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Chain Banks and Competition: The Effectiveness of Federal Reserve Policy Since 1977

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One-bank holding companies offer numerous financial and organizational advantages to bank owners. To achieve holding company status, however, the owners must satisfy Federal Reserve standards that involve financial, managerial, legal, and antitrust considerations. This paper examines the Federal Reserve's efforts to foster more competitive local banking markets through the application of a particular antitrust policy. It is concluded that the Federal Reserve's efforts have been largely successful.

The one-bank holding company has been a popular form of bank ownership for the past 15 years. From 1970 through 1985 nearly 7,000 applications to form such companies were filed with the Federal Reserve System. Approximately 98 percent of these applications have been approved. Those few applications, however, which were denied by the Federal Reserve were most often disapproved for financial, managerial, or legal reasons. In a small number of cases since 1977, however, disapproval has stemmed from competitive factors.

These competition-related cases were disapproved as part of what has been referred to as the Board's "chain bank" policy. Chain banking is a form of bank ownership in which control of at least two banks is vested in a single individual or a group of individuals. Occurring for the first time in the late nineteenth century, chain banking was a response to the restrictive branching laws of certain northwestern and southern agricultural states. Unable to establish branches throughout counties or across county lines, bankers who sought to expand the geographic scope of their operations simply acquired banks in different locations. Because these acquisitions were made by individuals rather than corporations, they were largely immune to formal antitrust review until the passage of the Change in Bank Control Act of 1978. As a result, many bankers acquired more than one bank within individual banking markets and frequently induced important anticompetitive effects.

The Federal Reserve Board began to examine the antitrust implications of some chain banking ownership patterns when owners of chain banks sought to place their banks into one-bank holding companies during the 1970s. The Board's analysis of these formations has typically been conducted in two stages. The first is an assessment of any competitive effects that could arise from placing the target bank into a one-bank holding company (this portion of the competitive assessment has almost always been a pro forma matter since the formation usually is merely a corporate reorganization). The second phase of the analysis consists of examining the competitive effects of any affiliation that the target bank may have formed with other banks in the same geographic banking market in the past. For example, assume that bank A, which has been in operation more than five years, applied to form a one-bank holding company in year t. Assume further

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that bank A's owner had in some earlier year, say t-5, acquired bank B — a bank located in the same geographic market. Since bank A and bank B had been competitors before the acquisition, common ownership in year t-5 would have eliminated the competition that had existed. If this anticompetitive effect is judged to have been substantially adverse with no outweighing benefits of fulfillment of community convenience and needs, the Board would normally deny the holding company application in year t even though this corporate reorganization generated no further anticompetitive effects.

The Board's rationale for denying such cases is twofold and is clearly stated in a number of Board orders. One, the chain bank policy is intended to prevent the use of the holding company mechanism to further what already is an anticompetitive arrangement. Two, it is believed that denying such applications will encourage the eventual disaffiliation of the chain banks and thereby promote a more competitive market structure.

The study in this article examines the Board's chain bank policy as it has been implemented since the first chain bank case was denied in 1977. Such an investigation is of interest despite the small number of cases involved because it provides an avenue for investigating the effectiveness of a specific policy in an area in which the Federal Reserve has a regulatory responsibility.

Part one of the study examines the level of bank holding company formation activity during recent years and discusses some of the advantages and disadvantages of this type of bank ownership. Part two defines the chain bank issue as delineated by the Board and presents an analysis of those cases that have been denied under this policy. Part three presents evidence with respect to the incidence of subsequent chain bank divestitures and thus "tests" the effectiveness of the Board's policy.

An important conclusion developed in part three of this study is that the advantages of the holding company — especially certain tax advantages — provide a strong incentive to form such companies. This conclusion is supported by evidence that demonstrates that bank owners are willing to go to considerable lengths to achieve holding company status for their banks. Some observations on the Board's more recent implementation of the chain bank policy are also presented. The final section summarizes the study.

I. One-Bank Holding Companies: Advantages and Disadvantages

The popularity of the bank holding company (BHC) as a form of bank ownership has increased steadily since 1970. Table 1 demonstrates that the number of approved formations has increased in each of most of the years between 1970 and 1985, with formation activity reaching a peak in 1982. Overall, from 1970 through 1985, the number of BHC formation applications filed with the Federal Reserve System amounted to 6,899.[1]

The large number of BHC applications suggests that the advantages of the BHC form of bank ownership outweigh any disadvantages. These advantages, moreover, are broad-based and relate to an organization's ability to engage in nonbanking activities, its ability to expand geographically, the degree of control it can exercise over its own corporate ownership, and the firm's financial flexibility.

Since 1970, when amendments to the Bank Holding Company Act of 1956 were enacted, BHCs have engaged in a growing number of nonbanking activities. These include, but are not limited to, such activities as mortgage banking, consumer finance, leasing, data processing, courier services, certain management consulting activities, and merchant of futures commissions. BHC entry into many of these product markets has been extensive and has afforded many BHCs an important opportunity for diversification.

BHCs can also provide a convenient vehicle for geographic expansion in states that have restrictive branching laws. States that permit BHC expansion generally allow BHC acquisitions on an unrestricted, statewide basis. Thus, BHC acquisitions can produce nearly the same degree of geographic

diversity as branching operations while preserving a high degree of local autonomy (through the retention of local officers and directors in the acquired bank).

Another advantage of the BHC form of bank ownership is the ability to exercise considerable control over corporate ownership. For example, the formation of a BHC provides the majority owners of the proposed bank subsidiary with an opportunity to eliminate minority shareholders within the bank and thus consolidate their control of the banking organization. This can be accomplished by forcing minority shareholders to accept cash (rather than shares of the forming BHC) for their bank shares. Certain regulations also give BHCs more flexibility than banks in incorporating anti-takeover measures into their corporate structure. BHCs, for example, have the ability to repurchase their own stock.

The BHC form of bank ownership also provides important financial flexibility. This flexibility derives from several sources. BHCs, for example, may enjoy an advantage in raising new capital and in structuring existing capital. Under present Federal Reserve standards, rules for including certain items as capital (such as equity commitment notes and intangible assets) are more liberal for BHCs than they are for banks. Also, certain BHCs (generally those with less than $150 million of assets) can engage in "double leveraging," in which funds borrowed by the parent company (debt) are "pushed down" to the subsidiary bank as equity capital.

Another very important financial benefit associated with the BHC form relates to the tax treatment of certain income and expenses.[2] One area in which these considerations are particularly important is the retirement of bank acquisition debt. Typically, personal debt is employed when an individual purchases a bank. The bank's owner usually retires this debt with bank dividend payments that accrue to him as owner of the bank. Dividend payments to the owner, however, are taxable as ordinary income. Thus, some portion of the dividend payments to the owner are "lost" to taxes and cannot be fully applied to debt retirement. All other things being equal, the amount of bank dividends that must be paid to service the acquisition debt will be greater in the case of individual ownership — in which "after-tax" dollars are being used to retire debt — than if all bank dividends went directly to debt retirement.

The creation of a one-bank holding company, however, enables all bank dividends to go toward debt retirement and thus effectively reduces the amount of dividend payments a bank must make in order to retire a given amount of acquisition debt.

TABLE 1

Bank Holding Company Formation Applications, 1970 - 1985

Year	Number of Applications	Number of Approvals	Number of Denials
1985	655	648	7
1984	963	959	4
1983	998	992	6
1982	1,089	1,086	3
1981	840	827	13
1980	690	681	9
1979	372	369	3
1978	273	259	14
1977	186	170	16
1976	155	143	12
1975	156	141	15
1974	154	138	16
1973	147	146	1
1972	123	112	11
1971	67	65	2
1970	31	31	0
Total	6,899	6,767	132

Source: *Federal Reserve Bulletin* for years indicated. Figures include both one-bank and multibank formations.

Typically, when the newly formed holding company "buys" the owner's bank, the BHC also agrees to assume the owner's acquisition debt as part of the purchase price of the bank. The source of funds to retire this debt remains, as in the case of the individual owner, bank dividends. A critical difference now, however, is that bank dividend payments to the BHC are (by IRS regulations) tax-free income to the BHC. Thus, the BHC can use the entire stream of bank dividends to retire acquisition debt. That is, no bank dividend payments are "lost" to tax payments.

The amount of bank dividends that must be paid in order to retire a given amount of debt, therefore, is less when the debt is retired by a BHC than when it is retired by an individual. Because the holding company can retire the acquisition debt with essentially tax-free dollars, the debt servicing burden on the bank is significantly less than if an individual retired debt with dollars on which he must pay income taxes.

A second important tax advantage of the BHC form is related to the ability of a BHC to file a consolidated tax return (combined parent company and bank subsidiary), and is known as the "tax-expense" benefit. Typically, bank subsidiary dividend payments to the parent company BHC (for small, undiversified holding companies) comprise the sole source of income to the parent holding company. These dividend payments, as noted earlier, are tax-free income to the parent holding company. Thus, the parent company has actual cash income but no taxable income (that is, it has a taxable income base of zero). The parent holding company, however, usually has tax-deductible expenses in the form of interest payments on acquisition debt assumed upon the purchase of its subsidiary bank. This combination of zero taxable income but positive deductible interest expenses generates a negative income tax liability for many small parent companies.

Without positive taxable income, however, the parent company cannot take advantage of its negative tax liability. By filing a consolidated tax return with a subsidiary bank that has a positive income tax liability, the parent company can effectively reduce the income tax liability of the overall organization by an amount equal to the subsidiary bank's marginal tax rate times the parent company's interest expense.

Typically, the subsidiary bank pays the parent company the value of this benefit. In the end, however, the subsidiary bank will not have incurred any greater total cash outlay than if the bank were owned individually. However, the holding company has additional cash which it may use to retire debt.

Compared to these substantial advantages, the disadvantages of the BHC form of bank ownership seem minor. Among the disadvantages are start-up and organizational costs which entail professional fees, franchise taxes, and staffing costs. In addition, the regulatory process itself imposes some costs upon the principals of proposed BHCs in the form of reporting requirements and greater regulatory scrutiny. These disadvantages notwithstanding, it is clear from Table 1 that the BHC is a form of bank ownership that many bank owners have chosen to adopt.

II. The Chain Bank Issue

The formation of a BHC requires the prior approval of the Federal Reserve System pursuant to Section 3(a)(1) of the Bank Holding Company Act.[3] Table 1 shows that all but 132 (two percent) of the 6,899 applications filed from 1970 through 1985 were approved. An examination of the formations that were denied reveals that most were disapproved for financial, managerial, or legal reasons. Twelve of the proposed formations, however, were denied for competitive reasons as part of the Board's "chain bank" policy, discussed earlier. (See Table 2).[4]

To reiterate, the Board's rationale for scrutinizing the competitive effects of one-bank holding company formations among commonly owned banks is that the BHC vehicle should not be used to further an anticompetitive arrangement, and that denial of such cases might lead to a procompetitive restructuring of the affected banking markets by precipitating a dissolution of common ownership. This rationale was clearly stated in the *Mahaska* decision, the first of the chain bank denials:

Section 3(c) of the Bank Holding Company Act requires the Board to consider whether any proposed acquisition by a bank holding company (1) would further the monopolization or attempted monopolization of a banking market, or (2) may substantially lessen competition or tend to create a monopoly in any banking market. Where, as here, a proposed acquisition involves the use of a holding company by a group of individuals to acquire control of a bank that is a competitor of another bank under the control of essentially the same individuals, the Board believes it must apply these standards. In the Board's view, the subject proposal presents a compelling case where the holding company is being used to further an anticompetitive arrangement.

While denial of the proposal may not immediately result in a complete termination of the present situation . . . it would preserve the distinct possibility that [the target bank] could again become an independent organization in the future. Approval, on the other hand would almost certainly foreclose that possibility since, as a result of the flexibility afforded by the holding company structure, Applicant would appear capable of servicing its acquisition debt, and, in addition, a mutuality of interest between the affiliate and [the target bank] would likely be established.[5]

When implemented in 1977, this method of analyzing the competitive effects of one-bank holding company formations clearly constituted a new approach to the Board's scrutiny of one-bank hold-

TABLE 2

Chain Banking Applications Denied by the Federal Reserve for Competitive Effects, 1977-1981

	Applicant	Bank to be Acquired	Date of Denial
1.	Mahaska Investment Co. (Oskaloosa, Iowa)	Farmers Savings Bank (Fremont, Iowa)	May 11, 1977
2.	Citizens Bancorp Inc. (Hartford City, Indiana)	Citizens Bancorp, Inc. (Hartford City, Indiana)	November, 18, 1977
3.	Midwest Bancorp (Gardner, Illinois)	Exchange Bank (Gardner, Illinois)	March 27, 1978
4.	Eicher Bancorporation (Iowa City, Iowa)	Hawkeye State Bank (Iowa City, Iowa)	April 25, 1978
5.	Mid-Nebraska Bancshares, Inc. (Ord, Nebraska)	Nebraska State Bank (Ord, Nebraska)	June 16, 1978
6.	First State Bancorporation (Fredericksburg, Iowa)	First State Bank (Fredericksburg, Iowa)	February 16, 1979
7.	Caneyville Bancshares Inc. (Caneyville, Kentucky)	Bank of Caneyville (Caneyville, Kentucky)	August 13, 1979
8.	Childress Bancshares, Inc. (Childress, Texas)	First State Bank in Childress (Childress, Texas)	January 28, 1980
9.	Lake Jackson Bancshares (Lake Jackson, Texas)	Lake Jackson Bank of Lake Jackson (Lake Jackson, Texas)	February 1, 1980
10.	Welch Bancshares, Inc. (Welch, Oklahoma)	Welch State Bank (Welch, Oklahoma)	August 19, 1980
11.	Semo Bancshares Corporation (Malden, Missouri)	Malden State Bank (Malden, Missouri)	May 12, 1980
12.	First Southeast Banking Corp. (Darien, Wisconsin)	First Bank Southeast of West Kenosha and First Bank Southeast of Twin Lakes (West Kenosha and Twin Lakes, Wisconsin)	March 6, 1981

ing company formations.[6] It was not clear, however, that the Board's approach to these cases would be beyond legal challenge, particularly in view of a related legal decision rendered in 1977. In that decision the Board's denial of a one-bank holding company formation on the basis of financial factors (*First Lincolnwood*) was overturned in district court on the argument that ". . . in order to be grounds for disapproval, the condition or tendency deemed not to be in the public interest must be caused or enhanced by the proposed transaction."[7]

In a second competitive chain bank denial which quickly followed *Mahaska,* however, the Board argued that the *First Lincolnwood* decision did not apply because (1) *First Lincolnwood* related to aspects other than competitive factors; (2) consummation of the current holding company formation proposal is related to competitive (not financial) factors and *would* enhance and further an anticompetitive arrangement; and (3) evasion of the Bank Holding Company Act would be facilitated and encouraged.

Any uncertainty regarding whether chain bank cases could be legally denied did not exist for long. In 1978, the U.S. Supreme Court upheld the Board's authority to deny one-bank holding company formations even though the formations did not exacerbate pre-existing financial factors.[8] This 1978 decision clearly established the Board's authority to deny one-bank formations for adverse financial and managerial factors. It was also seen as confirmation of the Board's authority to deny formations on the basis of competitive factors as well. Any remaining doubt on this point was removed in 1980 when the only legal challenge to a Board competitive chain bank denial was rejected in court.[9]

Characteristics of Chain Bank Denials

From 1977 to 1981, the Board denied twelve proposed formations for reasons relating to the competitive effects of past affiliations. These twelve cases, listed in Table 2, are examined more closely below to review the competitive factors in question. Some of the data relating to the cases are presented in Table 3.

TABLE 3

Market Characteristics of Chain Bank Denials[1]

Case	Geographic Market	Deposit Size of Market ($ million)	Deposit Size of Bank ($ million)	Number of Banking Competitors	Concentration	
					Four-Firm Ratio (percent)	HHI[3]
1. Mahaska	Mahaska County	92.4	12.4	5	92.8	3028
2. Citizens	Hartford City	76.8	27.5	4	100.0	3302
3. Midwest	Grundy County	180.6	8.6	6	87.8	2494
4. Eicher	Iowa City	281.8	17.4	9	78.2	2046
5. Mid-Nebraska	Valley County	46.4	14.7	5	90.8	2600
6. First State	Chickasaw County	88.2	10.9	6	78.6	1953
7. Caneyville	Grayson County	70.4	7.1	4	100.0	2805
8. Childress	Childress County	20.5	13.7	2	100.0	5558
9. Lake Jackson	Brazoria County	318.6	36.2	13	67.6	1310
10. Welch	Ottawa County	180.0	9.1	10	82.0	2786
11. Semo	Malden County	77.4	29.8	6	83.5	2331
12. First Southeast[2]	Kenosha County	292.1	11.1 9.0	8	87.4	2407

[1]Data are as of time of application.

[2]This application involved an existing one-bank holding company that applied to acquire five commonly owned banks. Three applications were approved; two were denied. For purposes of this study, the two denials are discussed as if they were a single chain case.

[3]The HHI is obtained by summing the squared market share of deposits of each banking organization. The Department of Justice presently considers an index of 1800 or higher to comprise a high degree of concentration.

Several important observations can be made from this information. First, virtually all of the target banks involved in the twelve denials were small banks located in small, primarily rural banking markets. The smallest of the target banks (*Caneyville*) had deposits of only $7.1 million at the time of application. Even the largest (*Lake Jackson*) had only $36.2 million of deposits. For the entire group of twelve banking organizations, the average bank size amounted to $16.0 million.

The markets in which these banks operated were likewise small and contained few banking competitors. Five of the cases, for example, involved markets with five or fewer banking organizations. Six other markets had between six and ten banking organizations, and only one application involved a market with more than ten banking organizations. Similarly, the total deposits of the twelve markets averaged only $144 million.

The markets in which these twelve organizations operated also were, in all but one case, highly concentrated at the time of application. Eleven of the twelve markets had four-firm concentration ratios higher than 75 percent and a Herfindahl-Hirschmann Index in excess of 1800.[10] Only one case (*Lake Jackson*) involved a market of moderate concentration.

The profile, then, that emerges of the banks and markets in these cases is one of small banks operating in small, highly concentrated markets. Within such markets, it is not difficult to imagine that past multiple acquisitions of banks could have resulted in significant anticompetitive effects.

An Analysis of the Denials

Data related to the anticompetitive effects of the twelve denials are presented in Table 4. Among the most obvious and most important aspects of these cases is that the target bank and its affiliate(s) accounted for a relatively large market share of deposits at the time the common ownership of shares (anticompetitive affiliation) occurred. Eleven of the twelve applications, for example, involved affiliations in which the combined market share was greater than 24 percent. Only one proposal (*Eicher*) involved a market share combination of lesser mag-

TABLE 4

Deposit Size and Market Shares of Banks Upon Occurrence of Common Ownership

Case	Deposit Size and Market Share of Target Bank		Deposit Size and Market Share of Target Bank's Affiliate(s)		Combined Market Share
	($ millions)	(% Total Deposits)	($ millions)	(% Total Deposits)	(% Total Deposits)
1. Mahaska	12.8	14.2	42.8	47.4	61.6
2. Citizens	18.1	34.7	8.4	16.2	50.9
3. Midwest[1]	7.1	4.4	44.1	27.8	36.8
			7.3	4.6	
4. Eicher	18.2	6.1	20.6	6.9	13.0
5. Mid-Nebraska	6.4	26.7	3.1	12.7	39.4
6. First State	5.2	14.2	10.9	30.0	44.2
7. Caneyville	6.7	10.0	18.9	28.2	38.2
8. Childress	13.7	66.7	6.8	33.3	100.0
9. Lake Jackson	26.9	12.7	27.4	13.0	25.7
10. Welch	0.9	4.2	5.8	28.0	32.2
11. Semo[1]	6.7	35.2	2.5	13.0	59.5
			2.2	11.3	
12. First Southeast[1]	3.6	1.7	27.6	17.3	24.8
	7.5	2.6	5.1	3.2	

[1]Each of these cases involved a target bank that had two or more affiliated banks within the same geographic market.

nitude. Denial of this application resulted from unfavorable financial as well as competitive factors. The average combined market share for all twelve applications was 44 percent, ranging from a low of 13.0 percent (*Eicher*) to a high of 100 percent (*Childress*).

Eight of the twelve proposals involved affiliations of four years or less (Table 5). In two cases (*Welch* and *Semo*), however, common ownership had been in effect for more than 20 years prior to the application to form a BHC.

The duration of the anticompetitive affiliations in these cases was of considerable interest to the Board. In particular, it was believed by some Board members that there was little likelihood of disaffiliation in those cases where the period of common ownership was lengthy. Thus, it was argued, denial would have little chance of precipitating a subsequent procompetitive divestiture. Chairman Paul Volcker and Governor Lyle Gramley voiced this concern in the *Welch* application:

> We do not believe that denial of this application at this time will increase the probability that common control of the two banks will be terminated. The combined market share of the two banks is certainly substantial, and we would join the majority of the Board if there was some reasonable possibility that denial might result in severance of this relationship.
>
> The duration of this relationship is significantly longer than in any application previously denied by the Board solely on competitive grounds, however, and thus it appears unlikely that denial would have any meaningful effect.

Similarly, Governor Lyle Gramley stated in the *First Southeast* proposal:

> The affiliation between Kenosha, West Kenosha, and Silver Lake Banks has spanned nearly a decade. Denial in any of these cases would not increase significantly the probability that common control of the three banks will be terminated . . . so that the prospects for disaffiliation seem small.

The issue of the likelihood of divestiture in these applications raises the question of whether the Board's chain bank policy in general has been effective in promoting subsequent divestitures. Also, how soon following denial did the divestitures, if any, take place; and was divestiture related to the length of the affiliation? Answers to these questions are presented in the next section. They provide some evidence as to the overall effectiveness of the Board's chain bank policy.

TABLE 5

Duration of Anticompetitive Affiliation of Chain Bank Cases

Case	Year in which Common Ownership Occurred	Year in which BHC Application was Filed	Duration of Anticompetitive Affiliation
1. Mahaska	1976	1977	1
2. Citizens	1973	1977	4
3. Midwest	1976	1978	2
4. Eicher	1977	1978	1
5. Mid-Nebraska	1972	1978	6
6. First State	1972	1979	7
7. Caneyville	1978	1979	1
8. Childress[1]	1979	1980	1
9. Lake Jackson	1976	1980	4
10. Welch	1956	1980	24
11. Semo[2]	pre- 1960	1980	more than 20
12. First Southeast	1972	1981	9
	1977	1981	4

[1]This affiliation occurred two days prior to the effective date of the change in Bank Control Act of 1978.

[2]The exact date of affiliation in this case is unknown. However, Federal Reserve records indicate that common ownership among the three affiliated banks in this proposal began to develop as early as 1939.

III. Divestitures

For evidence on the incidence of divestitures, this study examined Federal Reserve records and interviewed individuals associated with the twelve denied applications. The results of these inquiries are presented in Table 6. The data reveal that divestitures subsequently occurred in eleven of the twelve denied cases. The only application in which no divestiture was recorded was *First Southeast,* and, in that instance, the commonly owned banks later merged. In several instances (for example, *Citizens, Mahaska,* and *Mid-Nebraska*), subsequent applications by the resulting nonaffiliated banks to form BHCs were refiled and approved by the Board following divestiture.

relatively short time after denial. In three of the twelve cases (*Citizens, Caneyville,* and *Childress*), a divestiture was made within six months or less. In four others (*Eicher, First State, Lake Jackson,* and *Welch*), the time to divestiture was less than 24 months. In only four applications (*Midwest, Mid-Nebraska, Mahaska,* and *Semo*) was the divestiture period significantly longer (45 months to 60 months). The average time from denial to divestiture was 27 months, or just over 2 years.

It is not possible to account fully for the motivations behind the divestitures that occurred. A bank owner's willingness to sell a bank depends upon any number of factors including the terms of purchase, availability of purchasers, and the presence of regulatory barriers. However, the most likely explanation for such a broadly based result — a 92 percent rate of divestiture (11 of 12) — is that the lack of holding company status prevented the owners of these banks from realizing the important benefits of BHC status discussed earlier.

In particular, a lack of BHC status would have prevented the realization of important debt-servicing tax benefits — a fact of some importance given that, in all cases that were denied, the proposed purchase of the bank involved the immediate or planned assumption of debt.[11] Since the Board's denial prevented the parties from realizing tax benefits, the principals of the banks appear to have decided that continued common ownership of the affiliated banks was a less favorable proposition than BHC status.

Recent Board Policy on Chain Cases

Since the *First Southeast* case in 1981, the Board has not denied a chain bank case. There are several possible explanations for this absence of denials. One is that banking antitrust standards have eased as the result of important banking legislation. Specifically, both the Depository Institutions Deregulation and Monetary Control Act of 1980 and the Garn-St Germain Depository Institutions Act of 1982 have

TABLE 6

Elapsed Time to Divestiture Following Denial

Case	Date of Denial	Did Divestiture Occur?	Month of Divestiture	Elapsed Time To Divestiture (Months)
1. Mahaska	May 1977	Yes	January 1981	45
2. Citizens	November 1977	Yes	January 1978	3
3. Midwest	March 1978	Yes	March 1983	60
4. Eicher	April 1978	Yes	September 1979	18
5. Mid-Nebraska	June 1978	Yes	March 1982	45
6. First State	February 1979	Yes	December 1980	22
7. Caneyville	August 1979	Yes	January 1980	6
8. Childress	January 1980	Yes	June 1980	6
9. Lake Jackson	February 1980	Yes	December 1981	23
10. Welch	August 1980	Yes	February 1981	19
11. Semo	May 1980	Yes	March 1984	46
12. First Southeast	March 1981	No	N.A.	N.A.

strengthened the argument that thrift institutions should be regarded as partial or full competitors of commercial banks. Counting thrift institutions as competitors increases the total number of "banking" competitors and thereby lowers concentration within markets. Thus, the competitive effects of any horizontal affiliation are likely to be less severe.

Two other developments have also served to limit denials under the Board's chain bank policy in recent years. The first arose in a 1983 chain bank application involving an affiliation of more than 40 years. In that case, the Board suggested that bank affiliations established before the passage of the Bank Merger Act of 1960 might appropriately be exempted from antitrust review.[12] Reviewing the effects of affiliations established before that year, it was argued, would unfairly apply antitrust standards that were created subsequent to the affiliation. This proposition was reiterated and expanded somewhat in a second approval decision made by the Board in 1983:

> The duration of the affiliation here is 24 years and did not represent an attempt to evade the antitrust laws or the BHC Act. Common control was effected in 1959, before the Celler-Kefauver Antimerger Act of 1950 was believed to apply to bank mergers; before the enactment of the Bank Merger Act of 1960, which required regulatory agencies to take competitive factors into account in approving mergers; and before the enactment of the Bank Merger Act of 1966, which clarified the applicability of the antitrust laws to bank mergers.[13]

A final contribution to the approval of chain bank cases in recent years has been the Change in Bank Control Act of 1978. This law, which embodies a competitive standard equivalent to that of the BHC Act, requires that changes in the effective ownership or control of a bank receive prior approval from one of the three federal bank regulatory agencies. Thus, seriously anticompetitive affiliations of the type which raise a chain bank issue presumably have not occurred since the passage of this law. As a result, the pool of potential chain bank cases has shrunk since 1978.[14]

IV. Summary and Conclusion

Beginning in 1977, the Board forged a rather well-defined policy with respect to the formation of bank holding companies from chain banks. This policy requires an assessment of the competitive effects of any prior affiliations between the target bank and other banks located in the same banking market. If the original affiliation had substantially adverse effects on competition within the relevant geographic market, the Board will normally deny the formation application based upon the requirements of the Bank Holding Company Act. The Board's purpose in applying the standards of the Bank Holding Company Act to these chain bank cases is twofold: to prevent the use of the holding company vehicle to further an anticompetitive arrangement and to promote conditions under which the anticompetitive chain affiliation might be dissolved in the future.

From 1977 to 1981, the Board denied 12 chain bank applications. The target banks involved in these applications were nearly all small institutions located in rural, concentrated markets. An examination of these 12 cases revealed that the Board's chain bank policy was highly effective. Procompetitive divestitures occurred in eleven of the twelve cases.

The Board has not denied any chain bank cases since 1981 for several reasons, including a general easing of banking antitrust standards, a determination that pre-1960 affiliations should be exempted from antitrust review, and the effects of the Change in Bank Control Act. However, the experience of 1977-81 and the subsequent divestitures to gain BHC status suggest strongly that the BHC form of ownership enjoys decided advantages. Among the most important of these is the ability to service debt more advantageously than an individual. Other important advantages of the holding company include the ability to engage in certain nonbanking activities and, in some cases, to expand geographically in ways not available through normal bank branching. Greater flexibility in structuring capital, ownership and control, and anti-takeover provisions also derive from the holding company form and provide important additional benefits.

FOOTNOTES

1. Table 1 includes one-bank and multibank holding company formations. Available aggregate data did not permit the segregation of the two types of formations by number, although experience indicates that except for the early 1970s nearly all of the formations recorded in this table consist of one-bank holding companies.

2. IRS regulations stipulate that a BHC must acquire at least 80 percent of the target bank to qualify for the tax treatment herein described.

3. More or less routine formations involving no serious financial, managerial, or competitive issues are normally approved by the 12 Reserve Banks under delegated authority procedures. More complicated cases are approved or denied by actions of the Board of Governors of the Federal Reserve System.

4. Few studies have been conducted on the importance of chain banking within individual states. One such study involving five midwestern states, however, identified 86 chain organizations controlling a total of 332 banks. Within these states, the various chain organizations controlled as little as 4.2 percent of state bank deposits and as much as 16.9 percent of bank deposits (see Joseph T. Keating, "Chain Banking in the District," *Economic Perspectives,* Federal Reserve Bank of Chicago, Sept./Oct. 1977, pp. 15-20).

5. *Mahaska Investment Co., Federal Reserve Bulletin,* Vol. 63 (1977), p. 579.

6. In the early 1970s the Board routinely considered pre-existing relationships as part of its analysis of proposed multibank holding company formations. The Board generally did not regard these pre-existing relationships as raising any competitive issues because in most instances the affiliated banks had been started *de novo* by principals of the applicant's lead bank.

7. *First Lincolnwood Corp.* vs. *Board of Governors of the Federal Reserve System* 560 F.2d 258 (7th Cir. 1977)

8. U.S. Supreme Court in *First Lincolnwood Corp.* vs. *Board of Governors,* 439 U.S. 234 (1978).

9. *Mid-Nebraska Bancshares, Inc.* vs. *Board of Governors,* 627 F.2d 266 (D.C. Cir. 1980)

10. The Herfindahl-Hirschmann Index is obtained by summing the squared market shares of deposits (or some other measure, such as assets or loans) of each banking organization in a market. The Department of Justice presently considers an index of 1800 or higher to comprise a high degree of concentration.

11. Ten of the twelve acquisitions were to be made by an exchange of shares and the assumption of acquisition debt ranging from $297 thousand to $2.9 million. In two other applications, no acquisition debt was involved, but the newly formed holding companies planned to borrow funds that were to be used as capital injections into the respective banks.

12. *First Monco Bancshares, Inc., Federal Reserve Bulletin,* Vol. 69 (1983), p. 293.

13. *Texas East BanCorp, Inc., Federal Reserve Bulletin,* Vol. 69 (1983), p. 636.

14. This law actually became effective in early 1979. The date of effectiveness explains why two of the affiliations (*Caneyville* and *Childress*) that occurred in 1978 and 1979 were, nonetheless, reviewed by the Board under the chain bank policy.

Monetary Control Without a Central Bank: The Case of Hong Kong

Ramon Moreno*

The traditional critique of the "real bills" doctrine argues that the price level may be unstable in a monetary regime without a central bank and a market-determined money supply. Hong Kong's experience suggests this problem may not arise in a small open economy.

In our century, it is generally assumed that monetary control exerted by central banks is necessary to prevent excessive money creation and to achieve price stability. More recently, in the 1970s, this assumption is evident in policymakers' concern that financial innovations have eroded monetary controls. In particular, the proliferation of market-created substitutes for money not directly under the control of monetary authorities has led Phillip Cagan (1979) to argue for regulatory reform:

> New financial developments may make the past degree of monetary control increasingly more difficult to maintain. Yet pursuit of national policies to restrain inflation and stabilize economic activity appears impossible without effective monetary controls. The creation of a regulatory environment in which the erosion of monetary controls is kept to a minimum is particularly important in the present period of rampant inflation.

While this statement reflects the mainstream view today, it has not always been obvious that the government, rather than the market, should determine the money supply. A market-determined money supply is traditionally associated with the long discredited "real bills" doctrine. This doctrine proposed that the money supply and inflation could successfully be controlled by the market, without central bank control of the monetary base, as long as banks limited their credit to "satisfy the needs of trade".

The real bills doctrine was severely criticized on the belief that it could lead to instability in the price level. However, a number of leading economists such as Fama (1980) and Sargent and Wallace (1982, 1983) have recently argued in favor of regimes where the money supply is market-determined.

In this respect, Hong Kong provides an interesting example of an economy where there is no central bank, and where, to the extent possible, central banking functions are minimized. Thus, it provides a unique opportunity for ascertaining whether a market-determined money supply is consistent with overall macroeconomic stability, particularly stability in the price level.

Section I reviews the real bills doctrine and discusses how it may be feasible in a small open economy even if it may lead to price instability in a closed economy. The discussion identifies certain testable features that distinguish a stable monetary regime from an unstable one. These features form the basis for an empirical test on the stability of Hong Kong's monetary system in a later section.

Section II discusses three key features of Hong Kong's monetary sector typically believed to influence money creation and monetary control: (1) the note issuance mechanism under fixed and floating

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exchange rates, (2) the interest-setting agreement of the Hong Kong Association of Banks, and (3) liquidity ratios. Section III reviews Hong Kong's macroeconomic performance and includes an empirical test of the stability of Hong Kong's monetary system under floating exchange rates as well as a discussion of exchange rate stability.

The paper concludes that allowing the market to determine the money supply in a small open economy may be consistent with price level stability under either fixed or floating exchange rates, and that monetary authorities under such conditions may relax their control over monetary aggregates. Furthermore, such a prescription may be most appropriate under a fixed exchange rate regime since, under floating rates, Hong Kong was unable to counteract destabilizing speculation against the value of its currency.

I. The Real Bills Doctrine and the Price Level

The Closed Economy

For over two centuries, there was a widespread belief that price stability could be achieved as long as banks extended only short-term self-liquidating loans for business needs. Known as the "real bills doctrine", this viewpoint was once so influential it was a premise underlying the creation of the Federal Reserve System[1].

While John Law first proposed the real bills doctrine in 1705, the classic statement on this subject was provided by Adam Smith (1776). Smith suggested that an appropriate rule for money creation is for each bank to "discount(s) to a merchant a real bill of exchange drawn by a real creditor upon a real debtor, and which as soon as it is due, is really paid by that debtor." In other words, Smith advocated that banks only finance short-term commercial paper arising from real transactions in goods and services.

The original version of the real bills doctrine appears to have emphasized short-term commercial paper linked to real economic activity to ensure that banks indeed financed only those loans that would be repaid. By so doing, the doctrine also limited the quantity of those loans. However, it may not be necessary to restrict loans to certain types of activities[2] and to short maturities to guarantee repayment. Instead, banks may be allowed to finance any type of activity as long as they can correctly assess credit risk. This last criterion will still satisfy the essential requirements of the real bills doctrine: that loans respond to the requirements of the market, that they be selected in such a manner that they will be repaid, and that the volume of loans be limited. Thus, modern interpretations of the real bills doctrine, as well as the presentation adopted here, do not restrict loan supply to short-term commercial paper.

The previous discussion also suggests two possible models of the real bills doctrine. In one model, the real loan demand is defined in such a manner that borrowers are assumed always to repay their loans. In such a case, lenders could seek to accommodate any real loan demand by borrowers[3], and the real money supply thus passively accommodates real money demand. Most presentations of the real bills doctrine[4] implicitly make this assumption, which is equivalent to a monetary regime where a central bank targets interest rates.

The real bills doctrine may also be modelled by assuming that banks limit loan supply according to their perception of default risk. Real loan supply at any given interest rate therefore will not necessarily coincide with real loan demand because banks may ration credit rather than passively accommodate real credit demand. The result would be a loan and money supply function that is upward sloping (over a certain range) in relation to the rate of interest. A money supply function that is upward sloping in relation to interest rates also results if one assumes that bank operations are characterized by rising marginal costs. This is the supply function postulated by Patinkin (1965). As shown in the appendix, the macroeconomic equilibrium of a real bills regime depends significantly on the loan and money supply process assumed.

Most of its early proponents believed that the real bills doctrine would suffice to prevent an overissuance of notes and to maintain a stable price level because, under the doctrine, real loan supply would

be limited by real loan demand in the economy.[5] (Alternatively, loan supply may be limited by the perceived capacity to repay). Loan supply would in turn limit money creation, since banks concerned about the value of their monetary liabilities would seek to ensure that these are not excessive in relation to the loan assets backing them. The flaw in this reasoning is that if the nominal value of bank assets rises with inflation, then banks may also increase the nominal value of their liabilities, and create more money, without penalty.

Critics of the real bills doctrine have emphasized that while the market limits *real* loan supply and *real* money creation, this does not mean that the market will successfully limit *nominal* money supply or the price level. The mistake of the original exponents of the real bills doctrine was to confuse an equilibrium in real terms with an equilibrium in nominal terms. The appendix shows that in a closed economy, an endogenous or market-determined money supply may be inconsistent with price level stability.[6]

Another fault of the real bills doctrine, first found by Henry Thornton (1802), is the possibility of accelerating inflation under a real bills regime. Anticipating Wicksell by almost 100 years, Thornton argued that if interest rates were pegged below the equilibrium there would be a persistent excess demand for loans. Under the first model of the real bills doctrine described above, the nominal increase in loan supply to accommodate this excess demand would result in an increase in money supply and prices. The increase in prices would reduce real loan and money supply below equilibrium, and lead, in turn, to a further increase in nominal loan demand and nominal money. This would set off a process of continued expansion of loans, money and prices.[7] Notwithstanding these shortcomings, economists in recent years seeking to address the implications of unregulated banking have attempted to rehabilitate the real bills doctrine.[8]

The Open Economy

Smith's analysis avoided traditional objections to the real bills doctrine as the regime he described was a small open economy following a gold standard. Under this system, which closely resembles Hong Kong's monetary regime under fixed exchange rates, banks may determine the volume of loans and deposits created on the condition that their liabilities be fully convertible to gold at a fixed rate. This condition is sufficient to guarantee that banks will have to limit the amount of money they create according to the availability of gold in the domestic economy.[9]

In an open economy, convertibility to gold implies that the external sector will regulate the supply of money and the price level. The adjustment process in such cases is traditionally described by the classical price specie flow mechanism. An excess supply of money would tend to raise domestic prices and reduce international competitiveness. This, in turn, would tend to produce a gold outflow that would eliminate the excess supply of money and lower domestic prices until a trade balance is restored.

In a modern economy, a system analogous to a gold standard would be one that requires convertibility with some internationally traded asset at a fixed exchange rate (such as sterling or the U.S. dollar) and one in which capital mobility, as well as trade flows, govern the adjustment process. An excess supply of money in this case would tend to lower domestic interest rates and thereby create an incipient capital outflow. In the process of accommodating this capital outflow, the banking sector would supply foreign assets in exchange for its monetary liabilities at a fixed exchange rate.[10] This would preserve the fixed exchange rate while eliminating the excess money supply and preventing any instability in the price level.

Under both the classical gold standard and a modern economy with fixed exchange rates, a market-determined money supply is well-defined and self-limiting. Variations in the supply of the internationally traded asset would, however, induce fluctuations in the domestic price level of a modern economy such as Hong Kong's because the domestic rate of inflation depends on the rate of growth of the internationally traded asset.

As shown in the appendix, the money supply may also be self-limiting under flexible exchange rates if two key assumptions hold: domestic output is not fully insulated from the external sector, and the real loan supply — and therefore the real quantity of money supplied by profit-maximizing banks — is

positively related to interest rates. Capital mobility pegs the domestic interest rate to the world rate. This determines the real money supply. At the same time, interaction with the external sector determines an exchange rate and a price level consistent with money market and goods market equilibrium. Since the price level is stabilized by the external sector, bank decisions affecting real loan supply in effect determine nominal loan supply and nominal money balances. The reason this prescription does not work in a closed economy is that a closed economy has no external sector to regulate the price level.

Comparative statics exercises show that, at the exchange rate and price level consistent with equilibrium, an excess supply of money would result in an equilibrating reduction in loans and money because banks would find that real loan supply exceeds real loan demand at the prevailing rate of interest. In contrast, when prices are above equilibrium, the contractionary effects on the trade balance and aggregate demand would result in equilibrating price reductions. This contrasts sharply with the unstable Thornton/Wicksell scenario where money creation leads to price increases, and price increases lead to further money creation. The distinction is the basis for later empirical tests on the stability of Hong Kong's monetary regime.

A market-determined money supply under floating rates may lead to price level instability if either of the two key assumptions made above do not hold. If flexible exchange rates fully insulate the domestic economy, the external sector will not stabilize the domestic price level. Price instability is also possible if banks passively accommodate money demand rather than limit money supply at any given interest rate.

Aside from stability in money and prices, policymakers may be concerned with other implications of an exchange rate regime. For example, in a small open economy with a high degree of capital mobility, there may be sudden shifts in the demand for domestic assets. Under fixed exchange rates, these financial sector shocks can be offset by appropriate variations in domestic money supply. Under flexible exchange rates, these shocks are reflected in variations in the value of the currency. For a small economy where trade represents a large proportion of gross national product, informational advantages may favor a fixed exchange rate regime. Furthermore, persistent fluctuations in the value of the currency may lead to destabilizing speculation. As we shall see, the last consideration, in particular, appears to have influenced the choice of an exchange rate regime in Hong Kong.

II. Money and Monetary Control

A first step towards understanding the process of money creation in Hong Kong is to recognize that government intervention in Hong Kong is generally believed to be ineffective and harmful to growth.[11] This non-interventionist philosophy manifests itself in a conservative fiscal posture that is justified as a means of controlling money creation. Hong Kong's government believes that "the public sector's impact on the growth of the money supply should, on the average, be neutral".[12]

This philosophy is also apparent in the government's reliance on the market to determine the money supply. The market works within a framework of three institutional restrictions thought to influence money creation: the mechanics of note issuance, the interest rate setting agreement of the Hong Kong Association of Banks, and required liquidity ratios. In this section, we review the implications of these restrictions for price stability.

Note Issuance and Currency Backing

In a typical central banking regime, the monetary authorities control the creation of base money, defined as currency and reserves[13], by limiting its availability to private banks. Given the supply of base money, a money multiplier (a function of the banks' desired holdings of reserves in relation to total deposits and the public's desired ratio of currency to deposit holdings) will then determine the total money supply. In a real bills regime, each bank can either issue its own currency or, on its own initiative, present some asset it holds to the government in exchange for currency. In contrast to a regime with a central bank, where the availability of currency is controlled by the monetary authority, the amount of currency in a real bills regime is determined by the market, as is the total money supply.[14]

Hong Kong's monetary system operates exactly

like a real bills regime. Two note-issuing banks credit the account of a government Exchange Fund and receive the equivalent amount in Hong Kong dollar certificates of indebtedness against which Hong Kong dollar notes may be issued. The currency issue by the note-issuing banks is thus backed by the certificates of indebtedness (CIs) of the Exchange Fund. Under Hong Kong's monetary system, there are no government monetary liabilities other than the CIs, so the domestic monetary base consists only of currency.

It is worth emphasizing that note issuance occurs on the initiative of the private note-issuing banks. In implementing its mandate to "regulate the exchange value of the Hong Kong dollar," the Exchange Fund has not resorted to direct manipulation of the monetary base (through such familiar instruments as open market operations, reserve requirements, or the discount rate). Instead, it has allowed the market to determine the money supply while regulating the terms on which two note-issuing banks issue currency. The basis for note issuance has varied with the exchange rate regime, with potential implications for price level stability.

Fixed Exchange Rates

In Hong Kong's system of money creation, the Hong Kong dollar has been pegged to the U.S. dollar since October 1983 and the two note-issuing banks are required to hold government-issued certificates of indebtedness as backing for their note issuance. The two banks pay the Exchange Fund in foreign exchange when they desire to issue new bank notes at the fixed rate of HK$7.80 per U.S. dollar for the certificates required as backing for any increase in note issuance. When bank notes are withdrawn from circulation and the two banks surrender certificates of indebtedness, the Exchange Fund pays the banks the equivalent foreign exchange at the same fixed rate. The sterling standard in force prior to July 1972 operated in a similar fashion.

Under fixed exchange rates, the total money supply depends on total foreign currency deposits in Hong Kong banks — which, in turn, determines the monetary base — and a money multiplier that is a function of the extent to which banks convert their foreign currency deposits for domestic currency notes and the ratio of vault cash and currency to deposits. This multiplier is illustrated in the box.

The fixed exchange rate regime implemented in Hong Kong is consistent with the conditions for price stability under the real bills regime proposed by Adam Smith. Domestic notes are fully convertible into an internationally traded foreign asset due to 100 percent backing. And banks have to limit deposit and money creation to ensure that their liabilities can be fully converted into foreign currency.

An important difference between Hong Kong's Exchange Fund and a typical central bank is that the former does not actively intervene to achieve fixed exchange rates but relies instead on market arbitrage to do so. If the currency tends to depreciate (as when there is an excess supply of money), banks would have an incentive to redeem notes in exchange for foreign currency at the higher rate offered by the Exchange Fund, and then sell the foreign currency at a profit in the market. This process would lead to a monetary contraction that would preserve the fixed exchange rate (see example provided in box). Furthermore, this fixed exchange rate mechanism guarantees passive control of the monetary base and therefore of total money supply. Note issuance is limited by requiring domestic banks to deposit foreign assets at a fixed price to back currency creation.

Flexible Exchange Rates

Under the regime in force between July 1972 and October 1983 — a period largely corresponding to that of a floating Hong Kong dollar — note-issuing banks were allowed to issue currency by crediting the Exchange Fund with the equivalent in Hong Kong dollar deposits. The Exchange Fund would then seek to achieve full foreign currency backing of the currency issue by purchasing foreign assets with these deposits; it did not require banks to provide the backing themselves. As a result, during this period, foreign exchange availability no longer constrained the ability of the note-issuing banks to expand loan or money creation. Currency could be created on demand by creating a deposit liability in Hong Kong dollars with the Exchange Fund.

Hong Kong's Money Supply

Under fixed exchange rates, Hong Kong's money supply depends on total foreign currency deposits, the proportion of foreign assets that banks convert for the purposes of issuing domestic notes, and the banks' vault-cash-to-Hong-Kong-dollar as well as the public's Hong-Kong-currency-to-Hong-Kong-dollar deposit ratios. It can be shown that the multiplier is:

$$M = [(1-f)(1+c)/(c+v)]\ D'$$

where

- M = Hong Kong money
- D′ = Foreign currency deposits in banks
- f = the proportion of foreign currency backing of D′ (so 1 − f is the proportion of D′ used to back domestic note issuance)
- c = domestic-currency-to-Hong-Kong-dollar deposit ratio
- v = bank domestic-vault-cash-to-Hong-Kong-dollar deposit ratio

We will first assume that banks adjust the proportion of foreign currency backing of foreign currency deposits (f) to accommodate domestic money demand. This implies that foreign currency backing always exceeds the minimum level banks consider appropriate.

Table A illustrates a case where foreign currency deposits (D′) equal HK$300, f = ¼, c = ½, v = ¼, and the resulting Hong Kong dollar money supply is HK$450. Suppose there is an excess supply of Hong Kong dollars at this point. The public will then tend to shift out of Hong Kong dollar assets into foreign currency assets. This shift will tend to depreciate the currency.

Since the Exchange Fund stands ready to buy Hong Kong dollar notes at the higher fixed rate, note-issuing banks have an incentive to buy Hong Kong currency from the public and to redeem them for foreign currency from the Exchange Fund. Assume that once the public has converted HK$50 in currency, the domestic money market will be in equilibrium and there will be no further tendency to shift away from Hong Kong dollars or to depreciate the currency.

Assuming the desired vault-cash- and currency-to-deposit ratios remain the same, Table B illustrates the banking sector balance sheet in equilibrium. The money supply has contracted by HK$150. Banks have lowered the proportion of foreign currency assets they convert to domestic currency (1 − f) to ½, which is the level consistent with equilibrium at the exchange rate fixed by the government. Table B also shows that the liabilities (in the form of Certificates of Indebtedness) of the

TABLE A
Illustrative Banking Sector Balance Sheet
Fixed Exchange Rates
(Hong Kong Dollars)

Assets		Liabilities	
Private Sector		**Private Sector**	
Certificates of Indebtedness	225	Cash held by banks	75
Vault cash (V)	75	Cash held by public	150
Loans and Investments	450	Deposits (D)	300
Subtotal	750	Subtotal	525
Foreign currency assets	75	Foreign currency deposits (D′)	300
Private Sector Total	825	Private Sector Total	825
Public Sector		**Public Sector**	
Foreign currency assets (*)	225	Exchange fund foreign currency deposits	225
TOTAL	**1050**	**TOTAL**	**1050**

*For simplicity, it is assumed that foreign currency assets acquired from Exchange Fund deposits do not affect money creation.

Exchange Fund have fallen by HK$75, matched by an equivalent decline in public sector foreign currency assets.

In the first stage, the public's holding of domestic currency fell by HK$50, while its holding of foreign currency assets increased by HK$50. In the process of liquidating its loan liabilities in a manner consistent with its reduced money holdings, the public decreases the domestic deposit liabilities of banks by HK$100, and restores HK$50 in foreign currency assets to the banking sector. Note that in this example, the money supply contracts without reducing the private foreign currency deposits of the banking sector.

Another way of illustrating a monetary contraction is to assume that the proportion of foreign currency backing, vault cash and currency in the hands of the public does not change, while noting that capital inflows (changes in foreign currency deposits) affect domestic interest rates. An excess capital inflow will lower domestic interest rates below the world rate, producing equilibrating reductions in foreign currency deposits. An equivalent monetary contraction to that shown in Table B can be achieved if we assume the original parameters (f, c, v) are unchanged and that foreign currency deposits fall by HK$100. Under fixed exchange rates, the actual process of money creation and contraction in Hong Kong probably combines changes in parameters as well as capital flows, and includes secular declines in the vault cash- and currency-to-deposit ratios.

Under floating rates, the monetary base depends on the amount of currency note-issuing banks wish to create, so we may use the textbook multiplier

$$M = [(1+c)/(c+v)]\,H$$

where H is the currency issued by crediting the Hong Kong dollar deposits of the Exchange Fund.

Monetary stability is achieved only if the market-determined money supply limits the monetary base, H. Under a real bills regime that successfully guarantees price stability, the market should limit M. Given c and v, H will then be determined. The conditions under which interaction with the external sector limits the monetary base under floating exchange rates are discussed in the text and the Appendix.

TABLE B
Banking Sector Balance Sheet
After HK $150 Monetary Contraction
(Hong Kong Dollars)

Assets		Liabilities	
Private Sector		**Private Sector**	
Certificates of Indebtedness	150	Cash held by banks	50
Vault cash	50	Cash held by public	100
Loans and Investments	300	Deposits	200
Subtotal	500	Subtotal	350
Foreign currency assets	150	Foreign currency deposits (D′)	300
Private Sector Total	650	Private Sector Total	650
Public Sector		**Public Sector**	
Foreign currency assets*	150	Exchange fund deposits	150
TOTAL	**800**	**TOTAL**	**800**

Change in the Balance Sheet of the Public

	Assets		Liabilities	
Step 1	Currrency	−50		
	Foreign Assets	50	Loans and	
Step 2	Deposits	−100	Investments	−150
	Foreign Assets	−50	of Banks	

*For simplicity, it is assumed that foreign currency assets acquired from Exchange Fund deposits do not affect money creation.

An immediate effect of the 1972 revision was that domestic monetary issuance by banks need not have any relationship to the exchange rate set by the government. When a government pegs the exchange rate, it will find itself unable to enforce the pegged rate unless that rate was consistent with the market equilibrium rate. Independent money creation by banks could neutralize any effort by the government to fix the exchange rates. This was the sequence of events in Hong Kong between July 1972 and November 1974. The government attempted to peg the currency to the U.S. dollar only to abandon the effort because of the limited impact of its intervention. In effect, Hong Kong went into a floating rate regime by default because it had adopted an institutional arrangement inconsistent with a fixed exchange rate. As we shall show later, this institutional arrangement would have implications for the feasibility of stabilizing exchange rates in response to shocks.

Abandoning the requirement that currency issuance be backed by foreign assets also removed the self-regulating mechanism that limits the monetary base under fixed exchange rates. As discussed earlier (and shown formally in the appendix), in a small open economy such as Hong Kong's, where flexible exchange rates do not fully insulate the domestic economy, interaction with the external sector may nevertheless guarantee price level stability as long as banks limit the loan and money supply at any given interest rate.

If these conditions do not hold, money, prices, and exchange rates in Hong Kong could be indeterminate or unstable. This view is held by a number of observers of the Hong Kong scene. For example, in the December 1983 issue of the *Asian Monetary Monitor,* John Greenwood remarked:

> . . . Hong Kong's monetary arrangements (under floating exchange rates) constituted an indeterminate, metastable equilibrium system. This meant that for any given level of money supply and prices in Hong Kong, the exchange rate would adjust to that price level; alternatively, given any level of the exchange rate, money supply and domestic prices would adjust to that exchange rate.[15]

Greenwood's reasoning is analogous to the traditional criticism of the real bills doctrine. The economy may guarantee that real money demand equals real money supply even as the nominal money supply, prices and exchange rates are indeterminate or unstable.

Interest-Setting in Hong Kong

Since 1964, banks in Hong Kong have restricted the interest rates they pay on deposits with maturities of less than twelve months to a level determined by the Hong Kong Association of Banks (HKAB) or its predecessor, the Exchange Banks' Association. This restriction was designed to prevent the destabilizing interest rate competition experienced during banking crises in the early 1960s, and was formalized in legislation in 1981 that established the HKAB and empowered it to require banks to observe the interest rates it established. While this agreement was originally established for prudential reasons, subsequent discussions of its function have focused on the implications for price stability and monetary control.

Jao (1984) and Fry (1985) assert that the HKAB set interest rates consistently below the equilibrium determined by the world market. Given our earlier discussion of Wicksell and Thornton, it would seem that such a policy could create the potential for hyperinflation on the assumption that banks would set the loan rate as well as the deposit rate below the market equilibrium. Competition in the loan market could prevent this from happening. Furthermore, given that the loan rate was in fact set below the market equilibrium, the Thornton/Wicksell view also assumes that banks continually seek to accommodate an excess demand for loans. This may not occur if profit-maximizing banks respond to an excess demand for loans by rationing credit rather than continually raising the nominal loan and money supply.

There are also indications that the ability of the HKAB to influence interest rates was limited, particularly as the 1970s progressed, and that it probably had to adjust its interest rates to reflect market conditions. One reason it may have been forced to raise rates is that the profitability of Hong Kong's financial system depends on attracting depositors who have access to the Euromarket. Hong Kong banks must therefore pay internationally competitive rates. By affecting the cost of funds in a

competitive lending environment, the external sector would tend to bring overall Hong Kong interest rates into line with the world market equilibrium, and thereby limit the ability of the HKAB to set deposit rates that were excessively out of equilibrium.

Another factor that may have limited the ability of the HKAB to determine interest rates was the rapid growth of Deposit Taking Companies (DTCs) in the 1970s. DTCs were financial intermediaries that, up to 1976, had avoided banking restrictions by limiting their business to deposits with maturities in excess of three months. As DTCs were not subject to the interest rate agreement, they undoubtedly made it increasingly difficult for the Hong Kong Association of Banks to fix the interest rate. The frequency with which interest rates were revised suggests that the DTCs were influential. The HKAB revised its deposit rates only once, in 1976 when the Deposit Taking Ordinance was passed. This ordinance allowed DTC deposits of any maturity but imposed other restrictions on their operation. In 1980, however, just before major additional restrictions were imposed on DTCs, the HKAB revised its deposit rates 13 times. Thus, while concern about their inflationary impact was typically associated with DTCs, DTCs probably helped ensure that market considerations prevailed in determining interest rates in Hong Kong. The impact of the HKAB interest-setting agreement may therefore have been limited to some distortion of the term structure of interest rates, and, as in other countries where restrictions of this kind are imposed, may have reduced the availability of savings.

The government could use the interest-setting powers of the HKAB as an instrument for monetary control to the extent that the HKAB was not limited by competition to adjusting interest rates passively in response to market conditions. Variations in the interest rate could induce desired changes in real money demand or supply, and affect prices and exchange rates. However, this approach would not always work, as the criteria used by the HKAB in setting interest rates need not be based on macroeconomic considerations.

Furthermore, the government appears to have been unable to use the interest rate agreement to achieve certain macroeconomic objectives on certain critical occasions. For example, during the 1982-83 episode in which uncertainty about the future government of Hong Kong caused the value of its currency to plummet, a rise in the rate paid on Hong Kong dollar deposits could have dampened the drop in the value of the currency. Instead, the HKAB was reportedly reluctant to raise interest rates, and the government was reluctant to insist.[16]

Liquidity Ratios

Aside from the mechanics of note issuance and the interest rate agreement, the liquid assets ratio requirement is typically cited as a potential means for limiting the money supply in Hong Kong. Also established for prudential, rather than macroeconomic, reasons, this institutional restriction requires that the ratio of liquid asset holdings (mostly vault cash and foreign assets, given the limited amount of marketable government securities) of banks to deposits exceed twenty-five percent.

In Hong Kong, this requirement is often believed to restrict money creation in a manner analogous to reserve requirements. However, the analogy is invalid since the market, and not the government, determines the creation of liquid assets by the acquisition of foreign currency deposits or the mechanism of note issuance described previously. Thus, the liquid assets ratio has not functioned as a reserve requirement in the sense of requiring banks to hold liabilities of the government monetary authority, the supply of which is determined by policymakers. In particular, base money creation by banks could nullify any effects of liquid assets ratio requirements. In any case, the government has altered the liquid assets requirements very infrequently.

It may also be noted that the liquid assets ratio was not binding on banks, which typically held liquid assets significantly above the required level. For example, between 1972 and 1984, the year-end liquidity ratio of banks averaged well in excess of 40 percent. Up to the early 1980s, deposit-taking companies, which were close competitors of banks, were not subject to liquid assets ratio requirements.

The weakness of liquidity ratios as instruments for monetary policy under floating rates is illustrated by the effort of the government to use them to control money creation at the end of the 1970s. In February 1979, the government imposed a 100

percent liquid assets requirement on deposits of the Exchange Fund. As a result, note-issuing banks had to hold either currency or foreign exchange assets against these deposits.

If the constraint were binding, it would tend to contract the money multiplier, as the banks' vault cash to deposit ratio would have to rise. However, it would not necessarily limit the creation of base money. As the Hong Kong dollar depreciated, a fixed amount of foreign assets used to serve the liquidity requirement could support an increasing amount of domestic currency creation. That is, the effectiveness of this policy as a means for controlling the money supply was diluted because the government did not set a price for the Hong Kong dollar in relation to its foreign currency liquid assets cover.[17]

Our brief review of Hong Kong's monetary regime suggests that the stability of Hong Kong's money and price level depends on the process governing note issuance, including the pegged exchange rate arrangement, and that other institutional restrictions, such as the interest-setting agreement of the HKAB or liquid assets ratio requirements, are of limited importance.

Unlike most modern economies, base money creation in Hong Kong results from the initiative of two private note-issuing banks whose decisions are based on market considerations. The institutional restrictions on note issuance guarantee that money creation is self-limiting under fixed exchange rates. The stability of Hong Kong's monetary system under floating exchange rates is less obvious. Leading observers believe that the monetary process may have been unstable, and theory is ambiguous on this point. A closer look at the empirical evidence is therefore indicated.

III. Hong Kong's Macroeconomic Performance

Macroeconomic Indicators

If Hong Kong's monetary system had adverse effects on its economy, it is not apparent in the performance of the real sector. Real gross domestic product (GDP) growth averaged 8.0 percent between 1966-1972 when exchange rates were fixed, and 8.5 percent between 1974-1983 when the Hong Kong dollar was floating. In fact, as shown in Table 1, Hong Kong's economic growth has been among the highest in the world since the early 1960s.

This remarkable growth is partly attributable to a competitive labor market that has resulted in a high degree of real wage flexibility. Between 1974 and 1982, real wage growth averaged only 1.9 percent, and it fell sharply during certain years. For example, real wages fell 12 percent following the first international oil price shock in 1974, and 11 percent during the severe world recession of 1975.

Unemployment data, available on a yearly basis only since 1975, suggest a satisfactory economic performance. The unemployment rate averaged 4.4 percent between 1975 and 1983 notwithstanding periodic surges in the labor force caused by immigration, such as the ½ million immigrants from the Chinese mainland between 1978 and 1981.

One feature of a regime where the money supply is market-determined is that movements in the money supply tend to be procyclical. For example, M1 dropped 5 percent in 1974 and may have contributed to the rise in the unemployment rate to 9.1 percent in 1975. However, the cost of a procyclical monetary adjustment was offset by a drop in the inflation rate from 16 percent in 1974 to 1.6 percent the year after.

Furthermore, flexible real wages have undoubtedly been a major stabilizing influence and reduced the need for countercyclical monetary policy. For example, although annual real GDP growth slowed during the world recessions of 1975 and 1982 (to 2.2 and 2.9 percent, respectively), Hong Kong has not experienced a GDP decline in at least twenty years. While the costs to the real sector of Hong Kong's market-determined monetary regime are not evident, it is also necessary to investigate whether the stability of prices and exchange rates was affected.

As shown in Table 2, Hong Kong's inflation rate averaged 4.7 percent in the period 1966-1972 when fixed exchange rates applied. During the period when Hong Kong's currency floated, the average inflation rate almost doubled to 9.3 percent, but it

TABLE 1

Hong Kong and Selected Countries: Average Annual Real GNP Growth (Percent)

Hong Kong and Countries	1966-1972 Hong Kong Fixed Rates	1974-1983 Hong Kong Floating Rates
Hong Kong	8.0	8.5
Brazil	7.9	4.5
Colombia	6.4	3.9
Dominican Republic	8.4	4.5
Philippines	5.0	5.0
South Korea	11.2	7.5
Singapore	13.2	7.8
Thailand	7.5	6.7
United States	3.6	2.1
Japan	10.0	3.8
West Germany	4.1	1.6

TABLE 2

Hong Kong and Selected Countries: Average Annual Inflation Rates (Percent)

Hong Kong and Countries	Hong Kong Fixed Rates 1966-1972	Hong Kong Floating Rates 1974-1983
Hong Kong	4.7	9.3
Brazil	25.6	66.2
Colombia	10.5	24.1
Dominican Republic	2.6	9.8
Philippines	7.9	13.2
South Korea	12.5	16.9
Singapore	1.5	5.7
Thailand	2.6	10.1
United States	4.2	8.5
Japan	5.4	7.8
West Germany	3.3	4.8

Source: International Monetary Fund *International Financial Statistics. Monthly Digest of Statistics*, Hong Kong.

remained below that of five of the other six developing countries in the table. Furthermore, it was not much higher than the inflation rate of the U.S. (8.5 percent) or Japan (7.8 percent).

Aghevli and Khan (1980) surveyed some of the countries included in Table 2 (Brazil, Colombia, Dominican Republic and Thailand) and found that fiscal deficits in those countries lead to destabilizing monetary accommodation and inflation. Given the inflationary experience of countries such as Brazil and Colombia, it would seem that fiscal deficits represent a greater problem for monetary policy than does a market-determined money supply.

While Hong Kong's inflationary performance was clearly satisfactory when compared to other economies during the floating exchange rate period, such casual observation does not rule out the possibility that the regime was unstable. After all, the rate of inflation was much higher during the period of floating rates, and other factors, such as Hong Kong's rapid growth, may have disguised the effects of an unstable monetary regime. A more formal test is therefore desirable.

An Empirical Test

Earlier, we noted that in stable monetary regimes, disturbances to money and prices tend to correct themselves. In unstable monetary regimes, however, they do not, so an increase in the money supply leads to an increase in the price level, and an increase in the price level leads to a further increase in the money supply.

If the hypothesis that Hong Kong's monetary regime under floating rates was unstable were correct, money creation should induce inflation and price increases should have led to further money creation after 1972. The Hong Kong government's conservative fiscal stance permits us to rule out government deficits as the source of any monetary accommodation that may be found, and allows us to focus exclusively on whether the operation of the private market leads to instability.

Before proceeding with an empirical test, it is appropriate to remark on certain peculiarities of Hong Kong's statistics. In modern economies, it has become increasingly difficult to determine which monetary aggregate is most related to nominal gross national product or inflation. In Hong Kong, the problem is complicated by two additional considerations. First, until 1981, money supply data did not distinguish between the Hong Kong dollar and foreign currency. Second, Hong Kong does not separate Eurocurrency operations from domestic financial transactions. As a result, there may be large movements in the reported money supply that are unrelated to domestic economic activity and that would have no inflationary implications.

The measurement error in Hong Kong's monetary statistics implies that reliable estimates of the effect money may have on prices are not possible.[18] Thus, while preliminary tests suggest that money has a very weak influence on prices in Hong Kong — a result that is consistent with our description of a stable monetary regime in an open economy — this result is still open to question.

The measurement error in Hong Kong's monetary statistics do not preclude estimates of the impact of prices on money creation. Inflation leading to money creation is a necessary condition for monetary instability when the money supply is market-determined, and we will focus on it here. Furthermore, as the share of Eurocurrency transactions is much larger for Hong Kong's M2 and M3, tests will be limited to the effect of prices on M1. One technique for ascertaining whether prices "cause" money creation is the test of Granger causality. Prices are said to "Granger cause" money if past values of prices improve the forecast of the current money supply.

There are a number of ways to implement the Granger test[19], and two different methods were attempted here. The first method involved filtering the monthly series of money and prices for the period of floating exchange rates to remove trend and seasonality and to approximate white noise. Then the cross-correlation of de-trended and de-seasonalized money with prices was estimated for prices lagged backwards and forwards 30 months. A positive cross-correlation between past prices and current money supply would indicate that "innovations" in prices lead to "innovations" in money, and would be consistent with the view that prices "Granger-cause" money. This procedure is discussed in Pierce and Haugh (1977).

Table 3 reports the results of the first test. For the period January 1973-October 1983, the data failed to reject at a 10 percent significance level the hypothesis that the cross-correlation at 29 lags is zero. The hypothesis of zero cross-correlation would be rejected at 17 lags because the cross-correlation between past prices and current money exceeds two standard errors for prices lagged eleven months (with a correlation coefficient of 0.21) and thirteen months (coefficient −0.23). As the filtering procedure did not fully succeed in "whitening" the series, these coefficients probably reflect an annual seasonal factor. "Causality" of prices to money therefore cannot be inferred, and even if it could be, the alternating signs of the coefficients are ambiguous.

One difficulty with the above procedure is that the pre-whitening process may remove any evidence of a relationship between prices and money. As a result, an alternative test of Granger causality is reported below. Furthermore, although it was earlier argued that the imposition of a 100 percent liquid assets ratio requirement on Exchange Fund deposits in February 1979 had certain flaws, it may nevertheless have affected the link between prices and money. Subsequent estimation does not extend beyond this date.

The second test of Granger causality involved regressing the logarithm of money supply on its own past values as well as past prices lagged 1 to 12 months:

$$M_t = A + \sum_{j=1}^{12} B_{t-j} M_{t-j} + \sum_{j=1}^{12} C_{t-j} P_{t-j}$$

If past prices have significant coefficients, then they can be said to "Granger cause" money. Evidence of Granger causality is a necessary but not sufficient condition for instability in money and prices. Two starting periods were chosen in the second test: (1) January 1973 was some six months after domestic currency assets were permitted as a basis for note issuance. We have argued that this is inconsistent with fixed exchange rates and could lead to monetary instability. (2) November 1974 was when Hong Kong abandoned the effort to peg its currency to the U.S. dollar. After that month, we can be certain that any systematic effort to back domestic currency issuance with foreign assets at a fixed price was abandoned.

The results are shown in Table 4. As can be seen, no significant relationship, in the Granger sense, could be established between past prices and current money supply. The results therefore suggest that Hong Kong's monetary regime was stable even during the period of floating rates.

TABLE 3

Cross-Correlation Test of Granger Causality Lagged Prices to Current Money Supply

To Lag	Chi Square	df	Prob	Cross-Correlations				
5	6.48	6	0.371	−0.033	−0.137	−0.109	0.140	0.049
11	19.14	12	0.085	0.168	−0.157	−0.031	−0.066	−0.080
17	29.74	18	0.040	−0.033	−0.228*	0.169	0.092	−0.003
23	32.97	24	0.105	0.030	−0.108	0.007	−0.086	0.086
29	36.49	30	0.192	−0.035	−0.026	−0.128	0.084	0.066

*Exceeds two standard errors

Both variables have been pre-whitened by the following filters:

Money: $(1 + .144499B + .156379B^6)(1-B)M_t$

Prices: $(1 - .137484B + .306845B^2 - .092066B^4 - .194804B^6 - .124141B^{12})(1-B)P_t$

where $B^m x_t = x_{t-m}$

TABLE 4

Regression Test of Granger Causality Effect of Prices on Money (M1)

Period	F statistic for price coefficients (c_{t-j})	Significance Level
January 1973-February 1979	.5984	Rejected at 10%
November 1974-February 1979	1.0072	Rejected at 10%

Exchange Rate Stability

While Hong Kong's monetary regime under floating exchange rates appeared to be stable (in prices), the inability of the government to enforce a currency peg under floating exchange rates could prove costly.

This is illustrated by the 1982-83 fall in the value of the Hong Kong dollar caused by uncertainty about the future of Hong Kong. This uncertainty provoked a general shift out of Hong Kong dollar-denominated assets into foreign currency assets, and resulted in a drop in the trade-weighted value of the Hong Kong dollar of 27 percent over 15 months. Furthermore, it is quite possible that the crisis put the exchange market on a speculative path, on which expectations about further declines in the Hong Kong dollar created further pressure on the currency and thus tended to be self-fulfilling. In July 1982, when the Hong Kong dollar began its sharp decline, the annualized rate of depreciation was 7.7 percent. By September 1983 — the last month of the crisis — the Hong Kong dollar was depreciating at a 65 percent annual rate. The government was therefore compelled to take steps to break this accelerating erosion in the value of the currency.[20]

While the Exchange Fund could (and possibly did) intervene during the 1982-83 crisis by selling its foreign assets in exchange for Hong Kong dollar notes, note-issuing banks could fully offset this intervention by simply printing more notes to acquire foreign currency assets.[21] As pointed out previously, the ability of the government to influence interest rates through the interest-setting agreement of the HKAB also appears to have been quite limited.

Neither the market mechanism nor the weak instruments available to the government was sufficient to control the speculation against the Hong Kong dollar, so the government halted the Hong Kong dollar's precipitous drop by reforming the terms of note issuance. On October 15, 1983, it announced that it would peg the value of the Hong Kong dollar at 7.8 Hong Kong dollars per U.S. dollar and once more require the note-issuing banks to deposit foreign currency assets with the Exchange Fund to back note issuance.

The immediate result of this policy was that any further efforts to shift away from the Hong Kong dollar would contract the domestic money supply to the point where the supply of Hong Kong money was brought down to the level demanded. Furthermore, it would restore confidence in the Hong Kong currency, which now had foreign asset backing at a fixed price. The peg to a strengthening U.S. dollar was immediately effective and has been successfully maintained, with the result that the Hong Kong dollar has appreciated significantly on a trade-weighted basis since1983 — reversing the trend of the preceding five years.

This last episode highlights the risk of a market-determined money supply under floating rates. In the absence of discretionary instruments for monetary control, the requirement that note issuance be backed by an internationally traded asset at a fixed price appears to be necessary to offset shocks that prompt speculative attacks against the currency.

IV. Conclusion

Our inability to find results consistent with monetary instability in Hong Kong is somewhat surprising given the traditional critique of the real bills doctrine. The result expected from a real bills regime did not occur for one of two reasons. First, Hong Kong's monetary regime may actually not have satisfied the real bills doctrine. This would be the case if note-issuing banks did not base their loan decisions only on market considerations but cared about the price level and behaved as if they were a modern central bank. Second, proponents of the real bills doctrine may have been correct in arguing it would not result in price indeterminacy or instability.

The idea that the private note-issuing banks, particularly Hongkong and Shanghai Bank, acted like a central bank is appealing. As the major bank in Hong Kong, Hongkong and Shanghai Bank presumably could be affected by macroeconomic considerations such as price stability. However, decisions based consistently on public policy considerations could pose insurmountable problems for a bank accountable to its stockholders. There is no evidence, for example, that the Hongkong and Shanghai Bank voluntarily contracted note issuance, or that the HKAB sought to raise interest rates to stabilize exchange rates in 1982-83. Instead, the government had to *impose* a fixed exchange rate regime that would accomplish the necessary results.

Our findings are therefore consistent with the view that a market-determined money supply in a small open economy need not be associated with price level instability or indeterminacy. They suggest that monetary authorities under circumstances similar to those in Hong Kong could successfully relax their direct control over monetary aggregates. Casual observation suggests that certain features of Hong Kong's economy, such as a conservative fiscal posture and real wage flexibility, may help this monetary regime work.

However, the exchange rate regime and the institutional arrangements underlying it also are important to Hong Kong's monetary regime. Under the monetary system in force during the period of floating exchange rates, Hong Kong had essentially no instruments to prevent destabilizing speculation against the Hong Kong dollar. It did not control interest rates or the monetary base, and could not rely on the market to stabilize the value of the currency. Only through the current pegged regime do these problems appear to have been solved.[22]

APPENDIX

Formal Treatment of Regimes with An Endogenous Money Supply

In the case of a classical closed economy, a regime with an endogenous money supply may be characterized as follows (see Patinkin 1965, Sargent 1979):

$$G(y,r) = 0 \qquad \text{Goods market} \qquad (A.1.1)$$

$$(M/P) = m(r,y) \qquad \text{Money market} \qquad (A.1.2)$$

Given output (y), equation A.1.1 can determine the interest rate (r). Equation A.1.2 can determine combinations of money (M) and prices (P) that satisfy money market equilibrium. However, since money supply is endogenous, both nominal money and the absolute price level are indeterminate. Loosely speaking, the number of equations is not sufficient to determine the number of unknowns.

Somewhat less familiar is the applicability of these conclusions to an open economy with flexible prices. This may be illustrated in the simplest possible manner by modifying equations A.1.1 - A.1.2 to incorporate the effects of the external sector in a small open economy.

The price level in an open economy depends on both domestic and foreign prices adjusted for the exchange rate, that is,

$$P = P_H^{\alpha} E^{1-\alpha}$$

where P_H represents the price of goods produced at home, E is the domestic currency price of foreign exchange, and the foreign price is set equal to one.

We may begin by assuming perfect capital mobility as such a case is the easiest to illustrate. Under fixed exchange rates, the domestic interest rate equals the foreign rate of interest, and equilibrium is given by

$$y = y(E) \qquad \text{Aggregate Supply} \qquad (A.1.3)$$

$$\underset{+}{G}[\underset{+}{y}, \underset{-}{A}(\underset{+}{y}, \underset{-}{r_F}), \underset{+}{B}(\underset{-}{y}, \underset{+}{y_F}, \underset{-}{P_H/E})] = 0 \quad \text{Goods Market} \qquad (A.1.4)$$

$$(M/P) = \underset{-}{m}(\underset{+}{r_F}, \underset{+}{y}) \qquad \text{Money Market} \qquad (A.1.5)$$

where the signs under the arguments correspond to those of the partial derivatives and

r_F = world rate of interest

y, y_F = domestic and foreign output, respectively

A = domestic absorption

B = net exports

Equation A.1.3 applies because exchange rates affect aggregate supply in an open economy. A depreciation will raise consumer prices and reduce labor supply while not affecting labor demand.

Under fixed exchange rates, equation A.1.4 can determine the combinations of output and home prices consistent with equilibrium in the goods market. Equation A.1.3 determines y with fixed exchange rates, and, given the foreign interest rate and the home price, it is possible to determine nominal money supply in equation A.1.5.

While loan supply is still determined by loan demand, as was the case in the closed economy described by equations A.1.1 - A.1.2, the problem of price level indeterminacy does not arise here. The reason is that an increase in loans, and therefore of M, will result in an offsetting money supply contraction to maintain the fixed exchange rate. The fixed exchange rate guarantees a determinate quantity of money. Adam Smith was aware of this result and, while he subscribed to the real bills doctrine and a market-determined money supply, he also would have required banks to ensure that their monetary liabilities were fully convertible with gold at a fixed price.

Consider now the case of flexible exchange rates with an endogenous money supply. The reader may verify that equations A.1.3 to A.1.5 cannot determine the nominal levels of M, P or E. This problem is compounded by the fact that even output is now indeterminate. Once more, we may loosely say that there are too many unknowns given the number of equations. Reducing one plausible unknown does

not solve the problem. For simplicity, assume initially that domestic output is fixed, and insulated from the external sector so equation A.1.3 does not apply. Then the reader may verify that equations A.1.4 and A.1.5 can determine the optimal real money balances but not the nominal quantities M and P, or E.

The above provides a formal interpretation of a prevalent view that Hong Kong's monetary regime under flexible exchange rates was indeterminate. It also appears to be the rationale for the view of the *Asian Monetary Monitor,* quoted in the text.

Equation A.1.5, and equation A.1.2, assume that real money supply passively adjusts to accommodate real money demand. This is the standard way of modeling how a real bills regime operates in an economy with a central bank. It is also an appropriate way of modeling a market-determined money supply under fixed exchange rates, as it is consistent with the view that banks exploit any arbitrage opportunities arising from deviations from the fixed rate set by the Exchange Fund.

Hong Kong, however, has no central bank to take the initiative in adjusting money supply, and equation A.1.5 does not appear to portray accurately the behavior of profit-maximizing banks under a closed economy or in an open economy with flexible exchange rates. In particular, under flexible exchange rates, A.1.5 suggests that the real money supply always will be set by banks to equal the real money demand. At any given interest rate, however, it is more likely that private banks will only be willing to supply a limited amount of credit based on considerations of cost or default risk. Thus, they would follow the rule:

$$M/P = \underset{+}{S(r)} \qquad \text{(A.1.6)}$$

Substituting S(r) for M/P into A.1.5, it can be seen that, under floating rates, the behavior of profit-maximizing banks ensures an equilibrium. In particular, A.1.5 and A.1.6 determine the level of output and, through A.1.3, the exchange rate that would be consistent with equilibrium. Equation A.1.4 then determines the prices of home goods and therefore the price level. This will suffice to determine the nominal money supply.

Except for Patinkin (1965), most of the literature uses A.1.5 rather than A.1.6 to model the real bills doctrine. However, A.1.5 is not necessarily consistent with profit-maximization, and more appropriately describes the behavior of a central bank pegging the interest rate rather than the behavior of private banks.

A well-defined level of money, prices, and exchange rates occurs because we have assumed in equation A.1.3 that the domestic economy is not fully insulated from the external sector even under floating rates. If we assumed instead that exchange rates did not influence the level of output at all, and that output is fixed, we would once more have a situation where equation A.1.4 determines the ratio P_H/E, and equation A.1.6, the ratio M/P. However, neither the level of M nor P can be determined.

Another problem is that if interest rates were determined abroad, there would be no reason to suppose that the money supply given by equation A.1.6 is consistent with the money demand of equation A.1.5.

However, it is implausible to assume that the external sector does not influence domestic activity in a small open economy like Hong Kong's. Thus, it is likely that Hong Kong's nominal money and price level were well-defined even under floating rates.

We may now examine how similar results can be obtained if we relax the strong assumption that domestic and foreign assets are perfect substitutes. A more elaborate framework will also permit us to analyze the implications of the interest-setting agreement of the Hong Kong Association of Banks.

Following Tobin and de Macedo (1980), we used a modified IS-LM approach in which all asset markets satisfy flow as well as stock equilibrium. If we assume that the government maintains fiscal balance, there are four markets: the market for private domestic bonds or commercial paper, the market for foreign bonds, the money market, and the goods market. By Walras's law, equilibrium in the first three guarantees equilibrium in the fourth. Thus, we may characterize the overall equilibrium by:

$$y = y(E) \qquad \text{Aggregate supply} \qquad \text{(A.1.3)}$$

$$A^H(r_H, r_F, E, y, a) - q_H(r_H)K_{-1} = I(r_h, y) \quad \text{Domestic Bond Market} \qquad (A.1.7)$$

$$A^F(r_H, r_F, E, y, a) - EF_{-1} = T(E/P_H, y) \quad \text{Foreign bond market} \qquad (A.1.8)$$

$$m(r_H, r_F, E, y) = M/P \quad \text{Money market} \qquad (A.1.9)$$

where

- r_H = domestic interest rate
- a = asset preference shift parameter involving the relative desirability of domestic and foreign bonds
- q_h = the market valuation of a domestic bond
- K_{-1} = the pre-existing capital (or private domestick bond) stock of foreign bonds
- F_{-1} = the pre-existing stock of foreign bonds
- A(.) = asset demand
- I(.) = investment
- T(.) = trade balance
- m(.) = money demand

The arguments of the demand functions and their signs are generally familiar. The exchange rates enter to represent capital gains or losses from holding assets denominated in different currencies. If Hong Kong were a net creditor, the net holding of foreign assets would be positive and capital gains obtained from holding assets during a depreciation would be reflected in a rise in a demand for all assets. The reverse applies if Hong Kong were a net debtor.

The domestic interest rate, r_H, and output can be determined by substituting S(r) from A.1.6 into equation A.1.9 and using equation A.1.7. The corresponding nominal exchange rate follows from A.1.3, while equation A.1.8 can then determine the price of home goods. This is sufficient information to determine the absolute price level P, and the nominal money supply M in equation A.1.6. Thus, in a small open economy with flexible exchange rates and imperfect capital mobility, the price level, nominal money supply, and exchange rates are determinate.

Implications of the Interest-Setting Agreement

The HKAB sets the interest rates it pays on deposits, and this rate-setting may affect the corresponding loan rate. If we assume that the interest-setting agreement of the HKAB were effective in determining domestic interest rates, there would be no indeterminacy if banks passively supplied money according to this interest rate (that is, we could ignore equation A.1.6). This arrangement is equivalent to a central bank with an interest rate target.

In fact, given such a money supply rule, a fixed interest rate would be required to obtain a well-defined nominal equilibrium in money, prices, and exchange rates. Furthermore, this money supply rule would permit the use of interest rates as a policy tool.

Consider the 1982-1983 attack on the Hong Kong dollar which may be described as an effort to shift from domestic to foreign bonds (a persistent decline in the **a** parameter in equations A.1.7 and A.1.8). Comparative statics analysis reveals that the shift would lead to an exchange rate depreciation. Although not explicitly modeled here, if the depreciation in turn leads to further efforts to shift away from the Hong Kong dollar, we would have an unstable process. In contrast, an increase in interest rates by the HKAB would create an offsetting tendency towards exchange rate appreciation that may restore stability.

If we more realistically assume that the money supply function of profit-maximizing banks is upward sloping with respect to interest rates (equation A.1.6) when exchange rates are floating, the money market equilibrium could not be guaranteed unless the Hong Kong Association of Banks sets r_H in such a way as to ensure that money supply equals money demand. This is not a trivial calculation, and

the HKAB may set interest rates to create a persistent excess demand for or excess supply of money.

In the text of this article, we have noted that price instability may then result in line with Thornton and Wicksell's reasoning. Thornton and Wicksell, however, appear to have been describing a regime consistent with A.1.5 rather than A.1.6. If equation A.1.6 applies, banks may ration credit rather than create money given an excess demand for loans, and it is not obvious that price instability will necessarily follow. Furthermore, the relative weakness of the HKAB in a small open economy would favor price stability. Note, however, that the inability of the HKAB to determine interest rates in this regime would mean that there are no policy instruments available to offset an attack on the value of the Hong Kong dollar, as occurred in 1982-83.

One limitation of the discussion in this Appendix is that the models used — modifications of standard approaches — do not fully capture the role and motivation of banks in creating money in an open economy. For example, it would be desirable to reconcile A.1.5, which we assumed applies under fixed exchange rates, with A.1.6, assumed to determine money creation under floating rates. Both reflect efforts to exploit profit opportunities under different exchange rate regimes.

Furthermore, in light of the discussion of the money multiplier in the text, it would be desirable to spell out explicitly what determines the proportion of foreign currency deposits banks will convert for note issuance under fixed exchange rates. Such exercises would clarify the process by which a market-determined money supply in an open economy achieves stability, given the profit-maximizing behavior of banks. In the meantime, the examples used serve to illustrate the feasibility of stable, market-determined monetary regimes.

FOOTNOTES

1. One of the purposes of the Federal Reserve Act of 1913, according to its introduction, is "to furnish an elastic currency, (and) to afford means of rediscounting commercial paper". In line with this, Section 13 of the Act states that Federal Reserve Banks "may discount notes, drafts and bills of exchange arising out of actual commercial transactions; that is, notes, drafts and bills of exchange issued or drawn for agricultural, industrial or commercial purposes . . ." Note the similarity of this concept to Adam Smith's definition of the real bills doctrine, quoted in the next paragraph of the text of this article.

2. For example, the Federal Reserve Act sought to enforce application of the real bills doctrine according to this narrow concept by forbidding the discount of "notes, drafts or bills covering merely investments or issued or drawn for the purpose of carrying or trading in stocks bonds or other investment securities, except bonds and notes of the government of the United States".

3. Whether banks would *succeed* in accommodating real loan demand would depend on the real savings resources available in the economy. If at a given interest rate, the real savings resources are less than the demand for loans, the effort to accommodate loans may lead to the price instability described by Thornton and Wicksell, and discussed later in the text.

4. Sargent (1979) and McCallum (1984).

5. This view was not necessarily shared by Adam Smith, however. See Laidler (1981) and the discussion of the open economy under fixed exchange rates which follows.

6. As shown in the Appendix, the problem is that the level of nominal money balances and the price level become indeterminate. As this concept is less familiar than that of instability, in the text the term "instability" will be used loosely to refer to either indeterminacy or instability. Patinkin (1965) observed that indeterminacy arises because a change in prices does not affect the excess demand for goods in the economy. In particular, because the money supply is market-determined under a real bills regime, the equilibrium in the money market applies independently of the equilibrium in the goods market. This would not be the case if the money supply were determined by a central bank that sought to limit the nominal quantity of money.

7. The dynamic instability of a real bills regime has been succinctly described in a recent paper by Thomas Humphrey (1982), who showed that it may be associated with hyperinflation, hyperdeflation or an indeterminate price level.

8. For example, Fama (1980) solves the problem of price stability by suggesting that the chosen numeraire be one with a value that does not depend on the volume of deposits outstanding in the financial sector. Sargent and Wallace (1982) suggest that a real bills regime has certain welfare properties that make it in some sense superior to a regime with "quantity theory" restrictions consistent with price level stability. While not endorsing the real bills doctrine, McCallum (1984) shows conditions under which it may be consistent with price level stability.

9. The description of the operation of the gold standard in an open economy is attributed to Hume. However, Laidler (1981) observes that Hume had little to say about the operation of the financial sector under a gold standard. It was Adam Smith who first pointed out that full convertibility of the monetary liabilities of banks with gold was required to prevent note overissuance. He also recognized that any excess supply of money would "spill over" into the external sector.

10. The equilibrium of this system is described in the simplest terms in the Appendix, using the flexible price version of the Mundell-Fleming model.

11. This is a traditional government viewpoint, according to a former Financial Secretary. See Philip Haddon-Cave (1984).

12. Philip Haddon-Cave (1984). As a result of this fiscal conservatism, Hong Kong had no marketable government debt outstanding in 1982.

13. Wallace (1983) argues that reserve requirements would also be necessary to ensure that banks hold the currency liabilities of the government. However, if hand-to-hand currency were legal tender and the circulation of foreign notes forbidden, as it is in Hong Kong, these conditions may suffice to create a demand for the legal tender. For a related discussion, see Keeley and Furlong's paper in this issue of the *Economic Review*, and Fama (1983).

14. This of course does not preclude a central bank from following a policy that accommodates the market demand for money by targetting exchange rates or interest rates. However, it is still the central bank rather than the private sector that retains the initiative for money creation in this case.

15. Using a different framework, Beers, Sargent and Wallace have argued that the exchange rate was indeterminate in Hong Kong during the period of floating rates. Exchange rates could also be indeterminate under floating rates if Hong Kong money and foreign money were perfect substitutes, as shown by Kareken and Wallace (1981) in the context of an overlapping generations model. Maxwell Fry (1985) has also argued that Hong Kong's monetary regime in the floating rate period was unstable. Our general description of Hong Kong's monetary system under fixed and floating rates is closer to that of the *Asian Monetary Monitor.*

16. *Asian Monetary Monitor,* Vol. 7, No. 6.

17. A similar problem applied to the objective of the Exchange Fund of maintaining full foreign asset backing of note issuance. Under floating exchange rates, it is not clear what "full backing" means, since a fixed amount of foreign assets may "back" an increasing quantity of note issuance as the currency depreciates. Thus, the "backing" would not limit note issuance under floating rates, and, as argued in the text, would not be effective in pegging the exchange rate because note issuance would not be limited by the availability of foreign exchange assets.

In contrast, under fixed exchange rates, the Hong Kong dollar is fully backed in the sense that at the rate set by the government, the Exchange Fund always has enough foreign currency assets to redeem on demand any quantity of Hong Kong dollar notes in circulation. The fact that Hong Kong dollar note issuance is limited by foreign asset availability at the fixed rate ensures that the currency peg is enforceable.

18. Technically, the measurement error in the money series implies that when used as an explanatory variable for prices, it is correlated with the error term. This "errors in variables" problem implies that the estimated coefficient on money would be inconsistent.

19. Sims (1972) and Haugh and Pierce (1977).

20. The exchange rate drop was precipitated by a crash in the real estate market that reduced the loan collateral of banks and consequently their net worth. Beers, Sargent and Wallace (1983) present the intriguing hypothesis that the government may have allowed the exchange rate to depreciate to reduce the Hong Kong dollar deposit liabilities of banks and thus to improve their balance sheets.

Ketkar and Sweet (1984) discuss the balance sheet structure under which a depreciation will actually benefit banks, and suggest there is an optimal rate of depreciation (or appreciation) depending on the particular balance sheet structure of banks. As a general point, it should also be noted that, to benefit from a depreciation, the foreign assets of banks should exceed their foreign liabilities. In this way, their wealth increases from capital gains induced by a depreciation (see discussion of the Tobin-de Macedo model in the Appendix).

Although it is not clear that the balance sheet structure of banks in Hong Kong would have benefited from a depreciation in 1982-1983, the Beers, Sargent and Wallace argument highlights the potential use of exchange rate policy to satisfy certain objectives in the financial sector. This novel point raises many interesting questions for policy, but our discussion suggests that during the period of floating rates, the Hong Kong government simply did not have the instruments to conduct a deliberate exchange rate policy of the sort described by Beers, Sargent and Wallace.

21. In fact, note-issuing banks could speculate against the value of the currency by increasing the rate of note issuance to purchase foreign assets. The data on currency creation during 1982-1983 suggest that this did not happen at the time of the attack on the Hong Kong dollar, but in principle, this could be a destabilizing source of note issuance.

22. This is not to say that a fixed exchange rate regime has no disadvantages. It is not obvious that pegging to a strongly appreciating currency such as the U.S. dollar was the best course. Furthermore, Hong Kong's money creation and domestic inflation rate are particularly vulnerable to external disturbances under this regime.

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Predicting the Money Stock: A Comparison of Alternative Approaches

Brian Motley and Robert H. Rasche*

This paper develops two alternative procedures for making short-term predictions of the M1 money stock and compares their forecasting performance over the period from 1981 to 1984. The first procedure is the Rasche-Johannes money multiplier approach while the second involves the simulation of a structural model of the money market developed at the Federal Reserve Bank of San Francisco. Although the money market model provided better forecasts in 1983 and 1984, neither model is clearly dominant over the other. However, the relatively large forecast errors of both models suggest that the Federal Reserve's ability to "fine-tune" the money stock in the short run is very limited.

During the last ten years, and especially in the period from October 1979 to October 1982, the Federal Reserve System has stated its policy objectives in terms of the growth rates of monetary aggregates. During most of this time, the principal emphasis has been on M1, which consists of the public's holdings of currency and checking accounts, and thus represents a measure of the stock of "transactions money" outstanding. Since variations in the growth of M1 have been found historically to be closely related to variations in the growth of nominal GNP, the Federal Reserve has sought to affect the course of output and prices by influencing the growth of this aggregate.

Since the bulk of M1 consists of checking accounts, which are the liabilities of private depository institutions, the Federal Reserve cannot directly control the stock of transactions money outstanding. The central bank can, however, affect the money stock indirectly, through its influence over both the public's demand to hold money and the private banking system's ability and willingness to supply checking accounts.

Depository institutions are required to hold reserves equal to specified proportions of certain of their deposit liabilities, and the supply of these reserves is controlled by the Federal Reserve. When the Federal Reserve's Trading Desk buys securities in the open market, it increases the quantity of bank reserves because the transaction is settled by crediting the reserve account the seller's bank maintains at its Federal Reserve Bank. Similarly, when the central bank lowers the discount rate it charges for short-term borrowing by private depository institutions, the lower rate will tend, everything else being equal, to lead to a greater volume of such borrowing and thus, to a larger stock of bank reserves. Both ways of increasing the supply of reserves not only add to the quantity of deposit liabilities that the private banking system is able to supply but also, because they cause short-term interest rates to fall, increase the amount of M1 that the public demands to hold.

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The effects on M1 growth of changes in interest rates and the supply of bank reserves do not occur instantaneously. Instead, they tend to be spread over a period of several months in a pattern that cannot be predicted precisely. As a result, close short-run control of the stock of M1, such as was attempted in the 1979-82 period, requires the Federal Reserve continually to forecast the likely course of M1 growth in the weeks and months ahead. When the forecast indicates that M1 is likely to deviate from the target set by the Federal Open Market Committee (FOMC), the Trading Desk must adjust the supply of reserves with a view to bringing the aggregate back toward target. Thus, the success of policymakers in controlling M1 growth depends heavily on their ability to make accurate short-run forecasts.

Closer short-run control of the money stock after October 1979 was generally expected to make interest rates more variable (because the central bank would no longer accommodate short-run shocks to financial markets), and M1 growth less variable. In fact, although the Federal Reserve was "controlling" M1, the aggregate remained volatile, and unanticipated month-to-month fluctuations in its growth rate continued.

The fact that control of M1 is necessarily *indirect* and requires the use of *forecasts* suggests one reason[1] for this (at the time) surprising outcome. If the Federal Reserve cannot forecast M1 well enough to choose the correct settings of the discount rate and the stock of reserves needed to keep M1 close to its short-run targets, the central bank may destabilize the aggregate as it tries to control it.

It must be recognized, however, that while the ability to make good forecasts of M1 is necessary to the successful short-run control of the aggregate, it is not sufficient. Successful short-run control also depends on the operating instrument the Federal Reserve chooses to use. For an exhaustive discussion of various instruments, see David Lindsey and others (1981).

This paper seeks to throw light on the relationship between forecasts of M1 and short-run control of the monetary aggregate. It studies two methods for forecasting and compares their respective 3-months-ahead forecasting performance over the period from 1981 to 1984.[2] One model is a reduced form, money multiplier model; the other is a structural model of the supply of and demand for bank reserves and the principal monetary aggregates.

Both models have been used in the past for predicting M1.[3] The first is a variant of the money-multiplier component model that was developed by Johannes and Rasche (1979, 1981). That model is employed regularly by Rasche to develop forecasts of M1 as background for deliberations of the "Shadow" Open Market Committee — a group of private economists who meet periodically to discuss the Federal Reserve's monetary policy. The second model is the San Francisco Money Market Model, developed by Judd and Scadding (1981, 1982, 1984), that is used regularly by the staff of the San Francisco Federal Reserve Bank to make short-run forecasts of the monetary aggregates and to examine the likely effect of alternative policy actions.

For each of the four years 1981 to 1984, we estimated each model using data extending through December of the preceding year. In the case of the monetary aggregates and reserves series, we used the data actually available *at the time.*[4] For income and prices, we used the data available *now* (September 1985) since complete historical series were not easily accessible. Data on interest rates are never revised. Each estimated model for each of the four sample periods was then used to make four separate three-months-ahead forecasts of M1 in the year following the end of the sample period with information through December, March, June, and September, respectively. Thus, for each model, sixteen separate 3-months-ahead forecasts of M1 were constructed.

For each 3-months-ahead forecast, we used the reserves and monetary aggregates data *actually* available at the beginning of the period to which the forecast refers. For example, in projecting M1 growth over the three months from June to September 1983, we assumed that the forecaster was able to use the revised money stock data through December 1982 published in February 1983 and the preliminary data for January-June 1983 published monthly over that period. The former set of data was used to estimate the parameters of the two models, whereas the latter was used as the base for simulating the models.

The resulting forecasts were compared both with the preliminary actual data published immediately after each 3-month forecast period and with the

revised data issued at the beginning of the succeeding year. Their accuracy was measured by examining the forecast errors both over each year and over the four years as a whole.

The next section of the paper outlines the principal features of the two models used in our forecasting experiments. Sections II and III describe the estimation and simulation of each model in detail. The simulation results are set out in Tables 3-5 and discussed in the second last section. Our calculations show that the money market model would have provided more accurate M1 forecasts over the 1981-84 period, but that the errors from both models were sufficiently large to make close short-run control of M1 growth by the central bank quite difficult. The final section of the paper summarizes our results and offers some concluding comments.

I. The Models

In the *multiplier component approach* of Johannes and Rasche, the stock of M1 is modeled as the product of a money multiplier and a reserve aggregate:

$$M1 = m \cdot R$$

According to this decomposition, all changes in M1 reflect changes either in the reserve aggregate — assumed to be under actual or potential Federal Reserve control — or in the money multiplier. In a 1981 contribution, Johannes and Rasche argued that the multiplier may be forecasted with sufficient accuracy to make it possible for the Federal Reserve to control the growth of M1 quite closely over periods of six months to a year.

In this paper's version of the model, the reserve aggregate employed is the stock of nonborrowed reserves, adjusted for changes in reserve requirements, plus the quantity of extended-credit borrowings from Federal Reserve Banks. This is the reserve aggregate used by the Federal Reserve as its short-run operating instrument in the period from October 1979 to October 1982. Using this reserve aggregate, the money multiplier is defined as

$$m = \frac{1 + k(1 + tc)}{rb(1 + t_1 + t_2 + g + z)} \qquad (2)$$

where

- k = the ratio of the currency component of M1 to the transactions deposit component
- tc = the ratio of nonbank travelers checks to the currency component of M1 (for 1982-84 only).
- rb = the ratio of nonborrowed reserves (adjusted for changes in reserve requirements) plus extended credit borrowings to total deposits (M3 + government deposits + foreign deposits − currency − nonbank travelers checks).
- t_1 = the ratio of the difference between M2 and M1 to transactions deposits
- t_2 = the ratio of the difference between M3 and M2 to transactions deposits
- g = the ratio of U.S. government deposits at commercial banks to transactions deposits
- z = the ratio of foreign deposits at commercial banks to transactions deposits

An ARIMA model was estimated for each of these component ratios for each of four overlapping sample periods ending in December 1980 to December 1983. That is, each component was modeled as a linear function of its own past values. These estimated models then were used to generate 3-months ahead forecasts of the components and thus of the complete multiplier. The stock of nonborrowed reserves plus extended credit was treated as exogenously determined by the Federal Reserve.

Although the components of the money multiplier are influenced by the behavior of the non-bank public (which largely determines k, t_1, t_2 and tc), the "spirit" of the multiplier approach is that changes in the stock of M1 are caused mainly by changes in the quantity of reserves available to the banking system to support transactions deposits, and thus, that the stock of M1 is determined primarily from the *supply* side.

The second model used in the forecasting experiment, the *San Francisco Money Market Model,* is a structural model that describes the behavior of the

public, the banking system and the Federal Reserve in the markets for money, reserves and bank credit. A unique feature of this model is that M1 is viewed as serving a "buffer-stock" function in the public's asset portfolio. In the short-run, the public is assumed passively to accept at least part of any changes in the supply of money brought about by variations in the quantity of bank credit outstanding. Suppose, for example, there were an increase in the public's demand for loans which the banking system accommodates. The model posits that the public will hold a portion of the resulting rise in the supply of money temporarily without a change in interest rates (see Judd 1984), even though there has been no permanent increase in its demand to hold money balances. The public's willingness to hold "extra" money is due to the transactions costs associated with adjusting money balances quickly to desired levels. Also, although individual transactors can alter their money holdings by varying their rate of spending on goods and services, the nonbank public as a group cannot do so.

The San Francisco model may be used to generate forecasts of M1 growth under a variety of alternative assumptions about the Federal Reserve's short-run operating procedure. In most recent years, the Federal Reserve's short-run policy — although seeking to keep M1 growth within an annual target range — has generally been concerned with influencing money market conditions rather than closely controlling bank reserves or money on a month-to-month basis. This certainly was true prior to October 1979, when the Federal Open Market Committee (FOMC) directed the Trading Desk to keep the federal funds rate within a very narrow range through manipulating the supply of reserves. It also has been largely true since October 1982, when the operating instrument has been the level of borrowed reserves. (The current operating procedure is described in Wallich, 1984.) As Motley and Bisignano noted recently (1985), the use of discount window borrowing as the System's short-run operating objective is similar to a funds rate control procedure because it requires short-run variations in the banking system's demand for reserves to be accommodated by variations in the supply of nonborrowed reserves. This means that shocks to the reserves market are not permitted to affect the funds rate.

Between October 6, 1979 and the fall of 1982, the Federal Reserve's operating instrument was the supply of nonborrowed reserves rather than the federal funds rate. However, given its short-run money stock objectives, the Federal Reserve did not choose its target for nonborrowed reserves by projecting the money multiplier from its own past values as the Rasche-Johannes procedure would have recommended (see Rasche-Johannes, 1981). Instead, the Federal Reserve believed that changes in the supply of nonborrowed reserves affected the money stock through changing interest rates, and thus altering the underlying demand to hold transactions money. The nonborrowed reserves procedure therefore was similar in many ways to one in which the Federal Reserve varied the funds rate to attain its money stock objectives.

These considerations led us to treat the federal funds rate as exogenous in all the forecasting experiments with the San Francisco model. In effect, the federal funds rate that emerged in any given month was assumed to be the rate which the Federal Reserve believed *at the time* was required to attain its short-run M1 target.[5]

II. Estimating and Forecasting with the Multiplier Model

To forecast M1 with the money multiplier approach requires the use of separate forecasts of each of the component ratios that make up the multiplier expression in equation 2. These forecasts were provided by dynamic simulations of an estimated ARIMA model for each component ratio. Each of the estimation sample periods for these models started in January 1971 and extended through the December of the year prior to that being forecast. We used the same specifications of the ARIMA models for all of the estimation periods. Results from various subsequent diagnostic tests of the estimated equations supported this procedure by indicating that the structure of the models did not change. The parameter estimates for each of the samples are given in Table 1.

In addition to the parameter estimates indicated in Table 1, dummy variables were included in the

TABLE 1

Estimated Coefficients of ARIMA Models for Multiplier Component Ratios

k				
1980	$(1-B)(1-B^{12})\ln k$	=	$(1+.2097B)$	$(1-.5805B^{12})a_t$
1981			$+.2490$	$-.6017$
1982			$+.2714$	$-.5899$
1983			$+.2507$	$-.6701$
t_1				
1980	$(1-B)(1-B^{12})\ln t_1$	=	$(1+.2983B)$	$(1-.5433B^{12})a_t$
1981			$+.3467$	$-.5900$
1982			$+.3703$	$-.6037$
1983			$+.3020$	$-.6899$
t_2				
1980	$(1-B)(1-B^{12})\ln t_2$	=	$(1-.5239B)$	$(1-.7438B^{12})a_t$
1981			$-.5145$	$-.7461$
1982			$-.5071$	$-.8106$
1983			$-.5409$	$-.8124$
g				
1980	$(1-B)(1-B^{12})\ln g$	=	$(1-.5335B-.1949B^4)$	$(1-.5871B^{12})a_t$
1981			$-.5265\ -.2077$	$-.5969$
1982			$-.4996\ -.2057$	$-.5707$
1983			$-.5117\ -.2317$	$-.5884$
z				
1980	$(1-B)(1-B^{12})\ln z$	=	$(1+.1786B)$	$(1-.5813B^{12})a_t$
1981			$+.1235$	$-.6440$
1982			$+.1710$	$-.6640$
1983			$+.1727$	$-.6778$
rb				
1980	$(1-B)(1-B^{12})\ln rb$	=	$(1+.1273B)$	$(1-.6522B^{12})a_t$
1981			$+.1562$	$-.7060$
1982			$+.1107$	$-.7068$
1983			$+.0910$	$-.7109$
tc				
1981	$(1-B)(1-B^{12})\ln tc$	=	$(1-.5165B)$	$(1-.4635B^{12})a_t$
1982			$-.4925$	$-.4796$
1983			$-.4321$	$-.5208$

Notation: $B^iX_t = X_{t-i}$, ln = logarithm

estimating equations for k, t_1, t_2, g and z for the sample periods ending in December 1981 through December 1983. These dummy variables allowed for the introduction of nationwide NOW accounts in January 1981. At the time, that institutional change was judged to have induced many holders of passbook savings accounts and other small time deposits, which are included in M2 but not in M1, to consolidate their transactions and savings funds into a single NOW account. This consolidation would have raised the *level* of transaction deposits *permanently* and the *growth rate* of those deposits *temporarily* as the process was proceeding. These changes would, in turn, have affected the levels and growth rate of k, t_1, t_2, g and z. During 1981, the Federal Reserve published estimates of "shift-adjusted MIB"[6] that excluded that portion of the NOW account total judged at the time to represent funds transferred from savings accounts. A detailed discussion of this adjustment of the data is given in Bennett (1982). These estimates suggest that the consolidation of funds was largely complete by mid-1981.

The coefficients on the dummy variables in the fitted equations for k, t_1, t_2, g and z were not estimated jointly with the other parameters. They were chosen to approximate the effect on the component ratios of a shift into NOW accounts from deposits outside M1 of the magnitude represented by the difference between total and shift-adjusted M1 as published at the time. Although the coefficients on the dummy variables do not capture the exact month-to-month behavior of the difference between actual and shift-adjusted M1, they do represent the general trend in that difference. In particular, they include the assumption that the shift of funds into NOW accounts (and thus its effect on the ratios) was completed by mid-1981. The same adjustment was imposed on each of the various component models. The experience here, as with earlier adjustments of this form, is that the ARIMA coefficients remain stable once this adjustment is made. Our use of the dummy variable approach causes no problems for *ex ante* forecasts for 1982-84 since the coefficients on these variables were constructed with data publicly available in 1981.

Ex ante forecasts for 1981 raise other difficulties. At the end of 1980, there was no firm information available to measure the effect of nationwide NOW accounts on the various monetary aggregates. Our approach here was to regard the multiplier models estimated through the end of 1980 as appropriate for forecasting the levels of *shift-adjusted* M1B during 1981. Shift-adjusted M1B was the aggregate the Federal Reserve used to guide its policy decisions during most of that year. However, since the portfolio shift that necessitated the adjustment in the aggregate was essentially completed by the middle of 1981, the growth rate of unadjusted M1B in the second half of that year was close to the growth rate of shift-adjusted M1B. Thus, as far as growth rates are concerned, the forecasts for the second half of 1981 may be viewed as predictions either of adjusted or of unadjusted M1B.

In examining the errors in the forecasts for 1981, we compared the forecasted values with the published estimates of shift-adjusted M1B. It must be recognized, however, that any evaluation of model forecasts for 1981 is problematic.[7] The shift-adjustments to the data were made on the basis of estimates by the Board of Governors staff of the extent to which the introduction of NOW accounts would cause the public to consolidate their savings and transactions. Hence, the accuracy of the Board staff's estimates, and thus the shift adjustments applied to the data, affected the model forecasting errors in 1981. Yet even with the benefit of hindsight, it is impossible to measure the extent of portfolio shifts precisely since the composition of a NOW account between transactions and savings funds is known only to the accountholder.

One other modification was made to the multiplier model before using it to forecast M1 growth in 1981. Preliminary simulations of the ARIMA equations produced particularly large prediction errors in the first half of that year. In an earlier paper, Johannes and Rasche (1981, p. 305) found that the forecasting accuracy of their multiplier model deteriorated sharply in 1980 and that this deterioration was largely attributable to errors associated with the imposition of credit controls in March of that year. Examination of the "within-sample" residuals from the estimated ARIMA models in Table 1 revealed that the equation describing the ratio of non-borrowed reserves to total deposits (rb) significantly (relative to the standard error) underestimated this ratio in April and May of 1980.

Although the earliest forecasting experiment in

this study was for 1981, the structure of the ARIMA model for the rb ratio implies that errors in April-May 1980 would have significantly affected the M1-forecasts for those same months of 1981 if, as seems possible, the 1980 errors were the result of a unique event associated with the imposition and later removal of credit controls and thus not repeated in 1981. A detailed discussion of this issue has been placed in an Appendix. To prevent the forecasts of M1 in 1981 from being contaminated by the 1980 experience with credit controls, the ARIMA equation reported in Table 1 for the rb ratio in the sample period ending in December 1980 was modified to include dummy variables for March-May 1980. The result was a significant reduction of the money multiplier model's errors in the first half of 1981.

The effect of changes in legal reserve requirements on the time series of adjusted nonborrowed reserves posed a further problem. Each time there is a change in legal reserve requirements (about twice a year under the phase-in of the new requirements mandated by the Monetary Control Act of 1980), the procedure used in constructing adjusted nonborrowed reserves requires the entire history of the series to be reconstructed. This is a problem in principle for the forecasting of the rb ratio since it means that the historical data used to *estimate* the ARIMA model for rb through the end of the preceding year may be different from those available at the time of the *forecast*. In practice, the problem is not serious since the rb model in Table 1 (along with all other component models) is a model of the *rate of change* of rb rather than of its *level*. Adjustments to the history of the nonborrowed reserves series when reserve requirements change are fundamentally adjustments to the *level* of the series that preserve rates of change. The component model therefore should remain valid even if the data are adjusted for a change in reserve requirements between the end of the estimation period and the beginning of the forecasting period.

For each of the four sets of estimated coefficients in Table 1, four sets of three-month ahead forecasts of the component ratios were constructed for the year following the end of the estimation period. These four sets of forecasts were for December-March, March-June, June-September, and September-December. The forecasts of the component ratios can be combined to produce forecasts of the *not-seasonally-adjusted* nonborrowed reserves multiplier using the formula in equation 2. However, since the desired output of the forecasting experiment is *seasonally adjusted* M1, equation 2 must be modified to yield a forecast of the multiplier connecting *seasonally adjusted* M1 and nonborrowed reserves *not seasonally adjusted*. This modification was made using the seasonal factors that were published at the beginning of each year for the components of the monetary aggregates. If s_d, s_k and s_{tc} are the seasonal factors for transactions deposits, currency and travelers checks, respectively, the forecast of the multiplier connecting seasonally adjusted M1 and not-seasonally-adjusted nonborrowed reserves is:

$$(3)\ \hat{m} = \frac{\frac{1}{s_d} + \frac{\hat{k}}{s_k} + \frac{\hat{k}t\hat{c}}{s_{tc}}}{\hat{r}b(1+\hat{t}_1+\hat{t}_2+\hat{g}+\hat{z})}$$

where $\hat{m}$ represents the forecasted value of the seasonally adjusted multiplier, and $\hat{k}$, $\hat{t}_1$, $\hat{t}_2$, $\hat{g}$, $\hat{z}$, $\hat{r}b$ and $\hat{t}c$ represent the forecasted values of the multiplier components from the individual ARIMA models.[8]

Finally, the forecasts of *seasonally adjusted* M1 are constructed by multiplying the computed values of the multiplier, $\hat{m}$, from equation 3 by the not-seasonally-adjusted values of nonborrowed reserves plus extended credit in the forecast period.[9]

III. Estimation and Forecasting with the Money Market Model

The San Francisco money market model is a structural model of the supply of and demand for the monetary aggregates. A full description of the version of the model used in this paper is provided in Judd (1984). Given projections of personal income, prices, the discount rate and the federal funds rate, dynamic simulation of this model yields forecasts of M1, M2, various other short-term interest rates, and the stocks of bank loans and of borrowed and nonborrowed reserves.[10]

As with the multiplier model, the money market model was estimated over four overlapping sample periods. In the case of this model, the sample periods began in August 1976 and ended in December 1980 to December 1983. The choice of August 1976 as the starting date for all four samples was dictated by the widely acknowledged fact that the demand for money shifted in 1974-75. This shift made model estimates over those years produce unreliable coefficient values.

Because of the pivotal roles played in the model by the M1 demand function and the equation explaining bank loans, the coefficients of these equations in the four sample periods are reported in Table 2. As indicated earlier, the income, price and interest rate data used in this estimation were those available in September 1985, while the monetary and reserve aggregates were those available shortly after the end of each sample period.

For the three sample periods ending in December 1981, 1982, and 1983, each of which included 1981, a set of dummy variables also is included to allow the intercepts of the M1 and transactions deposits demand equations to shift upward in 1981 and thereby capture the effect of the nationwide introduction of NOW accounts. As discussed in the previous section, this institutional change apparently led some holders of passbook savings and small time accounts to consolidate their savings and transactions deposit holdings in a single NOW account. The result was an upward shift in the demand for M1. Coefficients on the dummy variables represent this demand shift. In contrast to our procedure with the multiplier component models, these coefficients were estimated directly from the non-shift-adjusted data. As in the multiplier model, the size of the upward shift in M1 demand during 1981 was estimated with data available at the end of that year, thus eliminating any problem in using the shift-adjusted data to make forecasts for 1982 and subsequent years.

The forecasts of M1 made for December 1980-March 1981 and for March-June 1981 on the basis of the model estimated through December 1980 were treated as forecasts of "shift-adjusted M1B" as published by the Federal Reserve at that time. As we pointed out earlier, this adjustment to the data was made on the basis of staff estimates of the extent to which savings funds would flow into new NOW accounts and thus cause an upward shift in M1 demand. In forecasting the growth of shift-adjusted M1 from March to June 1981, however, an "add factor" was introduced into the M1 demand equation to put the model "on track" at the beginning of that period. This add factor was structured so that any error in the staff's judgment of the demand shift from December to March, does not affect the model forecast of the M1 *growth rate* from March to June.

Since the shift of funds into NOW accounts seemed largely completed by mid-1981, and therefore affected the growth rate of M1 only temporarily, the model simulations for the third and fourth quarters of 1981 were regarded as forecasts of the growth rate of non-shift-adjusted M1. For these two quarters, add-factors were again introduced to put the model on track at the beginning of each forecast period and thereby ensure that shifts in the *level* of M1 did not affect the forecasted *growth rate*. Since a shift in money demand of unknown proportions was anticipated in 1981, an actual forecaster most likely would have used this add-factor procedure (or something like it) to take advantage of the information about the size of the shift that became available as the year advanced. (In forecasting the *growth rate* of M1 at the time, the staff of the San Francisco Federal Reserve Bank largely ignored the *level* of the aggregate because it was known to be distorted by the demand shift).

Unlike the multiplier model, in which forecasted values depend only on *past* values of the multiplier components, the money market model is a *structural* model in which forecasts of M1 growth depend also on the expected course of income and prices.

This aspect has two implications for the forecasting experiments. First, because the money market model uses more information, one would expect, *ceteris paribus,* its forecasts of M1 growth to be subject to smaller errors than those using the multiplier approach. Second, because the model requires more information, the quality of its forecasts depends on the accuracy of that information. If income and price predictions are wide of the mark, the M1-forecasts generated by the model are likely also to be poor. Thus, comparing the usefulness of the structural approach to that of the multiplier model requires striking a balance between these two conflicting considerations.

We attempted to deal with this dilemma by making two sets of M1 forecasts using the money market model. In the first set, we used the actual (presently-available) values of income and prices during each forecasting period. The resulting M1 forecasts were those that would have been possible with the model had the policymaker been able to predict income and prices perfectly. Clearly, in practice, this would not be possible, so actual M1-forecasting errors would be expected to be somewhat larger.

The second set of M1 forecasts used predictions of the growth rates of income and prices made by a well-known economic consulting firm and published close to the beginning of each forecasting period.[11] These forecasts, which may be more representative of those that an actual policymaker would have been able to achieve, would be expected *a priori* to exhibit greater errors than those generated under the assumption that future income and prices are known perfectly. *A priori,* the forecasting errors of an actual policymaker using the money

TABLE 2

Money Demand & Bank Loan Equations in the Money Market Model

Specifications

LM1 = A0 + A1 · DLBL + A2 · (LY-LP) + A3 · CPRT + A4 · NOWDUM + A5 · NOWDUM2 + A6 · NOWDUM3 + A7 · LP + A8 · (LLM1 − LP)
where A7 = 1

DLBL = B1 · DCPRT + B2 · DPRIME + B3 · DLY + B4 · CREDUM
where B1, B2 and B3 represent sums of distributed lag coefficients

Definitions of Variables

LM1	=	Log of M1
LLM1	=	Lagged value of LM1
DLBL	=	Monthly change in log of total bank loans
LY	=	Log of nominal personal income
DLY	=	Monthly change in LY
LP	=	Log of personal consumption expenditures deflator
CPRT	=	Three month commercial paper rate
DCPRT	=	Monthly change in CPRT
NOWDUM	=	1, 2, . . ., 12 during January - December 1981; zero before 1981; 12 after 1981
NOWDUM2	=	Square of NOWDUM
NOWDUM3	=	Cube of NOWDUM
DPRIME	=	Monthly change in commercial bank prime lending rate
CREDDUM	=	1 in April - September 1980 otherwise zero.

market model would be expected to lie between those of the two sets of forecasts generated in this article. As it happened, the differences between the two sets of forecasts were small in most cases.

For each of the sixteen forecasting experiments, the forecasted M1 growth rate was constructed by performing a three-month-ahead dynamic simulation of the model with the actual values of the monetary and credit aggregates in the immediately preceding month presumed to be known. Thus, the forecast of the level of M1 in September 1983, for example, used the model coefficients estimated using revised data for the sample period which ended in December 1982, and took as given the actual value of M1 for June 1983 published early in July. The simulated level of M1 in September and the actual level in June then were used to construct the forecast of the growth rate of M1 over the three-month span.[12] These simulated growth rates then were compared with the realized growth rates both from the preliminary data published during the year being forecast (1983 in the above example) and from the revised data published early in the succeeding year (1984 in the example).

TABLE 2 (Continued)

Estimated Coefficients (t statistics are in parentheses)

	August 1976-December 1980	August 1976-December 1981	August 1976-December 1982	August 1976-December 1983
Money Demand				
A0	0.421 (1.730)	0.098 (0.370)	0.063 (0.335)	−0.038 (0.301)
A1	0.560 (4.85)	0.407 (3.18)	0.425 (4.38)	0.333 (3.37)
A2	0.082 (3.79)	0.113 (4.65)	0.123 (6.84)	0.130 (6.74)
A3	−0.0014 (4.67)	−0.0020 (6.28)	−0.0022 (9.52)	−0.0023 (9.08)
A4	0	0.0032 (1.74)	0.0037 (2.56)	0.0030 (1.91)
A5	0	−0.0009 (1.97)	−0.0009 (2.70)	−0.0007 (1.97)
A6	0	0.00005 (1.79)	0.00004 (2.40)	0.00003 (1.70)
A7	1	1	1	1
A8	0.819 (23.16)	0.889 (21.10)	0.833 (27.41)	0.842 (36.87)
Bank Loans				
B1	0.0197 (2.23)	0.0119 (1.69)	0.0110 (2.03)	0.0103 (2.14)
B2	−0.0193 (2.17)	−0.0127 (1.84)	−0.0116 (2.17)	−0.0103 (2.19)
B3	1.237 (12.55)	1.172 (14.03)	1.157 (16.41)	1.151 (16.73)
B4	−0.0055 (2.17)	−0.0056 (2.43)	−0.0057 (2.67)	−0.0056 (2.65)

IV. The Results of the Forecasting Experiments

The results of the forecasting experiments are set out in Tables 3, 4, and 5. Both the preliminary and revised actual growth rates of M1 are shown. Since the multiplier model in the first instance predicts the *level* of M1 and the size of the portfolio shift into NOW accounts in 1981 was not known when the year began, the forecast and actual growth rates for the multiplier model in that year are for shift-adjusted M1B. For the money market model, the forecasts for the first half of 1981 also were regarded as predictions of the shift-adjusted aggregate. However, since the demand shift was completed by mid-year and the presence of a lagged, dependent variable in the M1 demand equation adjusts the forecasts for upward-shifts in the *level* of M1 (that is, the model in the first instance predicts the *growth rate* of M1 rather than its level), the projections of growth in the second half of the year are regarded as

TABLE 3

Forecasts of M1 Growth Multiplier Model

Date	Actual Growth Rate		Forecast	Forecast Error	
	Preliminary	Revised	Growth Rate**	Preliminary	Revised
1981*					
March	3.99	2.24	7.78	3.79	5.54
June	−0.96	1.94	−6.45	−5.49	−8.39
September	2.12	1.74	18.52	16.40	16.78
December	7.30	7.68	5.86	−1.44	−1.82
1982***					
March	6.62	6.99	1.45	−5.17	−5.54
June	2.86	4.28	2.50	−0.36	−1.78
September	8.06	8.65	13.11	5.05	4.46
December	15.64	13.13	16.33	0.69	3.20
1983					
March	16.05	15.05	6.44	−9.61	−8.61
June	11.33	11.68	8.52	−2.81	−3.16
September	4.22	6.26	0.00	−4.22	−6.26
December	3.09	4.93	−4.72	−7.81	−9.65
1984					
March	7.54	7.05	11.96	4.42	4.91
June	8.15	7.44	10.24	2.09	2.80
September	2.12	3.07	4.98	2.86	1.91
December	4.01	5.22	12.90	8.89	7.68

*For 1981, data refer to "shift-adjusted M1B" excluding non-bank travellers checks which were omitted from the monetary aggregates before July 1981.

**For March, "Forecast Growth Rate" refers to growth from the actual level of *revised* M1 in the preceding December (which was known when forecasts were made) to the forecasted level in March. For June, September and December, "Forecast Growth Rates" refers to growth from *preliminary* M1 in March, June and September to the forecasted level 3 months later.

***Growth rates from December 1981 to March 1982 are for M1, without shift adjustments and including travellers checks.

projections of actual (not-shift-adjusted) M1.

Over the four year period as a whole, the mean error in forecasting the annualized growth rate of M1 compared to the preliminary actual data published immediately after each forecasting period was 0.46 percent using the multiplier model and 3.06 percent using the money market model (assuming income and prices were known[13]). The corresponding mean *absolute* errors (that is, the average errors without regard to their signs) were 5.07 percent and 4.31 percent respectively.

Examination of Tables 3 and 4 shows that the different ranking of the two models according to these alternative criteria largely reflects the fact that in 1981, the forecast errors from the money market model were not only large but all in the same direction making the mean error the same as the mean absolute error in that year. By contrast, the multiplier model's errors in 1981, which also were large in the absolute sense, were both positive and negative, making the mean error smaller. Again, however, we should point out that the measured growth of shift-adjusted M1 in 1981 was based on estimates of the amount of funds shifted into NOW accounts from outside M1. Thus the size of both models' forecast errors in 1981 depends on the correctness of those judgments.

The tendency of the money market model to overestimate the growth of shift-adjusted M1 in 1981 was recognized at the time. The explanation for this over-estimate then suggested (see Bennett 1982) was that M1 growth was slowed in 1981 by

TABLE 4

Forecasts of M1 Growth
Money Market Model

Date	Actual Growth Rate		Forecast Growth Rate+		Forecast Errors			
			Income	Income	Income Known		Income Forecasted	
	Preliminary	Revised	Known	Forecasted	Preliminary	Revised	Preliminary	Revised
1981								
March*	3.99	2.24	9.87	9.16	5.88	7.63	5.17	6.92
June	−0.96	1.94	9.15	9.17	10.11	7.21	10.13	7.23
September**	2.54	2.45	12.12	10.82	9.58	8.28	9.67	8.37
December	9.64	9.37	17.36	15.73	7.72	7.99	6.09	6.36
1982								
March++	6.62	6.99	9.46	10.26	2.84	2.47	3.64	3.27
June	2.86	4.28	6.44	5.56	3.58	2.16	2.70	1.28
September	8.06	8.65	12.71	11.64	4.65	4.06	3.58	2.99
December	15.64	13.13	16.52	18.83	0.88	3.39	3.19	5.70
1983								
March	16.05	15.05	11.55	13.72	−4.50	−3.50	−2.33	−1.33
June	11.33	11.68	7.23	7.58	−4.10	−4.45	−3.85	−4.10
September	4.22	6.26	3.42	2.68	−0.80	−2.84	−1.54	−3.58
December	3.09	4.93	5.12	5.61	2.03	0.19	2.52	0.68
1984								
March	7.54	7.05	9.47	8.73	1.93	2.42	1.19	1.68
June	8.15	7.44	7.59	5.25	−0.56	0.15	−2.90	−2.19
September	2.12	3.07	4.91	3.55	2.79	1.84	1.43	−0.28
December	4.01	5.22	11.01	11.38	7.00	5.79	7.37	6.16

*For the first six months of 1981, data refer to "shift-adjusted M1B" excluding non-bank travellers checks.

**For the second six months of 1981, data refer to unadjusted M1B excluding non-bank travellers checks.

+ For March, "Forecast Growth Rate" refers to growth from the actual level of revised M1 in the preceding December to the forecasted level in March. For June, September and December, "Forecasted Growth Rates" refers to growth from preliminary M1 in March, June and September to the forecasted level three months later.

++ Growth rates from December 1981 to March 1982 are for M1, without shift adjustment, and including travellers checks.

the massive surge in ownership of money market mutual funds. These funds provided high yields and allowed some limited check-writing. As a result, they were strong competitors to the checkable accounts provided by commercial banks, the yields on which remained regulated. Thus, at the same time the nationwide introduction of NOW accounts was boosting the growth of M1, the spread of money funds was reducing it. The shift-adjustment of the data in 1981, which had the effect of reducing measured M1 growth, was designed to account for the first of these institutional developments, but no adjustment was made for the second. As a result, the model over-predicted shift-adjusted M1 growth.

In fact, in the first half of 1981, the money market model provided better forecasts of *non*-shift-adjusted M1B growth. This suggests that the effects of the two institutional developments on M1 demand tended to offset one another. Non-shift-adjusted M1 grew at an average rate of 6.4 percent in the December 1980-June 1981 period; the money market model forecast 9.5 percent and the multiplier model, 0.7 percent growth. Thus, if the comparison is made in terms of the unadjusted data, the money market model outperforms the multiplier model by a significant margin. In the second half of 1981, the shift of funds into NOW accounts was largely complete but that from M1 into money market funds actually accelerated. As a result, both models overpredicted the growth in both measures of M1.

In 1982, the mean absolute error was about the same for both models. But in 1983 and 1984, the money market model performed significantly better. Since October 1982, the Federal Reserve's operating instrument has been the level of borrowed reserves. This change to a new operating instrument has resulted in a reduction of the short-run volatility of short-term interest rates compared to the prior period in which the stock of nonborrowed reserves was the central bank's policy instrument. As the short-run volatility of interest rates was reduced, however, their longer run swings increased. Thus, one would expect a model using information about movements in interest rates as well as their impact on income and prices to have performed better in this period. By contrast, the components of the money multiplier may have become more difficult to forecast as financial deregulation increased the amount of shifting of funds among different classes of deposits.

The summary error statistics reported in Table 5 also were computed using the revised actual M1 data published early in the year following that being forecast. The results did not alter our conclusions regarding the relative forecasting efficiency of the two models, but they did reveal one noteworthy point. The revised forecast errors from the money multiplier model tended to be larger than those computed from the preliminary data, whereas errors from the money market model tended to be a little smaller. Over the four years as a whole (sixteen separate forecasts), the mean absolute error of the money market model was 4.3 percent with respect

TABLE 5

Summary Error Statistics*

Date	Mean Error			Mean Absolute Error		
	Multiplier Model	Money Market Model		Multiplier Model	Money Market Model	
		Actual Income	Predicted Income		Actual Income	Predicted Income
1981	3.32	8.32	7.77	6.78	8.32	7.77
1982	0.05	2.99	3.28	2.82	2.99	3.28
1983	−6.11	−1.84	−1.30	6.11	2.86	2.56
1984	4.57	2.79	1.77	4.57	3.07	3.22
1981-84	0.46	3.06	2.88	5.07	4.31	4.21

*The forecast errors were defined as the differences between the actual and predicted annualized growth rate of M1. They were computed from the preliminary actual data since these were forecast errors the Federal Reserve would have observed at the time.

to the preliminary data and 4.0 percent with respect to the revised data. The corresponding error statistics for the multiplier model were 5.1 percent and 5.8 percent.

We believe that the most likely explanation of this result is that the process of revising the data at the end of each year included revisions to the *seasonal adjustment* factors. As we described earlier, the multiplier component approach initially yields projections of not-seasonally-adjusted M1. It was used to generate seasonally-adjusted M1 forecasts by using the seasonal adjustment factors published *ex ante* to modify the expression which defines the multiplier in terms of its components (compare equations 2 and 3). Clearly, if these seasonal adjustment factors were later revised, the forecasts derived from the preliminary factors would tend to exhibit larger errors.

The forecasts generated by simulating the money market model are of seasonally-adjusted M1. Since the process of revising the seasonals for an economic time series tends to yield a "smoother" series, one expects the forecasting errors from the revised series to be smaller than those from the original published series. Our results confirm this expectation.

However, the fact that the money market model yielded better forecasts of the revised than of the preliminary data may provide little comfort to the real world policymaker who frequently is forced by the pressure of events to make decisions on the basis of preliminary data. Nonetheless, sharp departures of model forecasts from the preliminary published data may alert the policymaker to the possibility that preliminary data will be significantly revised later and thus should be treated with caution in making policy decisions. On occasion, the staff of the San Francisco Reserve Bank has found that model forecast errors are predictors of subsequent data revisions.

V. Conclusion

In summarizing the results of our calculations, two features stand out as important to policymakers. First, although the money market model provided better forecasts in 1983 and 1984, neither model is clearly better than the other. This conclusion suggests that both the supply conditions emphasized in the multiplier approach and the demand factors considered by the money market model play roles in determining monetary growth. Second, the relatively large errors in forecasting suggest that the central bank's ability to "fine tune" the money stock in the short-run is very limited. In sixteen separate forecasts, the multiplier model missed even the *direction of change* of the M1 growth rate five times; the money market model missed it three times.

Given that the central bank's control over the monetary aggregates is necessarily indirect, our results make the Federal Reserve's apparent inability to control M1 closely in the short run easy to understand. The empirical findings of this article strongly suggest that both the Federal Reserve itself and the small army of "Fed-watchers" who keep tabs on its activities from the sidelines should focus their attention on longer run movements in money growth.

Given the apparent difficulty of forecasting short-run movements in money growth, even when either the federal funds rate or the stock of nonborrowed reserves is assumed to be fully under the Federal Reserve's control, it seems unlikely that the central bank will be able successfully to counter unforeseen developments in the real economy by quickly varying the rate of money growth. This suggests to us that an operating procedure that *automatically* reverses short-run variations in the rate of money growth — and therefore does not require Federal Reserve officials to make judgements on the basis of forecasts — would tend to produce better long-run results.

APPENDIX

The Effect of the 1980 Credit Controls on Estimates of the Money Multiplier

As pointed out in the text of this article, the ARIMA model for the rb ratio exhibited large residuals in April and May of 1980. Although our forecasts began in 1981, one-time errors in 1980 would have had a significant effect on the M1 forecasts for 1981. This can be seen by rewriting the estimated ARIMA model for rb in Table 1 as:

$$(A1) \quad \widehat{lnrb}_t = lnrb_{t-1} + (lnrb_{t-12} - lnrb_{t-13}) + .1273\hat{a}_{t-1} - .6522\hat{a}_{t-12} - .0830\hat{a}_{t-13}$$

where $\widehat{lnrb}_t$ is the predicted value of $lnrb_t$ and $\hat{a}_{t-1}$, $\hat{a}_{t-12}$ and $\hat{a}_{t-13}$ are the estimated residuals from those previous periods. This equation in turn can be rewritten in terms of the previous predictions of rb and the associated prediction errors as:

$$(A2) \quad \widehat{lnrb}_t = \widehat{lnrb}_{t-1} + (\widehat{lnrb}_{t-12} - \widehat{lnrb}_{t-13}) + 1.1273\hat{a}_{t-1} + .3478\hat{a}_{t-12} - 1.0830\hat{a}_{t-13}$$

Now consider the implication of a situation in which the model accurately forecasts rb_{t-1} and rb_{t-13}, but predicts a small change in rb from date $(t-13)$ to date $(t-12)$ when a large increase actually occurs. That is, there is a large one-time innovation in the data at date $(t-12)$ that is not modeled explicitly. Under these circumstances, the large positive prediction error at date $(t-12)$ $(\hat{a}_{t-12} > 0)$ would be carried forward to generate a large positive predicted change between dates $(t-1)$ and t through the $.3478\hat{a}_{t-12}$ term.

By assumption, this change would not occur in the actual data series since the experience at date $(t-12)$ was a one-time occurrence. Consequently, rb_t would be overpredicted by a considerable amount. Since the elasticity of the multiplier with respect to rb is -1.0, the error in rb would appear as a large underprediction of the multiplier and the money stock at t. This phenomenon appears to be at least partially responsible for the large errors in the preliminary forecasts for March and June 1981.

There is no way to estimate accurately the month-to-month effects of credit controls in the spring of 1980 since we only had the single experience. One technique involves re-estimating the ARIMA model for rb with the addition of individual dummy variables for March-May, 1980. This model would take the form:

$$(A3) \quad (1-B)(1-B^{12})[lnrb_t - \alpha_0 CR1_t - \alpha_1 CR2_t - \alpha_3 CR3_t] = (1-\theta_1 B)(1-\theta_{12}B^{12})a_t$$

where CR1, CR2 and CR3 are dummy variables that take the value one in March, April and May of 1980, respectively, and zero in all other months. The estimate of equation A3 for the sample ending in December 1980 is:

$$(A4) \quad (1-B)(1-B^{12})[lnrb_t + \underset{(.0100)}{.0364}\, CR1_t + \underset{(.0115)}{.0195} CR2_t - \underset{(.0099)}{.0165} CR3_t] = (1 + \underset{(.1020)}{.0320}B)(1 - \underset{(.0928)}{.5869}B^{12})a_t$$

The first order moving average factor is no longer significant in this specification, and the credit control dummy variables have signs that are consistent with an increase in excess reserve holdings (or a reduction in borrowed reserves) at the initiation of the credit controls. This effect in March and April 1980 is subsequently, although only partially, offset as indicated by the negative coefficient on the May 1980 dummy variable.* The effect of the inclusion of these credit control dummies is substantial as they reduce the estimated error of the rb equation by approximately 9 percent.

In principle, the effect of the credit controls experience on other component ratios of the multiplier also should be investigated. We did not pursue

this investigation here both because no systematic pattern in the residuals of the other component ratios was observed during spring 1980 and because, except in the case of the t_1 ratio, the elasticity of the multiplier to the remaining component ratios is quite low. Therefore, even if the effects of the credit controls filter through to produce forecast errors in these other component ratios, they should exert only a minor influence on the multiplier forecasts.

The forecasts of M1 for 1981 shown in Table 3 are those computed using Equation A4 to simulate rb and the other component models in Table 1 to simulate the other components. Adding the credit control dummies improved the forecasting performance in March and June 1981 dramatically, while slightly hurting the already bad performance in September 1981. Over the year as a whole, the credit control dummies reduced the mean absolute error in the forecasted annual growth rate of shift-adjusted M1 from 9.20 percent to 6.78 percent.

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* If the effect of the credit controls on the reserve ratio is strictly temporary, then the sum of the coefficients on the variables should be zero. The sum of the three coefficients in equation A4 is .0394, which suggests, on the surface, that the impact may not have been fully reversed by the end of May 1980. However, the sum is not significantly different from zero (s.e. = .0259), so the case for introducing additional dummies for subsequent months is weak. Equation A3 could be re-estimated with the sum of the three coefficients on the credit control dummies restricted to zero, but that has not been done for these forecasting exercises.

FOOTNOTES

1. Other reasons for the volatility of M1 growth during the 1979-82 period have been suggested. For example, the credit control program imposed in 1980 was associated with very large changes in M1. Some economists have argued that even in the 1979-82 period, the Federal Reserve in practice did not attempt to control M1 closely in the short-run.

2. Our forecasts *assume* that the settings of the Federal Reserve's policy instruments over the forecast period are fully known. However, the Federal Reserve itself also makes M1 forecasts using both econometric and "judgmental" methods. If it changed policy in response to these forecasts, the *actual* values of the policy instruments in our models may be different from those that an outsider would have assumed at the beginning of any forecast period.

3. An earlier study examining the forecasting performance of both the Johannes-Rasche and San Francisco models — together with several other approaches to forecasting M1 — is reported in David Lindsey and others, 1981.

4. The Federal Reserve typically issues revised historical data for the monetary aggregates in February of each year. We used these revised data in our estimations.

5. Occasionally during the October 1979-October 1982 period, the Trading Desk permitted nonborrowed reserves to diverge from target in order to avoid temporary short-run interest rate fluctuations that were expected to disrupt financial markets but have little effect on M1 growth.

6. Prior to January 1982, the monetary aggregate that consisted of currency, demand deposits and NOW accounts was described as M1B. Since January 1982, this aggregate has been termed M1.

7. This comment applies equally to forecasts from the multiplier model and the money market model.

8. In February 1984, the Federal Reserve moved to a system of contemporaneous reserve requirements (CRR) from its previous system of lagged reserve requirements. This institutional change might have altered the statistical properties of the time-series of the rb ratio and thus affected our forecasts of the multiplier in 1984. In practice, tests conducted by Rasche subsequent to the completion of this article indicate that the effect of CRR on the monthly behavior of the multiplier has been small.

9. In cases where there were revisions to the nonborrowed reserves series between the end of the estimation period and the forecast period, the monthly growth rates of the revised series for nonborrowed reserves were used to extrapolate the unrevised series from the last available observation. The resulting constructed values of unrevised nonborrowed reserves were multiplied by the forecasted multiplier to generate a forecast for M1.

10. If either nonborrowed or borrowed reserves were regarded as the exogenous policy instrument, the model may be used to derive a forecast of the federal funds rate as well as the other endogenous variables. This procedure was not followed in the experiments reported here.

11. Unfortunately, it was not possible to obtain income and price predictions made precisely at the beginning of each forecast period.

12. The procedure was more complicated in 1981. The first three-month forecast (December 1980 to March 1981) was treated as a prediction of "shift-adjusted M1B" taking the level of actual M1B in December 1980 as given.

The second forecast (March-June 1981) took the level of *shift-adjusted* M1B in March as given and forecast its level in June after adjusting for the error made by the model in March. Since the portfolio shift into NOW accounts was complete by mid-year, the June-September and September-December forecasts were regarded as predictions of

non shift-adjusted M1B, taking the level of that aggregate at the beginning of each period as given but again adjusting for the errors made in the model forecasts for June and September.

13. Table 5 shows that the forecasting errors using the predicted values of personal income and prices rather than the actual values were almost identical. This reflects partly the fact that the income and price forecasts we used were quite good and partly the fact that the *short-run* impact of income and price changes on money demand is quite small.

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Bank Regulation and the Public Interest

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Bank regulation often is argued to be in the public interest. The rationale for this position is that an unregulated banking system would be characterized by market failures and reduced economic efficiency. This view is widely held despite the lack of systematic analysis of why market failures might arise in banking. This paper examines whether there are aspects of banking that could be expected to lead to market failures in the absence of regulation. Our analysis suggests that, to be viable, a fiat monetary system likely requires some degree of bank regulation. We also find that bank runs result from a market failure related to poorly defined property rights for depositors whenever the par value of deposits exceeds the market value of bank assets. We conclude that public policy measures that help define and enforce depositor property rights could have a positive effect on social welfare by eliminating runs and enhancing bank stability.

Much has been made of the "deregulation" of depository institutions. However, banking regulations regarding entry, capital requirements, location of offices, reserve requirements, and asset portfolio composition are still in force. The public policy debate concerning depository institutions centers on whether deregulation should proceed or whether there is a need to retain and perhaps even strengthen some aspects of bank regulation.

Arguments on both sides of this debate have referred to "public interest" considerations. Proponents of further deregulation point to the public benefit from increased competition and gains in economic efficiency. Their detractors appear to support continued regulation of depository institutions at least in part because they believe that unrestricted banking would not lead to the socially optimal behavior as defined in a microeconomic model of perfect competition. Key to the latter position is the presence of market failures associated with banking. Specifically, government intervention in the form of "correcting" market failures is presumed to have the potential to enhance the public interest.

As central as market failures are to linking the public interest to bank regulation, public policy toward banking generally has been formulated without a clear articulation of what those failures may be, why they may exist, or how regulation would correct them. In part, this is due to lack of much systematic analysis of possible market failures associated with banking.[1]

In this paper, we attempt to fill the gap by examining how bank regulation, in principle at least, might be related to the public interest because of market failures in banking. By focusing on the link between regulation and the public interest, we do not mean to suggest that the structure of bank regulation is shaped entirely or even primarily by public interest considerations. The implementation as well as the removal of regulatory constraints can

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result in a redistribution of wealth among various interest groups. Given the redistributive effects of regulations, many analysts argue that it is the relative effectiveness of the affected groups in promoting their own interests that ultimately shapes public policy. However, even within this "private interest" view of regulation, public interest considerations can play a role. This is because the dead weight losses from economic inefficiencies, whether due to market failures or regulation, will affect the degree of support for and opposition to regulations.

Since considerations of both public and private interests can have a bearing on regulation, a complete analysis of banking regulation would identify the groups benefiting from and those harmed by various regulations as well as the nature of market failures, if any, that characterize banking. Such an approach would be able to explain why certain regulations exist, how regulations would change as market forces change, how regulations affect the redistribution of income, and how they might rectify market failures.

The purpose of our paper is not to explain the incidence of regulation or to differentiate among theories of regulation. Our approach is to examine the conditions under which there could be market failures in the operations of the banking industry and to assess the types of public policy measures that might address those failures.

The organization of our paper is as follows. In Section I, we discuss the link between regulation and the public interest. We also discuss, in general, the sorts of market failures that are typically considered to justify regulation. Section II then investigates specific sources of market failures that might lead to regulation in banking. The focus there is on the connection between banks and the monetary system and on the credit intermediation services of banks. We also examine how market failures might be related to instability in banking. Finally the summary and conclusions are presented in Section III.

I. Regulation and the Public Interest

Economic theories of government regulation have been developed under two distinct lines of thought — the public and private interest theories. Within the public interest framework, the presence of market failures sometimes makes it possible for regulation to enhance economic efficiency. Microeconomic theory focuses on three major types of market failures — inadequate competition, externalities, and public goods — that lead an unregulated private market to an equilibrium not necessarily socially optimal.

Inadequate competition could arise in a market because of cartels or because of economies of scale in production in the relevant range of demand (that is, "natural monopolies"). Government intervention in terms of legal prohibitions and penalties for anticompetitive behavior (antitrust laws and regulations) and the regulation or control of natural monopolies have been rationalized as public interest responses to this type of market failure.

The main reason a competitive market would fail to achieve an efficient allocation and production of resources is the existence of nonpecuniary externalities. In such cases, the consumption or production of goods imposes costs or bestows benefits on parties not directly involved through some nonmarket channel. As Coase (1960) has shown, externalities arise whenever property rights are nonexistent or poorly defined.

An extreme case of a good characterized by positive externalities is a pure public good — that is, a good whose quantity does not diminish as the number of persons consuming it increases. Pure public goods are characterized by the quality of nonexcludability, which makes it impossible (or too costly) for a competitive private market to charge a positive price for them. As a result, the private market cannot provide them.

Pigou's solution to externalities was the imposition of taxes or subsidies. But in some cases, the legal assignment of property rights, regulation, or the governmental provision of public goods may internalize the externalities.

In contrast to the public interest framework for regulation, the private interest approach, perhaps most often associated with the pioneering work of George Stigler (1971, 1975), sees regulation as being sought by an industry (through political activities) to further its own well-being. Often, the industry desires regulation to shield itself from the

rigors of competition. In a sense, the private interest theory views regulation as analogous to a system of taxes and subsidies in which the regulated group receives subsidies at the expense of some other "taxed" group, or vice versa. The implicit taxes of regulation, however, are often hidden or indirect, like entry restrictions, price controls, exemptions from antitrust laws, or prohibitions on certain types of activities. Similarly, the subsidies are not direct payments by government but are the higher-than-normal profits that result from regulations.[2]

Nevertheless, even within a private interest theory approach to regulation, market failures and the impact of regulation on economic efficiency can be important. This is shown in a recent work by Becker (1983) that attempts to bridge the public and private interest theories of regulation. Becker develops a model of competition among political pressure groups in which, in keeping with a private interest framework, the groups compete to secure legislation beneficial to their own interests. This model departs from the more traditional private interest theory of regulation by considering the effects of the deadweight costs of taxes and subsidies on political pressure.

In the context of this paper, an important implication of Becker's integrated theory is that there are pressures to adopt public policies (regulations) that overcome market failures, and hence raise efficiency. Regulations that enhance efficiency to the benefit of all groups will be widely supported and unopposed. Even efficiency-enhancing regulations that harm some groups may be adopted if the gains to society sufficiently outweigh the harm imposed.[3]

Economic inefficiencies related to market failures are thus relevant to both the public and private interest theories of regulation. As a result, an important first step in analyzing bank regulation would be to determine the nature of market failures, if any, in banking. In the next section, we examine the arguments for why market failures might exist in banking. We focus on market failures related to externalities (including public goods) rather than inadequate competition. In doing so, we recognize that some components of the payment system in which banks have a role, such as check clearing and funds transfers, are probably characterized by economies of scale. In fact, the Federal Reserve is a major provider of both services. Also, various government agencies regulate bank mergers. These are not, however, practices subject to much controversy that stems from the special features of banks.

II. Why Regulate Banks?

As indicated earlier, the presence of externalities gives rise at least to the potential for regulation to improve efficiency in production. Banks' (the term is used here to represent all depository institutions) provision of monetary and credit services usually is cited as the main reason banking should be the focus of public policy concern. It is often argued that government oversight of money creation, the operation of a monetary payment system, and credit intermediation is necessary. In addition, some argue that unregulated competitive banking would be unstable and susceptible to runs with widespread adverse effects.

The Monetary System

Some economists have argued that banks should be regulated because of their key role in the monetary system. Others argue that banks need not have a special role and the fact that they do in most current monetary systems is a result of regulation — not a reason for regulation.

Much of this debate turns on what is meant by "money" and whether banks create money. Some economists have argued that, because banks have the power to create money, an unregulated banking system would lead either to an infinite or indeterminate price level (see Johnson, 1968; Pesek and Saving, 1967; and Gurley and Shaw, 1960); while others (most notably Tobin, 1963, and Fama, 1983) have argued that banks do not create "money" and that regulation is not needed to make the price level determinant.

In sorting through these positions, it is useful to keep in mind that money has two essential, highly related, but sometimes separate economic functions. It is the numeraire or unit of account in which

prices are quoted, and it is a medium of exchange that facilitates trade by eliminating the double coincidence of wants needed for barter.

The arguments for why banks may or may not have a "special" role in the current monetary system can be best understood by considering the roles of banks in alternative, simpler systems. Below, we discuss banks' role in several types of monetary systems to determine whether there is something inherent in banks' monetary role that results in market failures.

Commodity Money

Perhaps the simplest monetary system is a commodity system in which a commodity such as gold serves as the numeraire and circulates as the sole medium of exchange. In such a system, the price level is determined by the supply and demand conditions for the numeraire commodity (for both monetary and nonmonetary purposes) relative to supply and demand conditions for other goods.

Although such a monetary system (without banks as providers of payment services) is more efficient than a barter system, it is likely that it would be less efficient than a system with bank-provided payment services.[4] Indeed, even in systems with a commodity numeraire, bank debt, either in the form of privately issued banknotes or deposit liabilities such as checks, has served a role as a medium of exchange.[5]

One economic function of banks in such a system is to economize on the real resource costs of holding and transferring the numeraire and thereby facilitate trade by providing a financial medium of exchange. The question is whether there is some private market failure that characterizes the private provision of a medium of exchange. In particular, will an unregulated banking system lead to an infinite price level and return to barter or a pure commodity system?

Based on Fama's (1980) research, the answer appears to be no. Fama pointed out that in such a commodity-based monetary system with privately produced media of exchange, the price level is still determined by the supply and demand conditions for the numeraire commodity relative to other goods.[6] In other words, the Walrasian determination of equilibrium relative prices (in terms of the numeraire) holds even in an economy in which debt (or other financial assets) is used to facilitate exchange.

Thus, the quantity of debt, or other financial assets that serves as a medium of exchange and is used for payment purposes, does not directly affect the price level. In a commodity system, the price level is determined by the supply of and demand for the numeraire commodity (not debt[7]), banks do not create money in the sense of creating the numeraire (even though they might issue their own banknotes), and no restrictions are needed for price level determinacy.

With a commodity monetary standard, there remains the issue of price stability. Unanticipated changes in the supply of the commodity (for example, gold discoveries) or changes in the nonmonetary demand (for example, the invention of printed circuit boards that require gold connectors) would affect the price level. However, changes in relative prices caused by changes in real demand or supply conditions are not nonpecuniary externalities. Moreover, since this type of instability has nothing to do with the banking system it seems unlikely that any sort of banking regulation could eliminate it. This is not to say that a commodity with stable nonmonetary supply and demand conditions, and therefore a stable price, would not be preferable to one with a fluctuating price. Both lower computation costs involved in current exchange and a reduced degree of risk in future exchange may favor such a commodity.

Changes in the monetary demand for the commodity also would cause the price level to change. Even though a decline in the banking sector might increase the demand for the numeraire commodity as a medium of exchange (and thus lead to a decline in the price level), such an effect does not constitute a nonpecuniary externality if the decline in banks' ability to produce media of exchange is caused by an increase in their real costs of production.

An increased monetary demand for the commodity might, however, be caused by a "banking panic." And if banking panics themselves result from a market failure, some form of banking regulation that eliminated panics might enhance efficiency by reducing the waste involved in actually using a commodity as a medium of exchange (that is, by reducing the amount of financial intermediation).

Such panics might also impose costs by disrupting a competitive payments system. We discuss these possibilities in more detail later in this section.

Thus, aside from the possibility of banking panics or runs, no private market failures appear to be associated with the workings of a commodity-based monetary system in which payment services are competitively provided by banks. The only sort of regulation that might be warranted would be regulation that defined which commodity would be the numeraire, although private market forces historically appear to have been able to make that determination.

Fiat Money

Since virtually all modern economies have moved away from commodity standards to pure fiat money, we now discuss whether banks' behavior may be of greater public policy concern in a pure fiat system. In a pure fiat system, pieces of paper that (1) have no intrinsic value, (2) are not redeemable from the issuer for real goods, and (3) do not pay interest typically serve as both the numeraire and circulate as a medium of exchange. Compared to a commodity-based system in which the commodity circulates as the medium of exchange, a fiat system may be more efficient because it does not divert a real resource from nonmonetary uses to be used as a medium of exchange. However, it may be possible to have a commodity-based system in which the commodity itself does not circulate. In that case, it is unclear whether a fiat system would be more efficient. Nevertheless, a fiat system does differ importantly from a commodity based system in that it makes the social control of money, prices and credit possible, and it provides a source of tax revenue.

A workable fiat money system, however, cannot be provided by a competitive private market. Assuming there initially would be a demand for privately produced fiat money[8], and that all fiat money had the same unit of account (for example, dollars), each private producer would have an incentive to expand the quantity of money it issued as long as the money's marginal value exceeded its marginal cost (assumed to be zero). Each producer, however, would not take into account the negative externalities of its fiat money issuance, namely, a reduction of the real value of the money stocks of other private producers and holders of fiat money. The equilibrium private market solution would be a fiat money of zero value. A fiat money with no value, of course, cannot serve as a numeraire or a medium of exchange. Since the public could be expected to anticipate this equilibrium solution, there would be no initial demand for a competitively produced fiat currency.

The common solution to this problem is for the government to sanction or to be itself a monopoly supplier of fiat currency, and to use various regulatory techniques to create and enhance the demand for it. Although a monopoly supplier does not face any inherent technical problems in limiting the supply of fiat currency, it may face political problems in doing so. A number of countries, apparently unable to raise tax revenues from other sources, have increased their rates of monetary expansion with the result of hyperinflation. Under such circumstances, governments are often unsuccessful in maintaining a demand for their currency and their fiat systems have collapsed. Commodities or foreign currencies often do begin to circulate in economies with rampant inflation. Nevertheless, the relative success of fiat systems in many developed countries suggests that governments in general can maintain a demand for their currency as long as they also limit its supply.

In practice, there have been two common methods of creating or enhancing the demand for fiat currency: reserve requirements and the prohibition of the private issuance of hand-to-hand circulating media of exchange (for example, private banknotes). Reserve requirements create a demand directly, by requiring banks to hold fiat money, as well as indirectly, by taxing a substitute financial medium of exchange. Prohibiting the private issuance of banknotes prevents them from competing with government currency as a medium of exchange, and thus is equivalent to a 100 percent tax on a substitute medium of exchange.

Reserve requirements increase the demand for fiat currency, but there probably would be some demand for fiat currency even in their absence. Fama (1983) has argued that there probably is an inherent demand for a zero-interest circulating medium of exchange because of its convenience in facilitating small transactions. However, absent reserve requirements, there still might be a need for regulations to prevent the issuance of private banknotes. Even

though privately issued banknotes are not a type of fiat money (or numeraire) they would likely be a close substitute for government currency for use as a hand-to-hand circulating medium of exchange because they would have convenience features similar to government currency. This substitutability, however, could make the demand for government-issued currency unstable and therefore make it difficult to maintain a stable price level.

Finally, it seems possible that if technology continues to lower the cost of bank-provided payment mechanisms, such as electronic payments and checks, the demand for currency as a medium of exchange would decline. Monetary authorities would then have to offset the decline to stabilize the price level. It is even conceivable that in the future if rapid technological change occurs, the demand for currency (for domestic legal monetary purposes at least) could approach zero and lead to a collapse of a reserve-free fiat system.

For whatever reason, reserve requirements are a feature of virtually all fiat systems. To enforce reserve requirements, it is necessary to restrict the sorts of financial assets that can be used in transactions as media of exchange to those that are reservable. As Black (1970, 1975) and Fama (1980) have pointed out, in an unregulated banking system, as long as there is a well-defined numeraire, virtually all assets (in principle at least) could be used as media of exchange.[9] Thus, nonreservable financial assets could be used as media of exchange to circumvent, at least partially, reserve requirements. Without regulations limiting which assets could be used as media of exchange, the degree of circumvention would depend only on the substitutability of nonreservable assets in exchange.

In sum, a fiat money system may require some degree of banking regulation. However, it is not certain whether a fiat system, in which the numeraire is socially controlled and the media of exchange are regulated, is superior on microeconomic efficiency grounds to a commodity-based system in which a privately supplied commodity serves as the numeraire and the media of exchange also are supplied privately without government intervention.[10]

Even if a fiat system were not more efficient than a commodity-based system from a microeconomic standpoint, it has several distinguishing characteristics that may account for its almost universal adoption. First, the supplier of fiat money ("base money" in the U.S.) can raise revenue directly by issuing more money. Second, by varying the quantity of base or fiat money or by varying reserve requirements, the supplier can influence the price level. And third, in a fiat system with reserve requirements, the degree of financial intermediation (and possibly, real interest rates) can be influenced by varying reserve requirements or the quantity of reserves.

Regarding this third point, an increase in reserve requirements lowers the amount of financial intermediation, and this, in turn, may increase real interest rates by reducing the supply of credit. It is not possible, however, to increase the degree of financial intermediation beyond what would occur in an unregulated market. Although reserve requirements enable the social control of the degree of financial intermediation, they do so by increasing the cost of financial intermediation and are therefore a source of economic inefficiency from a microeconomic standpoint.

It seems likely that these characteristics of a fiat system are more important than any potential advantages in efficiency such a system might have over a commodity-based monetary system. If so, from a social welfare perspective, support for a fiat system with reserve requirements over, say, a commodity-based monetary system would seem to be based on the assumption that there are social benefits to government control of money and credit intermediation. The market failure implied by this perspective is that the macroeconomy, in the absence of government intervention regarding the money supply, would not have the desired stability in prices, credit intermediation, and economic activity. In pointing this out, we do not contribute to the debate about whether (discretionary) macroeconomic stabilization by the monetary authorities is either possible or a socially legitimate role of government. We merely note that if it were a goal, then some form of regulation would be necessary. The degree of regulation needed for these purposes is quite limited, however. It consists of restrictions on the private issuance of base money, limitations on the private issuance of assets that can

be used as media of exchange, and reserve requirements on assets that are used as media of exchange.

Banks as Credit Intermediaries

Aside from their roles in the monetary system, banks are involved in providing credit intermediation services. As credit intermediaries, banks generally hold a large volume of nontraded assets (loans). One reason these assets are not traded is that banks have specialized information about them that other market participants do not.

One study that attempted to establish that this aspect of credit intermediation by banks makes them special is Bernanke (1983). Because banks have specialized information, Bernanke argues that a disruption of the credit intermediation services of banks is possible and that such a disruption can be very costly to the economy.[11]

Bernanke's specific thesis is that the loss of bank intermediation services in the 1930s contributed significantly to the length and severity of the Depression. One obvious reason for the loss of credit intermediation services was the large number of bank failures.[12] But Bernanke argues that, even without failures, intermediation costs could rise if banks adjust their allocation of funds to head off depositor runs. That is, depositories could shift to "safe" assets such as Treasuries, that can be evaluated easily by the market. Such a "flight to quality" by banks could result in a reduction of the extension of new credit to the private sector and adversely affect the economy by contributing to a contraction in production.

Consistent with the framework of our analysis, such an increase in intermediation costs should be of public policy concern only if it constitutes an externality. However, higher intermediation costs could come about without external effects. One possibility is that the disruption of the banking system and the resulting higher intermediation costs come about because of an actual change in the economic environment that reduces or even eliminates the value of the information depositories have concerning borrowers. The Great Depression is a case in point. Information on the past behavior of borrowers would not have been extremely valuable to depositories in distinguishing the risks associated with lending to different customers during the 1930s. Furthermore, it might have been more costly for banks to evaluate the riskiness of new loans with a given level of confidence when the economic environment was changing so drastically.

To the extent that higher intermediation costs result from increased difficulty in evaluating borrowers, it is unlikely that public policy (greater regulatory or supervisory intervention) could help. Regulatory agencies could not be expected to hold any particular advantage over commercial banks in evaluating borrowers. Therefore, even federal deposit insurance might not be sufficient to affect banks' investment decisions. That is, even if the administration of deposit insurance accounted for the riskiness of a bank's assets as perceived by the insurance agency (which presumably would not have an advantage over banks in estimating risk), banks would not necessarily be less likely to shift into "safe" assets. In an environment that induces flight to quality, it might be true that some "good" borrowers would not be able to obtain credit — a problem in the 1930s cited by Bernanke. These would be good borrowers to the extent that, if the banks and depositors could obtain information costlessly about the true risk, credit would be extended. But, information is not costless and it is unclear whether public-policy measures (regulation) could reduce its cost in this case.

Alternatively, the banking industry may be disrupted not by an economic shock that changes the quality of bank assets or the ability of banks to judge the riskiness of borrowers but by a change in the public's perception of banks. In this case, the "inside" information possessed by banks is not transferred to depositors. This may be the situation to which Bernanke referred. Banks are aware of profitable loan alternatives but are unable to convince depositors, or, with the same result, unwilling to compensate depositors for the risk that they misperceive. This could be interpreted as there being "good" borrowers that were unable to obtain credit because of the public's misperceptions.

Why would the relevant information not be produced by the market? One answer, suggested by Leland and Pyle (1977), is that moral hazard hinders the transfer of information between market participants. That is, banks have an incentive to overstate the quality of their portfolios. This is especially true

if verifying banks' claims (information) is very costly. One solution to the moral hazard problem, suggested by Leland and Pyle, is for firms' managers to use their willingness to invest in a project as a signal to the market of the true quality of that project. This strategy would seem most useful for owner-managed firms. However, when ownership and control are separate, bank managers with specialized information may face a similar problem convincing potential shareholders.

The moral hazard problem could be circumvented if the relevant information were collected (and if necessary transferred) by disinterested parties — those that would not benefit from making biased evaluations of banks. Depositors constitute one set of candidates, but the usual assumption is that it is too costly for individual depositors to collect the information. A third party could acquire information on banks and sell it to depositors (or even bank shareholders). However, given the nature of information as a public good and the inability to prevent information from being resold, a private information agency might not be able to "force" all users to pay. In contrast, government regulatory agencies should not encounter this problem.

Alternatively, depositors might be willing to accept an arrangement whereby banks paid a third party directly for providing information on, say, loan quality. It might be noted that private rating agencies do currently collect and disseminate information on the debt quality of a wide variety of issuers, although it is not certain how well this would work for banks. Therefore some government role might be consistent with public policy that addresses the moral hazard problem in the generation of information on banks.

In practice, U.S. regulatory agencies currently gather information but do not provide it to depositors.[13] They also enforce regulations that control bank behavior instead of leaving the task to liability holders. This dual role does not follow directly from the information-deficiency argument, and would have to be rationalized on some other basis, such as the provision of federal deposit insurance which is discussed later.

Bank Stability

The discussion above raises the possibility that market failures in the workings of the monetary system and credit market may be a basis for some public policy measures such as reserve requirements, prohibitions against the private issuance of a hand-to-hand circulating medium of exchange, and government provision of information on banks. The susceptibility of banks to runs, which themselves may be related to market failures, also may be a source of public policy concern.

As suggested earlier, banks' roles in the monetary system may justify concern over the stability of the banking system. One reason is that disruptions to the banking system might impair the ability of a central bank in a fiat system to conduct monetary policy.[14] For example, a loss of public confidence (and the resulting instability) in the institutions whose liabilities are reservable could make the demand for base money (the numeraire) unstable. It likely could make it difficult, if not impossible, for the monetary authorities to take offsetting actions involving reserves to stabilize the price level and economic activity.[15] Also, a central bank would be unable to control shifts into currency and out of deposit accounts completely. Such shifts might cause large economic losses because currency and deposits are not good substitutes. In addition, Diamond and Dybvig (1981), as well as Bernanke, argue that bank runs impose real costs by disrupting credit intermediation and reducing production.

Assessing Banks Runs

A number of studies present models that explain why banks are vulnerable to runs. A useful example is Diamond and Dybvig. In their model, banks add value by transforming illiquid assets into liquid assets. They provide a kind of "insurance" for consumers, who are uncertain as to the timing of their consumption and, therefore, when they will need to tap their illiquid resources. An important characteristic of the transformation banks provide is that banks fund their illiquid assets with par-value liquid deposits.[16]

The uncertain timing of consumption makes the volume of withdrawals uncertain for banks. As a result, banks may not hold enough reserves to cover deposit outflows, and may have to undertake what is assumed to be a costly liquidation of assets. Depositors trying to avoid sharing in the resulting losses run on banks in such situations. In the Diamond and

Dybvig world, bank runs impose real costs on the economy because they disrupt credit intermediation and output. And depositors making withdrawals beyond the volume expected by banks (beyond the amount of reserves held by banks) impose social costs on other depositors.

In identifying the source of the market failures associated with bank runs, we note that externalities can arise when there are poorly defined property rights. This is what occurs with liquid par-valued deposits when banks incur losses that exceed net worth. The situation is analogous to the problem of a communal good. In that case, resources are used up "too" quickly as individuals attempt to convert the communal good to a private good. Similarly, with par-valued deposits, depositors have a fixed claim on a pool of assets. When depositors believe that the value of the assets is less than the par value of the fixed claims and the bank remains open, depositors' property rights are not protected. Accordingly, depositors act on their incentives to convert the communal pool of assets to private assets by withdrawing funds: they run on the bank.

The par-value feature of deposit contracts results in poorly defined (or poorly protected) property rights which can lead to externalities and expose individual institutions to runs. With par-value deposits, therefore, even a run on an individual bank can involve a market failure.

The more traditional concern with bank runs has been whether the banking system as a whole is vulnerable to panics. The Diamond and Dybvig model can provide little guidance on that question. Their model includes elements that make a run on one bank possible, but a systemwide run unlikely. Runs in their model are possible because the volume of withdrawals is uncertain. However, with a very large number of depositors, the withdrawals from the banking system should be predictable with a small error. If there were a number of banks, instead of one as in the Diamond and Dybvig model, the prediction errors for individual institutions would be larger. Even this complication should not be important since the free trading of bank assets, which are not risky (no default risk) in the Diamond and Dybvig model, would effectively pool systemwide reserves.

The problem of bank runs, however, involves more than bank liquidity and the predictability of deposit withdrawals. Bank portfolios are risky, and a bank can sustain sufficiently large losses as a result of credit and interest rate risk to generate a run.

With individual institutions susceptible to runs because of risky portfolios, the system as a whole also could be unstable if the value of bank assets is frequently reduced by common exogenous factors. Kindleberger (1985) makes exactly this point. He indicates that exogenous macro shocks were the predominant causes of bank failures in the 1920s and 1930s. Exogenous macro shocks such as the strength of the dollar, the unexpected drop in inflation and relative price changes (such as declines in oil prices) are again at the core of the problems of many failed and weakened banks in the 1980s. To the extent that such macro shocks stem from unexpected changes in fiscal and monetary policy, they represent the external effects of government activity on the private economy.

Another reason that the banking system generally is depicted as being susceptible to instability is that the failure of one bank increases the probability of runs at other banks. Such "contagion" effects, if they exist, would represent a classic example of externalities. The existence of contagion effects in banking, however, has not been substantiated by post-Depression empirical work. This lack of empirical support may be due to the presence of deposit insurance, but other evidence indicates that depositors are able to distinguish, to some degree, safe institutions from unsafe ones. Beebe (1985), for example, argues that the behavior of large bank holding companies' stock prices indicates that the market is able to make distinctions among holding companies on the basis of factors affecting the quality of their individual portfolios. In addition, Rolnick and Weber (1983) raise doubts that the evidence from the free-banking era supports the presence of contagion effects in banking.

Policy Responses

Whether contagion effects or macro shocks determine the potential for systemwide instability in banking, the vulnerability of banks to runs remains a problem of property rights. That problem is a function of three factors — par-value accounts, risk in banking, and the liquidity of deposits. The incentive to run on banks can be removed by muting the

adverse side effects of any one of the three components.

Par-Value Accounts

The par-value feature of deposits could be eliminated by converting depositors to equity holders, as are money market mutual fund shareholders. In a world of complete markets and no uncertainty, this change would not pose problems since banks, as well as other firms, would be indifferent to the mix of equity and debt financing. But that is not the state of the world; if it were, there probably would be no role for banks as intermediaries.

It seems likely that the economic contribution of banks as integrated providers of transaction and intermediation services would be affected adversely by a complete regulatory abolishment of par-value deposit accounts. Even before the Glass-Steagal Act, banks offered par-value deposit contracts. In part, this practice likely is due to the problem of determining the market value of many bank assets. In addition, the public may have a preference for par-value bank accounts for transactions needs since there may be some advantage to having a predictable account balance when planning purchases.

It is difficult to evaluate the importance of par-value liquid deposits to banking. The shift of many money market mutual funds from marked-to-market to amortized cost accounting, which results in quasi-par value accounts, suggests that there may be a demand for predictable balances for certain types of accounts. Nevertheless, the use of nonpar-value accounts for liquid deposits by banks would eliminate the incentives for bank runs. To the extent that bank runs are a public policy concern, regulation, at a minimum, should not prevent the development of nonpar-value accounts by banks.

Risk in Banking

Aside from par-value accounts, another condition for bank runs is that banks be exposed to risk. One way of preventing bank runs would to be eliminate risk in banks' portfolios — credit risk as well as interest rate risk. This would mean that bank assets would have to be free of default risk, and asset and liability durations would have to be matched.

To eliminate risk in banking, the structure of banking would have to be radically altered. Banks would not be allowed to hold commercial and industrial loans, consumer loans, mortgage loans, etc; but banks might still be able to originate loans and then sell them. Such stringent regulation would severely narrow the economic function of banks. A policy, for example, that made banks hold only liquid and riskless assets would make it impossible for banks to perform what Diamond and Dybvig argue is a key function — transformation of illiquid assets to liquid assets.

Public policy toward banks as currently structured can be viewed as a compromise between eliminating the riskiness of banks and maintaining their economic functions. Yet much present bank regulation has been justified as necessary to control risk in banking, and thereby to enhance stability. These so-called safety-and-soundness regulations include restrictions on activities, capital requirements and anticompetitive measures, such as limits on entry. Below, we discuss these regulations.

Restrictions on Activities

From a safety-and-soundness perspective, the usual arguments for limiting the economic activities of banks is that some activities, such as insurance underwriting and direct real estate investment, are considered highly risky. Furthermore, gains from diversification are viewed as unable to offset the risks these activities present. Limiting banks' activities, it is argued, would lower the institutions' risk-return positions.

There is considerable debate, however, over whether regulation can lower the risk-return position, and even whether regulation is counterproductive. To increase their return on equity, institutions might simply raise their risk exposure in permitted activities. Alternatively, banks, if allowed, might increase their leverage to re-establish a desired risk-return position. Moreover, regulations that limit the ability of institutions to diversify may exacerbate the problem of instability, by reducing returns without lowering risk.[17]

Capital Requirements

Capital requirements also have been justified on safety-and-soundness grounds. In the absence of regulation, banks could be expected to hold some level of capital, if only to increase the probability

that they could make good on noncontingent deposit claims held against them. The question facing policy makers is whether market-determined capital "requirements" for banks would be adequate.

To the extent that public policy regarding banks is based on the existence of market failures, the amount of capital demanded by the market would not be adequate. Moreover, in the present environment, the subsidized rate on federal insurance distorts the equity-deposit mix that would be demanded by the market by reducing the need for equity. We discuss the issue of federal deposit insurance more fully in the next section.

Anticompetition Regulations

In addition to portfolio constraints, the risk-return position of banks might be affected by anti-competition regulations such as entry restrictions. Entry restrictions are widespread in banking and include prohibitions on *de novo* entry through chartering regulations, as well as restrictions on branching, chain banking and interstate banking, although many of these appear to be breaking down (Keeley, 1985).

The primary effect of limiting entry is to create rents by restricting competition. The direct effect of entry restrictions (or any other anticompetitive regulation for that matter), then, would be to create a market failure — not to rectify one. By limiting competition, however, bank charters (the right to do business) have a capital value that would not exist in the absence of regulation. Moreover, this capital, unlike most assets, cannot be separated from the bank. It would appear, therefore, from a market-failure point of view, that the only justification for entry restrictions would be their usefulness as an indirect way of enforcing minimum capital requirements.[18] However, while this capital may provide some cushion, particularly for the deposit insurance agencies in the event of a failure, direct capital regulation could achieve the same result without the distorting influence of restricted competition.

To the extent that public policy concerning banks is based on the presence of certain market failures, capital requirements, linked with monitoring of risk-taking might be appropriate in principle. However, absent easily enforced restrictions that allow banks to invest only in riskless assets — a practice that would eliminate most of the economic functions of banks, there remains the question of whether regulation can ensure sufficient stability in financial markets to avoid disruptions to monetary control, the payment system, and credit markets. Depository institutions have incentives to circumvent regulatory constraints to improve their risk-return positions. But perhaps more importantly, much of the instability in banking appears to have stemmed from macroeconomic shocks. As long as banks maintain risky portfolios, it is doubtful that supervision and regulation can insulate banks from such shocks.

Deposit Liquidity

The third component in the bank run problem is deposit liquidity. Without ready access to their funds, depositors would not be able to act on their desire to avoid losses. One innovation that often is argued to neutralize the problems associated with liquid deposits is the existence of a lender-of-last-resort. A central bank, acting as lender-of-last-resort, is said to be able to prevent runs without limiting the liquidity of deposits by providing a market for bank assets.

By acting as a source of liquidity, a lender-of-last-resort could indeed prevent runs if the only source of losses for banks were unexpected asset liquidations, and if the lender-of-last-resort could significantly reduce the cost of such liquidations. As suggested earlier, however, banks are exposed to losses from a variety of sources, not all of which can be controlled by a lender-of-last-resort. If the lender-of-last-resort is required to mark bank assets to market, as is the case for the Federal Reserve, then losses related to, say, credit risk could be sufficient to prompt a run. That is, a lender-of-last-resort that marks-to-market does not fully address the property rights problem of liquid par-value accounts.

Diamond and Dybvig offer another approach for maintaining property rights when deposits are liquid. Their solution suggests that it is not necessary to deny depositors access to their funds to prevent runs. Instead, it is only necessary to prevent depositors from avoiding any liability when they do withdraw their funds. Runs are prevented in their model through the threat of an *ex post* levy on all depositors. This levy would meet deposit obligations at a

bank in the event of greater-than-expected withdrawals. Depositors do not have an incentive to withdraw their funds prematurely since, with the threat of an *ex post* levy, they would be no better off if there were a run, and they would be worse off if there were no run (for example, depositors making withdrawals might forgo interest income and incur other transactions costs).

Under current policy measures related to banking, depositors' claims are secured through the system of federal deposit insurance. The administration of federal deposit insurance parallels the approach suggested by Diamond and Dybvig to some degree. While the insurance agencies maintain funds, the effectiveness of federal deposit insurance lies in the understanding that the full faith and credit of the federal government stands behind the insurance funds. That is, the viability of the insurance funds rests on the taxing authority of the government. The ability to levy taxes to meet deposit withdrawals is similar to the *ex post* fees on depositors in the Diamond and Dybvig model.

Despite this similarity, the current deposit insurance system is quite different from the solution suggested by Diamond and Dybvig. While federal deposit insurance maintains well-defined property rights for insured depositors, it also involves pooling nonsystematic risk in banking.[19] This second aspect of federal deposit insurance raises the concern that the current insurance system generates distortions in the economy by creating incentives for depository institutions to take on nondiversifiable or systemic risk.[20] These incentives for risk-taking arise because the value of the insurance is not reflected in the cost of funds to individual banks.

The *ex post* levy in the Diamond and Dybvig model does not distort incentives for risk-taking even if bank assets are risky. In their model, there is only one bank and depositors know they must ultimately bear a *pro rata* share of losses that might result from the bank's risk-taking. There is no risk-pooling, only the enforcement of property rights. Depositors would consider risk-exposure in determining their expected rate of return on deposits, so the cost of deposits to the bank would be positively related to the risk of its portfolio. As a result, the cost of bank risk-taking would be internalized.

A system for preventing runs more in keeping with the solution suggested by Diamond and Dybvig would enforce property rights without government-provided insurance. With many banks in the system, one way to accomplish this would be to hold depositors, both past and present, liable for the losses of a failed bank and not the insurance funds and the general public. For past depositors to remain at risk, depositor liability would have to extend beyond the time when funds are withdrawn.

As a practical matter, a working definition of what constitutes a "past depositor" would be necessary and probably only the government could enforce an *ex post* levy on such depositors. Nevertheless, such an alternative to the current deposit insurance would have the effect of making depositors sensitive to bank risk. This is similar to the goal of deposit insurance reforms that stress increasing market discipline, but unlike them, it would still prevent bank runs.[21]

Such a system would take the government out of the deposit insurance business but keep it in the property rights enforcement business. At the same time, depositors would have an added incentive to optimally diversify their portfolios. Moreover, the program suggested to prevent runs would not preclude, and could even facilitate, the provision of private deposit insurance that took advantage of pooling nonsystemic risk in banking. If private insurance were not available, it would even be possible to have some nominal federal coverage for small depositors considered unable to take advantage of diversification. Such protection would not distort bank behavior.

III. Summary and Conclusion

The debate over the role of government in regulating depository institutions undoubtedly will continue. Although the debate in the political arena is partly about the distributive effects of regulation, regulation's social benefits and costs also can be important considerations from even a purely private interest perspective. We have therefore examined how banking regulation might be related to social welfare. This would seem to be a necessary first step in a more complete study that would also look at regulation from the viewpoint of private interests. Examining the distributive effects of banking regulation is, however, left for future research.

Our approach has been to determine whether there is a potential for market failures in banking as it relates to the monetary and credit systems. With regard to the monetary system, an unrestricted, competitive, private fiat system is not viable. A fiat monetary system requires control over the supply of money (the numeraire) and a demand for the fiat money. One way to ensure a demand is by imposing reserve requirements, although, if there were a stable demand for a fiat currency for transaction purposes, reserve requirements would not be necessary. Reserve requirements, however, make possible the social control of the degree of financial intermediation, but at a cost of restricting it to be less than it would be under a reserve-free system. In a monetary system where reserve requirements are used, it may be necessary to limit the types of privately issued assets used as media of exchange to enforce reserve requirements.

In providing credit, banks hold a large volume of nontraded assets (loans). The asymmetry in information of banks and the public concerning the quality of bank assets could inhibit the intermediation process. This situation, however, is not unique to depositories, but is shared by other private placers of credit, such as finance companies and life insurers. The problem of deficient information would seem to imply, at most, a need to collect and disseminate information — services the market might not be able to supply.

Where there may be a public policy concern regarding the credit system is the stability of banking. The stability question is also important to banks' role in the monetary system. For example, to the extent that the demand for fiat money is derived from reserve requirements, the stability of the institutions on which the requirements are imposed becomes important. Moreover, even in a system without reserve requirements, the stability (predictability) of the demand for money (demand for the numeraire) is related to the stability of the demand for bank-produced payment services. For banks (all depository institutions), the issue of stability is particularly important given their vulnerability to macroeconomic shocks and runs.

The problem of runs can be traced to banks' reliance on par-valued liquid liabilities which they use to fund risky assets. When the market value of a bank's assets are thought to be less than its liabilities, the poorly defined, or at least unenforceable, property rights of the deposit holders to the pool of assets can cause depositors to run. Property rights can be maintained through the use of nonpar-value or marked-to-market contracts. The full economic implications of "forcing" the use of non-par-value liquid accounts are not clear, but public policy should at least not inhibit their development.

Other public policy measures to ensure bank stability, such as safety-and-soundness regulation and lender-of-last-resort, can play roles in reducing the probability of a bank run, but they do not fully address the problem of property rights in deposit contracts. Deposit insurance, in contrast, can in principle protect property rights.

To prevent runs, a deposit insurance system does not rely solely on a reserve fund; it also relies on its ability to impose *ex post* levies. The effectiveness of a deposit insurance system depends on depositors' confidence in the ability and willingness of the system to impose such fees. In this regard, a government agency might be viewed as more effective than a private firm. Some government responsibility in the provision of deposit insurance might also have the effect of internalizing within the government sector the cost of macro shocks related to fiscal and monetary policy

The benefits of federal deposit insurance have not come without a price. As it is currently admin-

istered, the system raises a number of regulatory issues regarding the incentives it provides for risk-taking. Indeed, much of the current debate over traditional safety-and-soundness issues is cast in terms of these incentives and the risk exposure of the insurance funds. At best, safety-and-soundness regulation and risk-related deposit insurance premia will be only partially successful in checking bank risk-taking and limiting the inefficiency due to deposit insurance. The insurance itself likely will continue to distort bank behavior because the losses of an individual bank remain liabilities of the insurance funds and the general taxpaying public and *not* the liabilities of the shareholders and depositors of individual banks.

The question of how government intervention in banking relates to the public interest will continue to be a controversial one. Our contribution has been to focus the debate on market failures, partly because economists generally believe that market failures are the only "appropriate" reason for regulation and partly because understanding the nature of these failures is a necessary first step in understanding the possible distributive aspects of regulation.

FOOTNOTES

1. In fact, many analyses of the effects of regulations on the banking industry (see Dothan and Williams, 1980, and Kareken and Wallace, 1978) have used models of banks in which there are no market failures. The conclusion from such models is that no regulation is best. These analyses would seem to be of little practical use, however, because their conclusions follow directly from their assumptions. In contrast, our approach tries to determine first whether there might be market failures associated with banking activities.

2. There is now a literature in economics that at least partially validates this private interest view. A large number of regulations in the airline, automotive, steel, financial, trucking, agricultural, and communication industries have been shown to be primarily attempts to restrict competition. Although these sorts of anticompetitive regulations did not serve any discernible public interest goal in terms of rectifying market failures, they probably did redistribute income.

3. Becker's model also relates to the impact of deadweight losses stemming from regulations that are primarily intended to redistribute wealth. He shows that an increase in the deadweight cost of a subsidy reduces political pressure from the subsidized group because a given expenditure results in a smaller net benefit to them. Similarly, an increase in the deadweight cost of a tax leads to greater pressure by taxpayers to reduce taxes because a given reduction in their tax rates has a smaller effect on the revenues produced.

4. One reason is that in a pure commodity system the monetary demand for the commodity (to effect trade) will lead to more production of the numeraire commodity compared to a system in which the commodity is not held for purposes of monetary exchange. Even if the commodity is in fixed supply, so that production of the commodity money is not affected, the monetary demand for the commodity will lead to its diversion from productive nonmonetary uses for monetary uses. Thus, a commodity system in which the commodity itself serves as the sole medium of exchange wastes real resources compared to a system in which the costs of holding the commodity for a monetary purpose are reduced by using other less costly mechanisms to effect exchange. Moreover, physical transfers of the commodity needed to carry out trade may be very costly compared to the use of financial assets to effect trade through an accounting system of exchange or through the use of banknotes. It might be noted that a banking system with 100 percent required reserves thus could be very costly. Such a system could be more efficient than a commodity system since it might reduce the costs of physically transporting the commodity during exchange, but it would be less efficient than a system in which the commodity was relatively freed from monetary uses.

5. We do not use the term "medium of exchange" necessarily to denote an actual physical circulating medium such as currency or banknotes. Instead, we use it to refer to all bank-provided payment services including checks, wire transfers, credit cards as well as private banknotes.

6. Although the economics of a commodity-based monetary system with bank debt as one medium of exchange were discussed by Adam Smith (1776), this part of the monetary economics literature seems to have been neglected until recently as exemplified in the work of Fama (1980, 1983), Laidler (1981), Sargent and Wallace (1982), Hall (1983), and White (1984).

7. However, there still might be a question of whether regulation would be required to limit the private issuance of media of exchange to ensure their continued usefulness. One would expect that in such a commodity-based system, competitive private market forces would require that bank debt be redeemable in the numeraire commodity to prevent banks from issuing too much debt. Without redeemability, banks might be tempted to engage in Ponzi schemes, redeeming old debt in terms of new debt. Creditors of banks (for example, depositors) might not be able to ascertain the actual financial condition of such banks because of high information costs and incentives of banks to overstate their true financial conditions. Currently, to our knowledge, all debt is redeemable for the numeraire, although not necessarily on demand.

Competition also would force banks to charge the marginal costs of operating such a system and to pay a market rate of interest on debt, points often neglected by writers on this subject. The payment of interest on and redeemability of

bank debt would limit its issuance just as the payment of interest on and redeemability of other forms of debt limit its issuance.

8. Note that privately issued banknotes under a commodity system are not fiat money because they are not the numeraire. In fact, unlike fiat money, privately issued banknotes are redeemable for the numeraire commodity and are financial assets (that is, bank liabilities).

9. This is not to say that some assets would not be used more often than others to effect transactions. For example, the transaction costs of trading with assets whose prices are uncertain might be very high and thus limit their use in most trades.

10. A fiat system may eliminate the holding of commodities for monetary purposes and thus free real resources for other uses. Even with a fiat system, however, persons may hold commodities for monetary purposes. Today, large quantities of gold appear to be held for such purposes.

Moreover, a fiat system implicitly taxes the holders of fiat money in proportion to their holdings. (The tax is the foregone nominal interest associated with holding fiat money.) This tax distorts behavior and leads persons to hold less fiat money than is socially optimal. To achieve a socially optimal quantity of fiat money holdings (see Friedman, 1969), interest must be paid on fiat (base) money either directly or indirectly through deflation, and these interest payments must be financed by a nondistorting tax such as a head tax. Since private entities do not have the power to tax, this is another reason the private sector cannot produce a socially optimal fiat money system.

Furthermore, a private monopoly supplier would have no incentive to provide the socially optimal quantity of fiat money and would be likely to maximize the real revenue from printing money instead. Thus, government regulation of such a supplier could enhance efficiency.

11. This argument could apply to all private placers of credit such as insurance companies and finance companies.

12. Another reason for a decline in the level of financial intermediation in the second half of the 1930s would be the increase in reserve requirements that occurred in 1936 and 1937.

13. Information may not be made public because it is believed that, with deposit insurance, which has effectively covered all depositors, the public would not use the information to monitor banks. Most recently, with the FDIC looking for an increased role for market discipline, consideration has been given to greater public disclosure of information on banks.

14. As mentioned earlier, in a commodity-based monetary system, a bank panic might also be a concern since it could affect indirectly the demand for the numeraire and thus, prices.

15. Even under an interest rate targeting procedure, a loss of confidence in the banking system and a "flight to quality" can pose problems for monetary policy. In the 1930s, for example, low rates on safe assets do not appear to have sent the proper signal regarding whether the Federal Reserve was providing sufficient liquidity (reserves) to the economy. Also, with federal funds rate targeting, that rate could be affected by concerns over the stability of the banking system.

Finally, the traditional concern over stability in banking and monetary control is that shifts from deposits to currency could lead to a multiple contraction in the measured money supply, such as M1, because of the system of fractional reserves. Given the lessons that have been learned from the past, it is likely that the Federal Reserve would be able to maintain the level (or growth rate) of a predefined aggregate such as M1. However, a constant growth rate of M1 might not ensure financial stability, and the Federal Reserve may be unable to predict accurately just how much money (M1) it should supply to ensure stability.

16. In the Diamond and Dybvig model, banks are mutual organizations in the sense that in the last time period any residual above the guaranteed rate of return is shared by surviving depositors.

17. Given these problems, controlling risk through supervision (monitoring and controlling risks) rather than restricting particular activities is an alternative. That is, to limit risk it is more important to monitor and control how institutions carry out various activities than it is to regulate which activities they may pursue. One caveat is that the ability of regulators to monitor a bank's riskiness may be affected by the variety of activities in which the institution is involved. In addition some risky activities may be more difficult to monitor than others even though they are not inherently more risky. But it is not clear, *a priori,* which activities would involve higher monitoring costs.

18. A similar argument could be made about interest rate ceilings. That is, if they could be enforced by eliminating nonprice competition and disintermediation, they also would represent a restriction on competition that would not appear to address any market failure but instead would create one. Moreover, with nonprice competition, such ceilings have the effect of increasing the marginal cost of deposits while lowering the marginal return compared to the competitive situation, thus creating a further distortion.

A traditional rationale for deposit rate ceilings is that unfettered competition would drive up deposit rates and cause banks to take on riskier portfolios. This view now seems largely discredited because if banks could benefit from riskier portfolios without deposit ceilings, why would they not benefit from such activities with them?

Smith (1984) has argued that because depositors are heterogeneous in terms of withdrawal probabilities and, because the information is private, that bank runs and instability might occur essentially because of adverse selection. That is, while deposit ceilings do not affect the risk of banks' asset portfolios, they can reduce the risk of bank runs. However, his analysis, which views banks as providers of insurance, is far from persuasive and raises more issues than it settles. In particular, his conclusions seem at odds with the wide variety of financial instruments with different liquidities and maturities that are provided by banks and other financial intermediaries. Moreover, it seems possible that ceilings might lead to large deadweight losses for some types of depositors and even a breakdown in intermediation altogether.

19. In the case of systemic risk, the current deposit insurance system still serves to maintain depositors' property rights and, as such, is more in keeping with the Diamond

and Dybvig prototype. One difference between the two systems is that there would be some redistribution of wealth with the current system since taxes would not likely be based on individuals' deposit holdings.

20. See Darby (1986).

21. There are a number of proposals for increasing market discipline in banking to reduce the distortions associated with deposit insurance. These include lowering the statutory maximum insurance limit as well as permitting coinsurance, which would mean that only a fraction of the depositors' balances would be covered.

The modified payout plan is another example of how the deposit insurance agencies might seek to increase market discipline. The modified pay out plan introduced by the FDIC for a short period in 1984 was intended to change formally the practice of paying off all depositors in the event of failure. With the modified payout plan, depositors with balances above the statutory maximum received only a fraction of their deposit balances based on the FDIC evaluation of what it might recover from the liquidation of assets. Such measures for reforming deposit insurance are consistent with the small depositor protection rule of insurance. However, they are not necessarily in keeping with the view that deposit insurance is needed to insure stability because of market failures (see Furlong, 1984).

Approaches to reforming deposit insurance through regulation include risk-related deposit insurance premia and portfolio-adjusted capital guidelines. The usual criticism of the regulatory approach is that it is doubtful that insurance agencies would be successful in assessing risk *ex ante*. Proposals for risk-related premia and capital requirements also have been criticized because they continue the practice of defining regulatory and supervisory guidelines in terms of book value rather than market value. One way of looking at the degree of subsidy provided through deposit insurance is the extent to which it allows the market value of an institution's net worth to go below zero. If all institutions were closed when the market value of their capital reaches zero, there would be no insurance subsidy.

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