie at the Bank of England (London: Wright, 1801).

[2] David Ricardo, "The High Price of Bullion, a Proof of the Depreciation of Bank Notes," in Viner, op. cit., p. 125.

[3] Viner, op. cit., p. 125.

of real value, representing real transactions" cannot have any influence upon the price of bullion and the state of exchanges.[1] The anti-bullionists attributed the rise in bullion prices and the fall in foreign exchanges to the wartime disruption of trade and to foreign war expenditures by the British government.[2]

The Real Rate Versus the Bank Rate

The anti-bullionists were dogmatic in their opinion that banks could not issue notes in excess of the "needs of trade," because no one would pay interest on funds which he did not need. They argued that if banks issued an excess quantity of notes, these notes would rapidly return to the banks either in liquidation of bank loans or, under convertibility, for redemption in specie.[3] The bullionists tried to show the fallacies of this doctrine. Henry Thornton, author of the famous Bullion Report, played a central role in demonstrating the shortcomings of the "real bill" as a foundation for sound banking.

---

[1] Report of the Irish Currency Committee, 1804, p. 21.

[2] See Frank W. Fetter, Development of British Monetary Orthodoxy: 1797-1875 (Cambridge: Harvard University Press, 1956), p. 28.

N.B. Jacob Viner has classified Walter Boyd, Lord King, Thornton, John Wheatley and Francis Horner as bullionists. The most noted anti-bullionists were John Leslie Foster, Henry Parnell, Lord Lauderdale and the directors of the Bank of England and the Bank of Ireland. See Viner, op. cit., pp. 120-21.

[3] See Charles Bosanquet, Practical Observation on the Report of the Bullion Committee (second ed., 1810), pp. 49-64, and John Hill, "An Enquiry Into the Causes of the Present High Price of Gold Bullion" (1810), p. 36.

Thornton, a former banker, developed the thesis that there were no natural checks on the amount of notes that could be put into circulation by banks. He rightly argued that to the extent that the banks kept their discount rate below what he called the "current rate of mercantile profit," there would be no upper bound as to the amount in loans demanded by the public. In one of the most elaborate statements of the bullionists' position, Thornton pointed out before a House of Commons Committee on the Bank Restriction that not only the volume of bank credit depended upon the rates of interest charged by the banks, but that quantity also was determined by these rates. He convincingly argued that banks had no way of distinguishing the real bills from the speculative bills.[1] In his book, An Enquiry Into the Nature of the Paper Credit of Great Britain, published in 1802, Thornton made the following observation:

> The borrowers, in consequence of that artificial state of things which is provided by the law against usury, obtain their loans too cheap they demand in too great quantity. To trust to their moderation and forbearance under such circumstances, is to commit the safety of the bank to the discretion of those who, though both as merchants and as British subjects they may approve in the general of the proper limitation of bank paper, have, nevertheless, in this respect, an individual interest, which is at variance with that of the Bank of England.[2]

Thornton argued that the 5-percent rate of interest charged by the Bank of England throughout the Restriction Period was below the market

---

[1]Speech before the British Parliament on the Bullion Report, 1811.

[2]Henry Thornton, An Enquiry Into the Nature and Effects of the Paper Credit of Great Britain (London: Hatchard, 1802), p. 254.

rate, and was not, therefore, high enough to discourage speculative borrowing. Accordingly, he rejected adoption of policies which would allow the bank directors to use their own discretion in setting loan rates. At the same time, he opposed the idea that the public at large should impose their own prices upon the banks through political processes. He maintained that the best course of action to control the volume of credit was one which accounted for the spread between the cost of borrowing capital (interest rate charged by banks) and the rate of return which could be obtained from the employment of the borrowed capital.[1] One would expect that with the expansion of bank credit the spread between the bank rate and the "current rate of mercantile profit" would narrow, and the two rates would converge as investment opportunities were exhausted. But Thornton ruled out this possibility, and on the basis of such relevant considerations that they deserve full attention:

> The reader possibly, may think that an extension of banks' loans by furnishing additional capital, may reduce the profit on the use of it, and may thus lessen the temptation to borrow at five percent ... *but* capital by which term bona fide property was intended, cannot be suddenly and materially increased by any emission of paper. That the rate of mercantile profit depends on the quantity of this bona fide capital and not on the amount of the nominal value which an increased emission of paper may give to it.... There can be no reason to believe that even the most liberal extension of bank loans will have the smallest tendency to produce a permanent diminution of the applications to the bank for discount.[2] (Italics mine.)

---

[1] Thornton, op. cit., p. 255.

[2] Ibid., pp. 255-56.

In his Principles, David Ricardo also made the point that the applications to the Bank of England for money depended upon the expected rate of return on real capital and the rate charged by the Bank. "If they charge less than the market rate of interest," Ricardo wrote, "there is no amount of money which they might not lend, -- if they charge more than that rate, none but spendthrifts and prodigals would be found to borrow of them ..."[1]

The idea of making the bank rate effective, as recommended by Thornton and Ricardo, did not, however, receive attention. Popular adherence to the commercial loan theory of banking caused economists to ignore Thornton's principle that the bank rate could be used as an effective device to regulate the volume of note issue. The main reason for the slow acceptance of regulatory use of the bank rate was Smith's influence on economic thought. Throughout the nineteenth century, monetary economists, under the influence of Adam Smith's doctrines, believed that the "loan rate of the money market was simply the shadow of the rate of profit on real capital -- the latter being lent in the form of money -- and that quantity of money, however defined, had nothing at all to do with it."[2] To Smith and most of the economic theoreticians of the period, the money rate and the real rate were one

---

[1]David Ricardo, Principles of Political Economy and Taxation, in Jacob Viner, op. cit., p. 151.

[2]See Schumpeter, op. cit., p. 720, and Smith, op. cit., pp. 333-40.

and the same thing. They were not convinced, at least until the appearance of Knut Wicksell's contributions, that the money rate and the real rate were equal only in equilibrium. Nor were they convinced that the banking system, by persistently keeping its loan rate below the real rate, could ignite and feed an inflationary process.

Banks as the Cause of Inflation

In his book, The Paper Credit, Thornton laid the foundation of a complete analysis of the market for loanable funds theory by clearly distinguishing between the real rate of interest and the money rate. His analysis also provided a foundation for the famous Wicksellian monetary theory of cyclical fluctuations. Thornton's ideas as to the involvement of banks in inflationary processes may be best stated in terms of a theorem: Banks deliberately or without deliberation can cause inflation by charging an interest rate which is below the marginal efficiency of capital.[1] Thornton's reasoning is that an uncompensated expansion[2] of lending will increase money incomes and consequently raise demand schedules for goods and services. With an increase in demand for goods and services, there will be corresponding

---

[1] The argument presented above is essentially the dominant theme in The Paper Credit. Specific references to the relationship between the real rate and the money rate may be found on pp. 253-54 of The Paper Credit.

[2] Thornton does not specifically state whether expansion of loans is compensated by an increase in savings. His conclusions would be valid only if it is assumed that such expansions are uncompensated. Schumpeter believes that this assumption is, however, implicit in Thornton's analysis. See Schumpeter, op. cit., pp. 722-23.

increases in demands for loans. If banks fail to raise their loan rates to discourage this new wave of borrowing, then the process will continue indefinitely. Thus, the process will lead to increases in prices and a fall in exchanges. Thornton argued that if banks charged lower rates for bank loans than the current rate on mercantile profit, they set in motion inflationary forces that could be curtailed only by sufficient increases in the bank loan rate. Most of Thornton's conclusions were accepted by his contemporaries, most notably Lord King and David Ricardo. Nonetheless, Thornton's analysis of money, prices and the real rate of interest was largely ignored until 1823, when it was restated by Thomas Joplin.[1]

Joplin, in his search for a principle that would make it impossible for the banks to lend a sum in excess of what the public deposited with them, proposed that banks be required to hold 100-percent reserves. He believed that such a policy would make the money interest rate behave as it would with a purely metallic currency.[2] Although Joplin's scheme would eliminate the power of banks to create near money, it would not prevent the trade from doing so. Thornton realized this difficulty and demonstrated by means of an elaborate

---

[1]Thomas Joplin, The Cause and Cure of Our Commercial Embarrassment (London, 1844).

[2]Thomas Joplin, An Analysis and History of the Currency Question Together with an Account of the Origin and Growth of Joint-Stock Banking in England (London: Rodgway, 1823).

example in The Paper Credit that the non-bank public had as much power to create near money as did the banking system.

> Suppose that A sells one hundred pounds worth of goods to B at six months credit and takes a bill at six months for it; and that B, within a month after, sells the same goods at a like credit to C, taking a like bill; and again, that C, after another month, sells them to D, taking a like bill, and so on. There may then, at the end of six months, be six bills of hundred pounds each existing at the same time; and every one of these may possibly have been discounted.[1]

Joplin, a bullionist, dismissed the commercial loan theory of banking as fallacious and gave an articulate explanation of the process of credit creation by the banking system. Joplin's exposition of the process of credit expansion was the best to appear in the English language before the publication of H. J. Davenport's Economics of Enterprise in 1913. Therefore, Joplin, contrary to what Schumpeter has said, anticipated Simon Newcomb, Henry Dunning Macleod and C. A. Phillips.[2] The following passages from Joplin's Views on the Subject of Corn and Currency and The Cause and Cure of Our Commercial Embarrassments are illuminating. The first passage points out that bankers are not ordinarily aware that they are able to create conditions which would make an expansion of credit possible and which would make such an expansion necessary to the needs of trade.

> Bankers, indeed, have the idea that their issues are always called forth by the natural wants of the country, and that it is high prices that cause a demand for their notes, and

---

[1]Thornton, op. cit., p. 46.

[2]Schumpeter, op. cit., p. 1116.

> not their issues which create high prices and vice versa. The principle is absurd, but it is the natural inference to be deduced from their local experience. They find themselves contracted in their issues, by laws which they do not understand, and are consequently led to attribute the artificial movements of the currency to the hidden operations of nature, which they term the wants of the country.[1]

In the following two passages Joplin argues that individual banks do not realize that the banking system as a whole is subject to different limitations than an individual bank taken in isolation. Joplin contends that individual banks do not understand that their limitations on the power of issue do not apply to the banking system as a whole. Thus, bankers argue that they are unable to create deposits in excess of their holdings of currency.

> Every banker in London has therefore the power of creating bank money, and as money can always be lent at one rate of interest or another, there is no other limit to the exercise of this power than his own prudence. Whatever bank money he creates he must undertake to pay cash on demand, and I apprehend that bank money is always created by the bankers to the full extent that prudence will permit. If one-fifth of their deposits in cash be sufficient to meet any demand for payment by their depositors, for every thousand pounds of cash deposited with them, they discount to the extent of 5,000 pounds, and create 5,000 pounds of bank money.
>
> The process by which this is done, is not observable by the bankers themselves, but may be easily traced. 1,000 cash, for instance, is deposited with a banker beyond the amount of cash, say 20 per cent., which his previous deposits required him to keep. His deposits are consequently increased one thousand. But as it is necessary for him to keep only two hundred pounds in cash, to meet the additional 1,000 [pounds] of deposits, he has 800 [pounds] to spare, to be lent on securities. This sum he lends accordingly to parties who pay the amount, we shall assume, to the credit of their account

---

[1] Thomas Joplin, Views on the Subject of Corn and Currency (London, 1826), pp. 45-6.

> with some other banker, who being, as we shall suppose, in the same situation, finds his cash increased 800 [pounds], and his deposits 800 [pounds], and he has in consequence 800 [pounds] to spare, which he lends accordingly. This again being paid into another bank, the same operation again occurs, and so it goes on from bank to bank until the thousand pounds has created for itself deposits to the extent of 5,000 [pounds]. The reverse of this takes place when 1,000 [pounds] is withdrawn from the banks: the deposits or bank money is contracted to the extent of 5,000 [pounds].[1]

Joplin's analysis of the process of credit expansion is complete in the modern-day sense, except for one oversight. He does not mention that there will be a drain of cash into hand-to-hand currency as the banking system expands loans in response to the initial injection of cash into the system. This does not, however, invalidate his conclusions.

Joplin's exposition was later restated more elegantly by James Pennington. In a paper printed as an appendix to Thomas Tooke's Letter to Lord Grenville, Pennington asserted that bank deposits served the same purposes as other means of payment and they should be treated as money.[2] Pennington elucidated Joplin's analysis and completed Joplin's exposition of the process of credit expansion by taking account of the currency deposit ratio desired by the non-bank public. Pennington demonstrated that the currency deposit ratio imposed a check upon the maximum amount of credit that could be created by the banks taken in the aggregate. In addition, he observed that

---

[1]Thomas Joplin, The Cause and Cure of Our Commercial Embarrassments, pp. 33-4.

[2]Thomas Tooke and William Newmarch, A History of Prices and of the State of the Circulation from 1792 to 1856 (London: King, 1928), p. 36.

this ratio was not constant but susceptible to change. Further, Pennington charged that during periods of extraordinary speculation bankers induced the public to borrow more by charging interest rates below the real rate. Pennington denied that competition among banks could prevent overexapnsion of notes during periods of speculation. He believed that during such periods each banker expanded his credit "... being persuaded that his competitors would pursue the same course, and by so doing, prevent the inconvenient payment to each other of large balances, at the period of mutual liquidation."[1] In other words, he rejected Smith's conclusions that problems arising from the clearance process would tend to limit the credit expansion possibilities open to all banks.[2]

Wicksell Cumulative Process and its Restatement by Keynes

During the half century after the publication of Pennington's views, British economists were dismally unproductive in either developing or synthesizing the thought processes of their predecessors. Throughout this period, as Schumpeter has noted, the rate of interest "... remained, for practically all economists, a rate of return -- however explained -- to physical capital and the money rate a mere derivative of the real rate.[3] Economists of this period, with few exceptions, took it for granted that the real rate and the money rate of interest were one and the same thing, and governed by the same set

---

[1] Ibid., pp. 369-70.

[2] Smith, op. cit., p. 313.

[3] Schumpeter, op. cit., p. 1118.

of conditions. This attitude continued until the late nineteenth century when Knut Wicksell, a Swedish economist, entered the bullionist-antibullionist controversy. Like Thornton, Wicksell centered his theory of price fluctuations on the relationship and behavior of the real rate of interest and the money rate of interest. Wicksell theorized that price fluctuations occur due to divergences between the two rates.[1] In the Wicksellian theory of price fluctuations the real rate of interest is defined as the rate which would equalize the demand for and supply of real savings and is analogous to Keynes' marginal efficiency of capital. The money rate is defined as the rate prevailing in the loanable funds market, which is dominated by banks. In a money economy, Wicksell argues, the demand for and supply of real capital do not meet in their natural form, but in the form of money. In other words, it is held that in a money economy, the demand for and the supply of real capital are expressed not in real terms, but in money terms, the quantity of which money may be arbitrarily changed by banks. So long as the money rate of interest charged by banks is in line with the real rate, the rate of interest remains "neutral in its effects on the prices of goods, tending neither to raise nor to lower them."[2] However, when banks keep the money rate below the real rate, they induce entrepreneurs to borrow a greater quantity of capital from

---

[1] Carl G. Uhr, Economic Doctrines of Knut Wicksell (Berkeley: University of California Press, 1962), pp. 77, 120, 255-328.

[2] For an elaboration of the Wicksellian theory see Friderich A. Hayek, Prices and Production (London: George Routledge & Sons, Ltd., 1935), 2nd ed.: pp. 23-31.

banks in order to expand their activities. Under conditions of full employment, a fundamental assumption in Wicksell's system, these entrepreneurs are not able to obtain the extra resources needed for expansion at the existing price levels. Thus, they bid up wages and rents on the one hand, and increase the nominal incomes of workers and rentiers and, hence, aggregate demand on the other. Since full employment prevails, the increase in aggregate demand is translated into an increase in the general price level. The process of continued increases in wages, rents and the general price level goes on until banks increase their loan rate to a level which would discourage borrowing.[1] Wicksell is, however, ambivalent in his explanation of the circumstances which induce the banks to increase their lending rate. He is content to show how it starts (by a divergence between the real rate and the money rate) and how it ends (by appropriate adjustments of the loan rate to the real rate) without giving any consideration to what happens in between. Consequently without introducing some modifications in the model, one is unable to deduce the length of the duration of the cumulative process from it. Nor is it possible to decide whether the process ends in a crisis of hyperinflation. If it is assumed that the nominal interest rate always lags behind the real rate of interest, the cumulative process could continue indefinitely. In this case, the Wicksellian process is no more than a restatement of Thornton's theorem. If, on the other hand, it is assumed that in

[1]For a comprehensive statement of the Wicksell Cumulative Process, see Uhr, op. cit., pp. 233-45.

the Wicksell model savers have access to other forms of income-earning assets issued by non-bank institutions, then the cumulative process cannot continue forever. Competition between banks and non-bank institutions for funds would force the banks to increase their deposit rate and hence the loan rate. In these circumstances the duration of the process would be determined by the amount of time necessary for the nominal rate to catch up with the real rate. This is governed by a number of factors, including the rate of inflation, the degree of competition in the capital market, and the availability of other income earning assets. But preoccupied as Wicksell was with the working of his model, he did not explore the set of conditions which would govern the duration of his cumulative process.[1] Furthermore, Wicksell failed

[1] Although in principle agreeing with Wicksell that a divergence between the real rate and the money rate could initiate an inflationary process, Ludwig von Mises, one of Wicksell's contemporaries, held that the length of the cumulative process might be much shorter than implied by the Wicksell model. Mises held that the banks cannot indefinitely maintain a loan rate lower than the rate of interest for two reasons: (1) a real rate above the money rate leads to capital formation which in turn would reduce the productivity of capital, and (2) as the price level rises, non-bank creditors press for higher rates and if the banks persist in maintaining the low rate against their wishes, the system spirals toward a crisis. See Ludwig von Mises, _The Theory of Money and Credit_ (New Haven: Yale University Press, 1953), pp. 355-65. In his interpretation of the Wicksellian cumulative process, Gunar Myrdal argued that the sufficient condition for the cumulative process is that the real rate viewed _ex ante_ should be capable of varying independently of the loan rate. The necessary condition was, of course, that there be some lag in the adjustment of the two rates to each other. See Gunar Myrdal, _Monetary Equilibrium_ (London, 1939), pp. 54 ff. Erik Lindhal introduced the role of expectations in the Wicksell model and pointed out that if entrepreneurs are guided by anticipations of future price increases, the cumulative process may continue indefinitely until it is brought to an end by a crisis, in the course of which the loan rate is adjusted to the level of the real rate. See Erik Lindahl, _Studies in the Theory of Money and Capital_ (New York, 1939), pp. 180-82. Lindhal's conclusions would be correct if it is assumed that

to infer a correct conclusion from his model. He maintained that if banks adjusted their loan rate to the real rate, the price level would remain stable -- a conclusion which is not consistent with his model. To illustrate this point, let us assume that the real rate of interest increases due to an increase in productivity. If banks behave according to Wicksell's policy recommendation, then they should increase the loan rate to discourage borrowing. Under these circumstances, if the money stock does not increase (which it would not if banks raise their loan rate by as much as the increase in the real rate) and the velocity of circulation stays constant, then the economy would experience a price deflation. Of course, the reverse would be true in the case of a fall in the real rate of interest. The policy of a stable price level, the reader should note, is not compatible with the policy of maintaining a money rate equal to the real rate.

To some extent, John M. Keynes managed to fill some of the *lacunae* in Wicksell's model in his *Treatise on Money*.[1] Keynes credited Wicksell with having been the first writer to demonstrate clearly how the rate of interest affects the price level through its influence on the rate of investment.[2] Banks, Keynes argued, were able to exert direct influence over the short-term rate of interest and indirect influence over the long-term rate of interest -- the rate relevant for

---

borrowers hold higher price expectations than lenders.

[1]John M. Keynes, *A Treatise on Money* (London: The Macmillan Press, Ltd., 1971) Vols. V and VI.

[2]*Ibid.*, Vol. V, p. 177.

investment decisions involving fixed capital. Presenting statistics on the movement of short-term and long-term rates for both the United States and England, Keynes tried to demonstrate that upward movements in the short-term rates were accompanied by similar movements in the long-term rate. He reasoned that banks, as well as other financial institutions, were instrumental in narrowing the spread between the short-term and the long-term rates of interest:

> There are a number of financial institutions -- amongst which the banks themselves are the most important, but also including insurance offices, investment trusts, finance houses, etc. -- which vary from time to time the proportionate division of their assets between long-term and short-term securities respectively. Where short-term yields are high, the safety and liquidity of short-term securities appear extremely attractive. But when short-term yields are low, not only does this attraction disappear, but another motive enters in, namely, a fear lest the institution may be unable to maintain its established level of income, any serious falling off in which would be injurious to its reputation. A point comes, therefore, when they hasten to move into long-dated securities; the movement itself sends up the price of the latter; ... Thus, unless there is a serious reason in the minds of the majority of those controlling funds for positively fearing long-term securities at their existing price level, this price will tend to become a bigger one through its increasing the general anxiety amongst those who cannot afford to see their income from running yield suffer a serious fall, lest they miss the bus.[1]

In his elaboration of Wicksell's theory of price fluctuations, Keynes agreed that a divergence between the money rate and the real rate (or the natural rate, in his terminology) could cause price inflation or deflation, depending on whether the money rate was below or above the real rate. However, he denied that banks bear all the responsibility for this phenomenon. If I interpret Keynes correctly,

---

[1]*Ibid.*, Vol. VI, pp. 320-31.

he argues that it is the structure of the capital market, the stickiness of the money rate of interest and its slow adjustment to the real rate which prolong the duration of the cumulative process. This is an improvement over Wixksell. (Wicksell, like other monetary theorists of his period, assumed that prices were equally flexible upward and downward.)

> I think that the market rate of interest, as measured by the yield on long-dated securities, is very "sticky" in relation to the natural rate of interest. (The natural rate of interest ... is the rate at which savings and investment are exactly balanced.) That is to say, when the natural rate of interest is falling (or rising), the banking world does not quickly detect this or respond to it, so that there is a tendency for the market rate to lag behind and to fall (or rise) less than it should if it is to maintain contact with the natural rate. In other words, when savings are abundant or deficient in relation to the demand for them for investment at the pre-existing level of interest, the rate does not adjust itself to the new situation quick enough to maintain equilibrium between savings and investment.[1]

Keynes notes that usury laws and the absence of perfect competition are factors which contribute to the slow adjustment of the money rate to the real rate.

Having demonstrated that the money rate may diverge from the real rate, Keynes expressed the opinion that "... booms and slumps are simply the expression of the results of an oscillation of the terms of credit about their equilibrium position."[2] Thus, according to the Keynes of the Treatise, business cycles are purely monetary phenomena. Keynes' theory of cycles was not, however, original.

---

[1]Ibid., Vol. VI, p. 182.

[2]Ibid., Vol. V, p. 165.

Hawtrey had anticipated Keynes by almost two decades in developing a similar theory.[1]

Keynes argued that when the terms of credit were easy, that is when the bank rate is below the natural rate, banks would function as instruments for redistributing income from lenders to entrepreneurs and the owners of the factors of production. The gains to entrepreneurs would be reflected in the shape of the increased capital, and the gains to the owners of the factors of production would be in the form of higher rates of remuneration.[2]

To maintain price stability, Keynes recommended that the banking system should control the terms of credit in such a way that savings are equal to the value of new investment:

> If we start from a position of equilibrium, then -- provided that efficiency earnings are stable -- the condition for the continued stability of price levels is that the total volume of money should vary in such a way that the effect of the corresponding volume of bank lending on the market rates of interest is to keep the value of new investment at an equality with current saving.[3]

Elsewhere, in his discussion of the management of money, Keynes pointed out that when the value of new investment exceeds current savings banks will be charged with inflationary tendencies. Similarly, banks would "... lay themselves open to the charge of deflationary action unless they create enough credit to prevent the

---

[1]R. G. Hawtrey, Currency and Credit (London: Longmans, Green, 1923), 2nd ed.

[2]Keynes, op. cit., p. 165.

[3]Ibid., p. 197.

value of new investment from falling below the amount of current savings."[1]

Notwithstanding his position that price stability can be achieved only by maintaining the volume of credit at its equilibrium level, Keynes believed that in an open economy the necessity of preserving international equilibrium (domestic equilibrium) may force the domestic banking system to establish terms of credit which diverge from their domestic (international) equilibrium level. Apart from this, it was Keynes' opinion that the chief concern of bankers was not to preserve the stability of prices and employment. "Their object, under a gold standard, is to keep in step with the average behavior of the banking system of the world as a whole."[2]

Conclusion

Despite their shortcomings, continental economists of the eighteenth, nineteenth, and early twentieth centuries broke the ground for a theory of credit expansion and money supply. Most of these economists were unanimous in their opinion that the rates of interest charged by banks were the most important factors in determining the volume of credit. They also, if not unanimously, claimed that factors such as reserve requirements, currency-deposit ratio desired by the public, and convertibility would tend to limit over-expansion of credit by the banking system.

---

[1] _Ibid._, Vol. V, p. 165.

[2] _Ibid._, Vol. VI, pp. 165 and 199.

With regard to the involvement of banks in inflationary processes, economists were divided into three groups. The adherents of the commercial loan theory refused to hold the banks responsible for rising prices and unfavorable exchanges. Taking the opposite point of view, a second group argued that banks, by deliberately keeping their loan rates below the natural rate, started the inflationary spirals. The third group, which tended to be more analytical and less prejudiced in their analysis of banking and credit markets, held that situations in which the money rate of interest was below the real rate were not necessarily initiated by the actions of banks. Improvements in the expectations of profit, or diminution in the rate of savings, which may drive the natural rate above its previous level, could ignite an inflationary process if the money rate of interest failed to adjust to the real rate in a comparatively short span of time. It is to these economists that we owe a great deal of our insight into the functions of banking and credit markets. They also recognized the amount of power that central banks could exercise upon the conditions of the terms of credit. Most of them insisted that this power was not, however, unqualified but conditioned by the profit maximization behavior of banks and the behavior of the public at large. In the words of John M. Keynes:

> The volume of cash balances depends on the decisions of the bankers and is "created" by them. The volume of real balances depends on the decisions of the depositors and is "created" by them. The price ... is the resultant of the two sets of decisions and is measured by the ratio of the volume of the cash balances created to that of the real balances created.[1]

---

[1] *Ibid.*, Vol. V, p. 201.

CHAPTER III

A MICRO-ECONOMIC ANALYSIS OF BANKING BEHAVIOR IN AN INFLATIONARY ENVIRONMENT

Since 1960 a considerable amount of work has been done in the application of relative price theory to money and banking markets. As a prelude to the micro-economic models presented in Chapters III and IV, it will be fruitful to survey the existing literature in this area. This survey will also help clarify the basis of some of the assumptions underlying the models used for purposes of analysis of banking behavior. This is done in the first section of this chapter. The second section presents a highly simplified model, originally developed by Martin Bailey in his famous Journal of Political Economy article, "The Welfare Cost of Inflationary Finance."[1] Bailey's model is revised and reformulated to suit an economy with commercial banks. The predictions derived from the revised model are contrasted with those predicted by Bailey. The third section examines the relationship between the real rate of interest and the rate of inflation. I shall also discuss the ramifications of a variable real rate of interest (as contrasted with Bailey's constant real rate) for bank profitability in an inflationary environment. In the fourth section is discussed the portfolio behavior

---

[1]Martin J. Bailey, "The Welfare Cost of Inflationary Finance," Journal of Political Economy, LXIV, No. 2 (1965).

of the public and the banks. Banking behavior is discussed in a comparative statics fashion in the course of an anticipated inflation. In the fifth section, I have discussed banking behavior during an unanticipated inflation. The final section evaluates a study by David L. Grove on "The Role of the Banking System in the Chilean Inflation."

Theories of the Banking Firm

In recent years monetary economists have made a considerable effort to give the theory of the banking firm a wider scope than that afforded through the simplified textbook reserve-deposit multiplier analysis of the behavior of the representative commercial bank.

Attempts to replace the conventional textbook model of bank behavior fall into two main categories. The first of these, generally inspired and pursued by Yale economists, is the institutional investor approach. According to this view the behavior of the representative bank can be best analyzed along lines suggested by the theory of optimum asset-portfolio selection under conditions of uncertainty. The basic Markowitz model of portfolio selection, or some variant of it, has been and continues to be the primary tool of analysis in this approach.[1]

In the confines of the Markowitz model the key variables are expected relative interest yields on different assets and the degree of

---

[1] Harry M. Markowitz, Portfolio Selection (New York: John Wiley & Sons, Inc., 1959), and William F. Sharpe, "A Simplified Model of Portfolio Selection," Management Science (January, 1963), pp. 277-93.

variability of such yields. To the individual investor an investment is profitable if (1) the investment results in a ceteris paribus increase in total expected return on the portfolio, (2) the investment results in a ceteris paribus decline in total risk exposure on the entire portfolio and (3) the investment results in such changes in the expected return and risk exposure on the portfolio as to make the investor better off.[1]

The individual investor's choice of the actual asset portfolio is also governed by, besides relative expected interest yields, the investor's attitude towards risk. Thus an individual with positive preference for expected return and negative preference for risk will choose an asset portfolio providing him with those levels of expected return and risk which would maximize his expected utility. Markowitz has shown that in most cases the portfolio selected will be diversified, being composed of assets with different expected risks and returns.

Portfolio Theory Versus the Classical Theory of Consumer Choice

To a portfolio theorist, the classical theory of consumer choice has little relevance to the real world. Within the context of the conventional theory of consumer choice, the representative consumer has to make choices among alternatives that are static and

[1]For a brief restatement of the Markowitz model the reader may consult Fred B. Renwick, "Asset Management and Investor Portfolio Behavior: Theory and Practice," Journal of Finance, XXIV, No. 2 (1969), pp. 181-206.

certain. Having no uncertainty as to the return on various assets, the consumer is led to choose the asset which promises to pay the highest rate of return. In other words, it is argued that the traditional theory does not allow for portfolio diversification and thus cannot provide the backbone for a meaningful analysis of consumer choice under uncertainty.

Likewise, the modern portfolio theory holds that the neoclassical profit maximization criterion does not yield operationally meaningful and testable hypotheses about the behavior of a firm, whether the firm produces non-financial goods, like a manufacturing firm, or financial goods, like a bank. According to one of the defenders of this view: "... useful analysis of bank portfolios must recognize the importance of uncertainty to bank operations ... The crux of bank operations is uncertainty, and hence any reference to profits must be in a probabilistic sense."[1]

The portfolio literature frequently assumes that risk in banking can arise from uncertainty about future deposit levels, market value of securities, loan defaults, and the bank's ability to achieve its desired portfolio.[2] The representative bank is viewed as a "hedger," issuing claims on itself and using the proceeds to purchase other financial assets. The bank earns its income from different sources, such as loans, securities and capital gains. The only claim

---

[1] Richard C. Porter, A Model of Bank Portfolio Selection, Yale Economic Essays, Vol. I (1961), pp. 323-59.

[2] *Ibid.*, p. 322.

against this income is the cost of borrowed funds and the transaction costs on securities. Other operating costs, such as labor and capital costs, are totally ignored in this approach. The individual bank is led to choose a combination of income-earning assets which would maximize its expected return on its portfolio subject to acceptable levels of the risk constraints confronting it.

Implications of Portfolio Theory For the Money Supply Process

Most portfolio theorists have argued that money supply is an endogenous variable rather than exogenous, as implied by textbook theories of the money supply process. In his frequently quoted article, "Commercial Banks as Creators of Money," James Tobin[1] has aptly summarized the position of portfolio theorists with regard to this issue. In his words:

> A more recent development in monetary economics tends to blur the sharp traditional distinctions between money and other assets and between commercial banks and other financial intermediaries; to focus on demands for and supplies of the whole spectrum of assets rather than on the quantity and velocity of money; and to regard the structure of interest rates, asset yields, and credit availabilities rather than the quantity of money as the linkage between monetary and financial institutions and policies on the one hand and the real economy on the other.[2]

In this article, Tobin also insisted that the "widow's cruise" notion of the money supply process be replaced by the notion of a "natural

---

[1]James Tobin, "Commercial Banks as Creators of Money," in Banking and Monetary Studies, ed. by D. Carson (Homewood: Richard D. Irwin, 1963), pp. 408-19.

[2]*Ibid.*, p. 410.

scale" of the banking industry, the natural scale being determined by the cost and yield functions dominating bank operations. The following paragraph is illustrative of this point of view:

> Neither individually nor collectively do commercial banks possess a widow's cruise. Quite apart from legal reserve requirements, commercial banks are limited in scale by the same kinds of economic processes that determine the aggregate size of other intermediaries.[1]

Many of the suggestions made by portfolio theorists have received a great deal of attention from monetary economists writing during the last decade. The portfolio theorists' emphasis on the principle of substitutability between money and other financial assets has provoked a considerable number of journal articles.[2] Their insistence that monetary theory is in essence a part of a general theory of asset holding has led to various reformulations of the traditional money supply theory which takes into consideration the possibility of substitution between money and other financial assets. Traces of the impact of the methodology of the leading portfolio theorists can be found in the works of so-called "Keynesian" as well as "quantity" theorists. There are, however, major disagreements between portfolio theorists on the one hand, and Keynesian and quantity theorists on the other, as to the relevant factors in the money supply function. Most

---

[1] Ibid., p. 412.

[2] See, for example, David Laidler, "The Definition of Money," George G. Kaufman, "More on an Empirical Definition of Money," Richard H. Timberlake and James Fortson, "Time Deposits in the Definition of Money," Karuppan Chetty, "On Measuring the Nearness of Near-moneys," in Monetary Economics: Readings on Current Issues, ed. by William E. Gibson and George G. Kaufman (New York: McGraw-Hill, Inc., 1971).

portfolio theorists[1] have held that, in the absence of reserve requirements and other constraints, "variations in the monetary base do not affect the money stock," while the latter two groups have maintained that the monetary base and its rate of change is an important element of the money supply process. This difference in opinion is mainly due to lack of agreement on the role played by non-interest bearing money. According to portfolio theorists, economic agents hold a positive inventory of money only because of the transaction costs connected with purchasing and selling liquid assets. People, it is conceded, hold money because of brokerage fees for the purchase and sale of stocks and bonds. This point of view concerning the role of money should be contrasted with the monetarists' view that money is a productive asset with a yield (though implicit) that is held in some proportion (as a consequence of wealth optimizing behavior by economic agents) to all the other assets available to the individual transactor. It is argued that contrary to the supposition of portfolio theorists, "... media of exchange are not imposed by fate but result from optimizing search behavior of members in a social group."[2]

Whether the monetary base and its rate of change is an important factor in the money supply function is a question which can be best answered at an empirical level. To date, portfolio theorists have not produced sufficient evidence to support their point of view.

---

[1]For an excellent discussion of this issue, see Karl Bruner, "Yale and Money," Journal of Finance, XXVI (March, 1971), pp. 105-74.

[2]Ibid., pp. 169-70.

At a theoretical level it seems that the views espoused by Yale economists as to the relationship between the money supply and the monetary base are not consistent with their general line of analysis. Changes in the monetary base, whether brought about by open market operations, changes in the discount rate, or issuance of new currency, exert both a short-run and a long-run effect upon the credit market. Such effects, as reflected in the relative yield structure of both financial and real assets, would induce asset holders -- banks and the public included -- to reshuffle their portfolios in accordance with the changes that have occurred or are expected to occur in the relative interest rates. To argue that the monetary base is unrelated to the money supply is to say that changes in the stock of high powered money do not bring about perceptible changes in the relative yield structure of assets whether financial or physical. This, I believe, is an untenable argument.

Industrial Organization Analyses of the Banking Firm

The application of relative price theory to the banking firm is also manifested in recent "industrial organization" analyses of bank behavior. These studies basically focus on the performance of individual banks in localized markets. The general presumption here is that banking markets are not competitive and that banks are multiproduct firms. Market imperfection in banking markets is said to arise from geographical spread and governmental controls of entry into the banking industry.

Model of the Banking Firm

A model most commonly used in this approach is the model of the multi-product price discriminating monopoly. The fundamental assumption of the model is that the typical bank operates in a number of segmented markets, selling either the same product at different prices or offering various products at different prices. David Alhadeff, who pioneered the research in this area, distinguished the business loan as the major product of banking and identified deposits as the principal input of banking.[1] Other authors have expanded the list of bank outputs to include such financial services as payroll accounting, credit and market information, investment advice, and foreign transactions.[2] The present author has selected "loans" as the characteristic output of banking and has distinguished two segmented markets for this product -- the short-term loans market and the long-term loans market. In most of these studies, it is assumed that loan and deposit functions are separable. Donald Hodgman has challenged this point of view and has argued that the process of attraction of deposits and extension of loans cannot be separated in a meaningful manner.[3] Using an institutional investor approach, Hodgman has insisted

---

[1]See Lester Chandler, "Monopolistic Elements in Commercial Banking," Journal of Political Economy (February, 1938), and David Alhadeff, Monopoly and Competition in Banking (Los Angeles: University of California Press, 1954).

[2]Bernard Schull, "Commercial Banks as Multi-Product, Price-Discriminating Firms," in Banking and Monetary Studies, ed. by Deane Carson (Homewood, Ill.: Richard D. Irwin, 1963).

[3]Donald R. Hodgman, Commercial Bank Loan and Investment Policy, Bureau of Economic and Business Research (Urbana, Ill.: University of Illinois, 1963).

that the basic product of commercial banks is safekeeping and transfer of the means of payment. Hodgman has distinguished two sets of customers for a typical bank's output -- loans. These are the deposit-borrower (a customer who keeps a deposit account with the lending bank), and the non-deposit customer (a customer who does not have a deposit account). Hodgman observes that commercial banks are led to charge lower rates on their loans to their deposit customers, due to the fact that their deposits provide the banks with some income. Hodgman concludes that if banks are allowed to pay interest on deposits the observed differences in loan rates will be eliminated.[1] Although I do not challenge the validity of Hodgman's logic as to the differences in loan rates, it should be noted that such differences could also arise because of the differences in the elasticities of demand functions for loans. It may also be pointed out that his line of reasoning seems most applicable to a bank's largest customers, rather than to the small customers who are the principal sources of funds to the banking system.

Measurement of a Bank's Output

At first sight it appears that the monopoly model can be directly applied to the banking firm. This is not, however, the case. Economists, especially those who have been concerned with bank behavior at an empirical level, have encountered and continue to encounter, various difficulties in their definitions and measurements of a bank's

---

[1]Donald R. Hodgman, "The Deposit Relationship and Commercial Bank Investment Behavior," Review of Economics and Statistics, XLIII, No. 3 (1961), pp. 257, 268.

product. Such difficulties are essentially due to the phenomenon that the banking firm's inputs and outputs, however identified, have more than one dimension. Economists have often puzzled over the appropriate index of measurement of deposits and loans. Following Alhadeff's[1] original contribution, most economists measured bank inputs and outputs in terms of dollars, while others used the number of deposits and loan accounts as a proxy for bank inputs and outputs.[2] Still others employed measures such as current operating earnings to determine a bank's output.[3] In short, the choice of a unit of measurement for banking inputs and outputs has been arbitrary. Each measure implies a different production function for the banking firm and there is no concensus as to the superiority of one particular measure.

Comparison of the Two Approaches

As the reader may have noticed, the industrial organization view of banking comprises aspects of banking implied by the institutional investor approach. Within the context of the industrial organization approach, the banking firm allocates its "output" among different markets, such that marginal revenues over all markets are

---

[1]See Alhadeff, op. cit., and Paul M. Horvitz, "Economics of Scale in Banking," in Private Financial Institutions, Commission on Money and Credit (Englewood Cliffs, N. J.: Prentice-Hall, 1963).

[2]George J. Benston, "Economies of Scale and Marginal Costs in Banking Operations," in Studies in Banking Competition and the Banking Structure, The Administrator of National Banks (January, 1966).

[3]Stuart L. Greenbaum, "Costs and Production in Commercial Banking," Monthly Review: Federal Reserve Bank (March, 1966), pp. 11-19.

equalized. The uncertainty aspects of banking can also be incorporated into the analysis without too much difficulty. Uncertainty, with regard to relative interest yields of different income-earning assets or marginal revenues in different markets, arises due to the lack of perfect knowledge. As Karl Brunner has noted "the persistence of incomplete information (i.e. uncertainty) also reveals that information is produced at a positive marginal cost."[1] One can take account of the uncertainty problem, so important to portfolio theorists, by incorporating an information cost function into the analysis and examine bank behavior along alines suggested by the industrial organization approach.

Although each approach has its merits and defects, the industrial organization view of banking has two obvious advantages over the institutional investor approach. These are its simplicity and its consideration of the non-interest expenses of the banking firm. As was noted earlier, non-interest costs are considered insignificant in the institutional investor approach. From the standpoint of empirical analysis, the portfolio models of banking behavior have proved no more informative with respect to the general tendencies of banking behavior than the single- or multi-product versions of the industrial organization models.[2] There are essentially two reasons for this. First,

---

[1]Brunner, op. cit., p. 170.

[2]For an excellent example of the application of the Markowitz model to the banking firm see Joel S. Fried, "A Generalized Markowitz Model of Bank Portfolio Selection" (unpublished Ph.D. dissertation, Northwestern University, 1969). In his enquiry Fried has tested some

in the Markowitz model, one cannot obtain reliable estimates of the covariances between rates of return on different assets. Second, as some authors have argued, variance per se as a measure of risk may lead to selection of portfolios which are not optimum.[1]

Bailey's Model

The principal objective of this section is to lay out a theoretical framework to show the effects of price level changes upon bank earnings under different sets of conditions and assumptions. Save for a partial contribution by Martin Bailey[2] few references are found in economic literature which analyze the problem along lines employed in this study.

Our objective will be achieved through a different approach, but we think that Bailey's contribution serves as a good starting point. Accordingly we shall build upon the theoretical foundations set out by Bailey and shall introduce whatever modifications are necessary to sharpen and further the analysis as we go along.

In his verbal analysis of the impact of inflation on bank earnings in connection with his discussion of "The Welfare Cost of Inflationary Finance," Bailey wrote:

---

of the implications of the Markowitz model for the banking firm and has found that this model cannot explain bank behavior.

[1]Renwich, op. cit., p. 185.

[2]Bailey, op. cit.

> ... In the course of an inflation that everybody anticipates perfectly, it would become extremely profitable for banks to create the maximum possible quantities of bank deposits, if they were interest free, while making loans at the high nominal rates of interest which the competitive bidding of would-be borrowers would necessarily create in the loan markets. For any individual bank it would be profitable, if banking were competitive, to attempt to attract deposits from other banks in order to expand its loans. An individual bank could do so by offering interest on its deposits, and the effects of all banks competing with one another for deposits would be that they would all offer a nominal interest rate on deposits approaching, but not equal to, the rate of inflation.
>
> In this case the public would no doubt be tempted to hold no currency at all, since it pays no interest, and to hold cash only in the form of bank deposits; at high rates of inflation the incentive to substitute bank deposits for currency would be very great. The fact that banks may have legal or traditional minimum reserve ratios, however, sets a lower limit on the ratio of currency including bank reserves to deposits: the most extreme possibility is that all newly issued currency (along with old currency) flows immediately into the reserves of the banking system, which then issues new bank money in whatever ratio is permitted by its reserve ratio. In this case the ratio of currency to deposits becomes constant, after the inflation gets underway, at a level below that which obtained in noninflationary conditions.[1]

In his textbook, National Income and the Price Level, Bailey made a similar argument. He wrote:

> ... the commercial banking system may create some or all of the new money that feeds the inflation. Here, the commercial banks' depositors will directly receive the proceeds of the money creation, if the banks pay a competitively determined rate of interest on their deposits; if they do not the banks themselves will receive it, sometimes passing it on to their borrowers by failing to charge competitive interest on their loans. In this case income is transferred from holders of cash balances in general to the banks or their borrowers.[2]

In a footnote which immediately follows this passage, Bailey added:

---

[1] Ibid., p. 103.

[2] Martin J. Bailey, National Income and the Price Level: A Study in Macroeconomic Theory (New York: McGraw-Hill Book Company, 1971), p. 78.

> If the banks charge competitive interest rate, that is, the sum of real rate of interest and the expected rate of inflation, their profits will rise by the rate of inflation times their loans, which is just the rate of bank money creation.[1]

Before critically evaluating Bailey's conclusions, it is helpful to present his argument more formally. Fundamental to the theoretical framework used by Bailey are the following assumptions:

(1) Full employment.

(2) Investment is a function of the real rate of interest and is independent of the expected rate of inflation.

(3) The demand for real cash balances is a function of the real rate of interest plus the expected rate of inflation and real income.

(4) Money supply is a function of the nominal rate of interest.

(5) Inflation is fully anticipated. (This assumption implies that the expected rate of inflation is equal to the actual rate of inflation and would be valid if, and only if, prices are allowed to rise freely, that is, are not subject to government control.)

(6) Banks are fully loaned up.

(7) The public is initially willing to substitute the non-interest bearing fiat money for bank money for certain non-pecuniary and pecuniary advantages that the latter provides.

---

[1] Ibid.

(8) There are n identical banks in the economy, each $1/n^{th}$ of the market. (This assumption is not crucial to the ultimate conclusions that are to be drawn here, but its simplifying nature allows us to clarify the analysis.)

Definition

Inflation is defined as a sustained rise in the price level. A steady rate of inflation means that the price level will rise by the same amount during each period.

Having made the above assumptions we are ready to lay out the basic analytical apparatus used by Bailey. But before doing so, the causes of inflation in Bailey's economic model must be examined.

Causes of Inflation

Bailey has rightly distinguished two separate cuases of inflation: (1) the expectation of inflation, and (2) increases in the quantity of money.

> It is important to understand the two separate causes of a rise in the price level, each fundamentally different from the other. The expectation of inflation per se produces a rise in the price level, a once-for-all rise to be maintained but not repeated. In contrast, the price rise associated with the increase in the quantity of money must proceed continuously to maintain equilibrium. The total price rise after any interval of time has two components, one proportional to the increase in the quantity of money, the other a jump in the price level that will be but not repeated as long as expectations of further inflation remain unchanged.[1]

---

[1] *Ibid.*, p. 79.

Notations

In the analysis the following symbols are defined to be:

m^d = The quantity of real balances demanded per period of time.

m^s = The quantity of real money supplied per period of time.

E = The expected rate of inflation.

p* = The actual rate of inflation.

r = The real rate of interest.

i = The nominal rate of interest.

c = Currency in the hands of the public.

R = Total reserves held by the banks.

k = Legal reserve requirements.

D = Quantity of demand deposits.

L = Quantity of loans.

B = The monetary base, defined as the sum of currency held by the public plus the amount of reserves held by the banks: B = c + r.

l = The money multiplier.

In Bailey's model, price level expectations do not affect the expenditure sector. The impact of price level changes is confined to the monetary sector which he characterizes as:

$$m^d = m(i, y),$$

where i is the nominal rate of interest and y is the real income. It is postulated that the desired quantity of real cash balances increases with increasing income and decreases with increasing rates of nominal interest:

$$m^s = \frac{B}{P}S(i),$$

where m^s is the supply of real balances and B is the monetary base. Bailey does not, however, include the monetary base in his functional form of money supply. For our purposes we shall use this specification rather than the one used by Bailey.

$$i = a(r + E),$$

where i is the nominal rate of interest, E is the expected rate of inflation and a is defined to be the coefficient of adjustment of the interest rate. Bailey has assumed that a is equal to unity. We shall also make this assumption. Later we will examine the consequences of allowing a to vary from unity.

Stock Equilibrium with No Inflation

In the following diagram the nominal rate of interest, that is, the sum of the real rate of interest and the expected rate of inflation, is measured on the vertical axis, and the amount of real money demanded and real money supplied is measured on the horizontal axis. The money supply function is upward sloping for two reasons: (1) The higher the nominal rate of interest the higher is the opportunity cost of holding idle balances by the banks. Hence, at relatively higher interest rates banks should be willing to expand their supply of loans and credit. (2) At higher rates of interest banks

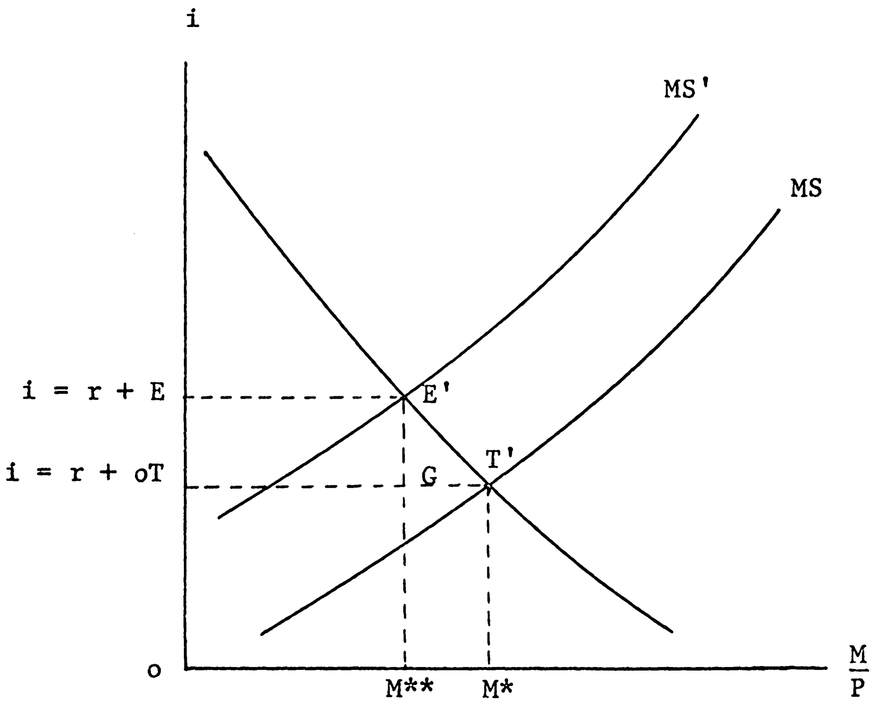


Fig. 1.--Inflationary equilibrium.

find it more profitable to attract primary deposits to buy interest-bearing assets.

With a stable price level the community will want to hold OM* amount of real balances per period of time and the monetary institutions are willing to supply OM** amount of real balances. The cost of holding this amount of real balances, assuming that interest payment on deposits is offset by the non-pecuniary disadvantages of bank money, is given by the area OTT'M*.

Inflationary Equilibrium

For inflationary equilibrium two conditions must be satisfied. As Bailey notes these are: (1) The money rate of interest must rise by the full amount of the expected rate of inflation; and (2) The rate of price change per period shall equal the expected rate of price change. Condition (1) implies that the loanable funds market will not be cleared unless both lenders and borrowers agree on a common rate of interest which, at the margin, would be equal to the previous rate of interest plus the expected rate of inflation. Condition (2) requires that the money supply, given a constant level of real income, should increase at the same proportionate rate as the public expects the price level to increase. In other words the money supply should be increasing at the rate of the ongoing inflation. If this condition is not fulfilled and the money supply is increased at a rate above or below what the public expects, then we will have a situation in which expectations are not in equilibrium.[1]

In terms of the above diagram, expectations of inflation (regardless of the way these expectations are formed) increase the cost of holding real balances by TE, which is equal to the expected rate of inflation. But at the price of OE the public would want to hold OM** amount of real balances. Consequently, the public would want to substitute real resources for part of its real balances, and in doing so it will induce a rise in the price level. The price level must rise enough to equilibriate the quantity of real balances demanded to the quantity of real balances in circulation. Once the rate of inflation becomes established at TE and is expected to continue at the same rate, the public would want to hold OM** amount of real balances per period of time. A rise in the price level is, however, equivalent to a reduction in the real money supply. Hence, the money supply schedule has to be redrawn and shifted to the left by the expected rate of inflation. Overall equilibrium is restored at E', which is the intersection of the real money demand function with the real money supply curve. The area of OEE'G represents the amount of depreciation of the real cash balances per period of time. In order to stay at E' the public should increase its holdings of real balances by the same amount. This is achieved only if the money supply is increased by

---

[1]Ideally, Conditions (1) and (2) above should be derived from a dynamic theory of prices and interest rates. To this date I have not been able to formally derive these conditions. I am, however, working on it.

the expected rate of inflation. Under these conditions OM** will be the equilibrium amount of real balances which the public desires to maintain at the expected rate of inflation represented by TE in the diagram.

A Reformulation of Bailey's Model

To analyze the impact of inflation on banks we shall use the results derived in the previous section. Initially, we shall be concerned with the operation of one bank under inflationary equilibrium; we shall later extend the analysis to the banking system taken in the aggregate.

To start with, let us assume that Figure 1 is representative of the market served by one of the n banks in the economy, and that this bank is a representative bank.

In our discussion of inflationary equilibrium it was noted that for inflationary equilibrium to persist the nominal money supply must be increased at the expected rate of inflation. Combining this condition with the assumption of a fully anticipated inflation the basic equilibrium condition may be written as:

$$E = p^* = M^*s, \qquad (1)$$

where E is the expected rate of inflation, p^* is the actual rate of inflation, and M^*s is the rate of growth of the nominal money supply. In what follows we shall find the rate of change of the money supply under different assumptions and substitute the results in Equation (1).

The money supply function may be written as:

$$Ms = \ell \cdot B \cdot S(i), \qquad (2)$$

where ℓ is the money multiplier, B is the monetary base and i is the nominal rate of interest. Using (2) the rate of change of the money supply can be written as:

$$M^*s = \frac{dMs}{Ms} = \ell^* + B^* + (eMs, i)\,\frac{di/dt}{i}, \qquad (3)$$

where ℓ^* is the rate of change of the money multiplier, B^* is the rate of change in the monetary base and the term in parenthesis is the elasticity of money supply function with respect to nominal interest rate.

The nominal interest rate i is defined to be:

$$i = r + E, \qquad (4)$$

where r is the real rate of interest and E is the expected rate of inflation. Taking the time derivative of (4) we have:

$$di/dt = dr/dt + dE/dt. \qquad (5)$$

By assumption the real rate of interest is constant. This implies that the first term on the right-hand side of (5) vanishes upon differentiation. If the expected rate of inflation is steady, that is, if the same rate of inflation is believed to continue, then the second term on the right-hand side of (5) also vanishes. At this stage we shall have to assume that the expected rate of inflation is steady.

With this assumption (3) reduces to:

$$M^*s = \ell^* + B^*. \qquad (3')$$

Equation (3') states that the rate of change of the money supply is equal to the rate of change of the money multiplier plus the rate of change of the monetary base.

The Rate of Change of the Monetary Base

The monetary base is defined to be:

$$B = c + r, \qquad (6)$$

where c is the currency in the hands of the public and R is the amount of reserves held by the individual bank against its deposits.

By definition the reserves held by the bank are:

$$R = k \cdot D,$$

where k is the reserve ratio and D is deposits. The assumption of a fully loaned up bank implies:

$$L = (1-k) \cdot D \text{ or } D = L/(1-k).$$

Substituting in (6) in terms of L we have:

$$B = c + \frac{k}{1-k}L. \qquad (6')$$

Using (6'), the rate of change in the monetary base is equal to a weighted average of the rate of change in the currency in the hands of the public and the amount of loans extended by the bank.

$$B^* = \frac{c}{B}c^* + \frac{k \cdot L}{(1-k) \cdot B}L^* \qquad (7)$$

Substituting (7) into (3') the equation for the rate of change of the money supply may be rewritten as:

$$M^*s = \ell^* + B^* \qquad (3')$$

$$M^*s = \ell^* + \frac{c}{B}c^* + \frac{k \cdot L}{(1-k) \cdot B}L^* \qquad (8)$$

Bailey has stated that, under inflationary equilibrium, the rate of change in the money supply is identical to the rate of change of the banks' loan creation. This conclusion is valid if we make the following two additional assumptions:

(1) The money multiplier remains constant, i.e., $\ell^* = 0$, and

(2) as soon as inflation gets under way, the public gets rid of all its currency by depositing it in the banks.

If these two assumptions are satisfied, then the monetary base would be identical to reserves held by the banking system. Under these assumptions we have:

$$B = R = k \cdot D = \frac{k}{1-k}L.$$

Assuming that the reserve ratio remains constant, then the rate of change of the monetary base is:

$$B^* = R^* = D^* = L^* \qquad (7')$$

Equation (7') states that in a situation where the public does not hold any currency at all, the rate of change of the monetary base is equal to the rate of change of the reserves, which is equal to the rate of change of the deposits. If banks are fully loaned up, then this rate is also equal to the rate of loan creation. All these rates will be equal to the rate of the change in money supply. Using these assumptions (8) is written as:

$$M^{*}s = B^{*} = L^{*} = D^{*} \qquad (8')$$

Substituting (8') into equilibrium condition (1) we have:

$$E = p^{*} = L^{*} = D^{*} \qquad (1')$$

<u>Bank Profit and Inflation</u>

Let the profit function of the i^{th} bank be represented by:

$$\pi = i \cdot L - r^{d} \cdot D - c_1 D - c_2 L, \qquad (9)$$

where i is the nominal interest earned on a dollar of loan, r^d is the interest paid on deposits, c_1 is the cost of creating and maintaining a unit of deposit and c_2 is the cost of making a unit of loan. If the banking system is competitive, then the individual bank is a price taker and it maximizes profit by treating both i and r^d as given. It is easily shown that under competitive equilibrium the interest paid per dollar of deposits is equal to the interest received per dollar of loan minus the imputed cost of holding legal reserves against per dollar of deposit minus all other unit costs.[1] To show this, we differentiate the profit function with respect to either amounts of loans or amounts of deposits and set the result equal to zero.

$$\frac{d\pi}{dD} = i \frac{dL}{dD} - r^d - c_1 - c_2 \frac{dL}{dD} = 0. \quad (10)$$

If the bank is fully loaned up, then:

$$L = (1-k) \cdot D, \quad (10')$$

where k is legal reserve ratio, and

$$\frac{dL}{dD} = (1-k) \quad (10'')$$

Substituting (10") into (10) and simplifying we have:

$$i(1-k) - f^d - c_1 - c_2(1-k) = 0 \quad (11)$$

Solving (11) for r^d we get:

$$r^d = i(1-k) - c_1 - c_2,$$

---

[1]See Vittorio Bonomo and Robert L. Sorensen, "The Discount Rate: A Phantom Policy Tool?" Western Economic Journal, VII, No. 3 (1970), pp. 262-64; Thomas R. Saving, "Outside Money, Inside Money and the Real Balance Effect," Journal of Money, Credit and Banking, VII, No. 1 (1970), pp. 83-100; Don Patinkin, "Inside Money, Monopoly Profits, and the Real Balance Effect: A Comment," Journal of Money, Credit and Banking, VIII, No. 2, Part 1 (1971), pp. 271-75; Thomas R. Saving,"Inside Money, Short Run Rents and the Real Balance Effect," Journal of Money, Credit and Banking, VIII, No. 2 (1971), pp. 276-80; Don Patinkin, "Money and Wealth: A Review Article," Journal of Economic Literature, 7 (1969), pp. 1140-60: Michael A. Klein, "A Theory

which is the solution predicted above.

If it is assumed that deposits and loans are created at zero marginal cost (11') reduces to:

$$r^d = i(1-k). \qquad (11'')$$

This equation states that the competitive deposit rate is equal to the loan rate minus the product of the loan rate with the reserve ratio -- imputed cost of holding legal reserves.

Inflation and the Deposit Rate

Taking the total differential of (11") we have:

$$dr^d = di(1-k).$$

Letting di, the increment in the nominal rate of interest, be equal to the expected rate of inflation, we have:

$$dr^d = E \cdot (1-k)$$

which states that under a fractional reserve banking system the deposit rate does not rise by the full rate of inflation even though the banks are charging their borrowers a nominal rate equal to the sum of the pre-inflationary rate and the current expected rate of inflation. The difference between what the depositors receive, E(1-k), and the expected rate of inflation, E, is a dead weight loss to society. It is neither earned by the banks nor is it paid to depositors.

---

of the Banking Firm," Journal of Money, Credit and Banking, VIII, No. 2 (1971), pp. 205-18.

To examine windfall gains or losses which accrue to a representative bank as the economy moves from a non-inflationary equilibrium to an inflationary equilibrium, we differentiate the profit function with respect to time: $\pi = i \cdot L - r^d \cdot D$.

$$\frac{d\pi}{dt} = L\frac{di}{dt} + i\frac{dL}{dt} - D\frac{dr^d}{dt} - r^d \frac{dD}{dt} \tag{12}$$

Having assumed that inflation is fully anticipated we have:

$$\frac{di}{dt} = E,$$

and

$$\frac{dr^d}{dt} = E(1-k).$$

Substituting these into (12) we have:

$$\frac{d\pi}{dt} = E \cdot L - D(1-k) \cdot E + i\frac{dl}{dt} - r^d \frac{dD}{dt} \tag{12'}$$

Using the assumption that the bank is fully loaned up, then (12') further simplifies to:

$$\frac{d\pi}{dt} = i\frac{dL}{dt} - r^d \frac{dD}{dt} \tag{12''}$$

By simple algebraic manipulations (12") can be rewritten as:

$$\frac{d\pi}{dt} = i \cdot L(L^*) - r^d \cdot D(D^*), \tag{13}$$

where (L*) and (D*) are the percentage changes in loans and deposits respectively. It has already been demonstrated that a prerequisite for inflationary equilibrium within the present framework is that the nominal money stock grow at the expected rate of inflation. Having already shown that the growth rate of nominal money stock is equal to the growth rate of deposits and/or loans, we can rewrite Equation (13) as:

$$\frac{d\pi}{dt} = iL \cdot E - r^d \cdot D \cdot E. \tag{13'}$$

Writing loans in terms of deposits and factoring out common terms we have:

$$\begin{aligned} \frac{d\pi}{dt} &= i \cdot E \cdot (1-k)D - r^d \cdot D \cdot E \\ &= E \cdot D[i(1-k) - r^d] \end{aligned} \tag{13''}$$

Equation (13") may be interpreted as showing the amount of profit or loss which accrues to the i^{th} bank between the time the economy moves from a non-inflationary equilibrium to an inflationary equilibrium. The equation states that the amount of gain or loss accrued to the bank is equal to the rate of money creation, which in this formulation is equal to the rate of inflation times the amount of deposits times the spread between the lending and borrowing rate. Whether a representative bank gains or loses from inflation depends largely on the existing market structure. If the banking system is competitive, then the term in brackets would approach zero at the margin and the representative bank may not be able to realize any gains from inflation. If bank loans are not indexed; that is, if they do not include an interest rate adjustment clause according to which rates could be adjusted upward or downward with movements in the price level, the respresentative bank would suffer losses on all its previous loans. The arithmetical magnitude of these losses would be equal to the amount of outstanding loans times the rate of inflation per period of time. The longer the maturity of the pre-inflation loans, the greater will be the amount of capital losses incurred by a representative bank. We shall have more to say on this particular subject in a subsequent chapter.

Monopoly Banking

Although monopoly banking will be considered in some detail later, it is instructive to pause here and briefly examine the ramifications of the present model for this case as well.

In situations where the representative bank has some monopoly power over the market, the term in brackets in Equation (13") may be interpreted as the spread between average revenue and marginal cost.

Proposition: A monopoly bank will gain from inflation if the expected inflation leads to a greater divergence between the lending rate and the borrowing rate. The bank will gain from inflation if inflation increases the bank's monopoly power as measured by the difference between average revenue and marginal cost. This will occur if the demand curve facing the monopolist becomes less elastic due to expectation of inflation. The quantitative gains or losses accruing to the monopoly bank from inflation may not be determined without additional information concerning the elasticities of the demand for loans function and the supply of deposits function. If it turns out that expectations of inflation increase the divergence between average revenue and marginal cost, then the bank is in a position to realize additional profits on its new loans. Whether these additional profits increase the net worth of the bank depends upon the portfolio composition which the bank maintained before the inflation got underway. If the bank held a large proportion of its portfolio in long-term bonds, loans and securities, then its capital losses on these instruments might outweigh its windfall gains.

Regulation of Monopoly Banks

Monopoly banks are generally regulated. They may not be allowed to raise their loan rate and deposit rate beyond a certain ceiling. In such cases the bank's power to make use of price measures to compete for deposits and loans may be limited. The rate on bank loans is not a free market rate and may vary according to the client, the magnitude of loan and other criteria.[1] Bailey has made the following observation with regard to this case:

> ... it is often observed in practice that banks ration their loans to customers and do not charge the maximum rate of interest they could get on the volume of loans they issue, or even the maximum they could get from the particular customers who borrow from them on the actual amounts ... banks might from pure force of habit or for other reasons, such as

---

[1]For interesting observations on bank loan rates when banks are subject to government control, see Robert V. Roosa, "Interest Rates and the Central Bank," in Money, Trade, and Economic Growth (New York, 1951), pp. 270-95.

> the existence of usury laws, continue to charge the pre-inflationary nominal rate of interest on their loans, rationing their loans to their regular customers in the customary amounts and paying no interest on deposits. In this case the real income extracted from the holders of bank balances through the inflationary prices would be transferred to those lucky enough to get bank loans.[1]

Several empirical investigations on the effectiveness of regulatory ceilings on the operation of the United States commercial banks have concluded that these ceilings have not been effective in curtailing either demand for loans by the public or bank demand for deposits during cyclical expansion of economic activity. Donald R. Hodgman[2] has noted that in mid-1957 when the banks were facing a strong demand for loans they turned to circuitous devices to pay interest on demand deposits. One device was that of selling government securities to a corporation under a repurchase agreement. The corporation would agree to pay for the securities with a check drawn on another bank. By this procedure the borrowing bank would be in a position to attract deposits from another bank in return for the interest income it paid out to the corporation which bought the securities. Very recently Benjamin Klein[3] demonstrated that prohibition of interest payments on deposits is almost wholly ineffective. Klein

---

[1]Martin Bailey, "The Welfare Cost of Inflationary Finance," pp. 103-104.

[2]Donald R. Hodgman, "The Deposit Relationship and Commercial Bank Investment Behavior," Review of Economics and Statistics (August, 1961), p. 249.

[3]Benjamin Klein, "The Payment of Interest on Commercial Bank Deposits and the Price of Money" (unpublished Ph.D. dissertation, University of Chicago, 1970).

has shown that competition for deposits forces the banks to pay interest on deposits in less direct ways. Edward Kane and Makiel Burton[1] have also accumulated evidence showing that competition induces the banks to use ancillary channels, such as reducing service charges, to attract deposits.

Choices of Assets: Public Vis-A-Vis Banks

In presenting the fundamentals of Bailey's model, we accepted two of his critical assumptions. One of these assumptions was that bank money was the only income earning asset in the economy. The second assumption was that inflation did not exert any influence on the real rate of interest. These two assumptions imply that during the inflationary process the yield on real balances remains above the yield on physical capital and nominal-interest bearing securities, and that individuals have no incentive to replace money with other assets. For this to be the case, the rate on bank deposits must be greater than the sum of the real rate of interest and the expected rate of inflation. Additionally it must be assumed that expectations with regard to the yield on real balances must be held with zero variance among individuals.[2] I have already shown that a competitive banking system which is able to create deposits and loans at zero marginal

---

[1] Edward Kane and Makiel Burton, "Bank Portfolio Allocation, Deposit Variability, and the Availability Doctrine," Quarterly Journal of Economics (February, 1965), pp. 113-35.

[2] See Alvin L. Marty, "Growth, Satiety, and the Tax Revenue from Money Creation," Journal of Political Economy, LXXXI (September/October, 1973), p. 1150.

cost, but is subject to a reserve requirement, cannot compensate its depositors by the full rate of inflation. The implication of this is that the bank rate on deposits would fall short of the Fisherian nominal rate of interest and that there would be some substitution of alternative forms of income-bearing assets for real balances.

To expand the scope of Bailey's model, I shall introduce another income-earning asset into the analysis. This asset, which I shall call share, is a claim to transferable physical capital. This modification allows us to deal with more general cases and provides us with more insight into the economics of inflationary processes.

A representative economic agent may be viewed as having to make three important decisions at the beginning of his planning period. They are the work/leisure decision, the consumption/saving decision, and the portfolio balance decision. In this section we shall assume that the representative agent has already made proper decisions with regard to his allocation of time between work and leisure and the allocation of his income between consumption and saving. Having made this assumption, we shall primarily be concerned with his portfolio balance decision.

The model developed below is based on the following assumptions:

(1) There are three types of assets which a transactor may hold. They are fiat money, bank money (demand deposits) and shares.

(2) Money is a productive asset and has a positive marginal product.

(3) The transactor has perfect certainty with regard to the non-pecuniary and pecuniary yield on each asset. In addition, it is assumed that the return on shares is fixed in real terms and the monetary value of the shares fall and rise in proportion to the price level.

(4) The transactor acts as if he is maximizing his economic well being -- his utility.

The Condition for Portfolio Balance Equilibrium

The problem facing a representative transactor in our hypothetical world is to allocate his accumulated savings or his carry-over purchasing power from the prévious period among shares, fiat money and bank deposits to maximize the utility or return that he expects these assets to provide.

Letting p^c denote the marginal productivity of fiat money, p^d the non-pecuniary yield on bank deposits, r^d the pecuniary yield on bank deposits and r the yield on shares, the problem of portfolio balance decision may be stated as:

$$\text{Maximize } R = p^c \cdot C + (p^d + r^d)D + r \cdot s \qquad (1)$$

$$\text{Subject to: } S + D + C - A \leq 0 \qquad (2)$$

$$S \geq 0 \qquad (3)$$

$$D \geq 0 \qquad (4)$$

$$C \geq 0 \qquad (5)$$

where R is total return and C, D, S and A are amounts of fiat money, bank money, shares and wealth, respectively. All the variables are defined in real terms. To maximize (1) subject to the inequality constraints listed above, we have to make use of the techniques of general mathematical progamming. Using the method of Lagrangian multipliers, the Kuhn-Tucker conditions for a maximum are derived as follows:

$$L(C, D, S, \lambda) = p^{c} \cdot C + (p^{d} + r^{d}) \cdot D + r \cdot S + \lambda(S + D + C - A + v) \tag{6}$$

where the Lagrangian multiplier is defined as $\lambda = \max(p^{c}, p^{d} + r^{d}, r)$ and v is a slack variable.

The first order conditions for a maximum are:

$$\frac{\partial L}{\partial C} = p^{c} - \lambda \leq 0 \tag{7}$$

$$\frac{\partial L}{\partial C}(C) = (p^{c} - \lambda) \cdot C = 0 \tag{8}$$

$$\frac{\partial L}{\partial D} = p^{d} + r^{d} - \lambda \leq 0 \tag{9}$$

$$\frac{\partial L}{\partial D}(D) = (p^{d} + r^{d} - \lambda) \cdot D = 0 \tag{10}$$

$$\frac{\partial L}{\partial S} = r - \lambda \leq 0 \tag{11}$$

$$\frac{\partial L}{\partial S}(S) = (r - \lambda) \cdot S = 0 \tag{12}$$

$$\frac{\partial L}{\partial \lambda} = S + D + C - A + v = 0 \tag{13}$$

From these conditions it can be inferred that when

$$p < \lambda \rightarrow C = 0, \quad p + r < \lambda \rightarrow D = 0, \quad \text{and} \quad r < \lambda \rightarrow S = 0.$$

Accordingly, the individual transactor allocates his wealth to those assets which promise the highest expected rate of return. The optimum amount of an asset may range from zero to total wealth. Unlike the classical linear programming problems, the Kuhn-Tucker conditions allow for corner solution; that is, they do not confine the optimum solution to the boundary of the opportunity set.[1]

The necessary condition for an individual transactor to hold all the three assets in his portfolio may be written as:

$$p^c = (p^d + r^d) = r = \lambda \qquad (14)$$

The rates of return in Equation (14) are all marginal magnitudes, rather than averages, and are expressed in percentage terms. If the non-pecuniary yield on bank money is sufficiently great, then the equilibrium rate on deposits may be negative.

Demand for Shares, Fiat Money and Deposits

Denote the proportion of wealth allocated to currency as k_1, the proportion of wealth earmarked to deposits as k_2 and the proportion of wealth allocated to shares as k_3. The relevant demand function for

---

[1]For a discussion of Kuhn-Tucker conditions see Michael E. Intriligator, Mathematical Optimization and Economic Theory (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1971), pp. 49-56.

each asset may be written as:

Currency:

$$k_1 = f^1(p^c, p^d + r^d, r) \text{ with } \frac{\partial k_1}{\partial p^c} > 0, \frac{\partial k_1}{\partial (p^d + r^d)} < 0, \text{ and } \frac{\partial k_1}{\partial r} < 0$$

Deposits:

$$k_2 = f^2(p^d + r^d, p^c, r) \text{ with } \frac{\partial k_2}{\partial (p^d + r^d)} > 0, \frac{\partial k_2}{\partial p^c} < 0, \text{ and } \frac{\partial k_2}{\partial r} < 0$$

Shares:

$$k_3 = f^3(r, p^d + r^d, p^c) \text{ with } \frac{\partial k_3}{\partial r} > 0, \frac{\partial k_3}{\partial p^c} < 0, \text{ and } \frac{\partial k_3}{\partial (p^d + r^d)} < 0$$

The interpretation of the partial derivatives are straightforward. The first partial, for example, states that the individual is, ceteris paribus, willing to hold more currency if, and only if, the marginal productivity of fiat money is increased. Likewise the second and third partials state that a ceteris paribus rise in the rate of interest on deposits or shares reduces the desire to hold real fiat money. A fall in the rate of interest has the opposite effect. Similarly, the fourth partial implies that the individual will be induced to hold more deposits relative to shares and fiat money if either the non-pecuniary or the pecuniary return or the sum of the two is increased. It is also seen that for a given income, state of arts, price level, yields on shares, deposits and fiat money there is an optimum currency deposit ratio and an optimum real balances share ratio which the transactor wishes to maintain in his portfolio.

The Impact of Inflation on Demand for Shares, Deposits and Currency

Inflation raises the opportunity cost of holding money and it induces asset holders to shift away from monetary assets to non-monetary assets. In the context of the model presented above, this means that currency and deposits become less attractive relative to shares to the representative transactor under inflationary circumstances. To avoid the extra cost of holding monetary assets brought about by rising prices, asset holders are induced to shift away from money toward real assets. As the transactors seek to reduce their holdings of monetary assets, prices move to a higher equilibrium level, thus reducing the real value of monetary assets and stimulating greater savings at given levels of the real rate of interest and real income (the Pigou effect). The increased demand for shares (savings) lowers the equilibrium real rate of interest at which the capital market is cleared.

For this argument to be entirely correct, one condition must be present. Under inflationary circumstances the yield on monetary assets -- the sum of pecuniary and non-pecuniary returns on money -- does not rise by the full amount of the expected rate of inflation.

In the context of the present theoretical framework, if the marginal productivity of currency -- p^c (the non-pecuniary return on currency) -- and total return on deposits -- pecuniary and non-pecuniary -- do not raise by the expected rate of inflation, the individual transactor is induced to substitute shares for currency and deposits in his portfolio. In other words, the individual transactor would seek to allocate a higher proportion of his real wealth to shares as compared to the pre-inflationary situation. Under a competitive banking system which is subject to reserve requirements, individual banks cannot afford to compensate their depositors by the full amount of the expected rate of inflation. The most the bank can pay is the rate of inflation times the quantity one minus the reserve ratio: $E(1 - k)$, where E is the expected rate of inflation and k is the reserve ratio. Now, if the non-pecuniary return on deposits does not rise by as much as the product of the rate of inflation with the reserve ratio, i.e., $E \cdot k$, the individual transactor finds himself in portfolio disequilibrium and would want to hold fewer deposits and more shares. Similarly, if the non-pecuniary return on currency does not rise by the full amount of the expected rate of inflation, there will be some substitution of shares for currency as well. Therefore, if it is assumed that non-pecuniary return and deposits do not rise or rise less than the expected rate of inflation, it is correct to infer that under inflationary circumstances transactors will expend effort to substitute real assets for monetary assets in their portfolios and thus drive the real rate of interest down.[1]

If this inference is accepted, it implies that the nominal loan rate of interest does not rise by the full amount of the expected rate of inflation. Banks will not, contrary to what Bailey has argued, charge a rate of interest equal to the sum of the original real rate of interest and the expected rate of inflation and consequently depositors will not receive enough compensation on their deposits. With the nominal rate of interest rising by less than the expected rate of inflation the opportunity cost of holding currency is: $r + H \cdot E - p^c$, where r is the original real rate of interest,

---

[1]Using an analytical framework originally introduced by Lloyd Metzler, Robert A. Mundell has shown that if money does not pay interest, inflation leads to a fall in the real rate of interest. For further analysis of the subject matter see Lloyd Metzler, "Wealth, Saving, and the Rate of Interest," Journal of Political Economy, No. 59 (April, 1951), pp. 93-116; Robert A. Mundell, "Inflation, Saving, and the Real Rate of Interest," Journal of Political Economy, No. 71 (June, 1963), pp. 280-83; J. M. Keynes, The General Theory of Employment, Interest, and Money (London: Macmillan, 1961), p. 143; Irving Fisher, The Theory of Interest (New York: Macmillan Co., 1930), p. 43; Edmund Phelps, "Anticipated Inflation and Economic Welfare," Journal of Political Economy (February, 1965), pp. 1-17; Milton Friedman, "Discussion of the Inflationary Gap," in Essays in Positive Economics (Chicago: University of Chicago Press, 1953), pp. 253-57. With the exception of Phelps, none of the authors mentioned above have explicitly introduced the banking system into analysis.

Edmund Phelps has made the observation that in a laissez faire banking system in which it is legal to pay interest on deposits, the advent of inflationary expectations would presumably lead profit-maximizing banks to raise the interest rate they pay to depositors enough to maintain the spread between the yields on money and shares and thus maintain their deposits and earnings in real terms. See his "Anticipated Inflation and Economic Welfare," Journal of Political Economy (February, 1965), p. 12.

As we have shown above, Phelps's conclusions are not entirely valid if the banks are subject to a reserve requirement.

H is a number less than one, E is the expected rate of inflation, and p^c is the non-pecuniary return on currency. Similarly, the opportunity cost of holding a dollar of deposit will be:

$$(r + H \cdot E)(1 - k) - r(1 - k) - p^d = H \cdot E \cdot k - p^d,$$

where p^d is the non-pecuniary return on deposits, and k is the reserve ratio. The conclusion to be drawn here is that within the theoretical framework developed by Bailey, the supply of bank loans has to increase by less than the expected rate of inflation. This implies that Bailey's conclusion that "Banks' profits will rise by the rate of inflation times their loans, which is just the rate of bank money creation"[1] is not valid. With a variable real rate of interest, bank earnings in nominal terms will increase by less than the rate of inflation. If this inference is correct, then bank earnings have to fall in real terms under inflationary circumstances.

Inflation and the Productivity of Real Balances

Karl Brunner and Allan Meltzer have argued that inflation "increases frequency of change in market conditions." These changes, they maintain, "increase uncertainty and the variance of exchange ratios and thus raise the marginal productivity of money during inflation."[2] At first sight, this seems to be an argument in favor of Bailey's implicit assumption that money remains a dominant asset in transactors'

---

[1] Martin Bailey, National Income and the Price Level: A Study in Macroeconomic Theory (New York: McGraw-Hill Book Company, 1971), p. 78.

[2] Karl Brunner and Allan H. Meltzer, "The Uses of Money: Money in the Theory of an Exchange Economy," American Economic Review (December, 1971), p. 801.

portfolios during an inflationary process. If the marginal productivity of money increases enough to keep the individual transactors indifferent in choosing between monetary and non-monetary assets, then there would be no shifts away from the former type of asset to the latter. This argument would not, however, be valid under conditions of anticipated inflation. An anticipated inflation causes changes in relative prices and thus is neutral in its effects on the variance of exchange ratios. The inflation tax on money, however, reduces the net return on holdings of real balances and induces the transactors to look for inflation-proof means of payments and assets whose yields are not vulnerable to increases in the price level. Substitution of non-monetary assets for monetary assets would be the natural course of action during an inflation which everybody anticipates. The Brunner-Meltzer argument may have some validity during conditions of unanticipated inflation. But Bailey has not considered this case, and his model is not applicable to situations of unanticipated inflation.

My conclusion up to this stage is that even in an economy as simple as the one hypothesized by Bailey, no definite and conclusive inference can be derived as to the effects of an anticipated inflation on banking profitability. In a subsequent section, I shall examine banking performance and the impact of anticipated inflation on bank earnings within a monopolistic market structure. Since most banking markets are closed and are characterized by monopolistic elements, my analysis of a monopolistic bank should shed more light on the subject matter of the present inquiry.

Demand for Bank Loans

In analyzing a transactor's demand for loans, one must examine two closely related issues: First, the factors which generally necessitate a need for borrowing; second, the reasons or motives of a transactor for choosing one type of debt instrument rather than another.

At this point, we shall limit the discussion to the second issue and will take up the first question at a later stage. In view of this, the representative transactor is presumed to have already made plans as to the amount of loans he wants to borrow at the beginning of his planning horizon.

Depending upon the existing financial market structure and his credit standing, a transactor has access to a variety of debt instruments to meet his loan demand. These may include borrowing from an intermediary (a bank), issuance of bonds, equities, commercial papers and/or stocks. To remain consistent, we shall continue to make the basic behavioral assumption that the representative transactor compares the costs of various debt instruments and acts as if he is maximizing his economic well being. To put it differently, the transactor is a wealth maximizer and will choose that set of debt instruments which, under the prevailing constraints, will minimize the expected costs of securing a specified amount of funds from available sources. Within the framework of the present analysis, the individual borrower may be viewed as facing a problem analogous to the problem facing the individual lender whose behavior we have examined in some detail. It was pointed out that the individual lender allocates his wealth among various assets such that at the margin the return on these assets adjusted for risk is equalized. Similarly, an individual borrower will choose that combination of debt instruments which maximizes his wealth. An optimal choice in this instance is attained when the perceived marginal costs inclusive of risk and transaction costs on different debt instruments are equalized.

To make the analysis lucid, we single out some further simplifying assumptions:

(1) There are two types of debt instruments which the individual may choose to hold -- bank loan and bond issue. Borrowing from the bank may be thought of as issuing short-term bonds to meet short-run contingencies. Bond issue may be looked at as borrowing in the long-term loan market.

(2) The individual borrower has perfect foresight with respect to the relative costs of different debt instruments.

(3) The bond market (or the market for long-term loans) is competitive.

With these assumptions in mind, a transactor's demand for loans may be written as:

$$L^d = g(r^L, r^B, p^*),$$

where L^d denotes demand for loans, r^L interest rate on loans, r^B interest rate on bonds and p^* the expected rate of inflation. We impose the following restrictions on the demand function for loans:

$\frac{dL^d}{dr^L} < 0$, which says the demand function for loans is downward sloping, and $\frac{dL^d}{dr^B} > 0$, which implies that bank loans and bond issues are substitute debt instruments. A <u>ceteris paribus</u> rise in r^B, the effective rate of interest on bonds, shifts the demand for bank loans to the right. Conversely, a fall in r^B shifts the demand for bank loans to the left, towards the origin.

A more realistic specification of demand for bank loans should include a proxy for the level of economic activity. As a first approximation we shall use per capita nominal income for this purpose. With this amendment the demand function for bank loans may be written in linear form as:

$$L^d = a_o - a_1 r^L + a_2 r^B + a_3 p^* + a_4 (Y/N),$$

where Y/N is per capita nominal income, and the other variables have the same definitions as given above.

In a similar fashion we shall write the demand function for bank deposits as:

$$D^d = b_o + b_1 r^d - b_2 r^B - b_3 p^* + b_4 (Y/N),$$

where r^d is the interest rate on deposits, r^B is the interest rate on bonds, p^* is the expected rate of inflation, and (Y/N) is per capita income.

Since, in the present model, lending and borrowing activities are conducted via a bank's intermediation we have to introduce a bank into the analysis. To determine the level of r^d -- interest payment on deposits -- we have to have an estimate of r^L -- interest rate on loans.

The following simplifying assumptions are made with regard to the economic position of the bank in the system.

(1) There is only one bank in the community under consideration.

(2) This bank is a monopolist and is regulated by the government.

(3) The bank is a profit maximizing entity.

(4) The bank has to make decisions with regard to (a) the composition of its assets and liabilities and (b) the scale of its operation.

(5) The bank faces at least three separate constraints: government directives with regard to reserve requirements; the public's demand for loans; and the public's demand for deposits -- supply of savings.

(6) The decision variables available to the bank are r^L and r^d, the loan rate and the deposit rate. Through making the necessary adjustments in these variables, the bank will make efforts to attain its optimal portfolio mix.

(7) The bank's portfolio has three components -- required reserves, customers' loans (short-term loans) and bonds (long-term loans).

(8) The bond market is competitive, while the short-term loan and deposit markets are not.

The Model

In the light of these assumptions, the monopoly bank may be viewed as operating in two different markets: the short-term loan market, and the bond market (the long-term loan market). The profit maximization hypothesis implies that a price discriminating monopolist allocates his output among different markets such that marginal revenues in all markets are equalized. Likewise, the monopoly bank will arrange its portfolio such that the marginal revenue earned in the short-term loan market is equal to the marginal revenue earned in the bond market.[1] The bank is in full equilibrium when the marginal cost of acquiring deposits is equated with the common marginal revenue earned in the short-term market and the bond market.

Assuming that there is only one individual borrower and one single lender, the demand function for loans and deposits may be written as:

$$L^d = a_o - a_1 r^L + a_2 r^B + a_3 p^* + a_4 Y \quad (1)$$

$$D^d = b_o + b_1 r^D - b_2 r^B - b_3 p^* + b_4 Y \quad (2)$$

The marginal revenue from loans is:

---

[1]An example incorporating this assumption is a model by Mario Monti, "A Theoretical Model of Bank Behavior and its Implication for Monetary Policy," L'industria (April, 1971), pp. 165-90.

$$Mr(L) = \frac{d(r^L \cdot L)}{dL} = r + L\frac{dr^L}{dL} =$$

$$= r^L + (a_o - a_1 r^L + a_2 r + a_3 p + a_4 Y) - (\frac{1}{a_1})$$

Given the assumption of a competitive bond market, the bank's marginal and average revenue from this market are equal. Hence the marginal revenue from bonds is:

$$Mr(B) = r^B + g^e,$$

where g^e is the expected net capital gain from holding a dollar of bond.

Equating the two marginal revenues we have:

$$Mr(L) = Mr(B) = -a_o + 2a_1 r^L - a_2 r^B - a_3 p^* - a_4 Y = \\ = a_1 (r^B + g^e) \quad (3)$$

Total cost is the sum of interest costs on deposits plus the costs of maintaining and servicing deposits, plus the cost of making loans. To simplify the algebra we assume that all other costs except the interest cost may be lumped together and denoted by C. For the time being, the transaction costs of selling and buying bonds are assumed to be zero. We also ignore the risk of default on loans. Note that C is the net of non-interest revenues (service charges) but includes expected capital losses on bonds.

Algebraically, the total cost function may be written as:

$$TC = r^d \cdot D + C$$

and marginal cost as:

$$MC = r^d + D \frac{dr^d}{D} + \frac{dC}{dD}.$$

Assuming that the marginal cost of creating a unit of deposit and making a unit of loan is negligible enough to be ignored (putting additional zeros in front of a dollar of deposit or a dollar of loan will not cost anything), the equation for marginal cost can be written as:

$$MC = r^d + (b_o + b_1 r^d - b_2 r^B - b_3 p^* + b_4 Y) \left(\frac{1}{b1}\right)$$

Setting marginal cost equal to marginal revenue, i.e., $r^B + g^e$, we have:

$$MC = MR(L) = MR(B) = b_1 r^d + b_o + b_1 r^d - b_2 r^B - b_3 p^* - b_4 Y = \qquad (4)$$

$$= b_1 (r^B + g^e)$$

The equilibrium solution for loan rate and deposit rate may be obtained from solving Equations (3) and (4) above.

The solution for the equilibrium loan rate is:

$$r^*L = \frac{(a_1 + a_2) r^B = a_3 p^* + a_4 Y + a_o + g^e b_1}{2a_1} \qquad (5)$$

The solution for the equilibrium deposit rate is:

$$r^{*D} = \frac{(b_1 + b_2) r^B + b_3 p^* + b_4 Y + b_1 g^e - b_o}{2b_1} \qquad (6)$$

Substituting the equilibrium values of loan rate and deposit rate in the demand for loans and supply of deposits we can derive the equilibrium level of deposits and loans as follows:

$$D^* = \frac{b_o + (b_1 - b_2)r^B - b_3p^* + 3b_4Y + b_1g^e}{2}$$

$$L^* = \frac{3a_o + (a_1 + 3a_2)r^B + 3a_3p^* + 3a_4Y + a_1g^e}{2} \qquad (7)$$

The equilibrium level of bonds can be derived from using the following identity:

$$R + L + B = D.$$

If k stands for the legal reserve requirement then this identity may be rewritten as:

$$kD + L + B = D,$$

from which we can calculate for B.

$$B = D - kD - 1.$$

Putting the equilibrium stocks of deposits and loans in this identity we get the equilibrium stock of bonds:

$$B^* = D^* - kD^* - L^*$$

or

$$B^* = (1 - k)D^* - L^*$$

Graphical Illustration

In Figure 2 the amount of credit produced by the bank is measured in dollars on the horizontal axis. Loan rate and bond rate are measured on the vertical axis. The bank faces a downward sloping demand curve for loans and a horizontal demand curve for long-term loans. The assumption of a competitive bond market implies that the bank is free to choose the amount of bonds which it finds profitable to hold per period of time. If the marginal cost of acquiring deposits is given by the upward cloping SS curve, the profit maximizing bank will want to produce a total volume of credit of OB per period of time. Of this amount, OL is allocated to the loan market and LB is diverted to the bond market.[1]

The bank charges a rate of Or^L on its loans and pays out a rate of Br^D on its deposits. Note that in this construction the marginal revenue of loans, MR^L, intersects the marginal cost curve below Or^B, the bond rate, which implies that the bank finds it profitable to operate in both markets. If the marginal cost curve cuts the marginal revenue curve above the going bond rate, the bank would want to operate only in the loan market as shown in Figure 3.

In Figure 3 the bank charges Or^L on a dollar of loan and pays LG on a dollar of deposit. Note that both the loan rate and the

---

[1]This type of graphical analysis of portfolio allocation has been used by a number of authors in different connections. See, for example, Bernard Shull's "Commercial Banks as Multiple-Product Price Discriminating Firms" in Banking and Monetary Studies, ed. by Dean Carson, op. cit., pp. 351-68, and Erik Brucker, "A Microeconomic Approach to Banking Competition," Journal of Finance (December, 1970), pp. 1133-41.

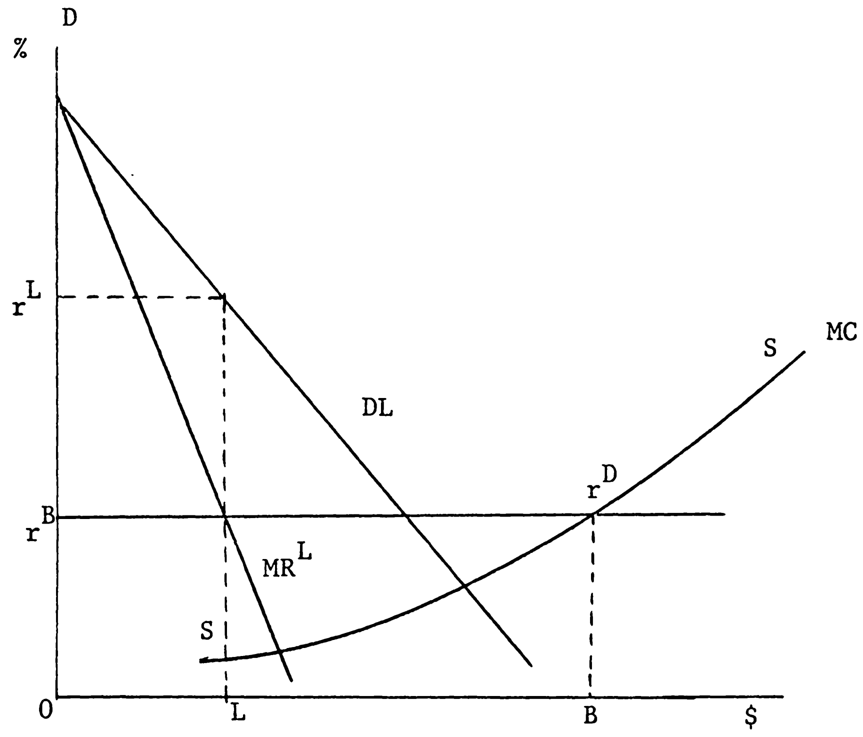


Fig. 2.--Portfolio allocation.

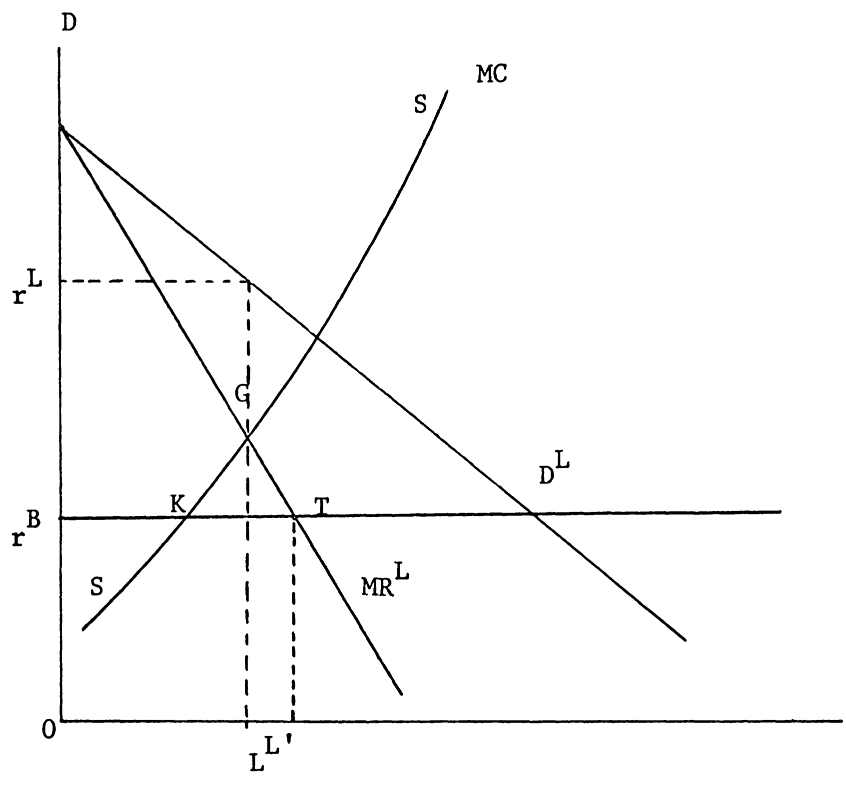


Fig. 3.--Portfolio allocation.

deposit rate are higher than the bond rate in this situation. This solution is not, however, stable if the bank already has some bonds in its portfolio. Assuming that the bank does not incur capital losses on its sale of bonds, it is less costly for the bank to turn to the bond market for purposes of securing funds. The bank will continue to sell securities to the point where the marginal cost of acquiring funds in both the security market and the deposit market are equal.

The Impact of Inflation on a Bank's Earnings

One way of measuring the impact of inflation on a bank's earnings is to determine whether inflation increases the spread between average revenue and marginal cost or not. This measure was originally proposed by A. Lerner and has been used by economists in different contexts.

Letting M represent the spread between the loan rate (average revenue) and the deposit rate (marginal cost), and using the equilibrium loan rate and deposit rate as derived above, we have:

$$M = r^*L - r^*D = r^B\left(\frac{a_1 + a_2}{2a_1} - \frac{b_1 + b_2}{2b_1}\right) + p^*\left(\frac{a_3}{2a_1} - \frac{b_3}{2b_1}\right) + Y\left(\frac{a_4}{2a_1} - \frac{b_4}{2a_1}\right) + g^e\left(\frac{a_1}{2a_1} - \frac{b_1}{2b_1}\right) + \left(\frac{a_o}{2a_1} - \frac{b_o}{2b_1}\right) \qquad (8)$$

Differentiating (8) with respect to the rate of inflation, p*, we have:

$$\frac{dM}{dp^*} = \frac{dr^B}{dp^*}\left(\frac{a_1 + a_2}{2a_1} - \frac{b_1 + b_2}{2b_1}\right) + \frac{dp^*}{dp^*}\left(\frac{a_3}{2a_1} - \frac{b_3}{2b_1}\right)$$
$$+ \frac{dY}{dp^*}\left(\frac{a_4}{2a_1} - \frac{b_4}{2a_1}\right) + \frac{dg^e}{dp^*}\left(\frac{a_1}{2a_1} - \frac{b_1}{2b_1}\right) \qquad (9)$$

If the bond market is competitive, then

$$\frac{dr^B}{dp^*} = 1,$$

and (9) is further simplifed:

$$\frac{dM}{dp^*} = \left(\frac{a_1 + a_2}{2a_1} - \frac{b_1 + b_2}{2b_1}\right) + \left(\frac{a_3}{2a_1} - \frac{b_3}{2b_1}\right) + \frac{dY}{dp^*}$$
$$+ \frac{dg^e}{dp^*} \qquad (10)$$

To be able to infer any conclusion at all from Equation (10) we must have information about the coefficients of the loan demand function and the supply of deposits function. It is obvious that different presumptions about these coefficients will lead to different conclusions. The crucial question, then, is: What kind of a priori assumptions can one make about the parameters of the loan demand function and the supply of deposits function? The present theoretical model is based on the assumption of a competitive long-term loan (bond) market and we shall utilize this assumption to carry the analysis one step further.

The assumption of a competitive bond market implies that marginal revenue and average revenue on bonds are equal, which further implies the following condition for an overall equilibrium:

$$Mr^B = Ar^B = Mr^L = Mc^D, \tag{11}$$

where Mr^B represents marginal revenue, Ar^B revenue in the bond market, Mr^L represents marginal revenue in the loan market and Mc^D marginal cost of acquiring funds.

Using this condition Equation (8) above may be rewritten as:

$$M = r*^L - r*^D \qquad M = r*^L - r^B \tag{12}$$

where $r*^L$ is the loan rate (average revenue), and $r*^D$ is the deposit rate (the marginal cost). In equilibrium, marginal cost (the deposit rate) is equal to marginal revenue in the bond market (the bond rate). Average revenue on loans is related to marginal revenue on loans according to the following formula:

$$Mr^L = r*^L(1 - \frac{1}{E}),$$

where E is the elasticity of the demand for loans and is defined as a positive number. This equation can be rewritten as:

$$r*^L = Mr^L \frac{E}{E-1} \tag{13}$$

This formula has a flaw in that it gives an indeterminate solution when the elasticity of demand is equal to unity. If the elasticity of demand is unity, then marginal revenue is equal to zero, and the formula predicts a solution for average revenue such that:

$$Ar = 0(\frac{1}{1-1}) = \frac{0}{0}$$

This difficulty is, nevertheless, apparent and not real and does not pose any difficulty within the present context. If the monopoly bank faces a unitary elastic demand schedule, it simply has to equate marginal cost with average revenue for profit maximization. Changes in the demand for loan schedule and the supply of deposits schedule have no bearing upon the spread between average revenue and marginal cost, as this spread remains zero so long as the demand remains unitary elastic.

With this qualification in mind, we shall make use of Equation (13) to further simplify Equation (12). Given that in equilibrium marginal revenue from loans is equal to marginal revenue on bonds, Equation (13) can be rewritten as:

$$r*^{L} = r^{B}\left(\frac{E}{E-1}\right) \qquad (14)$$

Substituting for average revenue on loans in Equation (12) we have:

$$M = r^{B}\left(\frac{E}{1-E}\right) - r^{B} \qquad (15)$$

To ascertain the effects of inflation on the spread between average revenue and marginal cost, Equation (15) is differentiated with respect to the rate of inflation.

$$\frac{dM}{dp*} = \frac{dr^{B}}{dp*_{B}}\left(\frac{E}{E-1}\right) + r^{B}\,\frac{\frac{dE}{dp*}(E-1) - \frac{dE}{dp*}\cdot E}{(E-1)^{2}} - \frac{dr}{dp*} \qquad (16)$$

The assumption of a competitive bond market implies that $\frac{dr^{B}}{dp*} = 1$. Using this assumption, Equation (16) can be further summarized to:

$$\frac{dM}{dp^*} = \frac{E-1 - r^B \frac{dE}{dp^*}}{(E-1)^2} \tag{17}$$

From Equation (17) one is able to derive some preliminary inferences regarding the impact of inflation on bank profitability:

(1) If the demand for loans is elastic, i.e., E is greater than unity, and the demand schedule shifts out in a parallel fashion due to inflation, then the monopoly bank gains, or at least is in a position to gain, from inflation.

(2) If demand is elastic, but becomes less elastic due to inflation, i.e., if $\frac{dE}{dp^*}$ is less than zero, then the monopoly bank gains from inflation.

(3) If the demand for loans is elastic and becomes more elastic, i.e., if $\frac{dE}{dp^*}$ is positive, no definite conclusion can be drawn from Equation (17) without prior knowledge about the magnitudes of E, $\frac{dE}{dp^*}$ and r^B.

(4) Finally, if the demand for loans is unitary elastic, inflation exerts no influence upon the spread between average and marginal revenues, and the individual is neither made better off nor worse off by inflation.

It is also obvious from Equation (17) that if the short-term loan market is perfectly competitive, demand elasticity will be infinity, and $\frac{dM}{dp^*}$ would approach zero. The bank will not be in a position to gain from inflation.

The Relevance of Cases 1 and 2

Historically speaking, some economists have led us to believe that inflation causes an increase in the marginal efficiency of capital and therefore, given the rate of interest, some investment projects which would be unattractive or doubtful in a period of stable prices may become definitely attractive under inflationary conditions.[1] This argument is based upon the Keynesian postulate that investment decisions are guided by the relationship between the marginal efficiency of capital and the rate of interest. Other things being equal, if prices and revenues as well as the operating costs relevant to an investment decision rise in approximately the same proportion, the excess of the prospective yield over the supply price of the asset in question rises -- implying that its marginal efficiency rises. This, of course, is a plausible argument if other things do, in fact, remain equal. More specifically, if any of the following conditions, or a combination of them, hold, then the argument may have some validity. These conditions are:

(a) All new investments are financed by borrowing.

(b) Movements in the rate of interest lag behind those of prices.

(c) The government takes appropriate monetary actions to maintain the rate of interest constant.

---

[1]See N. Kaldor, "Economic Growth and the Problem of Inflation," Economica (November, 1959), pp. 289-90.

(d) Due to a fall in the Fisherian real rate the rate of interest does not rise by the full amount of the expected rate of inflation.

For our purposes we shall assume that the first condition is present; i.e., all new investments are financed by borrowing, and hence shall address ourselves to the remaining conditions.

The Relationship Between the Rate of Interest and Prices

It is often argued that movements in the rate of interest tend to lag behind those of prices due to the fact that bond and security holders (savers) are slow in revising their preferences. The reason for this is not difficult to see. Bond and security holders may not be able to revise their preferences without suffering financial losses. At any given time, there exists a stock of bonds and securities which the public holds in its portfolio. Unless the rate of inflation and, by implication, the expected rate of interest exceeds a critical rate and the expectation of inflation is widespread, bond and security holders may be unwilling to shift from old to new securities. To put it differently, unless savers expect that the extra gains realizable on new bonds and securities exceed the capital losses on old bonds and securities, they may not want to revise their preferences. This point has often been ignored in economic theory and has not received adequate attention by economists who address themselves to the question of the relationship of the rates of interest and prices at an empirical level. In a recent study, William P. Yohe and

Denis S. Karnosky[1] have shown that there exists an inverse relationship between the adjustment time of interest rates and the rate of inflation. Their evidence indicates that the higher the rate of inflation, the shorter is the lag of interest rates behind prices. According to their findings, the total price expectations in the 1961-1969 period (a period that after 1964 was characterized by a rapidly rising price level) was higher than in the earlier period (1952-1960). In the 1961-1969 period the total effect on the short-term interest rates was about 90 percent of the annual rate of change in prices. The total effect on the long-term rates was about 80 percent of the rate of change of prices.[2] Although Yohe and Karnosky's study supports the old hypothesis that interest rates lag behind prices, they try to convey the impression that "the total effect of price expectations on interest rates and the speed at which they are formed appear to have increased since 1960."[3] Yohe and Karnosky do not, however, fully exploit the implications of their findings. Interest rates tend to lag behind prices, they seem to imply, because of imperfect foresight about the future prices and "the resulting inclination to extrapolate past price changes into the future in order to adjust interest rates for expected changes in prices."[4] They do, however, bypass the central question as to why interest rates adjust faster in the face of high

---

[1]William P. Yohe and Denis S. Karnosky, "Interest Rates and Price Level Changes, 1952-1969," Federal Reserve Bank of St. Louis Review (December, 1969), pp. 19-36.

[2]*Ibid.*, p. 29. [3]*Ibid.*, p. 35. [4]*Ibid.*, p. 19.

rates of inflation and slower under circumstances when inflationary pressures are not widespread. In the opinion of this writer, this phenomenon has to do with the expected costs and gains savers think they have to bear in order to readjust their portfolios. If the expectations of inflation are high and widespread, as has been the case since 1964 in the United States, savers (holders of bonds and securities) are induced to dampen their bonds and securities at a faster rate than when the expectations of inflation are low and limited.

If it is accepted that movements in the rates of interest lag behind those of prices, then the expectations of a higher rate of return on capital re-enters the credit market as an expanded demand for bank loans. Assuming that the monetary authorities do not follow policies to peg the loan rate by continuously beefing up the monetary base, there will be a rise in the market rate of interest but not by as much as the rate of increase of prices. To the extent that banks themselves engage in speculative activities, they may benefit from the lag of interest rates behind prices. But if the banks limit their activities to intermediation, there is no reason why this phenomenon should be beneficial to banks. To meet the extra demand for loans, the banks have either to sell their own securities (thus taking capital losses) or offer higher rates of compensation to their depositors and/or both. In this instance, the banks merely serve as vehicles for transferring income from one group of their clients to another. In a later section I shall present evidence indicating that in the 1950s and the 1960s the United States banks moved in both directions during expansionary periods.

Constant Loan Rates and Bank Profitability

In the last section of this inquiry I present data on the performance of the Chilean Commercial banks during an inflationary period extending from 1937 to 1950. During this period the Chilean monetary authorities followed policies aimed at keeping the loan rate fairly constant by maintaining the discount rate at 4-1/2 percent and providing the banks with a substantial amount of credit. The evidence tends to suggest that this policy gradually led to a wider and wider spread between the rate at which the banks could borrow money from the Chilean Central bank and the rate charged on their short-term loans. Although this policy allowed the Chilean banks to share the inflation tax revenue with the Chilean government, the evidence suggests that the inflationary environment intensified competition among the commercial banks, forcing them to share some of their gains (or all of their gains according to David L. Grove[1]) with those who were lucky enough to receive loans from banks. Grove, in his consideration of the impact of the Chilean inflation upon the commercial banks of that country, has made the following observation:

> The joint action of the banks intensifies the very effects which they are endeavoring to escape (i.e. a fall in their real profit), but this is not apparent to any individual banker, or, if it is, it does him no good to leave the race. The only

[1]David L. Grove, "The Role of the Banking System in the Chilean Inflation," International Monetary Fund Papers (September, 1951), pp. 33-59.

> thing he can do to protect his shareholders and to maintain the relative standing of his bank is to try to run a little faster than his fellow bankers. Moreover, once the inflationary process is well under way, bankers are likely to fear that any cessation of the inflationary process would involve a liquidation crisis and a deflation which would result in many loans turning sour, with consequent losses to the bank. Thus, to some extent, the individual banker finds himself between Scylla and Charybdis. If he does not expand credit at a rapid rate, the rising price level will reduce the real value of his bank's capital and earnings. On the other hand, each banker realizes that the more extended is his loan portfolio, the more vulnerable is his bank's position, because an eventual cessation of the inflationary process may well involve large scale insolvencies which may severely endanger the liquidity and solvency of the banking system. Nevertheless, once the inflationary process has begun, bankers ordinarily have little alternative but to join in the process, provided they can obtain funds from the Central Bank or elsewhere. The Central Bank of Chile, standing ready to meet the demands of the banks and other borrowers at low rates of interest, has not been an effective obstacle to the process of credit expansion by other banks.[1]

Grove's conclusion, inconclusive as it is, seems to shed some light upon my own conclusion. In deriving Equation (17), above, it was noted that inflation may have a perverse effect upon the elasticity of the loan demand function. The Chilean experience tends to suggest that the demand for loans became more elastic due to an intensified competition among the commercial banks of that country. In terms of Equation (17), this implies that the derivative of the demand elasticity with respect to the expected rate of inflation, $\frac{dE}{dp^*}$, is positive and that no definite theoretical conclusion may be made without prior knowledge of the elasticity of the loan demand function as well as the resultant change in the elasticity.

---

[1] *Ibid.*, p. 58.

The Real Rate of Interest and Inflation

In our discussion of the impact of inflation upon the real rate of interest, it was noted that movements in the nominal rate of interest may not lag behind those of prices. We cited a theoretical contribution by Robert A. Mundell[1] in which he demonstrated that the money rate of interest is likely to rise by less than the rate of inflation due to a fall in the real rate of interest. If we accept Mundell's conclusion, then we have a situation which is essentially analogous to Condition (2), discussed above.

Summary

It is worth emphasizing that attempts to reduce banking performance to a single equation without giving due consideration to elements of supply and demand are doomed to be no more than exercises in semantics. Workings of banking and credit markets are so complex that macro models of banking behavior tend to be more misleading than illuminating. It has been emphasized that application of relative price theory to banking and credit markets can improve our understanding of banking behavior to some extent. But the amount of insight gained is relative rather than absolute. There remain questions which ultimately have to be settled at an empirical level. A case in point is the performance of a monopoly bank during an inflationary period. It has been shown that without prior knowledge of the parameters of

---

[1]Robert A. Mundell, "Inflation and Real Interest," Journal of Political Economy (June, 1963), pp. 280-83.

the loans demand function and the supply of deposits function no definite conclusion can be drawn with regard to profitability of banking in inflationary periods.

Unanticipated Inflation and Banks

In the preceding sections the analysis was made in terms of models which assumed that inflation was fully anticipated. To make the analysis more general we shall relax this assumption and re-examine bank profitability under conditions of unanticipated inflation.

Unanticipated inflation differs from anticipated inflation in that the expectations about the rate of inflation fall short of the actual rate of inflation. In these circumstances, individual transactors fail to take account of the full inflation tax which they have to bear on their holdings of real balances and continue to increase their nominal holdings of cash balances at a rate equal to the difference between the actual rate and the expected rate of inflation. This implies that nominal interest rates do not increase as much as the actual rate of inflation.[1]

During the course of an unanticipated inflation expectations with regard to prices and interest rates cannot be assumed to be uniform. Depending on their degree of knowledge about market conditions and their past experience, different individuals would have

---

[1] Reuben A. Kessel and Armen A. Alchian, "Effects of Inflation," Journal of Political Economy, LXX (December, 1962), p. 525.

different probability distribution about rates of return on income earning assets and the future course of prices. The question involved here is how lenders, borrowers and banks formulate their expectations, and how they arrange their portfolios in light of their expectations. Do banks have better and cheaper access to information about the trend of prices and interest rates than the public? Do lenders and borrowers hold identical expectations about the future course of prices and interest rates, or is their subjective probability distribution about these variables substantially different? Which side of the market triggers an expansion of credit through the banking system?

To give any general answer to these questions is to venture into speculative territory. Nevertheless, one can draw on the present body of statistical and theoretical literature to give some partial answers to some of the questions raised above. It is to this end that the following model has been designed.

The Model

To make the analysis as simple as possible, we shall assume that the real quantity of deposits demand per unit of time is directly related to the deposit rate, inversely related to expected yield on bonds and the expected rate of inflation, and positively related to real income. Note that if the actual or realized rate of inflation is greater than the anticipated or expected rate, the nominal demand for bank money shifts to the right by the amount of the discrepancy between the expected and actual rate of inflation. Also note that if the banks continue to compensate their depositors at the rate of inflation they expect, rather than the actual rate, the demand for real bank deposits will remain invariant.[1]

Algebraically the demand for real balances may be written as:

$$\frac{D}{P} = b_0 + b_1 r^d - b_2 r^B - b_3 E^d + b_4 y \qquad (1)$$

where

$\frac{D}{P}$ is the real quantity of deposits demanded per unit of time,

r^d is the expected rate on deposits,

r^b is the expected bond yield,

E^d is the expected rate of inflation held by depositors, and

y is the expected real income.

Likewise we shall write the demand for real loans as follows:

$$\frac{L}{P} = a_0 - a_1 r^L + a_2 r^B + a_3 e^b + a_4 y, \qquad (2)$$

where L/P is the real quantity of loans demanded per unit of time, r^L is the expected loan rate, E^b is the expected inflation by borrowers, and the other variables are the same as above.

We shall retain our assumptions of a competitive bond market, a monopolistic loan market, and full employment. We shall also assume that inflationary expectations are set in motion by successive increases in the monetary base.

---

[1]See Kessel and Alchian, op. cit., p. 524. These authors maintain that during an unanticipated inflation the observed depreciation in the purchasing power of money implies no changes in relative demand and supply of bonds.

We begin the analysis by first considering the responses of deposit holders to changes in the expected rate of inflation. Given their expectations about price changes and the relative yield structure of different assets, deposit holders would plan to maintain a particular amount of real deposits at any point in time. With a zero expected rate of inflation, for example, the public demands D_1/P_1 amount of real deposits. Changes in the expected rate of inflation influence the deposit demand functions in two ways. First, given an expected bond yield, an increase in the rate of inflation shifts the demand function to the left (Figure 4). Second, given the assumption of a competitive bond market, an increase in the expected rate of inflation will exert some upward pressure upon the bond yield which in turn would influence the demand for real deposits. Whether the increase in the bond yield would further reinforce the leftward change in the deposit demand function or not depends upon the anticipation of deposit holders about the future trend of interest rates. If the deposit holders, for instance, regard the increase in the bond yield as a signal for further increases in the interest rate, they may choose to hold less bonds relative to deposits. On the other hand, if the increase in the bond yield is taken to be a temporary phenomenon, deposit holders may be induced to swap their bank money for bonds, bidding up bond prices in the process and thus lowering their potential yield. A third possibility would be for the deposit holders to remain passive to changes in the expected rate of inflation and bond yield if they believe that such changes are short run. In this case, bond yield has to increase at least above some threshold level to induce considerable movements from deposits into bonds.

Borrowers' Reactions

Changes in the expected rate of inflation affect the loan demand function in two ways: directly, via the inflation rate coefficient, and indirectly, through its influence upon the bond yield. In the course of an inflationary process, borrowers find that they need more and more cash and other liquid capital such as bank money to effect their current transactions. Additionally, if increases in the bond yield are interpreted as an increase in the rate of return on real investment, borrowers would be further encouraged to increase their demand for loans. In terms of Figure 5, an increase in the rate of inflation leads to a rightward shift in the demand for loans.

Reaction of a Representative Bank to Changes in the Demand for Deposits and Loans

The reaction of a representative bank to inflation-induced changes in demand for deposits and demand for loans can be investigated under various behaviorial assumptions about lenders, borrowers and the bank itself. The discussion can be greatly simplified if we make the assumption that the representative bank responds to changes in the demand for deposits and demand for loans to meet the same amount of real loans per period of time. Expressed differently, we shall assume that the bank acquires enough funds to maintain the volume of its loans constant in real terms.

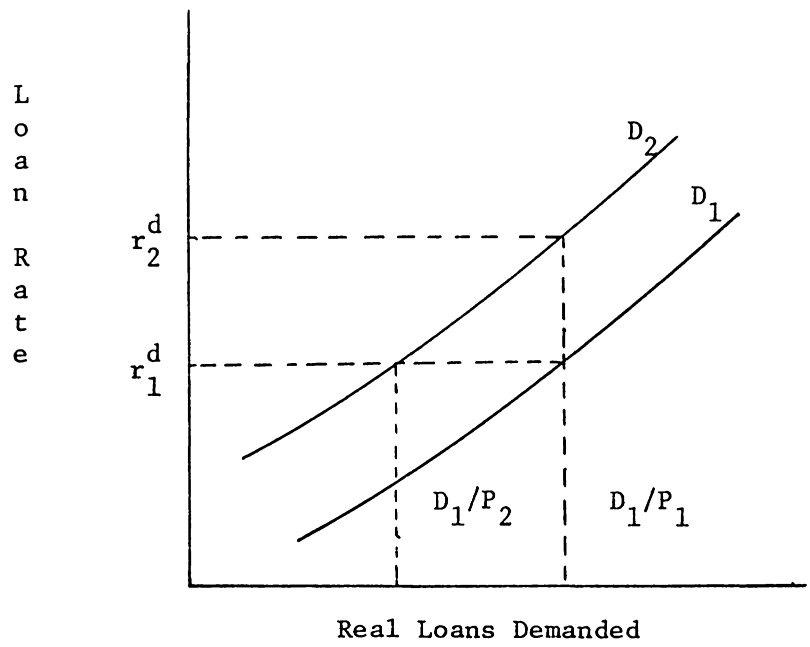


Fig. 4.--Loan demand function.

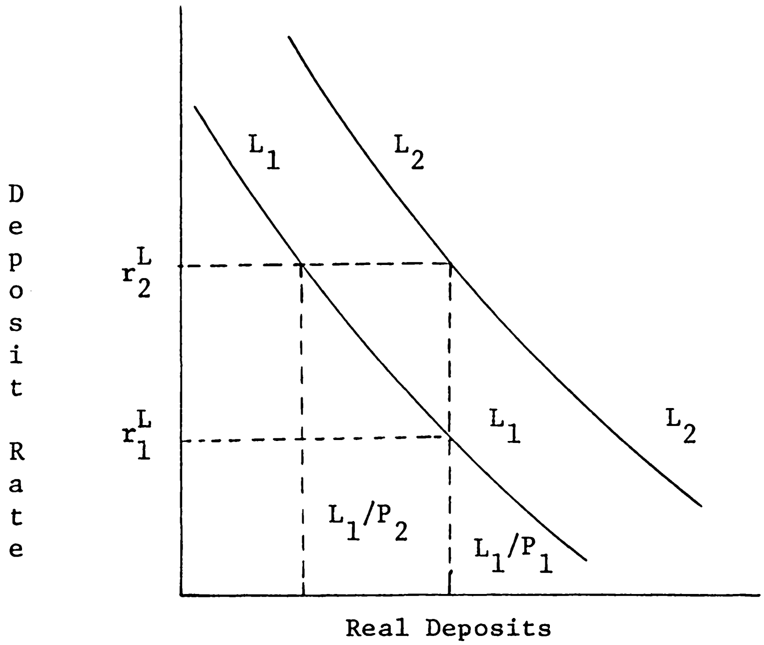


Fig. 5.--Loan demand function.

In terms of Figure 5, this implies that if, due to increases in the price level, the amount of real loans falls from the level denoted by (L_1/P_1) to the level marked (L_1/P_2), the bank takes whatever actions necessary to maintain its loan level at (L_1/P_1). Whether the bank can realize some extra income from this operation or not depends upon the reaction of the lenders to changes in the rate of inflation. In this connection one can conceive of various situations.

(1) Depositors remain passive to changes in the expected rate of inflation or they respond to such changes with a time lag. This case is illustrated in Figure 6. The demand for real deposits is horizontal up to a certain point and then becomes positively sloped. In this case, the increase in the rate of inflation reduces the real deposit rate from r_1^d to r_2^d and the quantity of real deposits from (D_1/P_1) to (D_1/P_2). If the deposit holders continue to increase their nominal holdings of deposits to keep its value constant in real terms, then the bank can and has the opportunity to profit from the passiveness of the public. The bank may share some of these profits with its borrowers. The extent of the gain accrued to the bank in this situation is derived mathematically below.

(2) Depositors do not react as strongly as lenders to changes in the expected rate of inflation and the associated changes in the bond yield. That is, one may conjecture a situation in which the extent of the shift in the loan demand function is greater than the shift in the deposit demand function. In this situation the percentage change in the loan rate is greater than the percentage increase in the

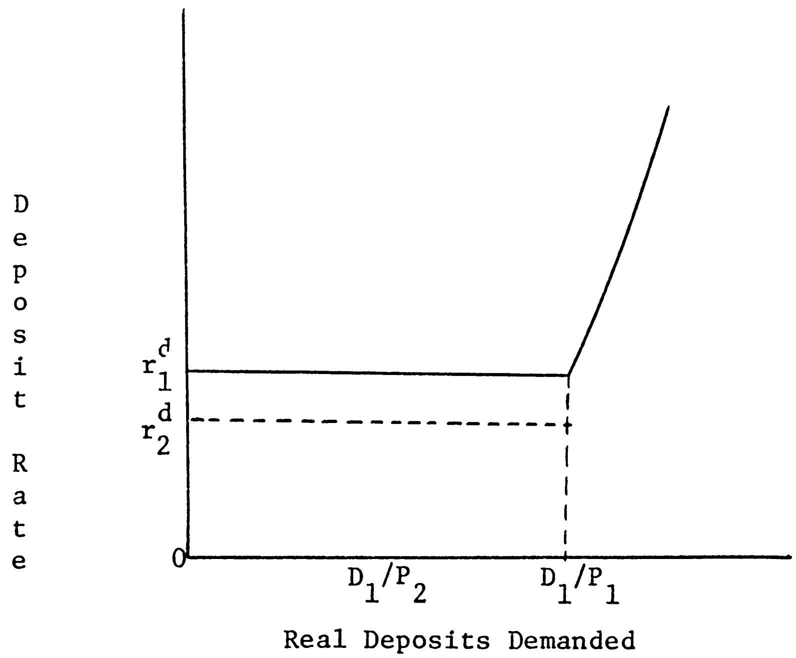


Fig. 6.--Demand for deposits.

deposit rate necessary to keep the same flow of real deposits forthcoming. This case is illustrated in Figures 7 and 8. As shown in Figure 8, an increase in the rate of inflation shifts the demand for real deposits from its initial position of D_1D_1 to D_2D_2. To induce the public to maintain the same amount of real deposits, the bank has to increase its deposit rate from r_1^d to r_2^d. To the extent that the percentage increase in the deposit rate is less than the percentage increase in the loan rate, the bank may realize some windfall profit. This process cannot, however, continue indefinitely. Once inflationary expectations become widespread, the discrepancy between lenders' price expectations and those of the borrowers would tend to disappear. This implies that as lenders and borrowers begin to form homogeneous price expectations both the demand for loans function and the demand for deposits would be shifted upward by the expected rate of the change in the price level.

(3) Yet a third, but less likely, situation is when lenders react to changes in the rate of inflation more strongly than borrowers do. In other words, the upward shift in the demand for deposits would exceed the upward shift in the demand for loans. In this case, the representative bank finds itself in a vulnerable position as some deposit holders would try to withdraw their deposits if the deposit rate is not increased sufficiently. This situation has not, however, been observed in "mild" inflationary processes.

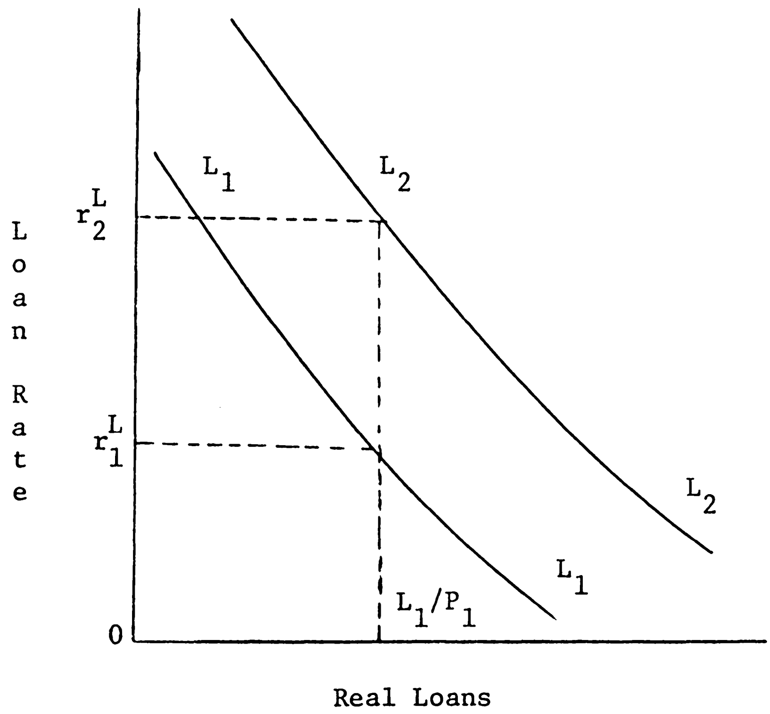


Fig. 7.--Effect of inflation on loan and deposit demand functions.

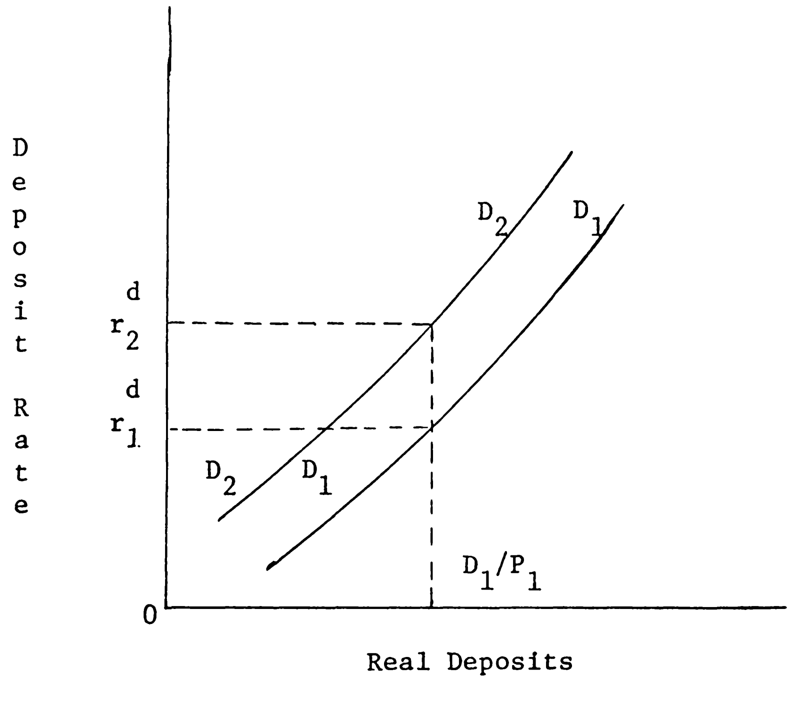


Fig. 8.--Effect of inflation on loan and deposit demand functions.

Mathematical Analysis

To sharpen the graphical discussion presented above, we shall restate the analysis mathematically.

Let the income earned by the representative bank per unit of time be denoted as π. Using the same symbols for deposits, loans and interest rates as before, we can write the following:

$$\pi = r^L(L/P) + r^B(B/P) - r^d(D/P) - C/P, \qquad (3)$$

where B/P is the real quantity of bonds held by the bank, and C/P is other non-interest costs.

Using the assumption that the bank is fully loaned up we can substitute for B/P in terms of L/P and D/P.

$$B/P + L/P + R/P = D/P, \qquad (4)$$

which implies

$$B/P = D/P - L/P - R/P.$$

Letting k represent reserve requirements against deposits we have $R/P = k \cdot D/P$. Substituting for R/P in Equation (4) we have the following:

$$B/P = D/P - L/P - k \cdot D/P = D/P(1 - k) - L/P \qquad (5)$$

With this information Equation (3) can be rewritten as:

$$\frac{d\pi}{dt} = \frac{dr^L}{dt}\left(\frac{L}{P}\right) + \frac{d(D/P)}{dt} * r^L + \frac{dr^B}{dt}\left(\frac{D}{P}\right)(1 - k) + \frac{d(D/P)}{dt} * r^B(1 - k)$$

$$- \frac{dr^D}{dt}\left(\frac{L}{P}\right) - \frac{d(L/P)}{dt} * r^B - \frac{dr^d}{dt}\left(\frac{D}{P}\right) - \frac{d(D/P)}{dt} * r^d - \frac{d(C/P)}{dt} \qquad (6)$$

Using the assumption that the representative bank takes the necessary actions to keep the real value of its loans and deposits constant, Equation (6) simplifies to:

$$\frac{d\pi}{dt} = \left(\frac{L}{P}\right) * \left(\frac{dr^L}{dt} - \frac{dr^B}{dt}\right) + \frac{D}{P}\left(\frac{dr^B}{dt} - \frac{dr^d}{dt}\right) * (1 - k) - \frac{d(C/p)}{dt} \qquad (7)$$

The rate of change of profits is obtained by taking percentage change of Equation (7):

$$\pi* = \left(\frac{L}{P}\right) * \frac{1}{\pi}(r^L \cdot r*^L - r^B \cdot r*^B) + \left(\frac{D}{P}\right) * \frac{1}{\pi}(r^B \cdot r*^B(1 - k) -$$

$$- r^d \cdot r*^d)) - \frac{C/P*}{\pi}C \qquad (8)$$

In Equation (8) the starred symbols denote percentage changes in the corresponding variables.

Given the assumption that the representative bank has monopoly power over the loan market, the loan rate r^L is greater than the bond rate r^B. Additionally, the percentage change in the loan rate is at least as great as the bond rate.[1] From this, it follows that the first

---

[1] In equilibrium the loan rate and the bond rate are related according to the following equation:

$r^L = r^B\left(\frac{e}{e-1}\right)$, where e is the elasticity of demand for loans.

Since the term in parenthesis is greater than one, it follows that the loan rate is greater than the bond rate; i.e., the bank is a monopolist in the loan market and a competitor in the bond market. The term on the right-hand side of Equation (8) is at least non-negative. If deposit holders adjust to changes in the market interest rate with a time lag, then $\dot{r}^{*d} = 0$, and the second term would also be positive. Assuming that the real non-interest costs do not increase during the inflationary process, the third term is zero.[1] In these circumstances the representative bank has the opportunity to gain from inflation. The bank may, however, due to various considerations, share some of these profits with its regular borrowers.

For some group of savers interest rate considerations are of minor importance, at least in the short run. Hoarders and absolute risk averters belong to this category. Such savers may continue to prefer the "sure" interest on deposits to the uncertain yield on bonds so long as the deposit rate is maintained at a rate as high as the rate of inflation. Alternatively, one may argue that inflation increases the productivity of money balances and eliminates the apparent discrepancy which develops between the yield on deposits relative to bonds. Unexpected changes in the price level, Karl Brunner has argued, "increases the cost of acquiring information about market arrangements,

---

percentage change in the loan rate (assuming that demand elasticity remains constant) is:

*L*B r = r.

[1]During an inflationary process the risk of default on collateral loans such as mortgages decreases, while operating costs such as the cost of labor and capital increase proportionately with the price level. The real non-interest costs may tend to fall rather than increase due to the decrease in loan default costs.

relative prices, or exchange ratios."[1] To reduce such costs individuals look for assets such as money balances with low marginal information costs to effect their transaction chains. This phenomenon enhances the productivity of money.

Whether savers adjust to changes in the market interest rate after a time lag or not is essentially an empirical question. The most that one is able to deduce from a theoretical model such as the one under discussion is that the higher the speed of adjustment and the larger the scale of adjustment by deposit holders in response to changes in the interest rates and the price level, the less would be the windfall gains that a representative bank is able to realize at the outset of an inflationary process. Such windfall gains would potentially continue to exist as long as depositors' expected rate of inflation is less than the actual rate of inflation.

Factual Evidence and Bailey's Hypothesis

One of the better tests of hypotheses derived from a Bailian-type model (that banks may gain from inflation) found in the literature is a study by David Grove on the role of the banking system in the Chilean inflation for the period 1937 through 1950. Though this study was published a few years prior to the appearance of Bailey's article, it wholly escaped Bailey's attention.

---

[1] Karl Brunner and Allan Meltzer, "The Uses of Money: Money in the Theory of an Exchange Economy," American Economic Review (December, 1971), pp. 784-805.

In his study Grove concluded that the overall impact of inflation on the commercial banks of Chile was unfavorable despite the tremendous expansion of loans and investments made by these banks. Restricting his analysis to flows of receipts and expenditures, Grove demonstrated that inflation continued to erode the net real earnings of the commercial banks from 1942 onward. Grove's findings, interesting as they are, are inconclusive; and, as we shall argue below, no definite conclusion may be drawn from his study with regard to the performance of the Chilean banks during the period examined.

On the Characteristics of the Chilean Inflation[1]

The Chilean inflation embodies certain characteristics that we think have great bearing on the objective of the present inquiry. Some of the most obvious of these characteristics are:

(1) Throughout the period covered by Grove, the rate of inflation in Chile did not reach a high enough level to cause a flight from currency, as was the case in the seven European hyperinflations considered by Bailey. The rate of inflation ranged from 2 percent in 1938 to 29 percent in 1945. Price level data and the rate of increases in prices are presented in Table 1.

[1]The Chilean inflation began with the aid of a leftist government which aimed at industrializing the economy through artificial means. The pursuit of this objective required increasing amounts of cheap credit to induce the Schumpeterian entrepreneurs to pioneer the process of industrialization of the Chilean economy. The deliberate interventions of the government in the credit and capital markets gave rise to a Wicksellian Cumulative Process which could not be easily brought under control.

TABLE 1

Cost of Living Index and its Rate of Annual Increase in Chile 1937-1950
1937 = 100

Year	Cost of Living Index	Percent Increase Over Preceding Year
1937	100	--
1938	102	2
1939	109	6.8
1940	119	9.1
1941	147	23
1942	184	25
1943	199	8
1944	229	15
1945	247	7
1946	321	29
1947	394	22
1948	461	17
1949	556	20
1950	649	16

Source: Grove, op. cit., Table 2, p. 35.

(2) Throughout the period from 1940 to 1950 the ratio of the Chilean Gross National Product to the money supply remained almost constant (Table 2). This suggests that the Chileans continued to hold almost the same proportion of their income in the form of cash balances throughout the period for which the data is available. Data relating to the pre-inflationary level of income velocity is not available. but the relatively high level of velocity (approximately 7) observed in Chile far exceeds that for the United States. For the United States income velocity has been ranging between 3 and 4 and has hardly ever been over 4. In my opinion, the chronic inflation in Chile has been instrumental in raising income velocity in that country. Being confronted with an average upward movement of 15 percent in the cost of living, it was quite natural for the Chileans to try to shorten the holding period during transactions and thus drive the velocity up much higher than it would have been otherwise.

(3) It is reasonable to assert that under the inflationary circumstances observed in Chile, increases in the money supply lead to pari-passu increases in the price level without a considerable lag. To substantiate this point, annual increases in the money supply are presented along with annual increases in the cost of living index in Table 3. As can be seen in Table 3, the rate of inflation adjusted for changes in income velocity and changes in productivity kept up with the rate of the increase in the money supply for all the years. From 1940 onward, prices were increasing almost as rapidly as the money supply, and in some years the percentage change in the cost of living index was

TABLE 2

Income Velocity of Money in Chile, 1940-1950

Year	Ratio of Gross National Product of Money Supply
1940	7.0
1941	7.2
1942	7.2
1943	7.0
1944	6.7
1945	6.7
1946	6.4
1947	6.6
1948	6.9
1949	7.2
1950	7.0

Source: Grove, op. cit., Table 4, p. 38.

TABLE 3

Annual Increases in the Money Supply and
the Cost of Living Index in Chile, 1937-1950

Year	Percentage Increase in Money Supply	Percentage Increase in Cost of Living
1937	--	--
1938	6	2
1939	15	6.8
1940	22	9.1
1941	23	23
1942	23	25
1943	27	8
1944	15	15
1945	16	7
1946	27	29
1947	21	22
1948	14	17
1949	19	20
1950	16	16

Source: Grove, _op. cit._, Tables 1 and 2, pp. 34-5.

slightly more than the percentage increase in the money supply. Table 3, Grove would say, is a classical illustration of the operation of the quantity theory of money.

Expansion in Money Supply

During the period under review the Chilean Central Bank provided almost all the fuel which fed the Chilean inflation. Between 1937 and 1950 the Central Bank increased its credit to banks and the public by more than 7.5 billion pesos (Tables 4 and 5). This tremendous increase in the Central Bank's credit triggered multiple expansion of credits and deposits in Chile. According to Grove, the 7.5-billion-peso increase in Central Bank credit accounted for more than 83 percent of the total increase in the sources creating bank reserves. In addition, during the entire period the Central Bank maintained its rediscount rate at 4-1/2 percent for commercial banks and 5 percent for Caja Nacional de Ahorros.[1] The Central Bank's rediscounting policy made borrowing quite attractive to the commercial banks and made the banks much more dependent on the rediscount window than on the public for purposes of acquiring primary reserves. Grove has noted that throughout most of the period, and particularly from the end of 1943 onward, most of the banks expanded credit to the maximum level permitted by the legal reserve requirement.

[1] A government-owned savings and loan bank.

TABLE 4

Origin and Absorption of Bank Reserves in Chile, 1937-1943
(End of Year Figures, in Millions of Pesos)

	1937	1938	1939	1940	1941	1942	1943
Origin of Bank Reserves							
Net international reserves	160.0	160.5	148.0	153.0	199.8	438.5	1,029.2
Central banks credit	920.5	1,013.5	1,162.5	1,369.3	1,719.2	1,951.5	1,889.9
To banks	24.1	73.7	123.3	216.2	422.8	345.7	213.6
Commercial banks	24.1	73.7	123.3	216.2	374.3	259.2	213.6
Caja National de Ahorros	--	--	--	--	48.5	86.5	--
To the treasury	790.9	758.0	750.0	741.8	733.4	724.9	777.9
To official development institutions	81.0	149.5	238.5	329.0	452.5	687.0	796.2
To public	24.5	32.3	50.7	82.3	110.5	193.9	102.2
Other assets of central bank[a]	22.2	19.3	15.4	41.1	31.3	34.2	34.8
Coin outside of central bank	31.0	34.0	38.0	45.0	32.0	28.0	46.0
Total	1,133.7	1,227.3	1,363.9	1,608.4	1,982.3	2,452.2	2,999.9
Absorption of Bank Reserves							
Notes and coins outside banks	630.0	719.0	862.0	1,034.0	1,310.0	1,700.0	2,100.0
Official deposits with bank	16.9	36.8	56.8	23.5	35.1	79.6	57.1

[a]Includes net claims against IMF and IBRD.

TABLE 4 -- Continued

	1937	1938	1939	1940	1941	1942	1943
Deposits of public with bank	36.9	16.9	33.4	29.0	79.3	54.4	66.8
Other nonmonetary liabilities of the Central Bank	138.7	148.2	157.3	202.0	218.2	248.5	255.7
Adjustment for float	2.1	-1.6	-11.5	1.4	-4.7	-9.2	-5.3
Total	827.3	919.3	1,098.9	1,289.8	1,637.9	2,073.3	2,474,3
Reserve Position of the Banks							
Cash and deposits with bank	306.4	308.0	265.9	318.5	344.4	378.9	525.6

TABLE 5

Origin and Absorption of Bank Reserves in Chile, 1944-1950
(End of Year Figures, in Millions of Pesos)

	1944	1945	1946	1947	1948	1949	1950
Origin of Bank Reserves							
Net international reserves	1,188.7	1,468.5	1,127.0	1,207.3	1,207.4	1,272.6	1,530.7
Central banks credit	2,172.0	2,293.1	3,377.9	4,147.1	5,155.3	6,628.0	8,415.1
To banks	364.5	448.9	1,026.9	1,232.1	1,648.2	2,454.8	2,658.0
Commercial banks	364.5	448.9	640.5	1,160.3	1,648.2	2,077.3	2,017.1
Caja Nacional de Ahorros	--	--	386.2	71.8	--	377.5	640.9
To the treasury	880.2	1,239.3	1,570.6	1,603.2	1,627.9	1,597.3	2,145.2
To official development institutions[a]	787.8	444.1	557.5	972.6	1,196.4	1,473.1	1,883.6
To public	139.5	160.8	214.2	339.2	682.8	1,102.8	1,728.3
Other assets of central bank[b]	69.4	69.7	176.5	231.0	20.7	45.2	83.4
Coin outside central bank	60.0	67.0	77.0	84.0	94.0	105.0	115.0
Total	3,490.1	3,898.2	4,758.4	5,669.4	6,477.4	8,050.8	10,144.2

[a]Includes the railroads.

[b]Includes net claims against IMF and IBRD.

TABLE 5 -- Continued

	1944	1945	1946	1947	1948	1949	1950
Absorption of Bank Reserves							
Notes and coins outside bank	2,390.0	2,682.0	3,170.0	3,677.0	4,316.0	5,208.0	6,316.0
Official deposits with bank	97.3	90.3	68.4	145.9	96.7	111.0	94.9
Deposits of public with bank	24.7	36.0	35.8	47.8	44.5	76.5	86.6
Other nonmonetary liabilities of the central bank[a]	371.6	388.0	541.1	636.3	450.2	619.3	1,647.3
Adjustment for float	2.1	1.4	11.1	56.2	10.8	45.6	24.6
Total	2,885.7	3,197.7	3,826.4	4,563.2	4,918.2	6,060.4	8,169.4
Reserve Position of the Banks							
Cash and deposits with bank	604.4	700.5	932.0	1,106.2	1,559.2	1,990.4	1,974.8

[a]All other liabilities excluding note issue and deposits of other banks.

As one would expect, the Chilean commercial banks continued to increase their loans and investments sharply and without interruption during the entire period. As can be seen from Tables 6 and 7, the commercial banks and the Caja Nacional de Ahorros expanded their total loans and investments from 2.8 billion pesos at the end of 1937 to 20.2 billion pesos at the end of 1950.

Bank Performance and Profitability

The performance of business firms is heavily conditioned and influenced by the prevailing market structure. In this the Chilean banks were no exception. During the period under examination the Chilean Central Bank itself was engaged in lending and borrowing activities. Although by the end of 1950 the Central Bank loans to the public accounted for only 9 percent, as compared to 1 percent in 1937 of total loans made by all banks, it is contended that the commercial banks had to compete with the Central Bank in their lending activities. Furthermore, the low rediscount rate of the Central Bank certainly induced intensive competition among the commercial banks. As is evident from Table 8, the average loan rate charged by the commercial banks was below the maximum permissible rate during the entire period. Although the Chilean Central Bank continued to adjust the maximum permissible rate upward throughout the period, the Chilean commercial banks kept their rates consistently about 4 percent below the maximum rate. The average loan rate was also much below what may be termed the equilibrium rate -- that is, the real

TABLE 6

Loans and Investments of Commercial Banks in Chile, 1937-1950
(In Millions of Pesos)

	1937	1938	1939	1940	1941	1942	1943
Loans to							
Public	1,941	2,016	2,131	2,270	2,667	3,032	3,486
Treasury and government agencies	9	8	112	142	143	143	153
Banks and Caja Nacional de Ahorros	--	15	11	10	5	3	1
Other institutions	70	72	119	120	106	49	40
Total	2,020	2,110	2,373	2,542	2,921	3,227	3,680
Investments							
Fiscal and municipal bonds	21	20	17	19	26	39	57
Mortgage bonds	11	10	12	16	21	6	6
Central Bank shares	69	75	78	80	81	90	99
Other	49	51	50	44	38	49	63
Total	150	155	157	158	166	183	225
Total Loans and Investments	2,170	2,265	2,530	2,700	3,087	3,410	3,905

TABLE 6 -- Continued

	1944	1945	1946	1947	1948	1949	1950
Loans to							
Public	4,192	5,236	6,456	7,824	10,145	11,902	12,761
Treasury and government agencies	141	160	167	338	266	371	451
Banks and Caja Nacional de Ahorros	15	3	5	9	9	8	12
Other institutions	18	25	30	20	94	105	88
Total	4,366	5,423	6,658	8,189	10,513	12,387	13,312
Investments							
Fiscal and municipal bonds	23	102	18	23	24	19	18
Mortgage bonds	8	7	8	8	7	13	13
Central Bank shares	122	128	139	139	146	218	227
Other	76	83	76	88	94	98	97
Total	229	320	241	257	271	348	355
Total Loans and Investments	4,595	5,743	6,899	8,446	10,784	12,735	13,667

Source: Grove, *op. cit.*, p. 50.

TABLE 7

Loans and Investments of the Caja Nacional de Ahorros, 1937-1950

	1937	1938	1939	1940	1941	1942	1943
Loans to							
Public	354	413	540	667	792	981	1,300
Treasury and government agencies	6	60	82	146	194	259	217
Other institutions	3	2	30	37	36	20	27
Total	363	475	642	849	1,022	1,260	1,544
Investments							
Fiscal and municipal bonds	242	253	286	284	289	321	526
Mortgage bonds	58	63	25	23	30	31	22
Other	9	9	9	9	16	16	35
Total	309	325	321	316	335	368	583
Total Loans and Investments	672	800	963	1,165	1,357	1,628	2,127

TABLE 7 -- Continued

	1944	1945	1946	1947	1948	1949	1950
Loans to							
Public	1,569	1,799	2,504	2,900	3,775	4,908	4,938
Treasury and government agencies	222	208	210	349	333	199	147
Other institutions	21	14	13	26	11	398	468
Total	1,812	2,021	2,726	3,275	4,119	5,504	5,553
Investments							
Fiscal and municipal bonds	681	757	1,070	980	818	816	794
Mortgage bonds	22	27	26	26	26	26	26
Other	57	57	69	143	159	152	159
Total	760	841	1,165	1,150	1,004	994	979
Total Loans and Investments	2,572	2,862	3,891	4,425	5,123	6,498	6,532

Source: Grove, *op. cit.*, p. 51.

TABLE 8

Interest Rates on Bank Loans in Chile, 1937-1950

Period		Average Rate Charged on Bank Loans	Maximum Permissible Rate
1937	1st Half	7.73	11.12
	2nd Half	7.96	11.60
1938	1st Half	7.93	11.94
	2nd Half	8.46	11.89
1939	1st Half	8.31	12.57
	2nd Half	8.38	12.46
1940	1st Half	8.31	12.57
	2nd Half	8.43	12.46
1941	1st Half	8.33	12.64
	2nd Half	8.50	12.50
1942	1st Half	8.64	12.75
	2nd Half	9.08	12.96
1943	1st Half	8.82	13.62
	2nd Half	9.01	13.23
1944	1st Half	9.02	13.51
	2nd Half	9.05	13.53
1945	1st Half	9.08	13.58
	2nd Half	9.34	13.62
1946	1st Half	9.16	14.01
	2nd Half	9.28	13.74
1947	1st Half	9.24	13.92
	2nd Half	9.30	13.86
1948	1st Half	9.84	13.95
	2nd Half	10.15	14.76

TABLE 8 -- Continued

Period		Average Rate Charged on Bank Loans	Maximum Permissible Rate
1949	1st Half	10.00	15.23
	2nd Half	10.41	15.00
1950	1st Half	10.38	15.62
	2nd Half	10.98	15.57

Source: Grove, op. cit., p. 46.

rate plus the rate of inflation for all the years (Table 9). According to the figures presented by Grove, under the inflationary conditions of 1937 to 1950 the real rate of interest was negative in all except three years -- 1938, 1939 and 1945 -- i.e., in all but these three years the purchasing power at maturity of the principal plus interest of a one-year loan was less than the purchasing power of the principal at the time it was lent. These figures, in my opinion, point to one conclusion -- that the Chilean inflation made the Chilean banking industry more competitive than it would have been otherwise. Grove himself has made the following observation:

> *In inflationary circumstances* the banks are under certain pressure to lend, and stockholders are likely to be quite insistent that the management expand credit to the maximum in order to increase earnings ... If profits are declining because of rising costs, bankers are likely to reassess the factors which made them reluctant to expand credit more rapidly hitherto, and may be willing to make loans and investments which, in the absence of a squeeze on their profits, they would regard as unattractive. Moreover, if the demand for loans is increasing, it becomes even harder for bank managers to justify smaller profits and dividends to the shareholders. This seems to have been the situation in Chile.[1] (Italics mine.)

Data relating to revenues and expenditures of the commercial banks of Chile are presented in Table 10. The table indicates that the nominal receipts of the banks increased from 209 million pesos at the end of 1937 to 1,830 million pesos at the end of 1950. During the same time period bank expenditures went up from 122 million pesos at

---

[1]Grove, op. cit., p. 55.

TABLE 9

Real[a] and Nominal Rates of Interest
in Chile, 1937-1950

Year	Average Rate Charged On Bank Loans	Yearly Increase in Cost of Living	Real Interest Rate
1937	7.8	12.6	-4.3
1938	8.2	4.0	4.0
1939	8.3	1.9	6.3
1940	8.4	12.3	-3.5
1941	8.4	15.1	-5.8
1942	8.9	26.3	-13.8
1943	8.9	16.2	-6.3
1944	9.4	11.4	-1.8
1945	9.2	8.9	0.3
1946	9.4	16.0	-5.7
1947	9.3	33.6	-18.2
1948	10.0	18.0	-6.8
1949	10.2	18.6	-7.1
1950	10.7	15.1	-3.8

[a]The real interest rate column is computed by the formula:

$$R = [(100 + i/100 + p) - 1]*100.$$

Source: Grove, *op. cit.*, p. 54.

TABLE 10

Annual Receipts and Expenses of the Commercial Banks in Chile, 1937-1950[a]
(In Millions of Pesos)

	1937	1938	1939	1940	1941
Receipts					
Interest received	175 (84%)	185 (84%)	200 (83%)	223 (82%)	247 (81%)
Other earnings	33 (16%)	35 (16%)	41 (17%)	48 (18%)	56 (19%)
Total	209 (100%)	220 (100%)	240 (100%)	271 (100%)	303 (100%)
Expenses					
Interest paid	29 (24%)	30 (23%)	32 (23%)	35 (22%)	37 (21%)
Salaries	68 (56%)	71 (55%)	79 (55%)	90 (57%)	105 (59%)
Taxes	9 (7%)	10 (8%)	14 (10%)	16 (10%)	14 (10%)
Other expenses	16 (14%)	18 (14%)	18 (13%)	18 (11%)	20 (11%)
Total	122 (100%)	120 (100%)	143 (100%)	158 (100%)	177 (100%)
Net receipts (+) or expenses (-)	+87	+90	+98	+113	+126
Ratio of receipts to expenses	1.71	1.69	1.71	1.71	1.71
Index ratio of receipts to expenses (1937 = 100)	100	99	99	100	100

[a]Details may not total due to rounding.

TABLE 10 -- Continued

	1942	1943	1944	1945	1946
Receipts					
Interest received	292 (81%)	331 (81%)	389 (82%)	468 (83%)	617 (84%)
Other earnings	68 (19%)	78 (19%)	86 (16%)	93 (17%)	117 (16%)
Total	360 (100%)	409 (100%)	474 (100%)	561 (100%)	734 (100%)
Expenses					
Interest paid	42 (21%)	39 (17%)	46 (17%)	66 (19%)	93 (20%)
Salaries	120 (59%)	140 (59%)	166 (60%)	299 (58%)	278 (59%)
Taxes	18 (9%)	30 (13%)	33 (12%)	39 (11%)	49 (10%)
Other expenses	25 (12%)	28 (12%)	34 (12%)	38 (11%)	53 (11%)
Total	205 (100%)	237 (100%)	279 (100%)	343 (100%)	474 (100%)
Net receipts (+) or expenses (-)	+154	+172	+196	+218	+260
Ratio of receipts to expenses	1.75	1.72	1.70	1.64	1.55
Index ratio of receipts to expenses (1937 = 100)	102	101	99	96	91

TABLE 10 -- Continued

	1947	1948	1949	1950
Receipts				
Interest received	768 (80%)	990 (79%)	1,249 (80%)	1,457 (80%)
Other earnings	188 (20%)	262 (21%)	308 (20%)	373 (20%)
Total	956 (100%)	1,252 (100%)	1,556 (100%)	1,830
Expenses				
Interest paid	96 (15%)	145 (17%)	202 (18%)	229 (17%)
Salaries	427 (65%)	535 (63%)	644 (58%)	823 (62%)
Taxes	69 (11%)	96 (11%)	155 (14%)	137 (10%)
Other expenses	63 (10%)	79 (9%)	109 (10%)	131 (10%)
Total	655(100%)	854 (100%)	1,110 (100%)	1,320 (100%)
Net receipts (+) or expenses (-)	+301	+399	+446	+511
Ratio of receipts to expenses	1.46	1.47	1.40	1.39
Index ratio of receipts to expenses (1937 = 100)	85	86	82	81

Source: Grove, *op. cit.*, p. 56.

the end of 1937 to 1,329 million pesos at the end of 1950. Expressed differently, the banks increased their earnings by 780 percent, but their expenses increased by 980 percent -- expenses rose faster than revenues. Translated into real terms, the Chilean banks were earning less in 1950 (Table 11) than they were in 1937. At first sight, these results seem to be counter intuitive for a number of reasons. First, the Chilean banks increased their loans and investments by more than 620 percent, which should have increased their interest income almost by the same amount. Second, the constant and low cost of borrowing from the Central Bank should have put the banks in a position to exploit fully the spread between the lending rate and the borrowing rate. In 1937, the average lending rate was 7.72 percent while the borrowing rate was 4.5 percent. This spread continued to increase throughout the period as the lending rate rose to 10.98 percent by the end of 1950. Third, the inflationary environment in Chile made long-term loans and securities quite unattractive to commercial banks. At the end of 1950 long-term loans and investments accounted for only 3 percent of the total loans of commercial banks. This evidence would suggest that the commercial banks had almost insured themselves against possible capital losses on their loans by reducing their holdings of long-term loans and securities to a minimum. Fourth, it is a time-honored hypothesis

TABLE 11

Capital, Profits and Capital Return
of Commercial Banks in Chile, 1937-1950
(In Millions of Pesos)

Year	Nominal Capital and Reserves	Real Capital and Reserves[a]	Nominal Profits	Real Profits	Real Return
1937	646.5	646.5	65.5	65.5	10.1
1938	702.6	675.7	69.6	66.9	9.9
1939	742.6	700.6	77.6	73.2	10.4
1940	766.2	643.9	84.7	71.2	11.1
1941	791.7	577.9	101.1	73.8	12.8
1942	835.8	483.1	110.5	63.9	13.2
1943	922.4	458.9	124.8	62.1	13.5
1944	1,026.5	458.3	155.2	69.3	15.1
1945	1,108.1	454.1	156.5	64.1	14.1
1946	1,323.5	467.7	213.7	75.5	16.1
1947	1,671.4	442.2	257.3	68.1	15.4
1948	1,833.3	411.1	309.8	69.5	16.9
1949	2,623.6	496.0	320.7	60.6	12.2
1950	2,826.9	464.2	361.3	59.3	12.8

[a]Figures for real capital and reserves are obtained by deflating the corresponding nominal figures by the cost of living index (Table 1). Real return is obtained by dividing real profits by real capital and reserves and is expressed in percent.

Source: Grove, *op. cit.*, p. 58.

of economic theory that inflation redistributes income from creditors to debtors if certain conditions are met.[1]

Stock Prices During an Inflationary Period: Alchian's Criterion

In an empirical study Armen Alchian and Reuben Kessel have argued that changes in the profitability of business firms during inflation periods are generally reflected in the sotck prices of these firms.[2] Business firms which are net monetary debtors and thus in a position to gain from inflation should show an increase in the value of their stocks relative to the net monetary creditors. Using cross-time series data for a sample of firms whose shares were traded in the New York Stock Exchange between 1914 and 1952, Alchian and Kessel have found strong evidence in support of the debtor-creditor hypothesis. They observed that firms which were net monetary debtors during the period under study showed considerable increases in their equity prices relative to firms which were classified as net monetary creditors. They also found that during deflationary periods firms which were net monetary debtors did worse than those which were net monetary creditors.

Without trying to undermine the significance of the Alchian and Kessel contribution, I would like to point out that net monetary

---

[1] Alchian and Kessel have attributed this hypothesis to Fisher and Keynes. However, this hypothesis was advanced many years before the publication of The Wealth of Nations. (See Chapter I.)

[2] Armen Alchian and Reuben A. Kessel, "Redistribution of Wealth Through Inflation," Science (September, 1959), pp. 535-39.

indebtedness is neither a necessary nor a sufficient condition for a firm to gain or lose from inflation. As an example, consider a capital intensive firm which is classified as a net monetary debtor but has substantial depreciation charges which it is allowed to deduct from its taxable income. This firm is affected by inflation in at least three ways. First, since depreciation charges are fixed in monetary terms, inflation decreases the real value of these charges.[1] Second, inflation may increase the real value of tax liabilities of the firm. And third, inflation reduces the real value of the fixed monetary debts of the firm under consideration. In the context of the present example, the firm will gain from inflation if, and only if, the present value of the firm's net monetary liabilities exceed the present value of present and future depreciation charges. This point may be further illustrated in a simple diagram. To simplify the exposition, let us assume that inflation leaves the present value of tax liabilities unchanged but affects only depreciation charges and other non-tax monetary liabilities. The value of the firm's equities is measured on the vertical axis of Figure 9. On the horizontal axis we have measured time. Figure 9 is superimposed on Figure 10. Present value of liabilities is measured on the horizontal axis and present

---

[1]Public finance scholars have realized and documented this effect rather extensively. See, for example, John F. Due, Government Finance (Homewood: Richard D. Irwin, 1959), pp. 170-72. In an important note Donald A. Nichols has challenged the validity of the hypothesis that changes in the market value of equities are indicative of all the major effects of inflation on real equity values. See his "A Note on Inflation and Common Stock Values," Journal of Finance (September, 1968), pp. 655-57.

value of depreciation charges is measured on the vertical axis of Figure 9. A 45-degree line passing through the origin of Figure 9 assists us in determining the spread between the present value of liabilities and depreciation charges. If inflation places the firm above the 45-degree line, the corresponding curve reflecting the equity prices of the firm is upward sloping. If inflation places the firm on the 45-degree line, then the corresponding curve for stock prices of the firm is the horizontal line. And, if inflation puts the firm below the 45-degree line, the corresponding curve for stock prices is downward sloping.

To sharpen our criticism of Alchian and Kessel's methodology we shall restate our geometric illustration mathematically.[1] To simplify the exposition we shall assume that inflation does not affect the real return on capital. This assumption implies that the prices of the products sold by a representative firm increase in the same proportion as the prices of factor inputs used by this firm. This assumption also rules out the wage-lag hypothesis; i.e., that prices of products sold by the firm adjust more rapidly to changes in price level than the prices paid by the firm to its factor inputs.

Representing total returns to capital by C, monetary liabilities by M, and depreciation charges by D, profits before taxes are equal to:

---

[1]The analysis in this section draws heavily on the contribution made by Nichols, op. cit., pp. 655-56.

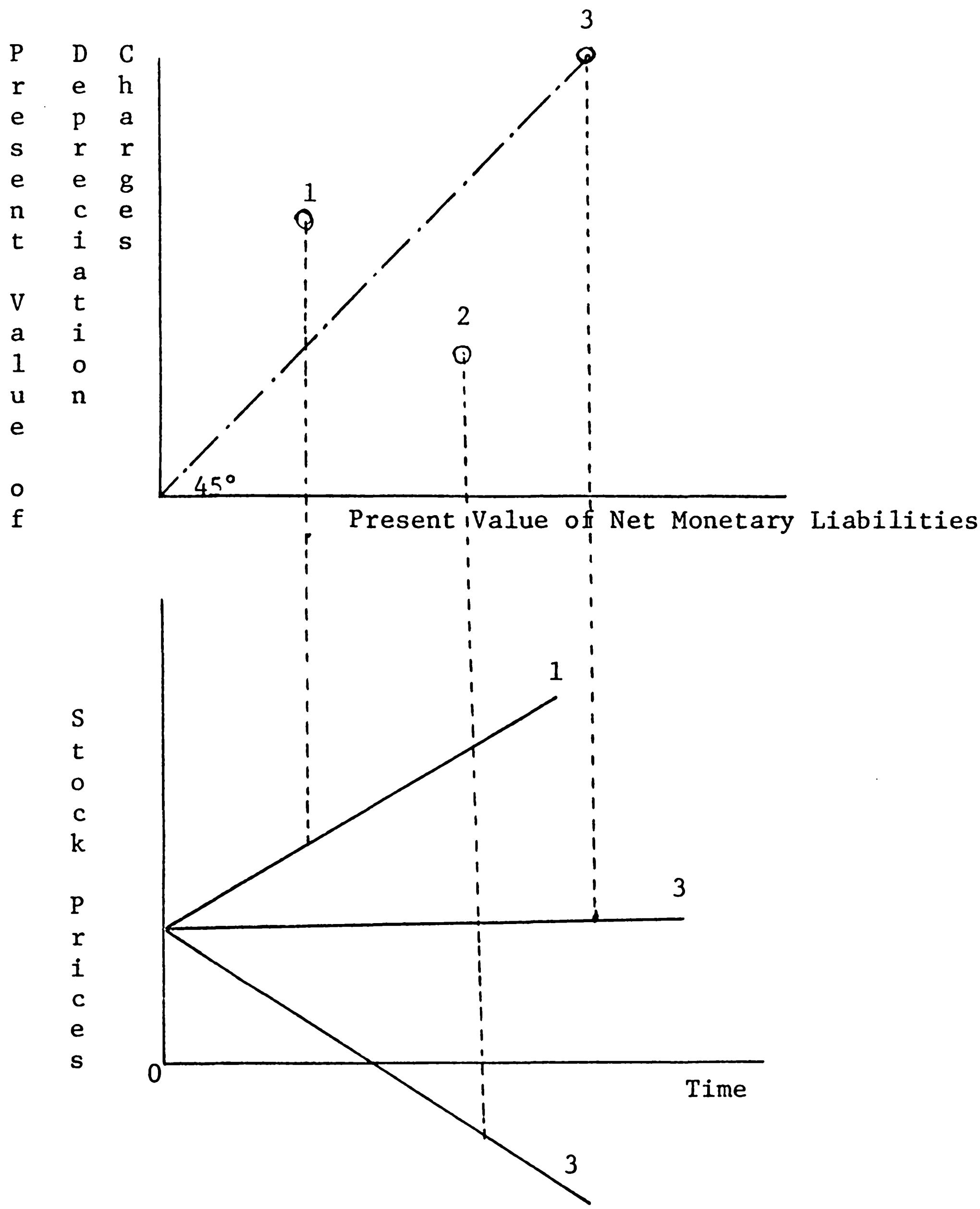


Fig. 10 (above) and Fig. 9 (below) --Effect of inflation on a firm.

$$P_t = C_t - r_t M_t - D_t, \quad (1)$$

where r_t is the interest paid on debts. Profits after taxes are equal to one minus the tax rate times the pre-tax profit, that is:

$$P^*_t = (1 - t)P_t = (1 - t)(C_t - r_t M_t - D_t), \quad (2)$$

where t is the tax rate. Total returns to equity owners of the firm are equal to profit after taxes plus depreciation charges. Denoting returns to equity by R we have the following equation:

$$R_t = P^*_t = (1 - t)(C_t - r_t M_t - D_t) + D_t \quad (3)$$

which simplifies to:

$$R_t = (1 - t)(C_t - r_t M_t) + tD_t \quad (4)$$

<u>The Effect of Inflation on Returns to Equity</u>

Having made the assumption that a rate of increase in prices of E percent per period of time increases total returns to capital, C, by E percent, while leaving interest and depreciation charges unaffected, total returns to equity increase according to the following equation.

$$R_t = (1 - t)[C_t(1 + E) - r_t M_t] + tD_t. \quad (5)$$

To obtain the real value of returns to equity we divide both sides of (5) by the quantity of one plus the rate of inflation:

$$\frac{R_t}{1+E} = (1 - t)[C_t - \frac{r_tM_t}{1+E}] + \frac{tD_t}{1+E} \qquad (6)$$

Differentiating (6) with respect to E yields an expression for the effect of an inflation of E percent per period of time on the real value of return to equity at time t.

$$\frac{d\frac{R_t}{1+E}}{dE} = \frac{(1-t)r_tM_t}{(1+E)^2} - \frac{tD_t}{(1+D)^2} \qquad (7)$$

The two terms on the righthand side of (7) have opposite signs. The larger the interest payment on monetary debts, the greater the increase in the real value of returns to equity due to inflation. Conversely, the larger the amount of depreciation charges the smaller the appreciation in the value of real returns to equity. From Equation (7), it is also observed that if the quantity $(1 - t)r_tM_t$ is equal to tD_t, the gains and losses accrued due to inflation offset each other and the value of returns to equity remain unchanged.

In conclusion, the analysis above implies that, generally speaking, firms which are net monetary debtors and have a relatively low capital/labor ratio are in a better position under an inflationary process than those with high capital/labor ratio. The analysis also shows that if inflation is fully anticipated by the creditors, or rather would-be creditors, of the firm, the real value of return to equity declines as a consequence of inflation. In terms of Equation (7) if inflation is fully anticipated, then the first term on the righthand side of this equation vanishes and there remains only the second term, which has a negative sign. Therefore, a second condition for the validity of the conclusions reached by Alchian and Kessel is that inflation should not have been fully anticipated by the creditors of the firm which is classified as a net monetary debtor.

Bank Shares and Inflation

In their paper, Alchian and Kessel have indicated that banks are typically net monetary creditors and thus are in a position to suffer wealth losses due to inflation.[1] While I do not disagree with the general proposition that net monetary creditors may be in a less favorable position than net monetary debtors under inflationary circumstances, I submit that net monetary indebtedness or net monetary creditability do not constitute sufficient conditions for possible losses or gains from inflation. There are other equally important factors besides net monetary indebtedness or net monetary creditability that have to be examined before some general conclusions are drawn.

Chilean Banks and Inflation

Had Chile had a well developed stock market, it would be possible to examine changes in the real value of Chilean bank equities along lines used by Alchian and Kessel, and then compare the results obtained by using this method to those that may be arrived at by making use of other methods. But this option is not, however,

---

[1] In his textbook, University Economics, Alchian has indicated that unanticipated inflation imposes a wealth loss on commercial banks "as they are invariably net monetary creditors." See University Economics (Belmont, Ca.: Wadsworth Publishing Company, Inc., 1967), pp. 653-58.

available to us. Unlike the United States, Chile has never had a well developed stock market or even a security market. This leaves us with other alternative methods such as income/sales ratio, rate of return, sales/equity ratio and, finally, income-expenditure data. Nevertheless, preliminary evidence indicates that Chilean commercial banks were in general net monetary debtors.[1]

The Relevance of Grove's Conclusions

Table 12 summarizes the nominal and real earnings of the Chilean commercial banks during the period 1937 to 1950. As it is seen from this table, real bank profits increased from 65.5 million pesos in 1937 to 73.8 million pesos in 1941. From 1942 to 1950, real bank profits were, with the exception of 1946, lower than the amount earned in 1941. In 1950 bank profits dropped to an all-time low of 59.3 million pesos, as compared to 65.5 million pesos in 1937.

Grove's interpretation of these figures leads him to conclude that inflation inflicted wealth losses upon the Chilean commercial banks. His argument is not, however, convincing. Table 12 shows that banks' real return on real capital and reserves, with the exception of 1938, continued to increase from 1937 to 1950. Compared to the average rate of return for the Chilean economy as a whole the rate of return earned by banks was higher than the national average

[1] I am still in the process of gathering data. I have tried various sources but it seems that I will not be able to get all the necessary information for a comprehensive analysis.

TABLE 12

Capital, Profits and Capital Return
of Commercial Banks in Chile, 1937-1950
(In Millions of Pesos)

Year	Banks' Real Return on Capital[a]	National Average of Real Return on Capital[b]	Banks' Nominal Capital	Banks' Nominal Profits	Real Capital
1937	13.86	13.5	252.5	35.0	252.5
1938	11.9	6.9	326.6	39.7	314.0
1939	12.97	4.8	337.6	43.8	318.4
1940	14.0	7.4	316.2	47.0	265.7
1941	20.43	7.2	309.7	60.5	226.0
1942	19.5	6.3	314.8	64.3	181.96
1943	19.1	5.2	227.4	62.8	113.13
1944	30.8	5.2	287.5	88.6	128.34
1945	28.1	4.5	288.1	80.9	118.0
1946	43.2	5.1	269.5	116.5	95.23
1947	34.9	10.2	498.4	139.2	105.3
1948	59.5	13.6	255.3	152.0	58.0
1949	18.75	6.2	620.6	116.3	117.31
1950	19.2	6.8	696.9	113.8	114.43

[a]Computed by dividing the real profits by the real capital.

[b]Markos Mamalakis and Clark W. Reynolds, Essays on the Chilean Economy (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 384.

throughout the period under consideration. This conclusion holds despite the fact that the real return computed by Grove is biased downward. To arrive at a better estimate of the rate of return on capital, I have disaggregated the figures for real capital and reserves and computed the rate of return on real capital rather than on real capital and reserves lumped together. To take account of the opportunity costs of holding reserves, I have computed the annual interest earnings that could be achieved by banks if they were to lend these reserves at the going interest rates. The opportunity costs of reserves are subtracted from nominal profits for each year and recorded in Table 12. Dividing the amount of real profits by the amount of real capital, we arrive at an estimate of real rate of return which is much more accurate and theoretically more meaningful than those computed by Grove. Comparing these figures with the average rate of return for the nation it is seen that the Chilean banking sector earned higher than average profits during 1937 to 1950.

Table 12 also reveals that real bank capital continued to decline from 1937 to 1950. This is not surprising. Having had access to cheap and readily available advances from the central bank, the commercial banks felt no obligation to commit their own capital to banking. According to one account, all the commercial banks including the state-owned Bank of Chile shifted their investments from debt to real estates. For example, in 1945, 50 percent of the investment of commercial banks was in real estate. In 1955, bank investments in real estate had reached 72.0 percent of their total investments.[1]

Simple Correlation Between Banks' Rate of Return and the Rate of Inflation

To further investigate the validity of Grove's conclusions his data was fitted to various regression models. The dependent variable used in each regression model is the rate of return on real capital and reserves and the independent variable is the rate of inflation for the period 1937 to 1950. The method of estimation used for all the equations is the ordinary least-squares method. The error term associated with each of the regression equations is assumed to be normally distributed with zero mean and a constant variance. The estimates of the constant term and the coefficient of the independent variable along with other information are presented below for each regression equation.

Equation I: The Linear Form

$R = a + b*E$, where

R = rate of return,

E = the rate of inflation, and

u = the error term.

The least-squares estimate of the parameters of this equation are:

---

[1] Mamalakis and Reynolds, op. cit., pp. 88-9.

R = 11.03		+ 0.14716 E
Standard error	(1.11)	(0.0621)
T-ratio	9.933	2.350
P-value	0.038458	
Simple correlation		0.57821
Degrees of freedom		11
Sum of squares of residuals		37.03
Variance of estimate		3.367
Standard error of estimate		1.835
Coefficient of determination (R-square)		0.3343
F(1, 11)		5.535
Multiple correlation coefficient (R)		0.5782
Corrected R-square		0.2888
Standard error as percent of mean		13.74809
Durbin-Watson statistic		2.70

Equation II: The Exponential Form[1]

$$R = e^{a-b/E}$$

By taking natural logarithms of both sides this equation can be transformed to:

$$\ln R = a - b/E.$$

---

[1]This functional form was suggested to me by Professor Thomas Hogarty of Virginia Polytechnic Institute and State University.

Setting lnR = R* and 1/E = E*, the equation is transformed to a linear form:

$$R^* = a - bE^*.$$

The least-squares estimates of the parameters of this equation are:

R* = 2.669		-0.83897 E*
Standard error (0.049)		(0.31)
T-ratio	53.6	-2.704
P-value	0.020513	
Simple correlation		-0.63188
Degrees of freedom		11
Sum of squares of residuals		0.1952
Variance of estimate		0.1774E - 01
Standard error of estimate		0.1332
Coefficient of determination (R-square)		0.3993
F(1,11)		7.311
Multiple correlation coefficient (R)		0.6319
Corrected R-square		0.3447
Barten's R-square		0.3568
Standard error as percent of mean		5.16516
Durbin-Watson statistic		3.11

Equation III:

$R = a{*}X^b$ is a power function. The results of a least-squares fit of its linear transformation are as follows:

$\ln R = \ln a + b \ln E.$

Setting $\ln R = R^*$ and $\ln E = E^*$, the transformed equation is linear:

$R^* = a + b^* E^*$

$R^* = 2.201$		$+0.14742\ E^*$
Standard error	(0.132)	(0.0495)
T-ratio	16.723	2.978
P-value	0.012564	
Simple correlation		0.66810
Degrees of freedom		11
Sum of squares of residuals		0.1799
Variance of estimate		0.1635E - 01
Standard error of estimate		0.1279
Coefficient of determination (R-square)		0.4464
F(1,11)		8.869
Multiple correlation coefficient (R)		0.6681
Corrected R-square		0.3960
Barten's R-square		0.4058
Standard error as percent of mean		4.95858
Durbin-Watson statistic		3.05

Equation IV:

$r = a + \frac{b}{E}$ is a hyperbolic function. By taking $E^* = \frac{1}{E}$ this equation can be linearized to:

$R = a + b \cdot E^*$

The estimates of the parameters of this equation are:

R = 14.45		-10.268 E*
Standard error	(0.67)	(4.2260)
T-ratio	21.315	-2.430
P-value	0.03342	
Simple correlation		0.59098
Sum of squares of residuals		36.20
Variance of estimate		3.291
Standard error of estimate		1.814
Coefficient of determination (R-square)		0.3493
F(1, 11)		5,904
Multiple correlation coefficient (R)		0.5910
Corrected R-square		0.2901
Barten's R-square		0.3045
Standard error as percent of mean		13.59302
Durbin-Watson statistic		3.10

Equation V:

$R = \frac{1}{a - b \cdot E}$ is a hyperbolic function. To transform this function into a linear form, we inverse the function by raising both sides to the power of minus one. The result is:

$$\frac{1}{R} = a + b \cdot E.$$

Setting $\frac{1}{R} = R^*$, we have:

$$R^* = a + b \cdot E.$$

The estimates of a and b are presented below:

$R^* = 0.09160$		$-0.000938\ E$
Standard error	(0.006)	(0.00036)
T-ratio	14.293	-2.595
P-value	0.024902	
Simple correlation		-0.61626
Degrees of freedom		11
Sum of squares of residuals		0.1234E - 02
Standard error of estimate		0.1059E - 01
Coefficient of determination (R-square)		0.3798
F(1,11)		6.736
Multiple correlation coefficient (R)		0.6163
Corrected R-square		0.3234
Barten's R-square		0.3364
Standard error as percent of mean		13.78778
Durbin-Watson statistic		2.39

Equation VI:

$R = \frac{E}{a + b \cdot E}$ is a hyperbolic function which can be transformed into a linear form according to the following procedure:

$$\frac{1}{R} = \frac{a + b \cdot E}{E} = \frac{a}{E} + \frac{b \cdot E}{E}.$$

Setting $\frac{1}{R} = R^*$, and $\frac{1}{E} = E^*$, we have:

$$R^* = a \cdot E^* + b.$$

The estimates of the parameters of this equation are:

$$R^* = 0.069786E^* + 0.06932$$

Standard error	(0.02322)	(0.00372)
T-ratio	3.005	18.612
P-value	0.011967	
Simple correlation		0.67147
Degrees of freedom		11
Sum of squares of residuals		0.1093E - 02
Variance of estimate		0.9933E - 04
Standard error of estimate		0.9966E - 02
Coefficient of determination (R-square)		0.4509
F(1,11)		9.032
Multiple correlation coefficient (R)		0.6715
Corrected R-square		0.4009
Barten's R-square		0.4105
Standard error as percent of mean		12.97356
Durbin-Watson statistic		3.11

Summary and Discussion of the Regression Results

Before proceeding with out interpretation of the regression results, it is helpful to present a summary of the estimates of the parameters of the various equations used in our statistical analysis. This is done in Table 13.

Looking at the regression results, one would certainly tend to conclude that inflation had a marked effect on the rate of return earned by the Chilean commercial banks during the period under review.

TABLE 13

Summary of the Results of Regression Equations I-VII

Regression Equation	Standard Error of Constant Term and T-Ratio	Standard Error of Independent Variable Coefficient T-Ratio	R^2	Standard Error of Estimate	Standard Error as Percent of Mean
I. $R = 11.03 + .14E$	(1.11) 9.9	(.0621 2.35	.33	1.83	13.74
II. $R = E^{2.6 - .83/E}$	(.049) 53.6	(.31) -2.7	.39	.132	5.16
III. $R = 2.2E^{.147}$	(.132) 16.7	(.0496) 2.97	.44	.127	4.95
IV. $R = 14.45 - \frac{10.2}{E}$	(.67) 21.3	(4.22) -2.43	.34	1.814	13.6
V. $R = \frac{1}{.091 - .0009E}$	(.006) 14.29	(.00036) -2.59	.37	.010	13.78
VI. $R = \frac{E}{.069 + .069E}$	(.0037) 18.6	(.0232) 3.005	.45	.0099	12.973

As can be seen from the table, the coefficient of the independent variable (the rate of inflation) turns out to be significantly different from zero at least at a significance level of 95 percent and with the right sign in all the regression models used above. It should, however, be added that a positive association between banks' rate of return and the rate of inflation at an aggregate level does not necessarily warrant a similar relationship at a disaggregated level. Indeed, it is very unlikely that each and every Chilean bank profited from the ongoing inflation in Chile during the period under consideration. Nevertheless, one would expect that a representative Chilean bank could not at least be harmed by the 1936-1950 inflation. As a matter of record, I may point out that a study by John Deaver[1] lends support to our conclusion that the average Chilean bank managed to share some of the inflation-tax revenue with the Chilean government over the period under review. In light of Deaver's evidence and the findings of the present inquiry, I would tend to conclude that Grove's evidence on the negative impact of the Chilean inflation on commercial bank profits is at best inconclusive and dubious.

Comparison of Regression Equations

When comparing different regression models fitted to the same body of data, one always has to make a decision on the best fit.

---

[1]John Deaver, "The Chilean Inflation and the Demand for Money," in Varieties of Monetary Experience, ed. by David Meiselman (Chicago: University of Chicago Press, 1970), pp. 7-49.

Traditionally, statisticians have proposed four criteria for this purpose. These are theoretical implications of the model, simplicity of the model, standard error of estimate (or its equivalent sum of squares of residuals) and Durbin-Watson statistics. Before we direct our attention to comparison of regression models, a word or two about the comparison procedure is in order.

When comparing two or more regression equations with the same dependent variable, the practice is to choose the functional form which yields the minimum residual sum of squares as the appropriate functional form. This procedure can be followed here with Equations I, IV, V and VI. A pair-wise comparison of these equations reveals that Equation IV yields the lowest residual sum of squares and, *ceteris paribus*, is an empirically more relevant functional form than all the others. Likewise, Equations II and III can be compared directly without any difficulty. In both of these equations, the dependent variable is expressed in terms of the natural logarithm of the rate of return. Using the standard error of estimate as the choice criterion, we choose Equation III over Equation II. Now, to be able to compare Equation III to Equation VI one has to standardize the dependent variable to the same common footing.[1] The dependent variable in

---

[1]The variance of the dependent variable changes with the change in the units of measurement; i.e., the variance of Y- the dependent variable expressed in levels is different from the variance of log Y. For a full discussion of this topic see G.E.P. Box and D.R. Cox, "An Anaylsis of Transformations," *Journal of the Royal Statistical Society*, Series B (1964), pp. 211-43. In their analysis of the choice between a linear regression and a log-linear regression equation, Box and Cox suggest a standardization procedure which involves the division of the dependent variable by its geometric mean.

Equation III is expressed in terms of the natural logarithm of the rate of return while in Equation VI the dependent variable is expressed in terms of level. In this case a direct comparison of the standard error of estimates is meaningless. To deal with this problem, one either has to standardize the independent variable in both equations or convert the standard error of estimates to a common unit of measurement. Since both of these methods generate the same result, we shall use the latter and the easier one for comparing the efficiency of the fit of the two regression equations. Taking the antilogarithm of the standard error of Equation III, it is seen that the standard error associated with this equation is much greater than the standard error of Equation VI (0.0099).

Theoretical Implications of Regression Equations

Both Equations III and VI exhibit a non-linear relationship between the rate of inflation and the rate of bank return. Equation III implies that the rate of return increases without bound with an increase in the rate of inflation. This implication is not, however, sanctioned by reality. Generally speaking, one would expect that if the rate of inflation exceeded a certain threshold limit people would stop using fiat and bank money altogether and would either turn to barter or would resort to an alternative medium of exchange. That this was the case during the seven European hyperinflations is well documented and need not be discussed at this point. The flight of the public from fiat money and bank deposits would lead to a collapse of the national monetary and banking system and force the commercial banks into bankruptcy.

Equation IV portrays a better picture of the relationship between banks' rate of return and the rate of inflation. Although it is not possible to extrapolate the relationship between banks' rate of return and the rate of inflation beyond the known range from this equation, the regression equation has a theoretically acceptable implication. The equation implies that up to a certain range, the rate of return increases at a decreasing rate with successive increases in the rate of inflation. But once the rate of inflation exceeds a certain threshold, the rate of return approaches a constant. To further illustrate this point, Equation VI is graphed in Figure 11 for the observed values of the rate of inflation. As can be seen from the graph, if the rate of inflation increases without bound, the rate of return asymptotically approaches a constant at 14.4 percent rate of return.

Conclusion

Our objective in this section was not to predict the relationship between the Chilean commercial banks' rate of return and the rate of inflation in that country for all the time periods. We have simply tried to show that Grove's evidence regarding the impact of inflation upon the economic performance of Chilean banks does not stand up under statistical scrutiny and has to be rejected as inconclusive.

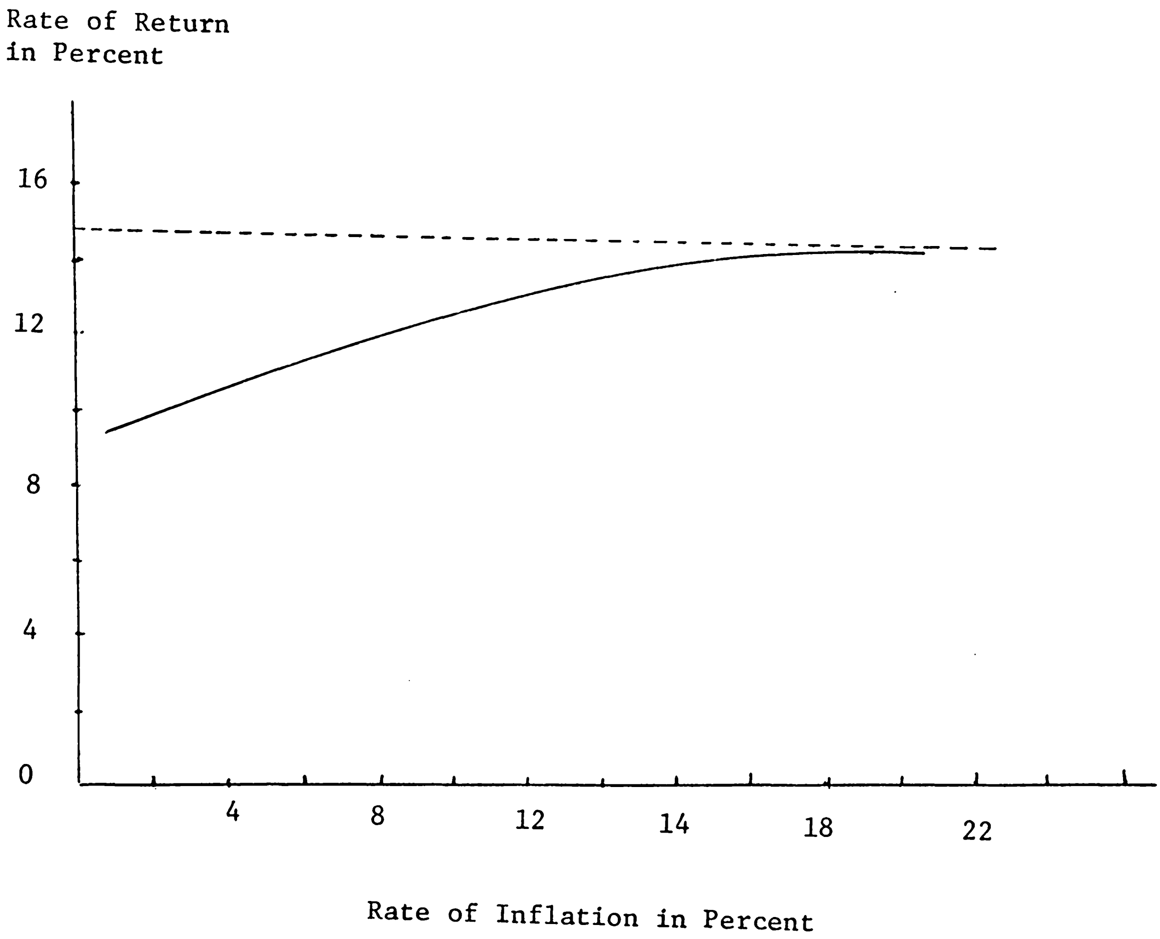


Fig. 11.--Equation IV: Observed values of the rate of inflation.

CHAPTER IV

PORTFOLIO BEHAVIOR OF BANKS IN INFLATIONARY PROCESSES

Inflation changes the relative yield structure of different assets and forces the asset holders to change their portfolio mix. Banks, as holders of financial assets of differing maturities, are no exception in this respect. Knowledge of bank responses to expected changes in the interest rates and asset prices is important not only for the appraisal of the impact of inflation upon bank income but also for the efficacy of monetary policy. To this end we shall extend the simple behaviorial model of Chapter III and shall attempt to verify some of the hypotheses that are derived from that model.

The Model

In Chapter III it was assumed that the typical bank supplied credit in two separate markets: the short-term loan market and the long-term market. The bank was assumed to face a downward sloping demand curve for short-term credit and a horizontal demand curve for long-term credit. In other words, it was assumed that the represen-tative bank was a monopolist in the short-term loan market and a competitor in the bond market. It was shown that the process of equalizing marginal revenues in these two markets led to a specific allocation of borrowed funds between the loan and the bond market. The profit-maximizing hypothesis, it was illustrated, led the individual bank to choose a portfolio mix of deposits, loans and bonds for which the marginal revenue from loans was equal to the marginal revenue from bonds, which in turn was equal to the marginal cost of acquiring funds.

To refresh the reader's memory, Figure 12 shows the optimal loan-bond mix chosen by a representative bank at time t for a given marginal cost of acquiring deposits. It is assumed that the bank is fully loaned up. In this figure the stock of deposits minus the amount of required reserves is measured on the horizontal axis; i.e., 00' = loans + bonds = deposits - reserve requirements. Denoting the quantity of bonds by B, the quantity of loans by L, deposits by D and reserve requirements by R, then 00' = L + B = 0L + 0'L. The quantity of loans is measured from right to left on the horizontal axis. Marginal revenue from loans is measured on the lefthand vertical axis and the marginal revenue from bonds is measured on the right-hand vertical axis. The negatively sloped marginal revenue from loans intersects the horizontal marginal revenue from bonds at point a in the diagram. According to the construction depicted in Figure 12, the typical bank maximizes profit by holding 0L dollars of short-term loans and 0'L amount of bonds for a given interest cost on deposits.

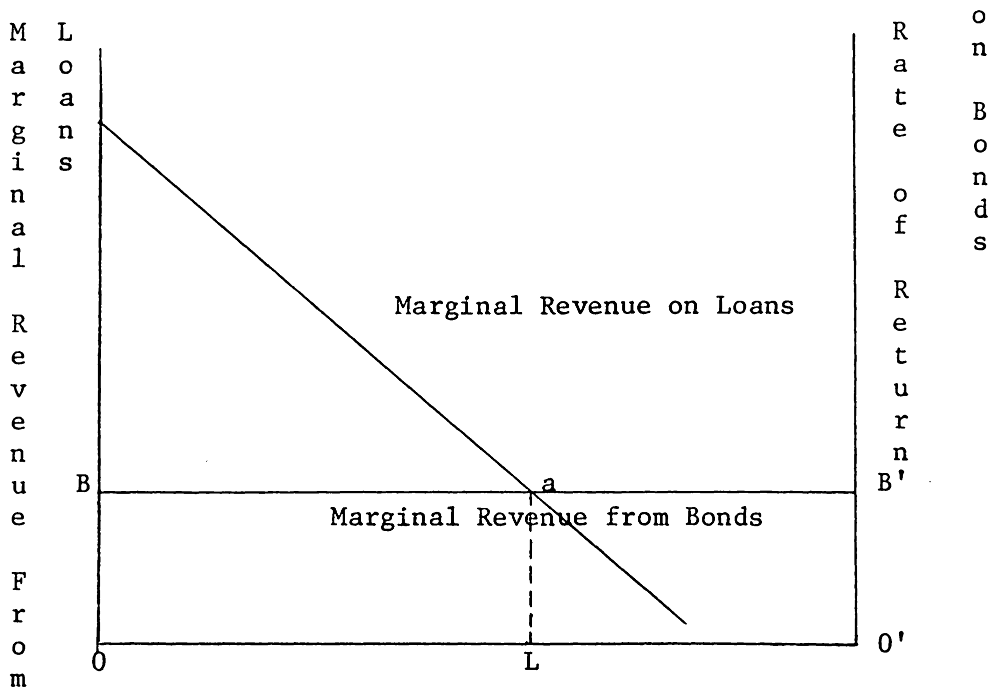


Fig. 12.--Asset choice of a representative bank in the loan and bond markets.

Changes in the Market Interest Rate
and the Value of Banks' Gross Assets

The market value of a bank at a given time depends upon, among other things, the maturity composition of the assets retained by the bank. Some of these assets, such as call loans and treasury bills, can be readily converted to cash at par value while others, such as long-term securities, may not be convertible to cash at face value. An increase in the long-term rate of interest, for example, reduces the market value of long-term bonds which a representative bank retains among its income earning assets. The bank cannot convert such bonds to cash without suffering some capital losses in the process. Several authors have argued, however, that to the extent that the bank does not have to realize its long-term securities before their maturity, such capital losses are paper losses rather than being real. Drawing on an article by Paul Samuelson on the "Effects of Interest Rate Increases on the Banking System,"[1] Harry Johnson makes the following argument:

> This concern of the banks with the capital values of their investments, however useful to official monetary policy, is nevertheless based on fallacious reasoning, and adherence to it is against the banks' own interest. The fall in the value of gilt-edged investments which results from a rise in the rate of interest is purely a paper loss. ... It does not become a real loss unless the banks have to realize the securities before they mature, thus being forced to take a lower price for them than that originally paid. Now, with the present excessively high liquidity of the banks' assets, it is

---

[1]Paul A. Samuelson, "The Effect of Interest Rate Increases on the Banking System," American Economic Review, XXXV, No. 1 (1945), pp. 16-27.

inconceivable that the banks would ever encounter a demand for cash sufficient to force them to liquidate their holdings of longer-dated stocks; any such need for cash could largely be met by calling in funds from the money market and not replacing holdings of Treasury bills as they matured..."[1]

Professor Johnson's view is neither compatible with actual bank behavior during periods of rising interest rates nor is it defensible at a theoretical level. Johnson's argument implies that (1) bankers do not or should not attach importance to the value of their assets and its relationship to their liabilities,[2] and (2) the market value of a bank which holds long-term securities does not fall due to a decline in the market price of securities.

With regard to the first implication, one may tentatively agree with Professor Johnson that a representative bank does not have to make changes in its portfolio in response to a decline in the market value of its securities if either of the following conceivable situations is present:

(1) If the monetary authorities undertake compensatory actions to maintain the prices of long-term securities;

(2) If the representative bank happens to hold sufficient excess reserves; and

---

[1]Harry G. Johnson, "Some Implications of Secular Changes in Bank Assets and Liabilities in Great Britain," Economic Journal (September, 1951), pp. 549-50.

[2]In a joint contribution Frank Brechling and George Clayton have strongly challenged Johnson's view on the portfolio behavior of banks and bankers' responses to changes in the market value of their assets and liabilities. See their "Commercial Bank's Portfolio Behavior," Economic Journal (June, 1965), pp. 290-316.

(3) If the central bank continues to discount the bank's eligible papers at par value.

Only under these circumstances is the representative bank unlikely to experience reserve deficiencies due to an increase in the market rate of interest. For otherwise, as Irving Fisher observed in his "Purchasing Power of Money," a decline in the market value of long-term bonds which a typical bank may retain in its portfolio is equivalent to a decrease in the level of bank deposits. In a discussion of the factors which tend to limit the volume of bank deposits, Fisher wrote:

> ... further, with the rise of interest, the value of certain collateral securities, such as bonds, on the basis of which loans are made, begins to fall. Such securities, being worth the discounted value of fixed sums, sell as interest rises; and therefore they cannot be used as collateral for loans as large as before. This check to loans is ... a check to deposits also.[1]

In terms of Figure 12, Fisher's analysis implies that a ceteris paribus increase in the bond yield induces a leftward shift in the righthand vertical axis.

Additionally, Professor Johnson's argument tends to obscure the distinction between liquidity and solvency.[2] An increase in the long-

---

[1]Irving Fisher, The Purchasing Power of Money (New York: The Macmillan Company, 1921), pp. 64-5.

[2]For a good discussion of solvency versus liquidity see James L. Pierce, "Commercial Bank Liquidity," Federal Reserve Bulletin (August, 1965). To quote Pierce, "Solvency measures the difference between the value of a bank's assets at maximum expected prices and its liabilities. Liquidity refers to realizable value of asset portfolio for a given time to sale and a given size of the actual sale." Thus, an increase in the expected market interest rate which leads to a decline in the market value of long-term assets will make a bank illiquid even though the bank may be solvent in the usual sense.

term rate of interest renders the individual bank illiquid, even though the bank may be solvent in the accounting sense. If such a bank is put up for sale, its assets, both long-term and short-term, will be valued at market prices rather than at acquisition prices and it will sell for a lower price than what could be obtained had there been no increase in the bond yield. Viewed in this manner, the fall in value of the individual bank is a real loss rather than a paper loss. The reaction of an individual bank to changes in the expected yield of its income-earning assets depends upon the expectations of the bank with regard to the future trend of the interest rates and the institutional constraints which the bank is subject to. Indeed, institutional constraints are so important that one is unable to conduct a useful analysis of the process of portfolio revision without giving adequate recognition to these constraints.

We are, of course, unable to examine the portfolio behavior of banks under all conceivable institutional and market structures. The best that is possible at this stage is to examine only the most prevalent institutional and market structures, and this is what we shall do in the ensuing sections of this chapter.

Perfectly Anticipated Inflation And Portfolio Choice

In a time of fully anticipated inflation, the representative bank has no incentive to revise its portfolio mix. Portfolio shifts are only profitable when the holding period yields of different assets are significantly out of line with one another. If the long-term rate is regarded as the average of expected future short-term interest rates, then both the short-term and the long-term rates of interest tend, except for differences in transaction costs, to increase by the full amount of the expected rate of inflation. Referring to Figure 12, the bond yield schedule shifts up by the same amount as does the marginal revenue curve on loans. In these circumstances, the representative bank cannot increase its earnings by reshuffling its balance sheet as the marginal revenue on loans remains equal to the marginal revenue on bonds. This situation is depicted in Figure 13.

Pegged Bond Yields and Portfolio Revision

Using the simple portfolio model considered above we shall consider the process of portfolio rearrangement which follows an inflationary disturbance. The disturbance in each of the cases discussed below is a shift in the demand for short-term loans brought about by inflationary expectations.

Referring to Figure 14, assume that the demand for short-term loans shifts to the right. The initial response of an individual bank, acting on its own, is clear. With an unchanged bond yield the bank, anticipating some superior profits in the short-term loan market, would want to expand its short-term loans from the level indicated by a in Figure 14 (reproduced from Figure 12) to the level indicated by b. Position b is not, however, attainable in the absence of compensatory actions by monetary authorities. To belabor the obvious, while an individual bank can sell all its long-term securities without

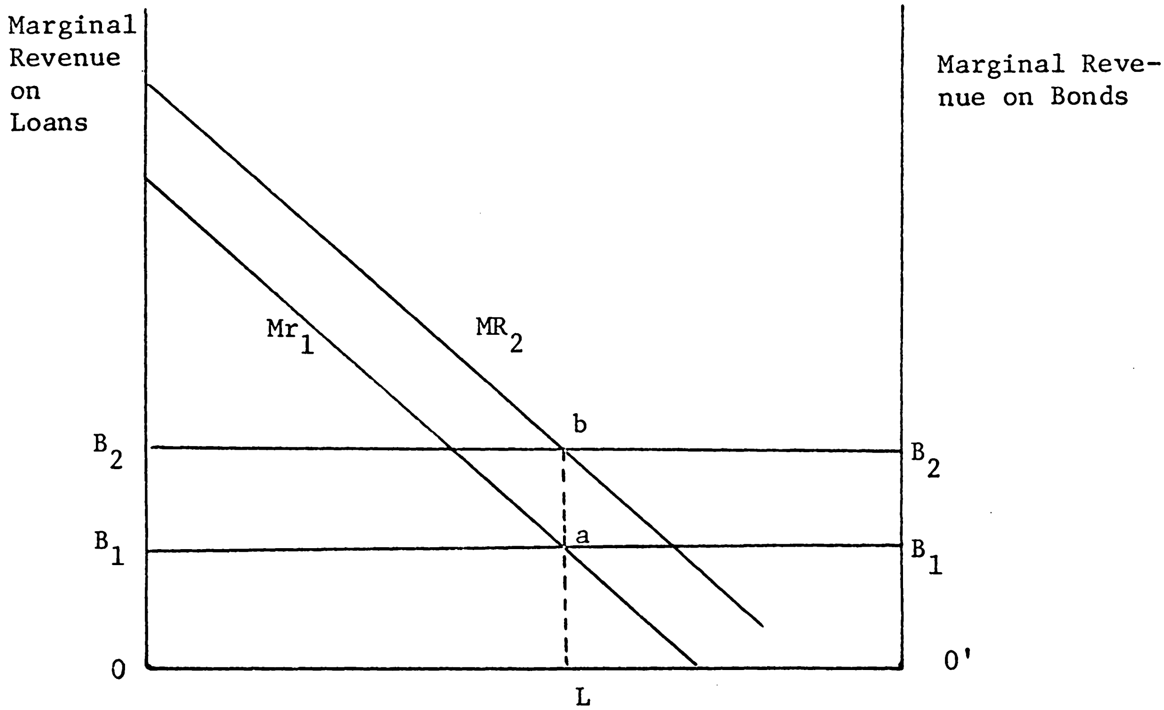
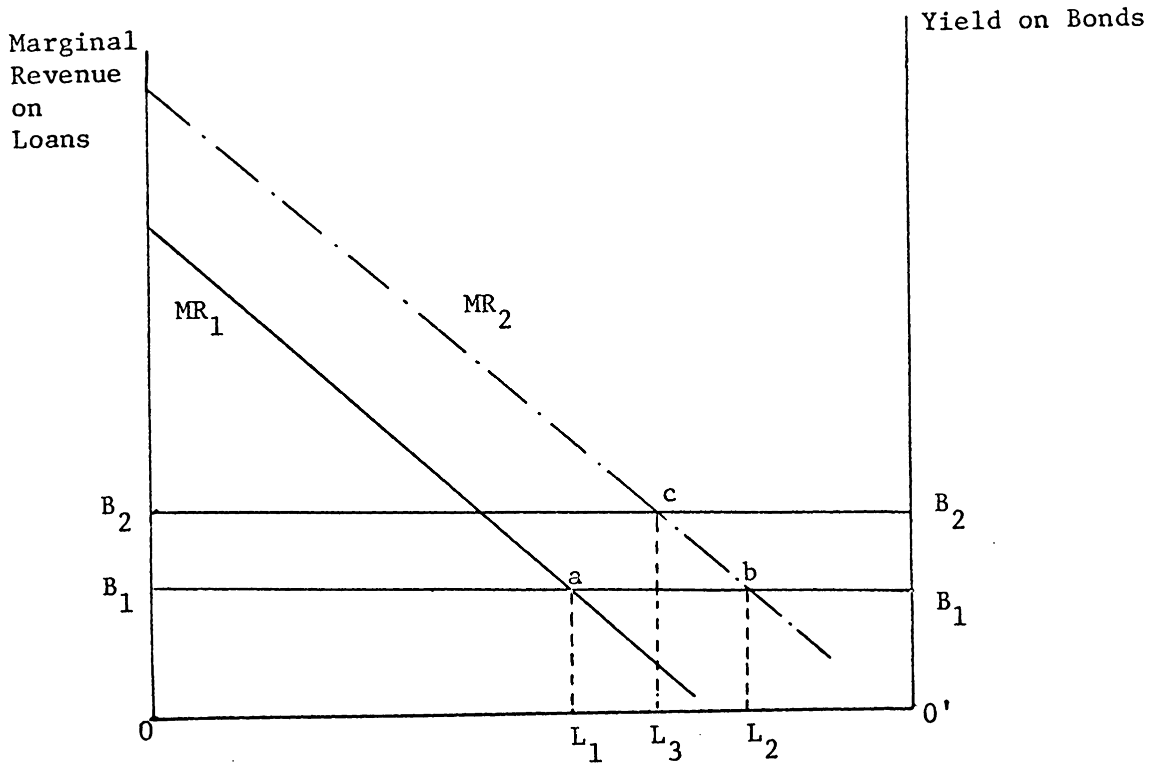


Fig. 13.--Portfolio choice under a regime of fully anticipated inflation.



Marginal Revenue on Loans
Yield on Bonds
MR_1
MR_2
c
a
b
B_2
B_1
B_2
B_1
0
L_1
L_3
L_2
0'

Fig. 14.

perceptibly depressing the market prices of these securities, the banking system as a whole cannot. The efforts of banks to reshuffle their balance sheets depresses bond prices and raises their relative yields. In terms of Figure 14, this phenomenon shifts the bond yield up from its initial B_1B_1 position to B_2B_2, and at the same time causes a shift to the left in the righthand vertical axis. The equilibrium loan-bond mix in this situation is dependent upon the expected bond yield and the perceived marginal revenue in the loan market over the upcoming period. Assuming that the individual bank is not constrained to a specific portfolio distribution, then the equilibrium loan-bond mix is reached somewhere between points a and b.

Central Bank Intervention in the Bond Market

By its intervention in the bond market, the central bank has the power to change the proportion of loans to bonds to which an individual bank may adjust under the free play of market forces. If the central bank, for instance, takes the actions necessary to support the prices of long-term securities, the BB curve in the diagram stays put.[1] As a consequence, the individual bank is neither concerned about the book value of its long-term assets, nor fears capital losses on its sales of securities. In this case, the only cost involved in portfolio revision is brokerage fees, and the typical bank expands its

---

[1]Price support of the government bond market by the Federal Reserve System in the United States was a common practice until 1951.

loans to the point where the equi-marginal rule is satisfied. Point a in Figure 14 is representative of this case. In this connection it may, however, be added that the increase in the demand for loans need not be and is usually not financed by the proceeds realized from the sale of bonds. Generally, central banks' open market operations which are designed to maintain security prices lead to an increase in the monetary base as the non-bank public exchanges its long-term securities for cash. This, in turn, will increase the quantity of primary deposits and consequently the total reserve of the banking system. To the extent that the cost of acquiring funds through issuing primary deposits is less than the cost of obtaining funds by selling securities, the individual bank finds it profitable to utilize the former source of funds rather than the latter to meet the increased demand for loans.

Market Determined Bond Yields and Portfolio Adjustment

The behavioral responses of banks to changes in the rates of interest can be substantially different in a situation where the central bank does not directly intervene in the bond market. The most obvious difference between this case and the one just considered is that the typical bank can no longer retain certain expectations with regard to future bond prices. Portfolio decisions have to be made with the help of expectations and from available data on the probable future trends of interest rates and bond prices. With this in mind, we shall extend the diagrammatic apparatus introduced above to explicate the general structure of events that may occur in the situation under consideration. To begin with, we shall make the simplifying assumption that all the other banks in the economy have made necessary adjustments in their portfolios except the individual bank whose behavior we are examining.

With reference to Figure 14 , we are considering the reaction of the individual bank confronted with the pictured situation. In doing so, we find it appropriate to brush aside a host of controversies such as those raised by Professor Johnson which do not touch on our central problem. In other words, we need only consider the possible responses of a banker to an increase in short-run demand for loans and an increase in the bond yield under the circumstances assumed. Supposing that the individual bank has little, if any, information about interest rates and bond prices beyond its planning horizon, we can delineate some of the more obvious actions that the typical banker would take to re-establish an optimum portfolio composition. Referring to Figure 14, it is observed that the bank can increase its short-run earnings by moving from a portfolio denoted by point a to a portfolio shown as point c in the diagram. This movement is profitable because up to point c, the expected marginal return on a dollar allocated to loans exceeds the expected marginal return on a dollar tied up in securities. At this juncture, however, it may be objected that the fear of capital losses on securities may deter the individual bank from making the switch. The answer to this objection may be positive or negative depending upon the banker's subjective estimates of the interest rates and bond prices and the actual behavior of these variables over the banker's planning horizon. If, for example, the increase in the bond yield is permanent and the banker refuses to make the switch, he has certainly sacrificed some income. The bank has suffered capital losses on its securities whether it switches to loans or not. The bank cannot avoid such costs by refusing to sell its securities.[1] As the economists say, "bygones are bygones" and are irrelevant for purposes of decision making. Risk of capital loss would influence the portfolio decision of a profit maximizing bank only when the banker expects that increases in the market rates of interest and declines in bond prices are transitory rather than permanent. This situation is, however, improbable in the early stages of an inflationary process when expectations of rising interest rates and declining bond prices prevail. If the typical banker, for example, behaves according to what is known in the literature as the "Adaptive Expectations Hypothesis"[2] and reformulates his expectations about

---

[1]For a similar point of view see Sam B. Chase, "Banks' Reaction to Security Losses," in Essays on Commercial Banking (Federal Reserve Bank of Kansas City, 1962), pp. 87-98. In his article, Chase has explored the validity of the so-called "locked-in effect hypothesis" and has concluded that the hypothesis is not verified by evidence.

[2]The "Adaptive Expectations Hypothesis," first formulated by Philip D. Cagan, simply says that asset holders utilize past experience in expectation formation to arrive at a new expectation. According to this hypothesis, the expected value of a variable for future time periods is estimated from the expected value of the variable in previous time periods and the deviation of this expected value from the actual value. Algebraically, if Ex_{t-1} is the expected value of variable x at time t-1, x_t is the value actually observed in time t for this variable, and Ex_t is the expected value for the future time period being

future interest rates and bond prices in the light of the current values of these variables and what he expected them to be in the preceding time period, his likelihood of being incorrect for an extended period of time is nil.[1] The typical bank cannot afford to err consistently in its predictions of the future course of the variables with which it constantly has to deal.

Having considered one extreme case of portfolio revision -- namely the case when the typical bank is the last bank to rearrange its portfolio -- let us consider another extreme case, a case where the

---

computed we have an expression such as:

$$Ex_t = a \cdot x_{t-1} + (1-a)x_t.$$

In words the expression says that the expected value of variable x computed at the current time period is a weighted average of the expected value of this variable at time t-1, and its actual value at time t. Cagan's adaptive expectations hypothesis has turned out to be a reliable tool for explaining price behavior over time. Cagan himself employed the method to explain formation of expectations with regard to the general price level in his empirical analysis of the seven European hyperinflations. For further elaboration of this hypothesis, see Philip D. Cagan, "The Monetary Dynamics of Hyperinflation," in Studies in the Quantity Theory of Money, ed. by Milton Friedman (Chicago: University of Chicago Press, 1965).

[1]In a recent study James L. Pierce has used the adaptive expectations model to explain the portfolio behavior of the United States commercial banks. In his inquiry Pierce has indicated that banks actively forecast future deposit levels as well as the future interest rates. See James L. Pierce, "A Cross Section Analysis of Commercial Bank Portfolio Management," a paper presented before the Econometric Society, December, 1965, and "An Empirical Model of Commercial Bank Portfolio Management," in Studies of Portfolio Behavior, ed. by Donald D. Hester and James Tobin, Cowles Foundation for Economics at Yale University, Monograph No. 2 (New York: John Wiley and Sons, 1967), pp. 171-90.

the typical bank is the first bank to make proper adjustments in its portfolio in response to the market signals. Under the presumed situation, the representative bank can sell all its securities without having to bear capital losses on these securities. If this bank expects the bond yield to remain invariant as short-term rates increase, its most profitable portfolio composition is point b in Figure 14. This situation is, however, unlikely in an inflationary process. There are two reasons for this. First, in the wake of an inflationary process borrowers would like to borrow long, while lenders, uncertain about the future trends of interest rates, would like to lend short. This phenomenon, by itself, tends to increase interest rates on long-term loan instruments. Secondly, as the banks and the non-bank public dampen their long-term securities to meet short-run contingencies, they depress the prices of such securities. In view of this, the relevant bond yield schedule to the representative bank is not the B_1B_1 schedule. For, if the representative bank revises its portfolio on the basis of the pre-inflationary bond yield schedule (B_1B_1) rather than the bond yield schedule that would prevail once inflation got underway (i.e., the B_2B_2 curve in Figure 13), the bank would have overreacted in its response to the increase in the loan demand function. As it can be observed from the diagram, if the representative bank uses the B_1B_1 schedule as the basis for its portfolio decision, it would expand loans up to point b in the diagram. At this point, the marginal revenue from loans falls short of the marginal revenue from bonds if the relevant bond yield is B_2B_2 rather than B_1B_1. Thus point b does not represent an optimum portfolio mix even if the representative bank is the first bank to guess correctly the expected magnitude of interest rates over its planning horizon. The optimum portfolio mix would rather be obtained somewhere between points a and b.

The Portfolio Adjustment Path

In our discussion above, we indicated that the representative bank can choose an optimum portfolio if, and only if, its estimates of market interest rates and bond prices coincided with those that would actually be obtained. This is by no means characteristic of the real world. To make an optimal portfolio choice, the individual bank needs to know the equilibrium bond and loan rates that would prevail over its planning horizon. This kind of information is not, however, available to any one bank. No one banker can decide upon an optimal portfolio mix without knowledge of what others will do. And if there are many others in the market, as is the case, the possibility of making the "correct" decision is rare indeed, if not impossible. Such decisions are further complicated if the monetary authorities do not increase the stock of high-power money at a uniform rate. In view of this, it is quite common for the community of bankers either to overestimate or underestimate the future interest rates and bond prices. The banks which have access to better information and are in a position to ascertain market expectations more correctly than others would naturally be less susceptible to mistakes in their anticipations of market interest rates. Those who are not so fortunate, and respond to changes in the interest rates with a "long" lag, may sacrifice the opportunity of earning some windfall income by failing to make the "right" decision at the right time. Referring to Figure 14, the bank which outguesses every other bank in its anticipation of the future increase in the bond yield schedule bears few capital losses, if any, in its switch from securities to loans, while the bank which is sluggish in its response has to sell its securities at a loss.

The analysis above may be generalized by expressing the process of portfolio adjustment in terms of two behaviorial equations. Letting X^j be the actual stock of the j^{th} asset, $X*^j$ the desired stock, and R an index of interest rates, one may impute the following two adjustment equations to each individual bank.

$$X*^j_{t+1} - X*^j_t = a(R_{t+1} - R_t) + u_t \tag{1}$$

$$X^j_{t+1} - X^j_t = b(X*^j_{t+1} - X^j_t) + e_t \tag{2}$$

These two equations may also be rewritten as:

$$X*^j_{t+1} = X*^j_t + a(R_{t+1} - R_t) + u_t \tag{1'}$$

$$X_{t+1} = X_t + b(X*^j_{t+1} - X_t) + e_t \tag{2'}$$

Equation (1), or its equivalent equation, (1'), states that the desired stock of the j^{th} asset over the planning period -- i.e., one period from now -- is related to the desired stock of the asset in question in time t and the expected spread between the current and the future interest rate. Equation (2), or its equivalent, (2'), states that the difference between the actual stocks of the j^{th} asset at times t and t + 1, respectively, is related to the spread between the desired stock of the asset in question over the planning period and its actual stock at the present.

Stock Adjustment Delay Versus Learning Delay

The stock adjustment model posited above differs from the standard stock adjustment models in that it takes into account two types of distinct delays which one would expect to occur in the process of portfolio adjustment.

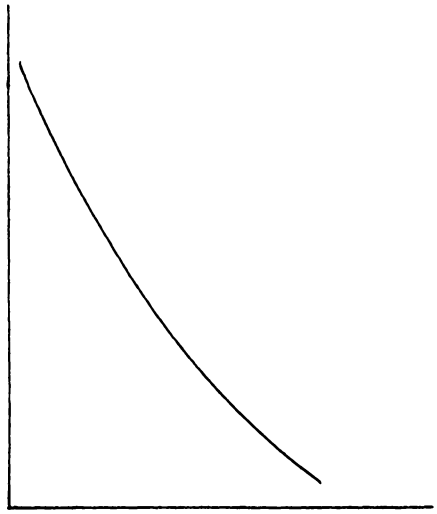
The first type of delay, which may be called the "recognition" or "learning" delay is expressed by Equation (1) or its equivalent, (1'). The learning delay reflects the time it takes for the desired stock of the asset under consideration to respond to changes in interest rates. This sort of delay, with very few exceptions, has been generally ignored both in portfolio and investment literature.[1] The distributed lag pattern corresponding to this type of delay may take a variety of shapes. If the individual bank, for instance, attaches more weight to current changes in the interest rates than to the less recent changes, the lag pattern will be of the Koyck type, declining steadily at an exponential rate (see Figure 15, Curve A). If, on the other hand,

---

[1] For an exception see Franco Modigliani, Robert Rache and J. Phillip Cooper, "Central Bank Policy, The Money Supply, and the Short-Term Rate of Interest," Journal of Money, Credit and Banking, II, No. 2 (1970), pp. 166-218.

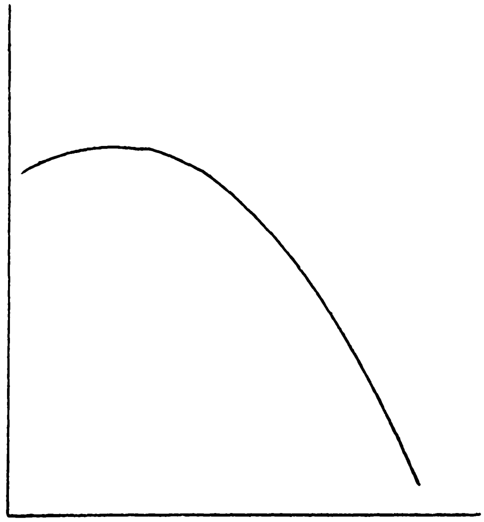
the individual bank attaches more weight to past changes of interest rates than to current changes, the lag pattern may look roughly like Curve B. This type of weighting structure corresponds to what is known in literature as the "extrapolative expectations." Still, if expectations are regressive, the weighting structure may exhibit a jagged pattern such as the one shown in Curve C. A priori, one would expect extrapolative expectations to be more prevalent in the course of an unanticipated inflationary process. At the outset of an inflationary process, the typical bank is not likely to have access to adequate information to ascertain whether the recent and current changes in interest rates are inflationary. This implies that in the beginning the typical banker proceeds slowly and with caution in readjusting his desired stock of the asset in question. But as the effects of inflation become more pronounced, the typical bank is able to ascertain better the nature of the past changes in interest rates and is able to speed up the recognition process.

The second type of delay is the usual stock of adjustment delay, reflecting the time it takes the individual bank to close the gap between the actual level and the desired level of the asset under consideration. The shape of the adjustment path corresponding to this kind of delay depends upon the characteristics of the market in which the asset in question is being traded. If the transactors hold uniform expectations and proceed towards portfolio revision simultaneously, the adjustment path would decline sharply throughout. In the absence of uniform expectations the approximate shape of the



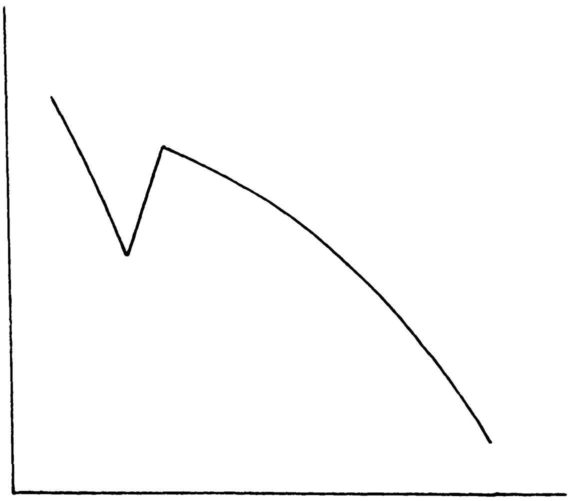
Koyck Lag

Curve A



Extrapolative Lag

Curve B



Regressive Lag

Curve C

Fig. 15.--Distributed lag patterns.

adjustment path is not obvious. Professor Vittorio Bonomo[1] has, however, argued that the adjustment path corresponding to this type of delay would exhibit two points of reflection. The points of reflection occur at that point in time in which expectations become widespread and some investors begin to think that adjustment has gone far enough. This phenomenon is illustrated in Figure 16.

As is seen in the figure, the typical bank proceeds slowly in revising its holdings of Asset j up to Point n. During the next stage, the bank tries to move as fast as anybody else in reducing its actual stock to its desired level. This process continues to the time period n + m. From then on, the adjustment process is pursued slowly.

Before combining the two types of delays it is illustrative to examine their relationship graphically. This is done in Figure 17, using the assumption of the extrapolative expectations.

Starting from a position of full equilibrium, that is, a position where the desired and the actual stock of the j^{th} asset are in line, the revision process would be as follows. The typical bank learns about its stock of the j^{th} asset over its planning period at Time t + 1 (see Curve A). The actual revision process as shown in Curve B starts at time period i, when a decision has been made as to the optimum stock of the asset in question. The revision process is completed in Time t + m.

---

[1]Department of Economics, Virginia Polytechnic Institute and State University.

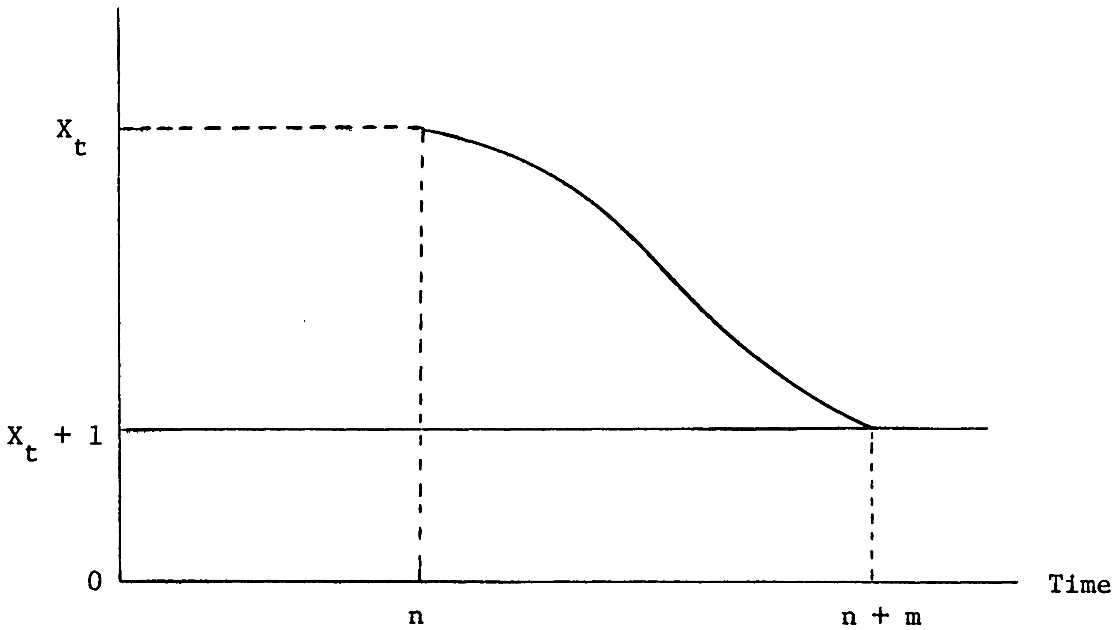


Fig. 16.--The adjustment path.

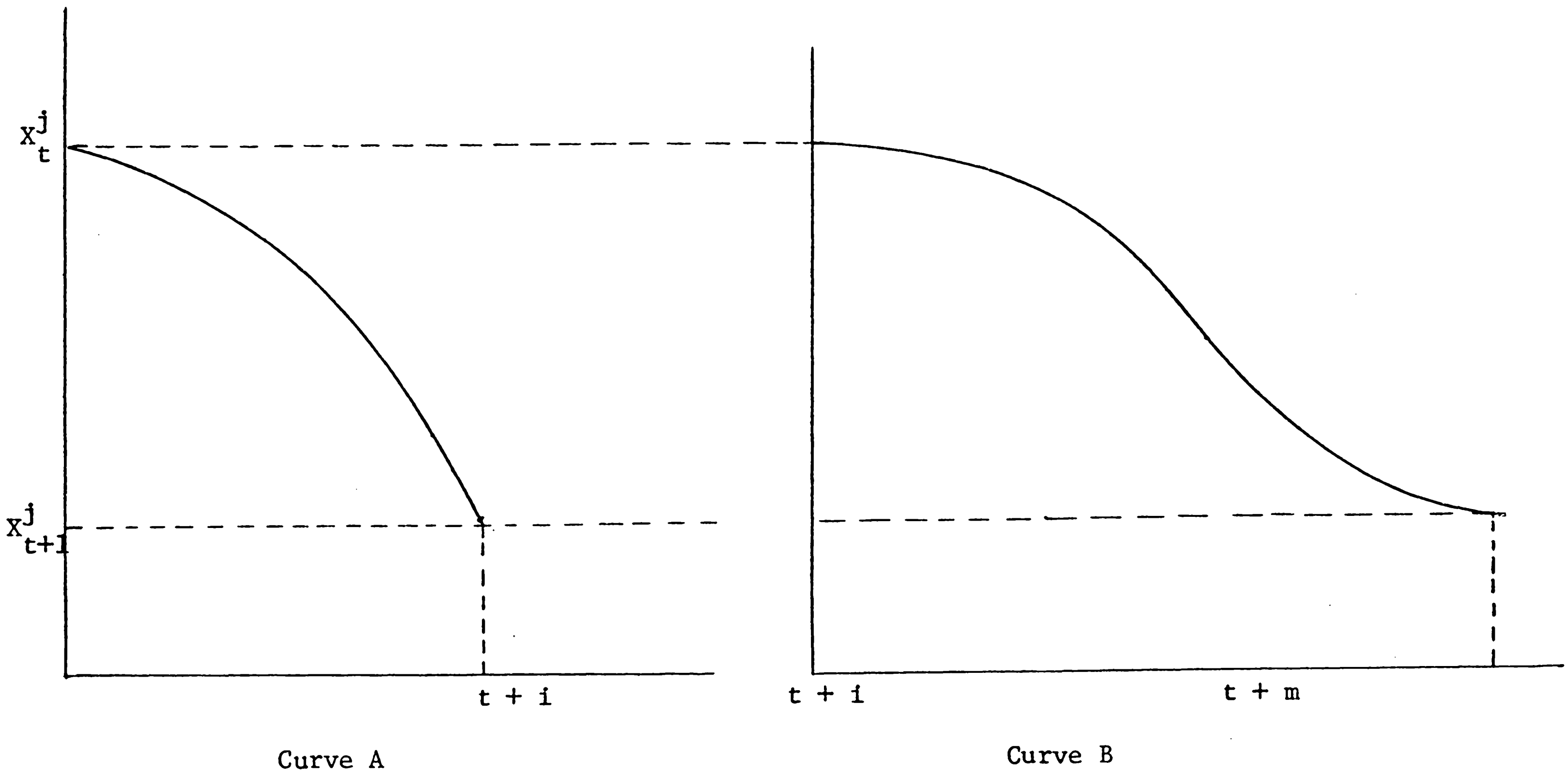


Fig. 17.--Adjustment delays.

Combined together, these two types of delays are shown in Figure 18. To simplify the diagram, we have shown the time span relating to the learning lag, rather than the shape of the distributed lag itself.

Similar conclusions may also be arrived at by combining Equations (1') and (2). Substituting for X^{*j}_{t+1}, from (1') into (2), we have:

$$X^j_{t+1} - X^j_t = bX^{*j}_t + a \cdot b(R_{t+1} - R_t) - bX^j_t + b_t + e_t \qquad (3)$$

Assuming that the typical bank was in equilibrium to begin with, Equation (3) simplifies to:

$$X^j_{t+1} - X^j_t = a \cdot b(R_{t+1} - R_t) + v_t \qquad (3')$$

where v_t is the sum of the error terms.[1]

---

[1]In a recent study, Stephen Goldfeld has found marked differences in portfolio responses of city banks as compared to country banks in the United States. His results show that city banks are more sensitive to interest rate changes than are country banks. See Stephen Goldfeld, Commercial Bank Portfolio Behavior and Economic Activity: A Structural Study of Monetary Policy in the Post-War United States (Amsterdam: New Holland Publishing Co., 1966). Interbank differences of portfolio response has also been examined by Arle Melnik of Cornell University. Using a stock adjustment model, Melnik has found substantial differences in the speed of portfolio adjustment among various banks. See Arle Melnik, "Commercial Bank Portfolio Behavior: An Empirical Analysis" (unpublished Ph.D. dissertation, Cornell University, 1968). In his famous contribution, "A Model of Financial Behavior," Frank de Leeuw has estimated a speed of adjustment coefficient of .27 for the banking system as a whole. See Frank de Leeuw, "A Model of Financial Behavior," The Brookings Quarterly Model of the U.S., ed. by J. Duesenberry, et al. (Chicago: Rand McNally, 1965), pp. 476-82.

None of these authors has, however, considered the recognition lag. This suggests that their empirical estimates reflect the combined effects of both coefficients, rather than the effect of the

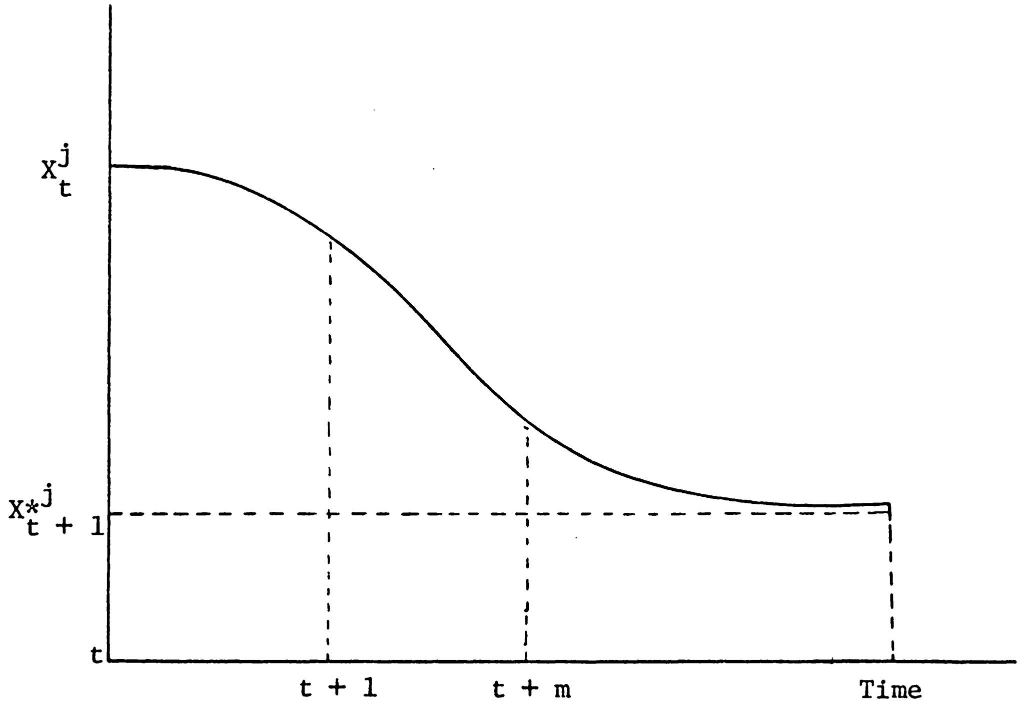


Fig. 18.--Portfolio adjustment path.

The Aggregate Distributed Lag Pattern

As the reader may have already noted, the two types of delays examined above would be different for different banks due to differences in asset positions, degree of knowledge about market conditions and location. To investigate the bearings of such inter-bank differences on the aggregate pattern of lag structure, we shall consider a simple three-bank case. These banks are ranked as (1), (2) and (3) according to their degree of knowledge about market conditions and the conformity of their expectations with ex post market conditions. Banks (1) and (3) are assumed to be atypical, while Bank (2) is assumed to be a representative bank. As shown in Figure 19, Bank (1), which has superior knowledge as compared to Banks (2) and (3), exhibits a shorter learning lag than either of the two other banks. The converse is, of course, true for Bank (3). The aggregate adjustment path would look somewhat like a normal curve, rising at a uniform rate in the beginning, then rising at an increasing rate, and finally reaching its peak when expectations become widespread and beliefs about market conditions tend towards uniformity.

From the aggregate adjustment path (Figure 20), it should be clear that what is true for the aggregates does not necessarily hold for the disaggregates. The macro adjustment path as shown by the bell-shaped curve is quite different from the micro adjustment paths.

---

speed of adjustment coefficient alone. Due to the presence of learning delay one has to conclude that the actual speed of adjustment may be much shorter than what is suggested by these authors.

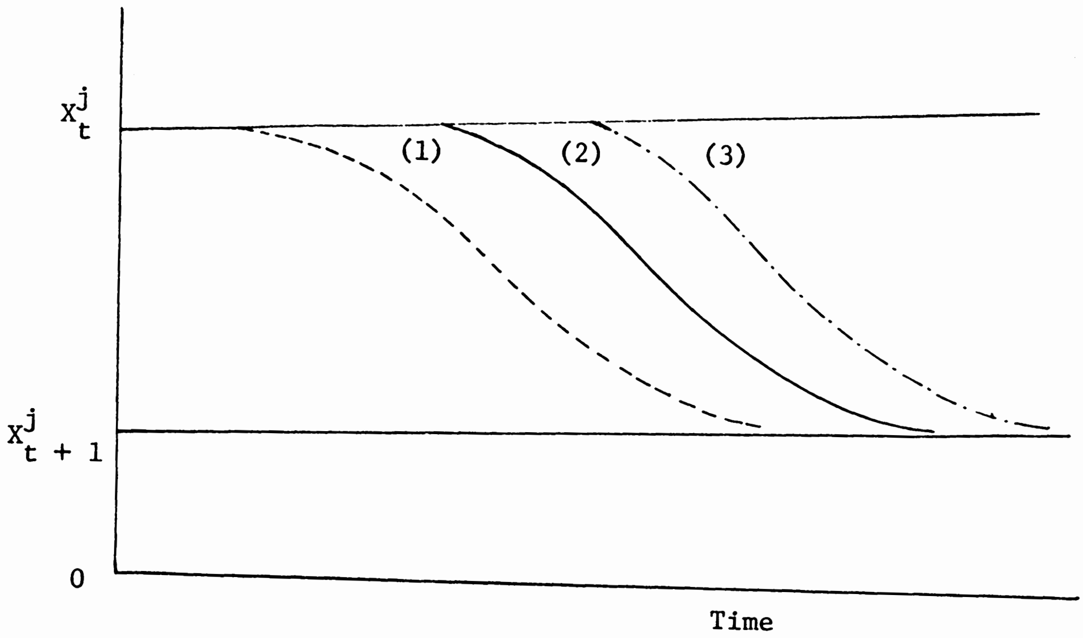


Fig. 19.--The adjustment path of different banks.

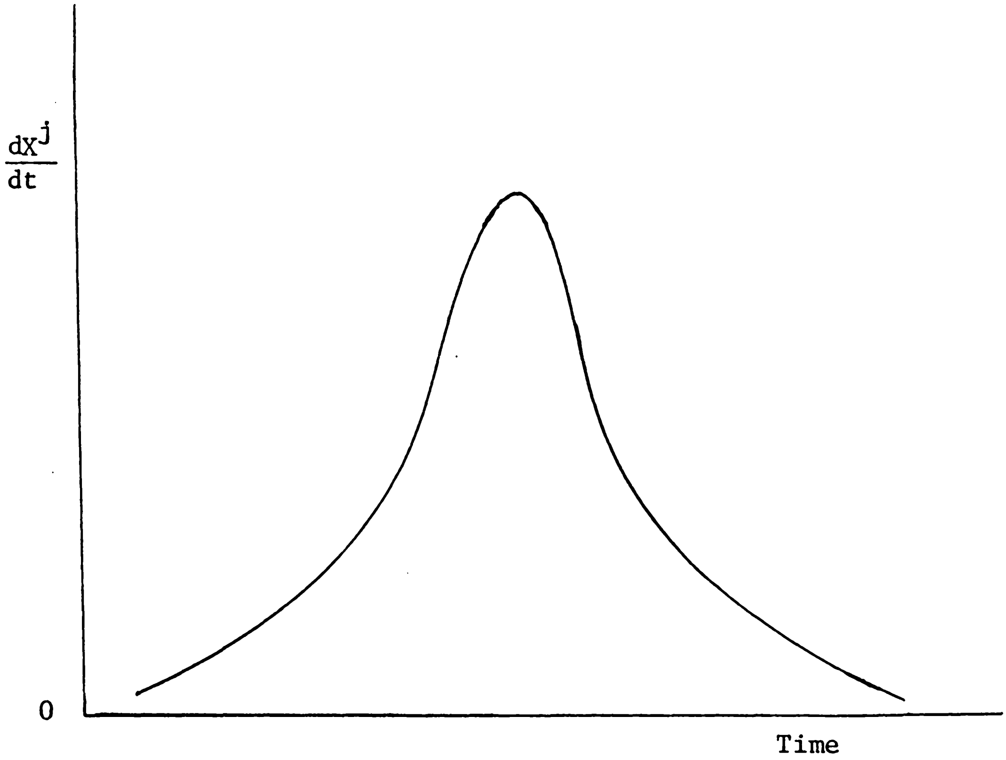


Fig. 20.--Aggregate adjustment path.

Note: The aggregate adjustment path is obtained by summing up the slopes of individual paths at each point in time.

The inference to be drawn here is that aggregate data may not yield meaningful information about the micro units which make up the aggregate.

At this point I would like to take a detour and compare the process of portfolio adjustment under the two institutional conditions examined so far. As the reader may recall, under the first institutional arrangement the banks can exchange their holdings of securities for cash without capital loss and then use the proceeds to finance short-term loans. Being assured that the bond yield would remain invariant (due to the price support of the monetary authorities), the representative bank would expand short-term loans up to Point a in Figure 14. Under the second institutional arrangement it was shown that the optimal loan-bond mix for the individual bank would lie somewhere to the left of Point a (for instance, Point c) in the diagram. Under the latter arrangement short-term loans would not be expanded as far as they would under the first arrangement. In other words, under a policy of bond price-support, an individual bank is able to extend more short loans than it would be able to in the absence of such a policy. Additionally, since government price support of the bond market eliminates the risk of capital loss on securities, bankers would naturally have a vested interest in this kind of policy.[1]

---

[1]For a supporting point of view see Johnson, op. cit., p. 550. Johnson has argued that stabilization of the gilt-edged market by official intervention would require continuation of a cheap-money policy. One would expect that banks which hold considerable amount of long-term securities would persuade the monetary authorities to follow favorable policies.

Moreover, for the bond price to remain invariant during an inflationary process the monetary authority has to increase the stock of high-powered money at an accelerating rate. This implies that the first institutional arrangement is more inflationary than the second.

Constrained Portfolio Selection

In the foregoing sections, we ignored some of the complications that banks are faced with in their selection of optimum portfolios. We shall pause here to examine some of the more popular restrictions that are imposed by monetary authorities upon commercial banks with regard to their choices of earning assets.

Banks and financial intermediaries have been traditionally subject to various direct and indirect constraints in their choices of portfolios. In the United States, for example, banks have to allocate their assets among alternative uses subject to such direct constraints as "pledged asset requirements,"[1] and "capital adequacy ratio,"[2] and less direct constraints such as ceiling rates on time and demand deposits. Such constraints, when effective, tend to cause various allocative and distributive distortions in the financial and capital markets. In a recent theoretical and empirical analysis, Frank Brechling and George Clayton have discussed the implications of asset

---

[1]In the United States, federal law requires that a bank which holds U.S. Government deposits retain securities as collateral for such deposits. In general, the U.S. commercial banks are required to hold a certain amount of securities regardless of their asset positions or risk attitudes.

[2]The capital adequacy ratio is a measure of risk of a bank such as loan/deposit ratio, capital/risk assets, etc.

constraints on the portfolio behavior of British commercial banks and have concluded that banks would have decided upon a different portfolio distribution had they not been subject to these constraints.[1] The effects of government restraints and price-fixing practices on banks' choices of assets was also the subject of a recent symposium on monetary issues. Two of the noted participants of the debate, James Tobin of Yale and Milton Friedman of Chicago, were unanimous in their opinion that the present ceiling rates on various deposits (Regulation Q) have and continue to exert distorting effects upon the portfolio behavior of commercial banks and have served as a means of redistributing income from small savers to big savers.[2] According to Tobin:

> Although the macroeconomic effects [of ceiling rates] are small and easily neutralized, the maintenance of effective low ceilings during a tight money period has important allocative and distributive consequences. Here again it is necessary to distinguish the interest ceilings on large denomination CDs from those on small time deposits and savings accounts. The latter are much more important.
>
> Funds priced out of CDs have become available to the banks' borrowing customers in ingenious indirect ways that bypass the ceiling. Funds shifted to Eurodollar deposits have been borrowed by U.S. banks. Through their parent holding companies banks have borrowed in the open market. Prime corporate borrowers have sold their own short-term obligations

---

[1]Brechling and Clayton, <u>op. cit.</u>, pp. 290-300.

[2]James Tobin, "The Controls of Interest Rates Payable on Bank Deposits," <u>Journal of Money, Credit and Banking</u> (February, 1970), pp. 4-14; Milton Friedman, "Controls on Interest Rates Paid by Banks," <u>Journal of Money, Credit and Banking</u> (February, 1970), pp. 15-32.

in the market. The Fed finds itself in a perpetual and probably a losing race to block these detours.[1]

Friedman's position on this subject may be most succinctly summarized in his own words:

> Though largely avoided, the controls are not completely ineffective. Many people receive lower interest rates on their deposits than they would in the absence of controls. Many people allocate their asset portfolios differently than they would in the absence of the controls. Many borrowers pay different interest rates on loans or must resort to different lenders because of the controls. And, as a complaint that will strike many as highly parochial, the meaning of monetary aggregates is affected in unpredictable ways, making them difficult to interpret ...[2]

Although it is very difficult to ascertain the exact effects of controls on banks and financial markets, one is able to point out some of the more obvious impacts of such controls on the basis of theoretical reasoning and empirical evidence. To begin with, let us assume that the individual bank is required to retain a minimum amount of government securities in its portfolio which exceeds the profit maximizing quantity of $O'L_3$ in Figure 14. Since the control is effective in this instance, the individual bank finds itself in disequilibrium, i.e., its loan/bond ratio falls short of the optimum loan/bond ratio consistent with a bond yield schedule of B_2B_2 and a marginal revenue curve of MR_2. At this point the bank's marginal earning in the loan market exceeds its marginal revenue in the bond market. Being unable to substitute bonds for loans, the bank may

---

[1] Tobin, "The Controls of Interest Rates," p. 8.

[2] Friedman, "Controls on Interest Rates," p. 27.

resort to other sources of reserves to meet the increased demand for loans. These other sources of funds may either not be immediately available, or if available may turn out to be more costly than loan financing through sales of securities. Thus, one would expect that the presence of effective controls would increase the costs involved in revision of portfolios. To investigate the other effects of controls, we must relax the assumption that interest rates on funds borrowed by the banks (i.e., demand and time deposits, certificates of deposits, etc.) are set by the banks themselves in accordance with demand and supply of loanable funds.

The Growth of Time Deposits Versus Demand Deposits

In the United States the prohibition of explicit interest payments on demand deposits has led, since World War II, to an inordinate expansion of time deposits relative to demand deposits. This phenomenon, according to prominant monetarists, has been caused by a growing divergence between the interest on time deposits and the rate on demand deposits.[1] Secondly, the imposition of ceiling rates, as noted earlier, has led to a redistribution of income from the small to the big savers. This conclusion is clearly justified on various grounds. First, big savers have access to better information on savings

---

[1]This conclusion has been reached, though not independently, both by Milton Friedman and Phillip Cagan. See Friedman, "The Controls on Interest Rates," p. 15 and Phillip Cagan, Determinants and Effects of Changes in the Stock of Money (New York: Columbia University Press, 1967), pp. 164-80.

opportunities than small small savers do. Secondly, small savers usually save to meet unexpected contingencies. For such savers interest rate considerations are of minor significance so long as they have the assurance that they can withdraw their funds when the unexpected happens and the interest they receive on their savings does not fall short of the going rate of inflation. On the contrary, big savers who are essentially interested in what they can earn on their money capital examine the whole spectrum of savings opportunities to find the highest paying outlets for their money capital. This situation has traditionally enabled the banks to discriminate against their small depositors in favor of their big customers.

Some General Observations of the Portfolio Behavior of the U.S. Commercial Banks

In the preceding sections it was shown that, in the course of an unanticipated inflation, banks tend to move from long-term assets into short-term assets. Fundamental to this conclusion was the tacit assumption that the yields on long-term assets did not increase as much as the returns on short-term assets during an unanticipated inflationary process. In this section we shall examine the plausibility of this assumption and its implications for the portfolio behavior of the United States commercial banks over the period from 1953 to 1970.

The U.S. Inflation: 1950-1970

Between 1950 and 1970 the rate of inflation in the United States failed to reach an anticipated level. As shown in Table 14, the consumer price index increased from 72.1 in 1950 (1967 = 100) to 116.3 in 1970, or by 44.2 percent. The rate of increase of the consumer price index was not, however, uniform over the period. Generally speaking, the price level tended to increase at a faster rate during periods of economic expansion as compared with periods of economic contractions. Table 14 also reveals the close relationship between bank loan and investment activity and the prevailing economic conditions: banks' investments in U.S. government securities (long-term assets) increased over the recession years of 1954, 1958, 1961 and 1970 and tended to decline during periods of economic recovery. The contracyclical investment behavior of the United States commercial banks strongly suggests that during periods of expansion, yields on long-term assets failed to rise by as much as the yield on short-term assets. In other words, and for the reasons we shall see below, long-term assets became less attractive to commercial banks as compared to short-term assets during periods of economic recovery, while the converse was true during periods of contraction.

The Influence of Unanticipated Changes in Price on Short-Term and Long-Term Rates

The conclusion above, interest rates on short-term assets fail to reflect price level changes by as much as the short-term rates do, is also warranted by an empirical inquiry by William P. Yohe and

TABLE 14

Consumer Price Index, Commercial Bank Loans, U.S. Government Securities, Other Securities and Demand Deposits at Mid-Year (1951-1973); Gross National Product (In Billions of Dollars)

Year	CPI	Commercial Bank Loans	U.S. Government Securities	Other Securities	Demand Deposits	Gross National Product
1950	72.1	--	--	--	--	--
1951	77.8	54.8	58.5	12.7	96.3	328.4
1952	79.5	59.2	61.2	14.0	103.4	345.5
1953	80.1	65.0	58.6	14.3	105.7	364.6
1954	80.5	67.3	63.5	15.5	107.0	364.8
1955	80.2	75.2	63.3	16.8	113.0	398.0
1956	81.4	86.9	56.6	16.5	115.8	419.2
1957	84.3	93.3	55.5	16.8	115.7	441.1
1958	86.6	93.6	64.2	20.1	117.1	447.3
1959	87.3	104.5	60.9	20.6	121.6	483.6
1960	88.7	114.8	54.2	19.9	119.5	503.8
1961	89.6	118.0	61.8	22.1	125.2	520.1
1962	90.6	129.2	64.4	27.0	128.8	560.3
1963	91.7	145.0	63.5	32.4	133.6	590.5
1964	92.9	164.5	59.3	36.4	135.6	632.4
1965	94.5	188.6	56.9	44.2	145.3	684.9
1966	97.2	212.0	53.5	48.8	153.8	749.9
1967	100.0	224.0	54.2	56.7	161.0	793.9
1968	104.2	244.6	58.6	64.4	177.8	864.2
1969	109.8	283.9	54.0	72.4	193.8	929.1
1970	116.3	296.1	51.6	75.6	193.0	974.1
1971	121.3	322.9	60.3	97.4	206.9	1,046.8
1972	125.3	370.9	60.3	111.5	219.1	1,151.8
1973	132.0	447.9	56.9	119.7	223.7	1,290.0

Source: Various issues of Federal Reserve Bulletin, 1950-1973.

Denis S. Karnosky.[1] Using monthly data, these authors regressed short-term rates and long-term rates on current and lagged values of price level changes for the period 1952 to 1969. One of the major findings of this study was that price level changes accounted for more than 50 percent of the variance in interest rates between 1952 and 1969 which supports the Fisherian hypothesis of a positive correlation between price level changes and the rate of interest. Other important findings of this study which have direct bearing on the objectives of the present investigation are as follows:

> 1. The long-term interest rate is relatively less responsive to changes in price expectations than short-term rates. The regressions results indicate that twelve months after the one per cent increase in prices, long-term rates would be 59 basis points higher than they were originally, as opposed to 72 basis points for short-term rates. The effect on long-term rates would be a total of 56 basis points after 48 months.[2]
>
> 2. The quarterly regressions suggest that if the annual rate of change of prices increases by one per cent in any quarter and remains at the higher level the short-term rate would rise by 84 basis points after four years. The long-term rate would rise by 66 basis points over the same period. Using the results of the monthly estimates, an increase by one per cent in the annual rate of changes in prices, would yield an increase of 69 basis points in short-term rates and 56 basis points in long-term rates after four years.[3]
>
> 3. The total price expectations effect is much larger in the 1961-69 period than in the earlier period. In the latter period the total effect on short-term rates is about 90 per cent of the annual rate of change in prices. The effect on long-term rates is about 80 per cent of the rate of price change.[4]

---

[1]William P. Yohe and Denis S. Karnosky, "Interest Rates and Price Level Changes," in Monetary Economics, ed. by William E. Gibson and George G. Kaufman (New York: McGraw-Hill, Inc., 1971), pp. 352-374.

[2]*Ibid.*, p. 362. [3]*Ibid.*, p. 363. [4]*Ibid.*, p. 366.

Yohe and Karnosky attribute the relative insensitivity of long-term rates to changes in the price level to the differences in the time span used for formation of price expectations. They maintained, as Fisher did, that transactors who deal in long-term rates look further into the past than transactors who deal in short-term rates. Consequently, buyers and sellers of short-term securities attach a greater weight to recent changes in the price level than those who participate in long-term securities market. Other authors have attributed the differences in the responses of short-term rates and long-term rates to price level changes to errors of forecast brought about by unexpected price level changes.[1] Reuban A. Kessel and Armen Alchian have argued that unexpected inflation causes the estimates of future price level changes to be biased downward -- below realized price level changes. This implies that nominal rates of interest in general and long-term rates in particular fail to reflect rising prices because of the downward bias in the estimate of future course of prices.[2]

The Relationship Between Short- and Long-Term Interest Rates

Over the period under review short-term rates as measured by three-month U.S. treasury bills and long-term rates approximated by the

---

[1] For a good discussion of error in forecast induced by price level changes see Joseph W. Conard, The Behavior of Interest Rates (New York: National Bureau of Economic Research, 1966), pp. 89-90.

[2] Reuben A. Kessel and Armen A. Alchian, "Effects of Inflation," Journal of Political Economy, LXX, No. 6 (1962), pp. 521-37.

yield on 10-year Treasury bonds moved in the same direction.[1] As shown in Figure 21 short-term rates, however, exhibited a greater volatility when compared to long-term rates during the period examined. Inspection of Tables 15 and 16 reveals that the percentage increase in the short-term rates of interest far exceeded the percentage increase in the long-term rates for all the expansion periods considered.

Implications

The evidence presented in Figure 21 and Tables 15 and 16, combined with the empirical findings of Yohe and Karnosky, tend to support the hypothesis that long-term instruments become less attractive to commercial banks relative to short-term assets during periods of rising price expectations. This, as already suggested, is due to the failure of long-term rates to keep up with the rising price level as well as the short-term rates do.

Woodworth's Investigation

In an empirical study of the portfolio behavior of a group of New York City banks over the period 1953 to 1966, G. Walter Woodworth[2] has accumulated evidence which strongly supports our inference about the reaction of commercial banks to changes in the yields of short-term

---

[1]As early as 1930 monetary economists were aware of the positive association between short-term and long-term rates. See, for instance, John M. Keynes, A Treatise on Money, pp. 316-17.

[2]G. Walter Woodworth, The Management of Cyclical Liquidity of Commercial Banks (Boston: The Bankers Publishing Company), pp. 59-83.

TABLE 15

Movements of Short-Term Rates and Long-Term Rates
Over the Five Expansion Periods Starting in October, 1949
and Ending November, 1973

Expansion Cycle[a]	Short-Term Rates Rate at Start	Short-Term Rates Rate at End	Long-Term Rates Rate at Start	Long-Term Rates Rate at End
Oct., 1949-July, 1953	1.04%	2.10%	2.50%	3.59%
Aug., 1954-July, 1957	0.84%	3.16%	2.94%	4.59%
April, 1958-May, 1960	1.13%	3.39%	3.67%	4.95%
Feb., 1961-Nov., 1969	2.41%	7.19%	4.43%	8.94%
Nov., 1970-Nov., 1973	5.29%	7.87%	8.97%	7.95%

[a]Dates represent the first and last month of business cycles.

Source: Various issues of the Federal Reserve Bulletin.

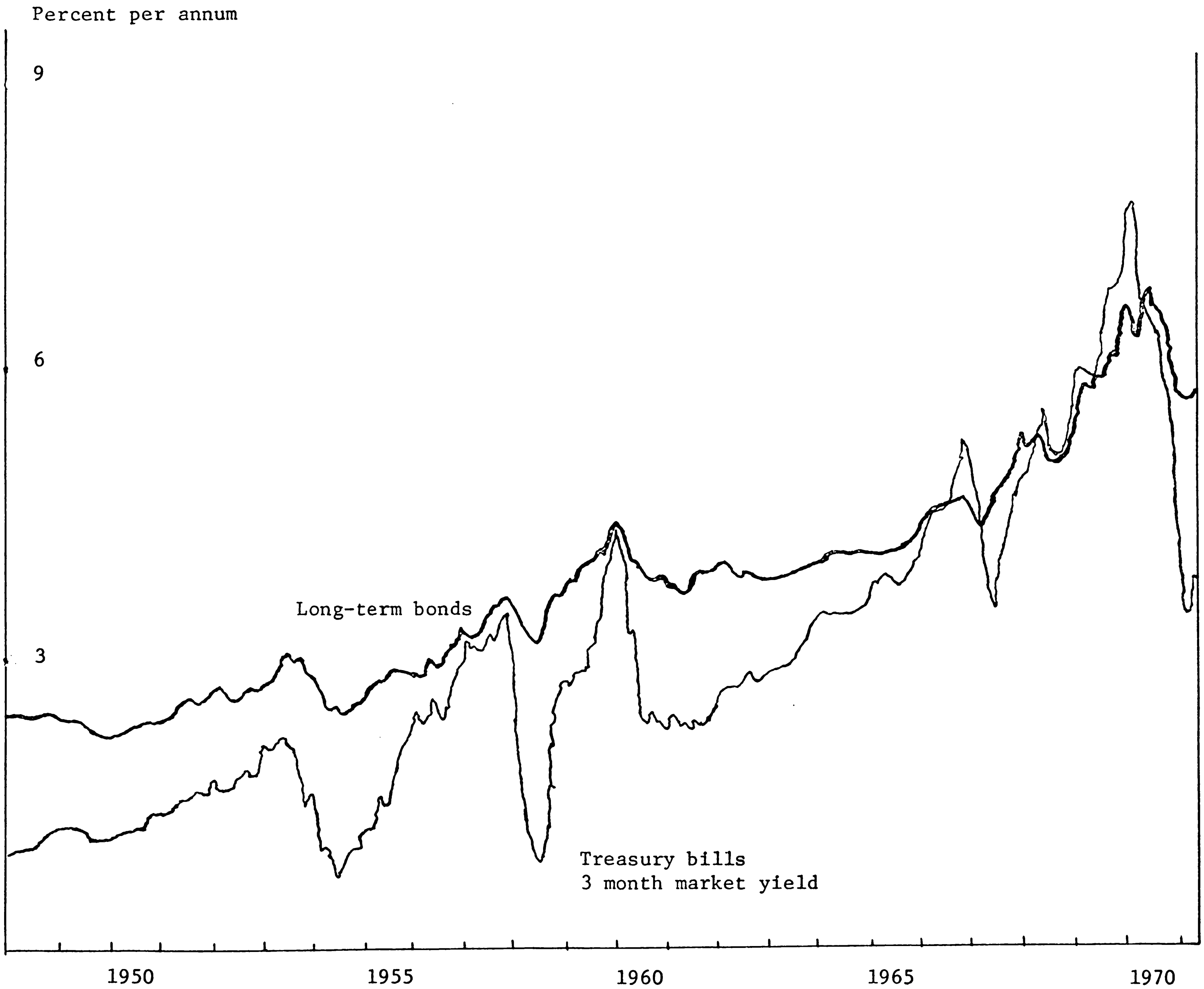
TABLE 16

Percentage Increase in Short-Term and Long-Term Rates Over the Five Expansion Cycles

Expansion Cycle[a]	Percentage Increase in Short-Term Rates	Percentage Increase in Long-Term Rates
Oct., 1949-July, 1953	101.9%	43.6%
Aug., 1954-July, 1957	276.19%	56.1%
April, 1958-May, 1960	200.0%	34.0%
Feb., 1961-Nov., 1969	198.3%	101.8%
Nov., 1970-Nov., 1973	48.7%	-11.3%

[a]Dates represent the first and last month of business cycle.

Source: Various issues of the Federal Reserve Bulletins.


Percent per annum
9
6
3
Long-term bonds
Treasury bills
3 month market yield
1950
1955
1960
1965
1970

instruments relative to long-term assets during cyclical expansions and contractions. In his inquiry Woodworth examines the asset portfolios of banks over three full business cycles, beginning with the peak in July, 1953 and ending with the peak in November, 1966. A summary of Woodworth's findings is presented below.

Tables 17 through 22 contain information about the relationship of deposits, loans, bank holdings of securities and borrowed reserves for the period July, 1953 through December, 1966. The group of banks used in this study includes all the reporting member banks operating in New York City. The first month appearing in Table 17 represents the peak of the cycle and the second month the low point of the cycle.

Table 17 reveals that during the contraction of July, 1953 to August, 1954 total loans declined by $802 million, while total deposits increased by $876 million. The table also shows that during this period banks increased their holdings of securities from $9,341 million in July, 1953 to $11,097 million in August, 1954. This suggests that the banks used part of the inflowing funds from loan contraction, increased deposits and borrowings, to buy securities.

Table 18 contains information for the half cycle starting from the low point of August, 1954 to the high point of July, 1957. This table indicates that during the expansion of August, 1954 to July, 1957 the sample banks reduced their holdings of securities by $4,061 million and increased their loans by $4,115 million. During the recovery period from mid-1954 to mid-1957 the Federal Reserve Index of Industrial Production increased by 15 percent and the Gross National Product rose

TABLE 17

Selected Assets and Liabilities of Weekly Reporting Member Banks in New York City, 1953-1954 (In Millions of Dollars)

	July, 1963	August, 1954	Change 1953 to 1954	Percent Change 1953 to 1954
Total loans	$12,204	$11,402	$ -802	-6.6%
Commercial/indust.	8,406	7.367	-1,039	-12.4
Total deposits	25,702	26,578	+376	+3.4
Demand deposits	23,346	23,023	-323	-1.4
Time deposits	2,356	3,555	+1,199	+50.9
Total investments	9,341	11,097	+1,756	+18.8
U.S. securities	7.348	8,728	+1,380	+18.8
Other securities	1,992	2,368	+376	+18.9
Cash assets	5,237	4,686	-551	-10.5
Total borrowings	170	328	+158	+92.9
Loans/deposits	47.5%	42.9%	-4.6%	-9.7

Source: Woodworth, op. cit., p. 62.

TABLE 18

Selected Assets and Liabilities of Weekly Reporting Member Banks in New York City, 1954-1957 (In Millions of Dollars)

	August, 1954	July, 1957	Change 1954 to 1957	Percent Change 1954 to 1957
Total loans	$11,402	$15,517	$+4,115	+36.1
Commercial/indust.	7.367	11,699	+4,332	+58.8
Total deposits	26,578	26,564	-14	-0.1
Demand deposits	23,023	22,944	-79	-0.3
Time deposits	3,555	3,620	+65	+1.8
Total investments	11,097	7,036	-4,061	-36.6
U.S. securities	8.728	5,350	-3,378	-38.7
Other securities	2,368	1,686	-682	-28.8
Cash assets	4,686	4,392	-294	-6.3
Total borrowings	328	515	+187	+57.0
Loans/deposits	42.9%	58.4%	+15.5%	+36.1%

Source: Woodworth, op. cit., p. 63.

by 23 percent. The rise in industrial production and Gross National Product was accompanied, as expected, by rather sharp increases in the interest rates and falling bond prices. According to an estimate by Woodworth the New York City banks suffered capital losses amounting to $127.7 million, or 9 percent of net current earnings before taxes during the three-year period 1955 to 1957.[1]

The impact of the short recession between July, 1957 and April, 1958 upon New York City banks is quite similar to the recession extending from July, 1953 to August, 1954. During this period money rates moved downward as indicated by a decline of the Treasury bill rate from about 3.5 percent to under 1 percent.

Table 19 is self-explanatory. The banks increased their holdings of securities by $1,998 million, but, as Woodworth has pointed out, the banks, remembering the large capital losses suffered during the 1955-1957 expansion, followed a more cautious policy during the 1957-1958 period. According to the available data, over two-thirds of the additional U.S. securities holdings were invested in maturities of under 5 years.

Table 19 is contrasted with Table 20, which contains similar information for the expansion of April, 1958 to May, 1960. During this period the Gross National Product rose by 17 percent and Industrial Production (Federal Reserve Board Index) increased by 33 percent. The expansion was accompanied by steady increases in Treasury bill rates from under 1 percent to 4-3/4 percent. The increase in Treasury bill

---

[1] _Ibid._, p. 63.

TABLE 19

Selected Assets and Liabilities of Weekly
Reporting Member Banks in New York City, 1957-1958
(In Millions of Dollars)

	July, 1957	April, 1958	Change 1957 to 1958	Percent Change 1957 to 1958
Total loans	$15,517	$15,580	$ +63	+0.4
Commercial/indust.	11,699	11,158	-541	-4.6
Total deposits	26,964	29,122	+2,558	+9.4
Demand deposits	22,944	24,215	+1,271	+5.5
Time deposits	3,620	4,907	+1,287	+35.6
Total investments	7,036	9,034	+1,998	+28.4
U.S. securities	5,350	6,819	+1,469	+27.5
Other securities	1,686	2,215	+529	+31.4
Cash assets	4,392	4,427	+35	+0.8
Total borrowings	515	523	+8	+1.6
Loans/deposits	58.4%	53.5%	-4.9%	-8.4%

Source: Woodworth, _op. cit._, p. 68.

TABLE 20

Selected Assets and Liabilities of Weekly Reporting Member Banks in New York City, 1958-1960 (In Millions of Dollars)

	April, 1958	May, 1960	Change 1958 to 1960	Percent Change to 1958 1960
Total loans	$15,580	$16,216	$ +639	+4.1
Total deposits	29,122	26,383	-2,739	-9.4
Demand deposits	24,215	22,315	-1,901	-7.9
Time deposits	4,907	4,068	-839	-17.1
Total investments	9,034	6,542	-2,492	-27.6
U.S. securities	6,819	4,624	-2,195	-32.2
Other securities	2,215	1,918	-297	-13.4
Cash assets	4,427	3,815	-612	-13.8
Total borrowings	523	868	+345	+66.0
Loans/deposits	53.5%	61.5%	+8.0%	+15.0%

Source: Woodworth, op. cit., p. 69.

rates coincided with rather sharp increases in interest rates and a substantial decline in bond prices. Banks increased their total loans by $600 million, but their deposits dropped by $2,700 million. At the same time the banks reduced their holdings of securities by $2,195 million, incurring substantial losses in the process. In 1959, these losses were estimated to amount to more than $167.5 million.

The final expansion which we shall review extended from February, 1961 to the last quarter of 1966. During this period two important developments took place in the United States money markets. These two developments were introduction of negotiable time certificates of deposit (CDs) and Eurodollars. Beginning in 1961, major United States banks started to issue CDs to meet the short-run liquidity problems brought about by an upsurge of demand for loans. These certificates were issued in large denominations to large corporations at competitive rates. Between February, 1961 and August, 1966, the banks had issued $18.6 billion of these certificates. As a result, during this period the banks did not have to liquidate as many securities as they had done in the previous expansions in order to obtain the necessary funds. The competition for these certificates did, however, drive the rate of interest on CDs up to 5.5 percent by August, 1966; this was the ceiling rate then set by the Federal Reserve. Due to this ceiling rate CDs could not be depended upon as a source of funds during the last phases of the expansion under review. Between August, 1966 and November, 1966 the amount of outstanding certificates declined rather sharply from $18.6 billion to $15.7 billion.

In addition to issuance of CDs, the United States banks turned to the Eurodollar market for funds during this expansion. According to official estimates, bank borrowings of Eurodollars amounted to some $2 billion during 1965 and the last quarter of 1966.[1] This kind of borrowing continued to increase during the remaining quarters of 1966. These two developments -- the emergence of time certificates of deposit and the Eurodollar in the United States money market -- turned out to be a source of relief, even though they were not highly dependable for the United States banks during the 1961-1966 expansion. Analysis of the portfolio composition of the New York City banks (Table 22) indicates that between February, 1961 and January, 1965 bank holdings of securities increased by nearly $15.9 million. Though this pattern of response contrasts sharply with the previous expansions reviewed thus far, it is by no means surprising. In contrast to the previous expansions the banks were not limited in their choices. They could either sell securities, issue CDs or borrow Eurodollars, and since the latter two sources of funds turned out to be more convenient and probably cheaper, the banks exploited the opportunity open to them.

During the short recession extending from May, 1960 to February, 1961 the changes in banks' portfolios are comparable to the alterations which took place during the 1958 recession (Table 19). Bank investments in securities rose from $7,045 million in May, 1960 to $9,423 million in February, 1961. During the period under review total deposits increased by $2,095 million while loans fell by $135 million.

---

[1] Federal Reserve Bulletin (April, 1967), p. 668.

TABLE 21

Selected Assets and Liabilities of Weekly Reporting Member Banks in New York City, 1960-1961 (In Millions of Dollars)

	May, 1960	February, 1961	Change 1960 to 1961	Percent Change 1960 to 1961
Total loans	$17,463	$17,328	$ -135	-0.8
Commercial/indust.	10,531	10,653	+122	+1.2
Roral deposits	28,412	30,507	+2,095	+7.4
Demand deposits	24,031	25,116	+1,085	+24.5
Time deposits	4,381	5,390	+1,009	+23.0
Total investments	7,045	9,423	+2,378	+33.8
U.S. securities	4,980	6,910	+1,930	+38.8
Other securities	2,066	2,514	+448	+21.7
Cash assets	4,108	3,733	-375	-9.1
Total borrowings	935	839	-96	-10.3
Loans/deposits	61.5%	56.8%	-4.7%	-7.6%

Source: Woodworth, op. cit., p. 75.

TABLE 22

Selected Assets and Liabilities of Weekly
Reporting Member Banks in New York City, 1961-1965
(In Millions of Dollars)

	February, 1961	January, 1965	Change 1961 to 1965	Percent Change 1961 to 1965
Total loans	$17,328	$25,240	$+7,912	+45.7
Commercial/indust.	10,653	13,827	+3,174	+29.7
Total deposits	30,507	40,289	+9,782	+32.1
Demand deposits	25,116	26,308	+1,192	+4.7
Time deposits	5,390	13,981	_8,591	+159.4
Total investments	9,423	10,922	+1,499	+15.9
U.S. securities	6,910	5,249	-1,661	-24.0
Other securities	2,514	5,673	+3,159	+125.7
Cash assets	3,733	4,057	+324	+8.7
Total borrowings	839	1,958	+1,119	+133.4
Loans/deposits	56.8%	62.6%	+5.8%	+10.2

Source: Woodworth, op. cit., p. 78.

CHAPTER V

SUMMARY OF FINDINGS

In this study I analyzed three aspects of banking behavior during an inflationary process: (1) the involvement of banks in inflationary processes, (2) the effects of inflation on banks' earnings, and (3) the portfolio behavior of banks in an inflationary environment. In discussing Point (1), I traced the evolution of the "credit theory of inflation" and found myself in agreement with the Thornton-Wicksell hypothesis that banks may ignite an inflationary process by failing to adjust their loan rates to the real rate of interest. I have, however, concluded that this shortcoming need not be deliberate and may arise out of market imperfections and government intervention in the capital market. Furthermore, I indicated that the type of inflationary process envisaged by Thornton and Wicksell cannot persist unless accompanied by expansive monetary policies by the central bank.

My analysis of the second aspect of banking behavior began with an examination of bank earnings in an abstract world in which inflation is fully anticipated and the banking system is competitive. First, I presented the fundamentals of a model by Martin Bailey in which it is hypothesized that, under inflationary equilibrium, the rate of change of the money supply is identical to the rate of bank loan creation. My analysis shows that Bailey is correct if (a) the public holds no currency, (b) the elasticity of the nominal money supply with respect to nominal rate of interest is zero, (c) the real rate of interest does not change due to inflation and (d) the yield on real balances (pecuniary and non-pecuniary) is greater than the alternative returns on physical capital and nominal interest bearing securities (money substitutes) throughout the inflationary process. I showed that Bailey's model is inconsistent because a competitive banking system which is subject to a reserve requirement cannot afford to pay its depositors a rate of remuneration which is equal to the sum of the real rate and the rate of inflation. Furthermore, I have shown that violation of Condition (d) rules out Condition (c). After introducing all the essential modifications into Bailey's model, I established that a competitive banking system is more likely to lose from an open inflation rather than gain from it.

To provide a structure for a micro analysis of banking behavior the assumption of a single income-earning asset is dropped. Another asset, share, assumed to be a claim on transferable physical capital, is introduced into analysis. Individuals are assumed to allocate their savings among fiat money, bank money and shares in a wealth maximizing framework. The choice of assets is assumed to be affected by the expected yield -- pecuniary or non-pecuniary -- on these assets. Likewise, it is assumed that the representative bank allocates its output between the short-term loan market and the long-term loan market in a manner consistent with the profit maximization hypothesis. The bank is assumed to be a price-discriminating firm facing a perfectly elastic demand for long-term loans and downsloping demand for short-term loans. The banks' equilibrium supply of loans and demand for deposits are derived from the demand and supply specifications. It is shown that if the demand for loans facing the monopolist does not become less elastic due to inflation, the bank may be able to realize some windfall gains from inflation. This is, however, a tentative conclusion, as it is not possible to determine a priori how inflation affects the elasticity of the demand for loans. I have argued that without prior knowledge about the parameters of the demand for loans function and the supply of deposit function no definite conclusion may be drawn as to the effects of inflation on a bank's income.

This study has also examined banking behavior during conditions of unanticipated inflation. It has been demonstrated that banks can gain from unanticipated inflation if (a) depositors respond to changes in the rates of interest with a time lag, and (b) depositors' probability distributions of expected returns are biased downward. This situation occurs if savers' expectations are sticky, or if savers have to incur substantial transaction costs in revising their portfolios. It has been argued that if the rate of inflation does not exceed a certain threshold level and savers are uncertain about the future trend of interest rates, they may not press for higher rates of remuneration on their savings. This situation may, to some extent, enhance the banks' profit opportunities in the short run. Nonetheless, if the banking system is competitive (freedom of entry), and short-run rents are substantial, new banks will enter the industry and wipe out these short-run profits. On the other hand, if the banking market is characterized as monopolistic, windfall gains from inflation may persist until savers catch up with the going rate of inflation. Under conditions of unanticipated inflation monopolistic banks may serve as vehicles for redistributing income from lenders to borrowers by sharing some of their own profits with their loan customers.

In an empirical analysis of the profitability of Chilean commercial banks during 1937 to 1950, I found that due to the special discounting provisions of the Central Bank of Chile, the Chilean commercial banks managed to share some of the inflation tax revenue with the Chilean government. My findings in this regard are different from the results of a previous study by David L. Grove of the International Monetary Fund who studied bank earnings for the same period. Grove had concluded that the Chilean banks lost from the inflation of 1937-1950.

Another finding of the present inquiry is that unanticipated inflation encourages the banking system to revise its portfolios of income-earning assets. These revisions are brought about by the differential impact of unanticipated inflation on long-term and short-term rates of interest. Citing examples from the United States, it has been shown that the United States commercial banks have invariably increased their holdings of long-term securities during periods of economic contraction and have decreased their holdings of such assets during periods of economic expansion and rising price levels. It has been shown that the percentage increase in the yield of short-term assets has been much greater than the percentage increase in the long-term assets during periods of economic expansion. Consequently, the banks found it profitable to move from long-term instruments into short-term instruments during periods of economic prosperity. Such behavior by commercial banks during periods of expansion may have an adverse effect upon the price level. By being able to use the funds obtained from sales of long-term government instruments for purposes of expanding loans and advances to their customers, banks may neutralize the efforts of the monetary authority to curb the rate of inflation for an extended time period.

Future Research

There appears to be a substantial reward in a statistical analysis that examines the relationship between bank lending rates, the "natural rate," and the actual rates of inflation that have been observed in either the developed or underdeveloped economies since the inception of the "keynesian Revolution." Such an inquiry must necessarily be conducted on a disaggregated (micro) level so that due consideration can be given to institutional, legal and organizational variables that constrain banking market operations. Such an inquiry would also make it possible to ascertain the degree of validity of the hypotheses that have been advanced in this dissertation regarding banking behavior during periods of inflation.

SELECTED BIBLIOGRAPHY

Books

Alhadeff, David A. Monopoly and Competition in Banking. Berkeley: University of California Press, 1954.

Ashton, S. T, and Sayers, R. S., ed. Papers in English Monetary History. London: Oxford University Press, 1964.

Bagehot, Walter. Lombard Street: A Description of the Money Market. London: Murray, 1927.

Bailey, M. J. National Income and the Price Level. New York: McGraw-Hill Book Co., 1971.

Bollman, Eric. A Second Letter ... on the Practicability of the New System of Bullion Payments. London: Murray, 1819.

Boyd, Walter. A Letter to the Right Honorable William Pitt on the Influence of the Stoppage of Issues in Specie at the Bank of England. London: Wright, 1801.

Cantillon, Richard. Essai sur la Nature du Commerce. Translated by Henry Higgs. London: Macmillan, 1931.

Cassel, Gustav. The Crisis in the World's Monetary System. Oxford: Clarendon Press, 1932.

Commission on Money and Credit. Report of the Commission. Money and Credit: Their Influence on Jobs, Prices and Growth. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1961.

Conard, Joseph W. An Introduction to the Theory of Interest. Los Angeles: University of California Press, 1959.

Fisher, Irving. The Theory of Interest. New York: Macmillan, Co., 1930.

Friedman, Milton. Dollars and Deficits. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1968.

Fullerton, John. On the Regulation of Currency. 2nd ed. 1845.

Goldfeld, Stephen. Commercial Bank Behavior and Economic Activity. Amsterdam: North-Holland Publishing Company, 1966.

Gregory, T. E. Select Statutes, Documents and Reports Relating to British Banking, 1832-1928. London: Oxford University Press, 1936.

Hawtrey, R. G. The Art of Central Banking. London: Longmans, Green, 1933.

__________. Currency and Credit. 2nd ed. London: Longmans, Green, 1923.

Hayek, F. A. von. Monetary Theory and the Trade Cycle. Translated by N. Kaldor and H. M. Croome. New York: Harcourt, Brace, 1939.

__________. Prices and Production. London: Routledge, 1931.

Hicks, John R. Critical Essays in Monetary Theory. London: Oxford University Press, 1967.

__________. Value and Capital. London: Oxford University Press, 1946.

Hodgman, Donald. Commercial Bank Loan and Investment Policy. Champaign, Ill.: University of Illinois Press, 1963.

Hume, David. Essays, Moral, Political and Literary. Edited by T. H. Green and T. H. Grose. London: Longmans, Green, 1875.

Intrilligator, Michael D. Mathematical Optimization and Economic Theory. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1971.

Joplin, Thomas. An Analysis and History of the Currency Question Together with an Account of the Origin and Growth of Joint-Stock Banking in England. London: Rodgway, 1823.

__________. An Essay on the General Principles and Present Practice of Banking in England and Scotland. London: Baldwin, Crackdock and Joy, 1822.

Johnson, Harry G. Essays in Monetary Economics. Cambridge: Harvard University Press, 1967.

Keynes, John M. The General Theory of Employment, Interest and Money. New York: Harcourt, Brace and Co., 1936.

__________. A Treatise on Money. London: Macmillan, 1930.

Locke, John. The Works of John Locke. London: J. Churchill and S. Manship, 1714.

Mamalakis, Markos; and Reynolds, Clark W. Essays on the Chilean Economy. Homewood, Ill.: Richard D. Irwin, Inc., 1965.

Markowitz, H. Portfolio Selection. New York: John Wiley, 1959.

Meiselman, David. The Term Structure of Interest Rates. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1962.

Mill, John Stuart. Principles of Political Economy. Edited by W. J. Ashley. New York: Augustus M. Kelley, 1965.

Mises, Ludwig von. The Theory of Money and Credit. New Haven: Yale University Press, 1953.

Mitchell, W. C. Business Cycles and Their Causes. Los Angeles: The University of California Press, 1959.

Monroe, Arthur Eli. Early Economic Thought. Cambridge: Harvard University Press, 1924.

Morrison, George R. Liquidity Preferences of Commercial Banks. Chicago: University of Chicago Press, 1966.

Overstone, Lord S. J. L. Tracts and Other Publications on Metallic and Paper Currency. London: Harrison, 1857.

Pesek, Boris P., and Saving, Thomas R. Money, Wealth and Economic Theory. New York: Macmillan, 1967.

__________. The Foundations of Money and Banking. New York: Macmillan, 1967.

Ricardo, David. Principles of Political Economy and Taxation. Edited by E. C. K. Connor. London: Bell, 1891.

Ritter, Lawrence S., ed. Money and Economic Activity. 3rd ed. Boston: Houghton Mifflin Co., 1967.

Robinson, Ronald. The Management of Bank Funds. 2nd ed. New York: McGraw-Hill Book Company, Inc., 1962.

Schumpeter, Joseph A. History of Economic Analysis. London: Oxford University Press, 1959.

Shackle, G. L. S. Expectations, Investment and Income. London: Oxford University Press, 1968.

Smith, Adam. An Inquiry Into the Nature and Causes of the Wealth of Nations. New York: The Modern Library, 1937.

Smith, Warren L., and Teigen, Arnold L., ed. Readings in Money, National Income, and Stabilization Policy. Homewood, Ill.: Richard D. Irwin, Inc., 1970.

Thornton, Henry. An Enquiry into the Nature and Effects of the Paper Credit of Great Britain. London: Hatchard, 1802.

Tooke, Thomas, and Newmarch, William. A History of Prices and of the State of the Circulation from 1792 to 1856. London: King, 1928.

Uhr, Carl G. Economic Doctrines of Knut Wicksell. Berkeley: University of California Press, 1962.

Viner, Jacob. Studies in the Theory of International Trade. New York: Harper and Bros., 1937.

Woodworth, G. Walter. The Management of Cyclical Liquidity of Commercial Banks. Boston: The Bankers Publishing Company, 1965.

Yeager, Leland B., ed. In Search of a Monetary Constitution. Cambridge: Harvard University Press, 1962.

Articles and Periodicals

Alchian, Armen, and Kessel, Reuben A. "Redistribution of Wealth Through Inflation." Science (September, 1959), 535-39.

Alhadeff, David A. "A Reconsideration of Restrictions on Bank Entry." Quarterly Journal of Economics (May, 1962).

Bailey, Martin. "The Welfare Cost of Inflationary Finance." Journal of Political Economy (April, 1956), 93-110.

Barro, Robert J. "Inflation, the Payments Period and the Demand for Money." Journal of Political Economy (November/December, 1970) 1228-63.

Benston, George J. "Interest Payments on Demand Deposits and Bank Investment Behavior." Journal of Political Economy, LXXII (October, 1964), 431-49.

__________. "Economics of Scale and Marginal Costs in Banking Operations." Studies in Banking Competition and the Banking Structure. The Administrator of National Banks, January, 1966.

Bonomo, V., and Schotta, C. "A Spectral Analysis of Post-Accord Federal Open Market Operations." American Economic Review, LIX (March, 1969).

__________, and Sorensen, Robert L. "The Discount Rate: A Phantom Policy Tool?" Western Economic Journal (September, 1970), 262-64.

Brucker, Eric. "A Microeconomic Approach to Banking Competition." Journal of Finance, XXV (December, 1970), 1133-41.

Brechling, Frank, and Clayton, George. "Commercial Bank's Portfolio Behavior." Economic Journal (June, 1965), 290-316.

Brunner, Karl, and Meltzer, Allan. "The Uses of Money: Money in the Theory of an Exchange Economy." American Economic Review (December, 1971), 784-805.

Buchanan, James M. "Predictability: The Criterion of Monetary Constitutions." In Search of Monetary Constitution. Edited by L. B. Yeager. Cambridge: Harvard University Press, 1962.

Cagan, Phillip. "Changes in the Cyclical Behavior of Interest Rates." Review of Economics and Statistics, XLVIII (August, 1966).

__________. "The Monetary Dynamics of Hyperinflation." Studies in the Quantity Theory of Money. Edited by Milton Friedman. Chicago: University of Chicago Press, 1959.

Chandler, Lester. "Monopolistic Elements in Commercial Banking." Journal of Political Economy (February, 1938).

Chow, Gregory C. "On the Long-Run and Short-Run Demand for Money." Journal of Political Economy, LXXIV (April, 1966), 111-31.

Deaver, John. "The Chilean Inflation and the Demand for Money." Varieties of Monetary Experience. Edited by David Meiselman. Chicago: University of Chicago Press, 1970.

Feldstein, M. S. "Inflation, Specification Bias, and the Impact of Interest Rates." Journal of Political Economy, LXXVII (November/December, 1970).

Foster, Edward. "Costs and Benefits of Inflation." Studies in Monetary Economics. Minneapolis, Minn.: The Federal Reserve Bank, 1972.

Friedman, Milton. "The Role of Monetary Policy." American Economic Review, LVIII (March, 1968).

Friedman, M., and Schwartz, A. "Money and Business Cycles." Review of Economics and Statistics, XLV (February, 1963).

Friedman, Milton. "Controls on Interest Rates Paid by Banks." Journal of Money, Credit and Banking (February, 1970), 15-32.

Gibson, W. E., and Kaufman, G. G. "An Empirical Study of Interest Rate Determination: A Comment." Review of Economics and Statistics, LII (August, 1970).

__________. "The Sensitivity of Interest Rates to Changes in Money and Income." Journal of Political Economy, LXXVI (May/June, 1968).

Greenbaum, Stuart L. "Costs and Production in Commercial Banking." Monthly Review of the Federal Reserve Bank (March, 1966).

Grossman, H. I. "Money, Interest and Prices in Market Disequilibrium." Journal of Political Economy, LXXIX (September/October, 1971).

Grove, David L. "The Role of Banking System in the Chilean Inflation." International Monetary Fund Papers (September, 1951), 33-59.

Hamburger, M. J., and Silber, W. L. "An Empirical Study of Interest Rate Determination." Review of Economics and Statistics, LI (August, 1969).

Hayek, F. A. von. "A Note on the Development of Forced Savings." Quarterly Journal of Economics, XLVII (November, 1932), 123-33.

Hicks, John R. "A Suggestion for Simplifying the Theory of Money." Readings in Monetary Theory. Edited by F. A. Lutz and L. W. Mints. Homewood, Ill.: Richard D. Irwin, Inc., 1951.

Hodgman, Donald R. "The Deposit Relationship and Commercial Bank Investment Behavior." Review of Economics and Statistics, XLIII (August, 1961).

Hollander, J. H. "The Development of the Theory of Money from Adam Smith to Ricardo." Quarterly Journal of Economics, XXV (May, 1911), 429-70.

Horvitz, Paul M. "Economics of Scale in Banking." Private Financial Institutions. Commission on Money and Credit. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1963.

Johnson, Harry G. "Some Implications of Secular Changes in Bank Assets and Liabilities in Great Britian." Economic Journal (September, 1951).

Johnson, Harry G. "Is There an Optimal Money Supply?" Journal of Finance (May, 1970), 435-42.

__________. "Inside Money, Outside Money, Income, Wealth, and Welfare in Monetary Theory." Journal of Money, Credit and Banking (February, 1969), 30-45.

Kaldor, N. "Economic Growth and the Problem of Inflation." Economica (November, 1959).

Kane, Edward J., and Malkiel, Burton. "Bank Portfolio Allocation, Deposit Variability, and the Availability Doctrine." Quarterly Journal of Economics, LXXIV (February, 1965), 113-35.

Karnosky, D. S. "The Significance of Recent Interest Rate Movements." Review, LIII (August, 1971).

__________, and Yohe, W. P. "Interest Rate and Price Level Changes, 1952-1969." Review, LI (December, 1969).

Keran, M. W. "Expectations, Money and the Stock Market." Review, LIII (January, 1971).

Kessel, Reuben A., and Alchian, Armen. "Effects of Inflation." Journal of Political Economy, LXX (December, 1962).

Laidler, David. "The Definition of Money." Monetary Economics: Reading on Current Issues. Edited by William E. Gibson and George G. Kaufman. New York: MacGraw-Hill, Inc., 1971.

Marty, Alvin L. "Growth and the Welfare Cost of Inflationary Finance." Journal of Political Economy (February, 1967), 71-6.

__________. "Growth, Satiety, and the Tax Revenue from Money Creation." Journal of Political Economy (September/October, 1974).

Meltzer, Allan. "The Demand for Money: The Evidence from the Time Series." Journal of Political Economy, LXXI (June, 1963).

Modigliani, Franco; Rache, Robert; and Cooper, J. Phillip. "Central Bank Policy, the Money Supply, and the Short-Term Rate of Interest." Journal of Money, Credit and Banking (May, 1970), 166-218.

Monti, Mario. " A Theoretical Model of Bank Behavior and its Implication for Monetary Policy." L'Industria (April, 1971), 165-90.

Mundell, Robert. "Inflation and Real Interest." Journal of Political Economy, LXXI (June, 1963).

__________. "Growth, Stability, and Inflationary Finance." Journal of Political Economy (April, 1965), 97-109.

Nichols, Donald A. "A Note on Inflation and Common Stock Values." Journal of Finance (September, 1968), 655-57.

Niehans, Jurgen. "Money in a Static Theory of Optimal Payment Arrangements." Journal of Money, Credit and Banking, I (November, 1969), 702-26.

Patinkin, Don. "Inside Money, Monopoly Profits, and the Real Balance Effect: A Comment." Journal of Money, Credit and Banking (May, 1971), 271-75.

__________. "Money and Wealth: A Review Article." Journal of Economic Literature, VII (1969), 1140-60.

Pierson, G. "The Effect of Economic Policy on the Term Structure of Interest Rates." Review of Economics and Statistics, LII (February, 1970).

__________. "Why Have Interest Rates Risen." Review of Economics and Statistics, LIII (February, 1971).

Phelps, Edmund S. "Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time." Economica (August, 1967), 254-81.

Porter, Richard C. "A Model of Bank Portfolio Selection." Yale Economic Essays, I (1961), 323-59.

Renwick, Fred B. "Asset Management and Investor Portfolio Behavior: Theory and Practice." Journal of Finance, XXIV (May, 1969), 181-206.

Ricardo, David. "High Price of Bullion." The Works of Ricardo. Edited by J. R. McCulloch. London: Murray, 1846.

Rothbard, Murray N. "The Case for a 100 Percent Gold Dollar." In Search of a Monetary Constitution. Edited by Leland B. Yeager. Cambridge: Harvard University Press, 1962.

Samuelson, Paul A. "The Effects of Interest Rate Increases on the Banking System." American Economic Review, XXXV (March, 1945), 16-27.

Saving, Thomas R. "Outside Money, Inside Money and the Real Balance Effect." Journal of Money, Credit and Banking (February, 1970), 83-100.

__________. "Inside Money, Short Run Rents and the Real Balance Effect." Journal of Money, Credit and Banking (May, 1971), 276-80.

Scott, R. H. "Liquidity and the Term Structure of Interest Rates." Quarterly Journal of Economics, LXXIX (February, 1965).

Schull, Bernard. "Commercial Banks as Multi-Product, Price-Discriminating Firms." Banking and Monetary Studies. Edited by Deane Carson. Homewood, Ill.: Richard D. Irwin, Inc., 1963.

Sharpe, William F. "A Simplified Model of Portfolio Selection." Management Science (January, 1963), 277-93.

Sprinkle, B. W. "Inflation: Its Cause and Cure." American Academy of Political and Social Sciences, CCCXXVI (November, 1959).

Tobin, James. "Commercial Banks as Creators of 'Money'." Banking and Monetary Studies. Edited by Deane Carson. Homewood, Ill.: Richard D. Irwin, Inc., 1963.

__________. "The Controls of Interest Rates on Bank Deposits." Journal of Money, Credit and Banking (February, 1970), 4-14.

Wright, A. L. "The Rate of Interest in a Dynamic Model." Quarterly Journal of Economics, LXXII (August, 1958).

Miscellaneous

Bell, Frederick W., and Murphy, Neil B. Cost in Commercial Banking: A Quantitative Analysis of Bank Behavior and its Relation to Bank Regulation. Research Report Number 41. Boston: Rederal Reserve Bank.

Edwards, Franklin R. Concentration and Competition in Commercial Banking: A Statistical Study. Research Report Number 26. Boston: Federal Reserve Bank.

Friedman, Milton. A Theoretical Framework for Monetary Analysis. National Bureau of Economic Research Occasional Paper Number 12. 1971.

Great Britain. Parliament. Report of the Select Committee on the High Price of Bullion, 1813, Vol. III.

Great Britain. Parliament. Report by the House of Lords Secret Committee to Inquire into the State of the Bank of England; with Reference to the Expediency of the Resumption of Cash Payments, 1819, Vol. III.

Kessel, R. A. The Cyclical Behavior of the Term Structure of Interest Rates. National Bureau of Economic Research Occasional Paper Number 91. 1965.

Schull, Bernard. Nonlocal Competition for Time Deposits in Isolated and Two Bank Towns. Staff Economic Studies Number 40. Board of Governors of the Federal Reserve System.

The vita has been removed from the scanned document

BANKS AND INFLATION

by

Nozar Hashemzadeh

(ABSTRACT)

This dissertation examines three aspects of banking behavior: (a) involvement of banks in inflationary processes, (b) the effects of inflation on bank earnings and (c) the portfolio behavior of banks in an inflationary period. The study first traces the evolution of the "credit theory of inflation" from the eighteenth century to the early twentieth, and finds that under certain conditions banks may ignite an inflationary process by failing to adjust their loan rates to the real rate of interest.

The analysis of the second aspect of banking behavior is carried out at the micro-economic level. After a critical appraisal of Martin Bailey's macro model of banking behavior under conditions of fully anticipated inflation and a competitive market structure, the study finds that Bailey's conclusion as to the favorable effects of inflation on bank profit is inconsistent with his model. The study revises Bailey's model and develops two models of banking behavior along the lines of the neoclassical approach of manufacturing firms. The first model examines banking performance under conditions of a competitive market structure and fully anticipated inflation. The model predicts that under these circumstances the banking system is more

likely to lose than gain from inflation. The second model analyzes banking behavior when the banking market is characterized as monopolistic. It is inferred that no definite conclusions may be drawn with regard to the effects of inflation on bank earnings without an empirical knowledge of the parameters of the demand for loans and the supply of funds to the banking system.

The study also analyzes banking behavior under conditions of unanticipated inflation. It is found that if savers respond to changes in the rates of interest only after a time lag, or if their subjective probability distribution of expected returns on income earning assets is biased downward, banks are in a position to earn some windfall gains from inflation.

The third section of the dissertation analyzes bank portfolio behavior under both anticipated and unanticipated inflation. It is shown that unanticipated inflation forces the banks to alter their portfolio of income earning assets, and it is argued that such activities by banks may nullify the restrictive monetary policies that the monetary authority may impose upon the money market to slow down the rate of inflation.

The study also presents evidence on the profitability of Chilean commercial banks during 1937 to 1950, and finds that due to the special rediscounting provisions of the Chilean Central Bank these banks earned more than average rates of return on their capital outlay. The study also suggests that the Chilean commercial banks were instrumental in perpetuating the inflation.

Evidence is also presented on the portfolio behavior of U.S. commercial banks for the period 1950 to 1970. It is shown that the U.S. commercial banks moved from long-term assets to short-term assets during all the expansion periods observed between 1950 to 1970. This behavior by U.S. commercial banks is explained by the differential impact of the unanticipated inflation on short-term and long-term rates of interest for the period under review.