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# New England Economic Review

Federal Reserve Bank of Boston

Nov./Dec. 1995

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*Joe Peek and  
Eric S. Rosengren*

*Is Bank Lending Important for the  
Transmission of Monetary Policy?  
An Overview*

*Joanna Stavins*

*Firm Strategies in the Personal Computer  
Market: Are Established Brands Better Off?*

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*The Soaring Trade in "Nontradables"*

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*Safety and Soundness of Financial  
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## **Is Bank Lending Important for the Transmission of Monetary Policy? An Overview**

*Joe Peek and Eric S. Rosengren*

To improve our understanding of the role of banks in the transmission of monetary policy, the Federal Reserve Bank of Boston convened a conference in June of 1995 to consider the question, "Is Bank Lending Important for the Transmission of Monetary Policy?" That banks are an important element in the transmission process is not an issue, because monetary policy operates through the banking sector. However, the description of the exact role played by banks remains hotly disputed, with the debate focusing on the importance of the role for bank lending as a transmission channel (the lending view) distinct from the generally accepted channel operating through interest rates (the money view).

Bankers, economists, and other financial specialists met to discuss whether bank lending should be considered an important component of the transmission of monetary policy. Proponents argued that changes in bank assets as well as bank liabilities influence the future course of the economy. Many economists remain skeptical of the role of banks, however, believing that a focus on interest rates or money aggregates is sufficient for understanding the transmission of monetary policy. This article presents an overview of the papers presented at the conference and the comments of their discussants. 3

## **Firm Strategies in the Personal Computer Market: Are Established Brands Better Off?**

*Joanna Stavins*

The personal computer market underwent significant structural changes throughout the late 1970s and 1980s. While some manufacturers of personal computers managed to remain in the market for a number of years, many others left after a short time. Besides the more visible movement of firms in and out of the industry, each firm also made underlying decisions regarding which models to offer.

This article analyzes model selection strategies adopted by personal computer (PC) companies from 1976 to 1988, focusing on differences between established and new firms. While new firms were more likely to produce models with similar characteristics, established firms offered a larger variety of models. With such model "dispersion" strategies, they avoided replacing their existing models and occupied new, top-of-the-line market segments before entrants. High-priced models, controlling for their technical attributes and brand effects, were more likely to leave the market. Brand effects were also significant in affecting PC models' probability of exit. Models produced by firms with more experience, both in years and in the number of models produced in the past, were more likely to survive longer. 13

# Contents

## The Soaring Trade in "Nontradables"

*Norman S. Fieleke*

In recent years international trade has flourished in a category heretofore considered largely nontradable. Services are being exchanged across national boundaries in unprecedented volumes, with growth rates exceeding those for trade in merchandise. In addition to cross-border trade, foreign direct investment and sales by foreign affiliates are also growing rapidly. The phenomenon has attracted growing attention both from impartial analysts and from government officials seeking to expand their countries' exports.

This article examines the nature of this trade and considers which countries compete most effectively. Among the various types of services traded, the most dynamic growth has occurred in private sector activities such as advertising, accounting and finance, legal services, and computer and data processing services. Obstacles to the trade, such as government barriers, are explored, and the efforts of the Uruguay Round of trade negotiations to reduce them are evaluated. 25

## Safety and Soundness of Financial Intermediaries: Capital Requirements, Deposit Insurance, and Monetary Policy

*Richard W. Kopcke*

More than two-thirds of the \$25 trillion of financial assets held in the United States is managed on behalf of investors by financial intermediaries, ranging from trusts, mutual funds, and mortgage pools to insurance companies, pension funds, and banks. Because of their importance, governments have long regulated the activities of these intermediaries to ensure sound financial markets, a foundation of secure economic development. Currently, regulators both here and abroad are considering reforms that not only might foster more efficient domestic financial markets, but also might prepare the way for more equitable global markets.

When not all investors are fully informed about the prospective returns on all assets, the cost of funds for financial intermediaries depends on savers' state of confidence in their investments. Because the regulations that govern intermediaries affect the price of risk in financial markets and because this influence varies with economic conditions, the actions of regulators, like those of the monetary authority, may need to adjust with economic conditions in order to foster the prudent valuation of assets. The prompt enforcement of fixed, risk-based capital requirements, for example, might diminish the ability of financial intermediaries to cope with economic shocks. Because capital ratios measure neither the insurance inherent in intermediaries' balance sheets nor the capacity of this insurance to contend with different risks, more revealing assessments of the safety and soundness of intermediaries should consider how their earnings and cash flows might change with economic conditions. 37

## September/October 1995 Corrections

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# *Is Bank Lending Important for the Transmission of Monetary Policy? An Overview*

**T**he importance of banks for the transmission of monetary policy has been a major topic in monetary economics for some time, and several factors have served to heighten that interest recently. One such factor has been the slower than expected U.S. recovery from the 1990–91 recession, which was accompanied by slow growth in bank lending. This spawned a substantial literature on regulatory-induced credit crunches, with a number of studies finding that bank lending behavior was a major contributing factor to the slow expansion.

A second factor has been the importance of banks in recent international economic crises. Japan, Latin America, and Scandinavia have each experienced major problems in their banking sectors that coincided with severe recessions. The role of banks in both the crises and the subsequent recoveries is likely to be the subject of research for some time.

A third factor is the recent (and ongoing) structural change in banking, which may significantly alter the role of banks in the transmission of monetary policy. As the banking industry and financial markets in general continue to evolve, it is not yet clear how useful historical data will be in understanding future business cycle fluctuations. Thus, a major concern of policymakers must be understanding the ways that changes in the banking industry and in the patterns of firm finance may alter our ability to control, or even predict, business cycle fluctuations.

To improve our understanding of the role of banks in the transmission of monetary policy, the Federal Reserve Bank of Boston convened a conference in June of 1995 to consider the question “Is Bank Lending Important for the Transmission of Monetary Policy?” That banks are an important element in the transmission process is not an issue, because monetary policy operates through the banking sector. However, the description of the exact role played by banks remains hotly disputed, with the debate focusing on the importance of the role for bank lending as a transmission channel (the lending view) distinct from the generally accepted channel operating through interest rates (the money view).

*Joe Peek and  
Eric S. Rosengren*

*Professor of Economics, Boston College, and Visiting Economist, Federal Reserve Bank of Boston; and Vice President and Economist, Federal Reserve Bank of Boston, respectively.*

The conference was designed to explore the conditions necessary for bank lending to be an important channel for the transmission of monetary policy. The first three papers, focusing on banks and bank loans, examined the conditions necessary for a distinct bank lending channel to be operative. Charles P. Himmelberg and Donald P. Morgan documented that, for many firms, other debt instruments were not perfect substitutes for bank loans, providing a rationale for why bank lending might be especially important for monetary policy. The second paper, by Joe Peek and Eric S. Rosengren, showed that both regulatory and monetary policy could alter the amount of bank lending, so that the financial condition of banks is an important factor in determining the size and nature of the effects of monetary policy that are transmitted through the banking sector. The paper by Carl E. Walsh and James A. Wilcox showed that bank lending can affect output and may indeed have played an important role in the slow recovery from the most recent recession.

The final two papers focused on borrowing by firms, in order to explore the conditions necessary for a distinct bank lending channel. Simon G. Gilchrist and Egon Zakrajšek examined the distributive impact of the bank lending channel and found that small firms rather than large firms reacted the most to tighter policy. Fabio Schiantarelli assessed the methodological issues involved in empirical tests of the implications of capital market imperfections. He also reviewed the firm-level panel data evidence from other countries, finding that in most countries it is the small firms that bear the brunt of financial fluctuations.

No clear consensus was reached on the importance of a bank lending channel distinct from the more traditional effect operating through movements in interest rates, but several themes did permeate the conference. First, credit market imperfections remain important for banks and for those firms that depend on banks for financing. Thus, banks continue to play an important role in evaluating and monitoring smaller firms with relatively little publicly disclosed financial information. However, it was also generally agreed that this role was likely to diminish as credit markets became deeper and more liquid, especially for small firms.

Second, one should not expect the impact of monetary policy to remain constant over time. Because the financial condition of firms and banks will vary over a business cycle and from business cycle to business cycle, their responses to changes in monetary policy will also vary. Thus, the impact on the economy

of changes in monetary policy will be sensitive to the state of firms' balance sheets and the health of the banking sector.

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*Significant financial innovation and regulatory changes may alter the future effectiveness of monetary policy, requiring policymakers to adapt their policy actions so as to incorporate the effect of these structural changes on the transmission of monetary policy.*

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Third, significant financial innovation and regulatory changes may alter the future effectiveness of monetary policy, requiring policymakers to adapt their policy actions so as to incorporate the effect of these structural changes on the transmission of monetary policy. With the substantial change in financial markets and financial regulations in recent years, historical data on the transmission of monetary policy may not necessarily be a reliable guide for current or future policy. This presents a significant challenge to monetary policymakers to remain abreast of financial developments and to modify their policies accordingly.

### *I. The Role of Bank Lending*

The first group of papers explores three conditions necessary for a distinct bank lending channel. First, to what extent is bank lending special for firms and, if it is critical for a subset of firms, is that subset large enough to have a macroeconomic impact? Second, if bank lending is special, can we influence bank lending with monetary or regulatory policy in a way that affects macroeconomic fluctuations? Finally, if policy can alter bank lending, will bank lending have a significant and predictable impact on GDP?

#### *Is Bank Lending Special?*

Charles P. Himmelberg and Donald P. Morgan contend that not only are bank loans special but a

surprisingly large percentage of firms continue to depend on banks for financing. They first examine whether banks' declining share of nonfinancial business credit has made banks "obsolete." Despite much previous work emphasizing the dwindling role of

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*Himmelberg and Morgan conclude that bank lending remains an important source of funds for many businesses, and one that is not easily substituted for by funds obtained through other types of intermediaries or by debt directly placed in credit markets.*

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banks, they show that the reliance of manufacturers on banks has not declined over the past decade, and that small manufacturers remain especially dependent on banks. They also show that while commercial paper has been a major source of funding for large, creditworthy firms, 83 percent of firms included in the Compustat file borrow only from financial intermediaries rather than directly accessing credit markets. Himmelberg and Morgan attribute this dependence on intermediated debt to the fact that financial intermediaries are better able to monitor borrowers and enforce covenants. This is substantiated by evidence that issuers of public debt are generally limited to large, capital-intensive firms, while borrowers dependent on intermediaries are generally small, rapidly growing high-tech and inventory-intensive firms.

While a large percentage of firms depend on intermediated debt, they do not necessarily depend on bank debt. However, for borrowers, the substitutability of intermediated debt from alternative sources is limited by the fact that intermediated debt is to a large extent a segmented market. Insurance companies provide primarily long-term credit, to match the long-term liabilities generated by insurance products. Finance companies provide short-term credit that is collateralized by assets with high liquidation values. Banks, on the other hand, specialize in short-term credit that is collateralized by illiquid assets or is unsecured.

The authors conclude that bank lending remains an important source of funds for many businesses, and one that is not easily substituted for by funds obtained through other types of intermediaries or by debt directly placed in credit markets. Nonetheless, given the continuing evolution of credit markets and financial regulation, the degree of bank dependence of firms and the degree of substitutability among alternative sources of credit may be quite different in the future.

Robert R. Glauber agreed that both empirical and theoretical work support the view that a large group of firms is, and has been, dependent on banks. However, he was not convinced that this is likely to persist in the future. In particular, a maturity mismatch between assets and liabilities for insurance companies is not much of a barrier to entry into the shorter-term loan market favored by banks, given the ease of altering the maturity of loans with new financing techniques. And, finance companies are becoming more adept at making cash flow loans as well as asset-backed loans, which would allow them to make inroads into traditional bank lending markets.

Raghuram G. Rajan argued that bank-intermediated debt continues to be important. However, he shared Glauber's view that it was likely to be less important in the future. He emphasized that if monitoring hard-to-evaluate firms was banks' comparative advantage, this advantage would be eroded as more information and inexpensive computers made processing information easier and less costly. Nonetheless, even if banks continue to lose market share to other intermediaries, an operative lending channel is still possible, although it would not necessarily be limited to bank lending.

#### *Do Monetary Policy and Regulatory Policy Affect Bank Loans?*

Joe Peek and Eric S. Rosengren find evidence consistent with both monetary and bank regulatory policy altering the supply of bank loans. However, they emphasize that to the extent a distinct lending channel exists, its magnitude is likely to be dependent on the financial condition of banks. They provide a simple static model to illustrate that capital-constrained and unconstrained banks react very differently to changes in monetary policy. In particular, when capital requirements are binding, the lending channel is eliminated. Because an increase in the availability of reserves will not release a binding capital constraint and allow a bank to expand, the increase in transactions deposits associated with the

increase in reserves is exactly offset by a decrease in nontransactions deposits at capital-constrained banks. Using data for New England banks, Peek and Rosengren provide evidence that capital-constrained and unconstrained banks react differently to changes in the federal funds rate. Moreover, because so many banks in New England were capital constrained in the late 1980s and early 1990s, the total loans aggregate for all New England banks behaved in the same manner as that for the sample of constrained banks, failing to increase in response to lower federal funds rates.

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*A major implication of Peek and Rosengren's findings is that the capital requirement constraint faced by banks, as well as the bank reserve constraint, should be taken into account in determining the likely effect of monetary policy.*

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A major implication of their findings is that the capital requirement constraint faced by banks, as well as the bank reserve constraint, should be taken into account in determining the likely effect of monetary policy. Both the nature and the size of the effect of monetary policy transmitted through the banking sector will be affected by the financial condition of banks (especially with respect to their capital) and by regulatory policy. In particular, the size of the effect operating through the lending channel will be especially sensitive, differing from one episode to another as more or fewer banks come under a binding capital constraint. Thus, it is critical that, when setting monetary policy, policymakers understand and take into account the financial condition of banks and the regulatory environment in which banks are operating.

R. Glenn Hubbard emphasized that it was difficult to distinguish fully between the effects of changes in the federal funds rate on constrained banks and on unconstrained banks, using only a limited time series for one region of the country. The limited number of observations available for the constrained sample severely limits the power of the empirical test. Hubbard suggested that a more convincing test would require a national data set, allowing for more regional comparisons and providing a better benchmark for uncon-

strained institutions. With the current sample, the large standard errors make it difficult to draw strong conclusions from the evidence. Furthermore, the results face the common problem of isolating loan supply from loan demand. He cautioned further that examining bank reactions to monetary policy shocks was only a small part of the lending view, and that more complete tests would match borrowers, loans, and lender characteristics.

Christopher James suggested that a discussion of banks' reactions to monetary policy must carefully consider more than just the leverage ratio constraints. Two institutional elements that are potentially important, but not fully discussed in the paper, are deposit insurance and risk-based capital requirements. Deposit insurance is important because it affects the substitutability between implicitly or fully insured demand deposits and uninsured large CDs. Risk-based capital is important because it affects the substitutability between alternative assets in a bank's portfolio, for example, loans and Treasury securities. Because the degrees of substitutability among alternative bank assets and liabilities are critical for the effectiveness of the lending channel, it is important to understand fully how banking regulations alter those substitutabilities. Thus, while confirming that regulatory policies must be considered when examining the transmission of monetary policy, James emphasized that regulations other than the leverage capital constraint may be equally important.

#### *How Is Bank Lending Related to Output?*

James A. Wilcox presented a paper co-authored with Carl E. Walsh that examines whether bank lending is related to output, and whether that relationship has changed over time. They estimate a vector autoregression that includes the index of coincident indicators (their proxy for aggregate economic activity), the change in the consumer price index, the nominal federal funds rate, the prime rate, and real bank loans. They assume that shocks to bank loan supply are reflected in shocks to the prime rate and that shocks to loan demand are proxied by shocks to the quantity of real bank loans. They find this identification of supply and demand to be consistent with results of both a structural vector autoregression and the Choleski decomposition of their basic vector autoregression. Consistent with their use of shocks to the prime rate as a proxy for bank loan supply shocks, they find that upward shocks to the prime rate (which they interpret as a reduction in bank loan supply) are

correlated with increases in bank capital ratios, increases in required reserves, and the imposition of credit controls in 1980, while these same factors are not correlated with their proxy for loan demand shocks.

Decomposing the shocks from their vector autoregressions, Walsh and Wilcox find that the supply of bank loans had less effect on bank lending than output or the federal funds rate but that, nonetheless, shocks corresponding to changes in capital ratios, reserve requirements, and deposit insurance fees did affect bank lending. However, in the early 1990s, reduced bank loan supply aggravated declines in lending already under way as a result of tighter monetary policy.

Walsh and Wilcox also relate loan demand and supply shocks to output and find that these shocks are not the dominant force in output movements over the past 35 years. Nonetheless, they do find that output

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*Walsh and Wilcox find that for now bank lending remains a determinant of aggregate output, even though the bank lending channel may have been attenuated by greater substitutability of other forms of credit over the past 35 years.*

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was more affected by changes in loan supply than by changes in loan demand, and that loan supply was a factor in the boom in the late 1980s and the recession in the early 1990s. Although loan supply shocks are not typically the primary determinant of recessions, Walsh and Wilcox show that they played an atypically large role in the 1990–91 recession. Still, over time the average response of both output and loan volume to loan supply shocks appears to have declined. While the bank lending channel may have been attenuated by greater substitutability of other forms of credit for bank loans, for now bank lending remains a determinant of aggregate output.

Stephen G. Cecchetti was not convinced that supply and demand had been appropriately identified. This is a problem for any empirical examination

of whether bank lending affects output. Because bank assets equal bank liabilities, distinguishing between the effects of money (bank liabilities) and loans (bank assets) is problematic. Looking at interest rates does not necessarily obviate this problem, because banks often drop low-quality borrowers rather than raise interest rates, so that the reported interest rate does not reflect the marginal cost of bank funds to a constant quality borrower. In addition, the prime rate used in this study has changed over the past 30 years in terms of both what it means and how it is set. Even without the data problems, Cecchetti was skeptical that vector autoregressions could be used to distinguish shifts of supply from those of demand. To really understand how monetary policy works through the banking system, disaggregated micro data, rather than aggregate time series data, are the most promising area for future research.

Alan H. Meltzer credited the authors with using a monthly output measure that appears to be an improvement over previous studies and with making a serious effort to show the validity of their measures of demand and supply shocks. However, he remained uncomfortable with the identification of supply and demand shocks. On the identification of supply shocks, he was particularly concerned with two characteristics not incorporated in the model, that borrowers can substitute nonbank sources of credit for bank lending and that banks can substitute nonreservable deposits for reservable deposits. In addition, the model is misspecified insofar as it omits both government securities and any measure of aggregate reserves or base money. Furthermore, Meltzer was not convinced that loan supply was a significant factor in the early 1990s. Instead, the drop in lending was a result of weak demand due to the recession and of the very slow rise in bank reserves due to restrictive monetary policy. His own view is that the effect of bank lending on output is close to zero: The supply of credit may have been important when Regulation Q was binding, but he is skeptical that bank lending has altered output at other times.

## *II. The Lending Channel: Evidence from Firms*

For a bank lending channel to be operative, firms must be unable to easily substitute other sources of credit for bank loans. Individual firm panel data can provide evidence of whether financial constraints alter firms' investment, employment, and financing deci-

sions. The next two papers examined whether evidence of financial constraints was present in data for firms of different sizes, with the second paper providing an overview of the foreign evidence of the importance of financial constraints.

### *The Importance of Credit for Macroeconomic Activity: Identification through Heterogeneity*

Simon G. Gilchrist and Egon Zakrajšek examine the role of credit in the transmission mechanism for monetary policy and as a propagation mechanism for business cycle shocks. They emphasize the financial accelerator, which, like the credit channel, relies on credit frictions. The financial accelerator emphasizes that the cost of external financing for a firm will depend on the condition of the firm's balance sheet. The premium on external finance should vary over the business cycle, across different-sized firms, and across firms with differing degrees of leverage, with these differences altering firms' investment financing decisions.

Gilchrist and Zakrajšek find that the ratio of the short-term debt of small firms relative to all short-term debt is a much better predictor of future economic activity than other debt mix variables, such as the mix between bank loans and commercial paper. They attribute these results to the effects of monetary tightening, which restricts the ability of small firms to raise external debt at the same time that large firms are expanding their debt in response to declining cash flows and rising inventories.

Gilchrist and Zakrajšek also examine firm-specific data and find that leverage as well as size alters firms' responsiveness to monetary policy shocks. They find that inventories of high-leverage firms are more responsive to a reduction of cash flow than those of low-leverage firms, and that this responsiveness increases during recessions. They conclude that monetary policy has distributional consequences, causing the effects of monetary policy to be altered by the financial condition of firms and the distribution of those firms in the economy. Thus, the impact of monetary policy will change as the composition of firms and their financial condition change, both over a business cycle and relative to similar stages of previous business cycles.

William C. Brainard emphasized that, to the extent that asymmetric information and moral hazard are still important credit market imperfections, their importance should continue to diminish as the costs of getting information and monitoring firms decrease. In

addition, such imperfections are likely to be generated by concerns with ownership and control and with bankruptcy, considerations frequently not stressed when discussing the costs of external financing. A useful line of research would be to better document the costs of external financing and whether these costs were likely to vary over the business cycle. If the responses do vary, implying nonlinear responses, they are unlikely to be captured accurately by vector autoregressions. If the effects of the financial accelerator vary over business conditions and across cycles, a movement to firm-level micro data will be necessary in order to address these issues.

Stephen D. Oliner concurred that monetary policy has a much stronger effect on small firms than on large firms, although we have probably only scratched the surface on understanding the role played by small firms in the monetary transmission process. The evidence provides a fairly strong indication that some form of a credit channel is at work, but it is not clear whether it operates through banks or is a more general

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*Gilchrist and Zakrajšek conclude that monetary policy has distributional consequences, causing its effects to be altered by the financial condition of firms and the distribution of those firms in the economy.*

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balance-sheet effect. In fact, because the composition of debt between bank and nonbank debt changes little for small or for large firms following a monetary contraction, the underlying mechanism may be a more generalized flight to quality for all lenders, rather than a distinct bank lending channel. While the evidence that large firms increase their market share of credit relative to small firms as a result of monetary contractions may indicate distributional effects, it does not necessarily tell us much about the aggregate importance of the credit channel for real economic activity. Two areas that warrant further investigation are the nature of bank relationships with small firms and the role of trade credit.

*Financial Constraints and Investment:  
A Critical Review*

Fabio Schiantarelli examines the empirical evidence from abroad on the importance of financial constraints. He begins with an overview of the difficulties faced by any empirical investigation of financial constraints. The basic approach has been to assess whether firms likely to suffer from informational and agency problems show significant departures from standard models, which are derived under assumptions of perfect capital markets and convex adjustment costs. Such tests are problematic because adjustment costs are not convex, the absence of perfect capital markets makes modeling the investment behavior of constrained firms difficult, and correctly partitioning the set of firms into subgroups of constrained and unconstrained firms is not straightforward. While these difficulties are a problem in any study of financial constraints, they can be particularly troublesome when examining international evidence, where the industrial and institutional structure can be quite different across countries.

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*Schiantarelli suggests that future research attempt to identify the information and agency problems that cause external finance to be more expensive than internal finance, thus making financial constraints important for the transmission of monetary policy.*

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Despite the difficulties in estimation, Schiantarelli finds that a number of results appear consistently. First, information asymmetries and agency problems generate significant departures from standard models derived under the assumption of perfect capital markets. Second, even though financial structures differ substantially across countries, internal finance remains the dominant source of financing. Third, in many countries, firms create business groups that allow the formation of an internal capital market that supplements the capital allocation function of the external market and improves their access to external

funds, and this access affects the relative importance of banks. Banks are particularly important in countries with less developed capital markets, but remain important even in countries with very well-developed capital markets, such as the United States.

Finally, the nature of financial constraints can vary with macroeconomic conditions, the stance of monetary policy, and the financial condition of firms. Thus, financial constraints will be influenced by both the business cycle and structural changes in financial markets, so they should not be expected to be invariant over time. Schiantarelli suggests that future research should attempt to identify more specifically the information and agency problems that cause external finance to be more expensive than internal finance, thus making financial constraints important for the transmission of monetary policy.

Steven M. Fazzari emphasized that the financial accelerator mechanism tested in the literature was not limited to a bank lending channel. Financial constraints also could work through a collateral channel, with higher interest rates reducing the value of collateral, which in turn would limit a firm's access to credit and raise the cost of internal finance, lowering investment. Alternatively, tighter monetary policy could reduce firms' profits, decreasing their cash flow. With a reduced supply of low-cost, internally generated funds, firms would reduce investment. Thus, if a bank lending channel is operative, one should find evidence of financial constraints, but such evidence is not sufficient to establish the importance of a bank lending channel. While financial constraints are important, the source of the constraints has yet to be clearly identified. Another major challenge remaining for empirical research on this topic is to separate the role played by financial variables that influence investment as a signal for future profits from their role as a signal indicating whether firms are financially constrained.

Donald D. Hester also emphasized the difficulty in testing for financial constraints. To the extent that the constraint is attributed to the banking sector, we must recognize that much commercial and industrial lending is done offshore and presumably is little affected by changes in domestic monetary and regulatory policy. He also emphasized that evidence of financial constraints on firms cannot be taken as evidence of the importance of bank lending for the transmission of monetary policy. In particular, using a firm's net worth as a proxy for being constrained suffers from reliance on a measure of the difference between sums of arbitrarily valued assets and liabili-

ties that are to a large degree endogenously determined by the firm itself. The difference between two arbitrarily valued series is likely to contain serious measurement errors, even if it were the appropriate proxy for financial constraints.

In addition, Hester notes, if firms feel credit-constrained, the market has developed substitutes. Capital-starved firms increasingly can lease equipment and structures, and joint ventures and mergers with firms with access to credit provide an obvious way of removing firm-specific constraints that might otherwise have macroeconomic consequences. In any case, the serious problems with identifying supply and demand make it difficult to conclude that the evidence provides any substantial support for the proposition that the severity of financial constraints varies over the business cycle and with the stance of monetary policy.

### *III. Conclusion*

The importance of understanding the monetary policy transmission mechanism has increased with financial innovations and changes in banking structure that have the potential to alter traditional chan-

nels of monetary policy. While most conference participants agreed that financial constraints on firms may have been important in the past, it was less clear how important they would be in the future. Recent changes can be expected to alter not only the distributional impact of monetary policy, but also the magnitude of monetary policy effects on the economy.

Financial constraints are likely to be ameliorated over time as information technology and financial innovation give even relatively small firms increased access to national credit markets, but the extent of changes in the degree of financial constraints faced by firms will be difficult to quantify. The intensity of financial constraints will vary both over time and over business cycles. Separating secular changes in financial constraints from changes over the business cycle will present a challenge to policymakers attempting to identify optimal monetary policy.

The pace of financial innovation is not independent of public policies. Regulatory policy, merger policy, and trade policy, as well as monetary policy, will affect the role of banks both in the monetary policy transmission mechanism and in the economy more generally. Understanding these changes, and adjusting policy accordingly, will remain a significant challenge for setting monetary policy in the future.

### *Is Bank Lending Important for the Transmission of Monetary Policy?*

At the Federal Reserve Bank of Boston's economic conference on June 11, 12, and 13, 1995, bankers, economists, and other financial specialists met to discuss whether bank lending should be considered an important component of the transmission of monetary policy. Proponents argue that changes in bank assets as well as bank liabilities influence the future course of the economy. Many economists remain skeptical of the role of banks, however, believing that a focus on interest rates or money aggregates is sufficient for understanding the transmission of monetary policy. The conference agenda is outlined below.

### *Is Bank Lending Special?*

Charles P. Himmelberg, Columbia University  
Donald P. Morgan, Federal Reserve Bank of New York  
Discussants: Robert R. Glauber, Harvard University  
Raghuram G. Rajan, University of Chicago

### *Do Monetary Policy and Regulatory Policy Affect Bank Loans?*

Joe Peek, Boston College and Federal Reserve Bank of Boston  
Eric S. Rosengren, Federal Reserve Bank of Boston  
Discussants: R. Glenn Hubbard, Columbia University  
Christopher James, University of Florida

### *How Is Bank Lending Related to Output?*

Carl E. Walsh, University of California, Santa Cruz  
James A. Wilcox, University of California, Berkeley  
Discussants: Stephen G. Cecchetti, Ohio State University  
Allan H. Meltzer, Carnegie Mellon University

### *What Is the Distributive Impact of the Bank Lending Channel?*

Simon G. Gilchrist, Boston University  
Egon Zakrajšek, Federal Reserve Bank of New York  
Discussants: William C. Brainard, Yale University  
Stephen D. Oliner, Board of Governors of the Federal Reserve System

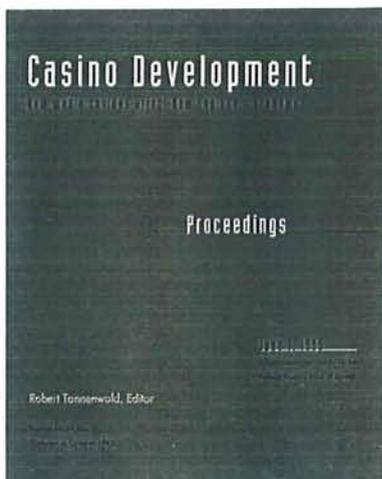
### *What Is the Experience from Abroad?*

Fabio Schiantarelli, Boston College  
Discussants: Steven M. Fazzari, Washington University  
Donald D. Hester, University of Wisconsin, Madison

The proceedings, Conference Series No. 39, will be published early in 1996. Information about ordering will be included in a later issue of this *Review*.

*Casino Development:  
How would casinos  
affect New England's  
economy?*

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In 1992, Connecticut became the first New England state to allow casino gambling within its borders. Since then, the region's other states have seriously considered whether to follow Connecticut's example. One of the most controversial, unresolved issues in these debates has been the economic effects of casino development. While interest in this issue is intense, relevant empirical evidence is scant. For this reason, the Federal Reserve Bank of Boston held a one-day Symposium on Casino Development on June 1, 1995, bringing together experts from academia, government, Native American nations, and the gaming industry. This special report summarizes the participants' remarks.

Copies of *Casino Development: How would casinos affect New England's economy?* may be obtained without charge by writing to Research Library—D, Federal Reserve Bank of Boston, P.O. Box 2076, Boston, MA 02106-2076. Or telephone (617) 973-3397.

## *Firm Strategies in the Personal Computer Market: Are Established Brands Better Off?*

**S**ince its beginnings in January 1975, the market for personal computers has ballooned. Yet the rising tide of demand has not lifted all boats, as New England and other entrants to the industry discovered. While some personal computer manufacturers managed to remain in the market for a number of years, many others left after a short time. This article examines some of the factors contributing to success in the personal computer industry, with particular attention to the role of experience.

Among the article's findings are that brand effects count for a lot. Models produced by firms with more experience, as measured by both years in business and numbers of models produced in the past, had greater longevity than similar models produced by less experienced companies. Another finding, one that runs somewhat counter to conventional wisdom, is that the more technically advanced models are introduced by the more experienced firms. This appears to be part of a dispersion strategy, by which established companies offer a variety of models, thereby avoiding replacing existing models and preempting top-of-the-line market segments. New firms were more likely to concentrate their models in a particular market segment and to introduce models embodying established technologies.

The article analyzes patterns of entry and exit of individual models in the personal computer (PC) industry. In the case of entry, firms' decisions about which models to produce are analyzed, with a focus on asymmetries in location of new products<sup>1</sup> between incumbents and entrants. Who introduces the most technologically advanced models: entrants or incumbents? Do incumbents preempt the market by segmenting it, that is, do they locate all their models in a single market segment, or do they disperse their models along the product space? The advantage of incumbents over entrants is also tested in the case of exit. The questions addressed are whether firms' reputations and experience helped them

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and their models survive in the market longer, controlling for models' prices and attributes.<sup>2</sup>

The article begins with a brief history of the PC industry in the United States, followed by an outline of some theoretical issues associated with strategic model location. Previous work in the area is then summarized. The next two sections describe the data used in this study and the way models' quality is measured. Then entry and exit results are provided. A summary and conclusions follow.

### I. History

The microcomputer or personal computer industry in the United States has undergone major changes in its market structure. The industry has grown substantially from its beginnings in January 1975, when the first microcomputer, the Altair 8800, was introduced. During its early development, the industry was dominated by a few small-scale companies, mainly hobbyist-run. Entry into the market was determined by technological innovation and the availability of system-compatible software. Companies tended to design their own software, with little compatibility among systems. IBM introduced its personal computers in 1981 and dominated the market for several years. Gradually producers of software and hardware began separating, with less vertical integration and more compatibility among products.

The 1980s brought a large number of smaller firms into the market, making the industry more competitive. Figure 1 shows changes in the market concentration in the personal computer industry, as measured by the Herfindahl index,<sup>3</sup> while Figure 2 shows changes in total employment in the computer and office equipment industry. By the end of the 1980s, substantial product differentiation had occurred, with most firms offering several models, often with several versions each. Throughout the period, new product development was the engine of the industry's rapid growth. One Massachusetts-based computer manufacturer, Data General, claimed a new product or major product modification every 10 to 12 working days in 1980 (Kuhn 1982, p. 2).

In some high-tech industries, entry by new firms may be difficult because the existing companies incor-

Figure 1

*The PC industry's market structure has become more competitive.*

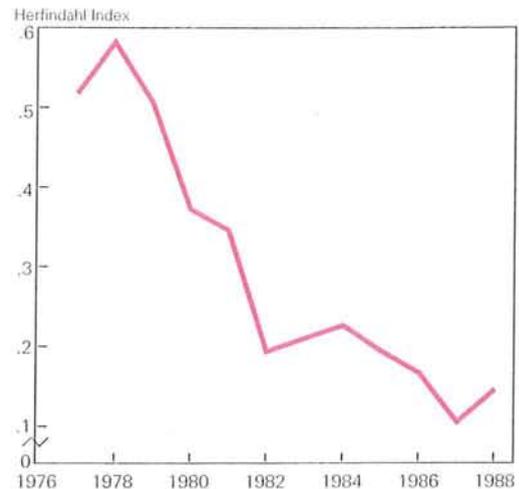
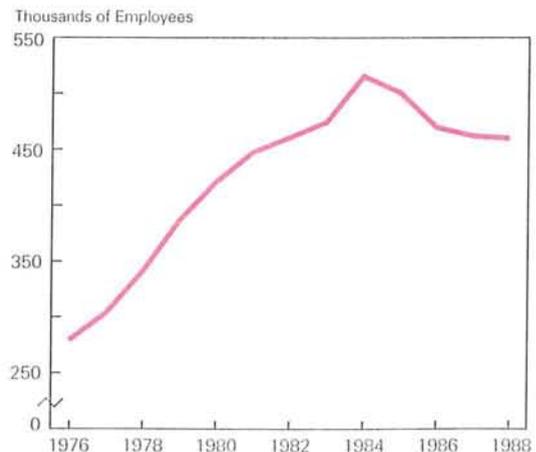


Figure 2

*U.S. employment in the computer industry increased over time.<sup>a</sup>*



<sup>a</sup>Employment shown is for SIC code 357, "Computer and Office Equipment."

Source: U.S. Bureau of the Census.

<sup>1</sup> Products and models in the PC market are used interchangeably.

<sup>2</sup> For a more detailed analysis of this topic, see Stavins (1995).

<sup>3</sup> The Herfindahl index is defined as a sum of the squares of the market shares of all the firms included in a particular market.

porate their own components that are difficult or impossible to imitate (for example, because of patent protection). In the PC market, few such technical barriers to entry were present. Existing technology typically has been widely available and components often manufactured by other firms. Despite the seemingly easy entry into the market, however, firm entry and new product introduction required sunk entry costs, such as establishing retail channels and advertising. With the continuously evolving market, few companies managed to survive in the market beyond one or two years. As Figure 3 shows, the majority of exiting firms were only one year old.

In industries with firms producing several different products such as PCs, individual firms need to decide which *models* to introduce, not just whether to enter or leave a given market. The situation becomes even more complicated in the case of firms producing several products. Incumbent firms introducing new products must decide whether to replace their old models with similar new ones (possibly “cannibalizing” their own products) or to enter new segments of the market. In other words, firms decide where to place their new models in a “space” of existing products. Such spatial location decisions might be

intended to deter entry by other firms. Industries with firms producing several different goods allow for analysis of entry and exit of products, and of strategic behavior on the part of their producers.

## II. Theoretical Background

In the PC market, a decision about which models to offer for sale is strategic, not simply technological. PC components are, to a large degree, produced by firms other than those that sell complete systems. Indeed, the technology embodied in microprocessors and storage devices can be assumed to be available to any firm at a given time. Each firm chooses which models it is going to offer, subject to the constraints imposed by existing technology. Incumbents face a choice:

- (1) They can place all their models in a single segment of the market, by locating their new models close to their existing ones. The strategy allows firms to take advantage of their “local” scope economies<sup>4</sup> but at the same time creates substitutes for their previous models. This strategy results in market segmentation, where each firm produces only close substitutes.
- (2) They can try to preempt the entire market by placing their new models further away in product space. That way they avoid cannibalizing their existing models and occupy empty market niches before entrants do. This strategy leads to market interlacing, where various firms’ models alternate.

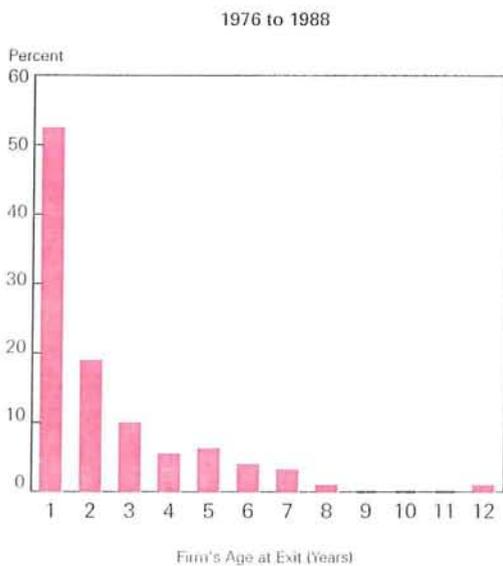
If existing firms choose the first strategy, they may steer customers away from their own existing products in favor of their new products. But entering new market segments is more risky, as it entails incorporating new technology before it is established in the market and accepted by consumers.

In the PC market, existing firms have significant advantages over potential entrants. For example, consumers are more likely to buy familiar brands, and older firms may have long-term contracts with distributors, lowering their costs relative to those of new firms. Because of such considerations, new entrants may be forced to search for empty market segments to avoid price wars with more established firms. Hence,

<sup>4</sup> Economies of scope exist when it is cheaper to produce several products jointly than each one separately. For example, it may be cheaper to produce screws and nails together than each in a separate establishment, since the bulk of the investment (factory, machines, labor) has already been made.

Figure 3

*Few firms survived beyond their first year.*



incumbents would be expected to distribute their models along the entire spectrum to make entry by new firms difficult.<sup>5</sup> Under this scenario, incumbents' models will be more dispersed in product space than new entrants' models.

### III. Previous Research

Beginning with Hotelling's (1929) model of spatial location (see the box), several theoretical models of entry deterrence and preemption in a multifirm market have been developed. In Hotelling's model, two identical firms locate next to each other along a line. The results change in the case of heterogeneous firms, sequential entry, and companies producing several products, but few analyses deviate from the standard assumptions.

The results of the theoretical studies are inconclusive. While some support the market segmentation scenario, others conclude that market interlacing is more likely. The results depend heavily on the assumptions of specific models, such as number of competitors, order and timing of their entry into the market, whether they produce one or more goods, and whether the products are identical or differentiated. The market segmentation results are shown in Schmalensee (1978) and in Eaton and Lipsey (1979). In Schmalensee (1978), the market was dominated by a small number of colluding firms, which localized their brands in order to deter entrants most effectively. In Eaton and Lipsey's (1979) model, an incumbent monopolist in a growing industry introduces a substitute for his own product before an entrant does, in order to preempt the market.

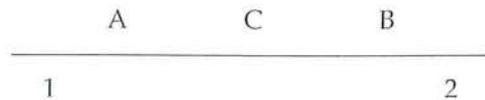
Market interlacing results from the models of Bonanno (1987), Spence (1976), and Brander and Eaton (1984). Bonanno (1987) showed that with no threat of entry, existing firms would locate as far away as possible from each other. If they faced a threat of entry, incumbents would deter entrants by greater product dispersion, in order to create competition in all market segments and make entry unprofitable. In Spence's (1976) model, a firm would not offer substitutes for its own product, as that would lower demand for its existing commodity. The firm would opt for

<sup>5</sup> Some theoretical studies predict that an existing firm producing several products will preempt the entire market with its own products. See, for example, Prescott and Visscher (1977), Eaton and Lipsey (1979), Eaton and Kierzkowski (1984). However, since it is costly to introduce new models, incumbents must limit the number of models they market.

#### *Hotelling's Model of Spatial Location*

The idea of spatial location of firms began with Hotelling's (1929) model. In his model, two ice cream vendors (1 and 2) decide where to locate along a single street. The vendors are identical in all respects (they offer an identical product at the same price), except for their location. Every block has the same number of consumers, each buying one ice cream cone. Consumers care only about proximity to the vendor—they always buy from the nearest one.

In the picture below, person A will prefer to buy from vendor 1, while person B will choose vendor 2. Person C, located equally far from the two vendors, is indifferent between them. Where should the vendors locate to maximize their profits? Each wants to be closest to the highest possible number of consumers, whatever the location of the other vendor. Each vendor also assumes that the other will remain in his current location. In the picture below, vendor 2 would locate just to the right of vendor 1 (because then everyone to the right of vendor 1 would buy from him), while vendor 1 would locate just to the left of vendor 2 (because then everyone to the left of vendor 2 would buy from him). As a result, the two vendors would get closer and closer to each other. In the end both vendors would locate in the middle of the street, each serving half of the city residents. The Hotelling model explains why fast food vendors and gasoline stations often locate on the corners of the same intersection. Although Hotelling used geographic space, his model could also be applied to characteristic (quality) space and the location of individual products in that space.



more distant products instead. Brander and Eaton (1984) showed that with no entry, a segmented market structure yields higher profits, but a possibility of entry reverses the result.

The theoretical results are thus inconclusive. Empirical analysis is clearly required, but no previous empirical papers have measured the degree of model dispersion by firms.

#### IV. Description of the Data

The data set includes annual prices and technical attributes for new personal computers sold in the United States from 1976 to 1988.<sup>6</sup> For each observation, the data include a set of technical specifications and a price, as well as each model's name and its producer. Table 1 lists the major attributes and their descriptive statistics.

Table 1  
Summary Statistics for Major Variables,  
1976 to 1988

PC Variable	Mean	Std.		
		Deviation	Min.	Max.
Price (dollars)	2726	2119	40	13995
RAM Memory (KB)	500.7	496.4	.5	4096
Clock Speed (MHz)	7.75	4.81	.5	25
Hard Disk Capacity (MB)	15.58	34.48	0	314
Number of Floppy Drives	1.07	.61	0	3
Number of Slots	4.72	3.72	0	22
Dummies:				
16-bit Processor	.480	.500	0	1
32-bit Processor	.124	.329	0	1
B&W Monitor	.408	.492	0	1
Color Monitor	.028	.166	0	1
Portable	.156	.363	0	1
Additional Hardware	.018	.134	0	1
Discount Price	.278	.448	0	1

The definition of a model changed over time. Initially, models did not carry discrete options for memory, storage capacity, and the like; rather, models had fixed specifications. Towards the end of the sample period, however, most models could be customized with alternative configurations of memory, speed, and hard disk capacity. However, firms still had to make the strategic decision of whether to introduce a new model or continue the old one with new specifications. Introduction of a new model carries a fixed cost of a new design, marketing, and dealer arrangements. The sample has 134 firms and 472 models.

#### V. Measuring Quality

Personal computers are vertically differentiated products, composed of a variety of characteristics.<sup>7</sup> Each attribute is measured in different units. To com-

pare locations of many different models in an imaginary product "space" (similar to Hotelling's street), it is necessary to adjust for differences along several dimensions. This study summarizes the most important attributes in a single "quality" measure. After each model is assigned a quality measure, the models' location along a line can be compared. Each PC model  $m$  is assigned a single-dimensional quality  $q_m$ , equal to the weighted sum of its specifications  $z_{jm}$  (with  $j = 1, \dots, J$ ), with weights  $\beta_j$ :<sup>8</sup>

$$q_m = \sum_{j=1}^J \beta_j z_{jm} \quad (1)$$

The weights  $\beta_j$  should represent the marginal value that consumers and producers place on the  $j^{\text{th}}$  attribute, which can be approximated by the estimated marginal implicit prices from a hedonic regression (see the box).

#### Hedonic Regression

Table 2 reports hedonic regression estimates of coefficients on major technical attributes, producer dummies, and age of each model, based on how they contribute to real prices of personal computers.<sup>9</sup> For each model  $m$ , produced by firm  $i$  in year  $t$ , the hedonic regression is:

$$\ln P_{mit} = \beta_0 + \beta_i + \beta_t + \beta_1 \ln(\text{RAM}_{mit}) + \dots + \beta_j \text{AGE} + \dots + \varepsilon_{mit} \quad (2)$$

where  $\beta_j$  ( $j = 1, \dots, J$ ) indicates an estimated coefficient on the  $j^{\text{th}}$  characteristic. Most coefficients on the technical attributes are positive and statistically significant, indicating that adding an extra unit of storage (hard disk), memory (RAM), or speed (MHz) raises

<sup>6</sup> The data were originally collected by Cohen (1988) and later updated by Kim (1989). Sources include technical model reviews in June issues of *Byte*, *PC Magazine*, and *PC World* for list prices and attributes, as well as ads in the Business section of June Sunday issues of *The New York Times* for discount prices.

<sup>7</sup> Products are said to be vertically differentiated if all consumers agree on which products they prefer when all the prices are equal. For example, most consumers would choose a Cadillac over a Chevy if their prices were the same. By contrast, products are horizontally differentiated if the optimal choice depends on consumer taste. For example, some consumers would choose a red car, while others may prefer a blue one.

<sup>8</sup> The index is a valid approximation of the correct quality if product characteristics are separable, that is, if a change in one characteristic does not affect the impact of other characteristics on quality. See Triplett (1987) for details.

<sup>9</sup> "Real prices" indicates prices in 1982 dollars.

### Hedonic Estimation

Hedonic regression is used to estimate the relationship between product prices and the attributes of respective products. The estimated coefficients on attributes in the hedonic equation represent marginal implicit prices of each attribute. For example, to find out how much more would be paid for an additional cubic centimeter of engine capacity in a car (how much the market has judged that cubic centimeter to be worth), one could estimate a regression of automobile prices on engine capacity, size of wheelbase, number of cylinders, horsepower, a set of dummy variables indicating whether a car has anti-lock brakes, power doors, and air conditioning, as well as its make. A coefficient on the engine capacity variable would indicate the price of an additional unit of capacity, holding all the other measures constant.<sup>10</sup> Similarly, in the case of personal computers, a hedonic coefficient on clock speed indicates the implicit price of an additional megahertz of speed, even if units of speed are not offered for sale. Hedonic coefficients represent the value attached to each attribute by the market, encompassing both demand for a particular characteristic and the additional cost a company has to incur to add an extra unit of that attribute. Hedonic coefficients are used as weights for the quality measure shown in equation (1).

the price of a PC. Strong brand effects also show up: PCs manufactured by major firms command a higher price than similar machines that carry lesser, unknown brand names, controlling for other attributes. The reason for the brand effect is that reputation and name recognition may raise the established firms' value to consumers. By contrast, year dummies (which indicate the average difference in price between each year and 1976, controlling for other attributes) have negative coefficients. The estimated coefficients on year dummies indicate that PC prices dropped sharply year after year, controlling for quality and brand effects. In earlier research, Berndt and Griliches (1993) found that quality-adjusted prices of PCs declined by an average of 28 percent per year.

<sup>10</sup> See, for example, Griliches (1971 and 1988) for a discussion of hedonic estimation.

Table 2  
*Hedonic Regression of PC Prices on Attributes,<sup>a</sup> 1976 to 1988*

Variable	Coefficient	t-Statistic
Intercept	6.517	47.60
log (Hard Disk)	.164	19.64
log (RAM)	.336	18.10
log (MHz)	.228	5.82
log (Number of Floppy Drives)	.370	7.98
log (Number of Slots)	.087	4.38
Model Age	.055	3.95
Attribute Dummy Variables:		
Black & White Monitor	.068	2.53
Color Monitor	.126	1.93
Discount Market	-.274	-9.86
Extra Equipment	.222	2.68
Portable	.224	5.66
16-bit Processor	.248	7.24
32-bit Processor	.575	9.59
Producer Dummy Variables:		
Apple	.181	2.67
Atari	-.561	-7.66
Commodore	-.388	-6.23
Compaq	.338	6.51
IBM	.037	.75
NEC	.140	2.25
Radio Shack	-.010	-.45
Zenith	.244	3.78
Wyse Technology	.040	.54
Epson	-.117	-1.53
Kaypro	.098	1.18
NCR	.319	4.04
Northgate	.192	1.94
Year 1977	-.572	-3.45
Year 1978	-.823	-4.77
Year 1979	-.924	-5.85
Year 1980	-.985	-6.44
Year 1981	-1.212	-7.79
Year 1982	-1.452	-9.46
Year 1983	-1.918	-12.80
Year 1984	-1.948	-12.89
Year 1985	-2.375	-15.30
Year 1986	-2.799	-17.76
Year 1987	-3.125	-19.62
Year 1988	-3.501	-21.45
R <sup>2</sup> = .759		F = 115.7
		N = 1436

<sup>a</sup>Dependent variable is log (Real Price), where prices are measured in 1982 dollars. The omitted firm category is "Other."

### Quality Space

To reduce several attributes to a single-dimensional measure, a single number representing quality was assigned to each PC model. Quality was mea-

sured as a weighted sum of each model's attributes, such as storage, memory, and speed. The attribute weights,  $\beta_{jt}$ , were derived from the hedonic estimation described above. Since implicit prices of technical attributes of PCs declined significantly over the period covered by the data, a separate hedonic regression was estimated for each year. The equation in Table 2 is therefore illustrative only and represents average coefficients on attributes over time.

## VI. Entry

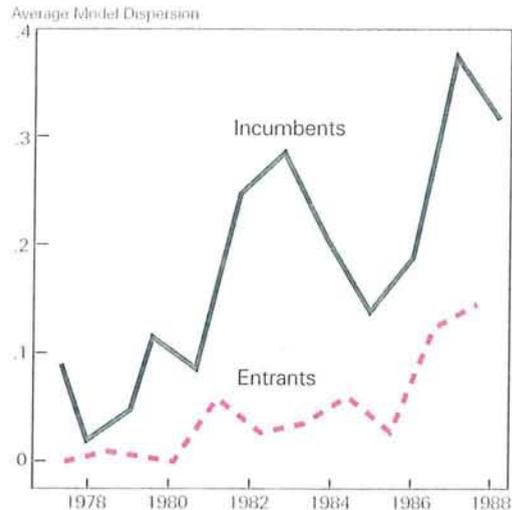
Both incumbent and entering firms make strategic spatial location decisions when they introduce new models into the market. Existing firms try to keep potential new entrants away, that is, to deter future entry. In industries where each firm produces a single product, the optimal strategy is for firms to distribute themselves evenly in the product space so as not to leave any empty spaces for new entrants.<sup>11</sup> Such a strategy is most likely to prevent potential entrants from coming into the market. But in the case of firms that produce several different products, such as the PC industry, an existing firm must decide where to place its new models relative to the existing models, taking into account not only potential entrants' products, but also possible effects on the demand for its own products.

### Dispersion among Models

A measure of within-firm model dispersion was constructed to test the hypothesis that incumbents spread their new models along quality space more than entrants.<sup>12</sup> For each firm, the within-firm disper-

Figure 4

*Incumbent PC firms show higher dispersion in model quality than entrants.*



sion measure was compared with overall dispersion in the PC market in that year to obtain a measure of relative dispersion—that is, the degree to which a firm's models were dispersed in the quality space relative to those of other firms.

As can be seen from Figure 4, incumbents had a consistently higher model dispersion than new entrants, consistent with the hypothesis. The dispersion was also higher for older firms, on average, as can be seen in Figure 5. The difference could not be attributed to the fact that new firms introduce fewer models; the dispersion measure controls for the number of models, and firms that came in with only one model were not included in the dispersion analysis (they had no dispersion).

Econometric estimation was used to determine whether dispersion changes continuously with the age of firms or asymmetry exists between entrants and incumbents, and whether firm experience accumulates with years on the market or with the number of models a firm has produced. Table 3 shows the estimated relationship between the relative dispersion index and a set of factors that might explain firm decisions regarding the spatial location of their models.

Older firms ( $FIRMAGE_{it}$ ) with more model expe-

<sup>11</sup> See, for example: Bonanno (1987); D'Aspremont, Gabszewicz, and Thisse (1979); Hay (1976); and Schmalensee (1978).

<sup>12</sup>  $\sigma_{it}$  is a measure of within-firm dispersion:

$$\sigma_{it} = \frac{\sum_{m=1}^{M_{it}} (q_{mit} - \bar{q}_{it})^2}{M_{it}}, \text{ where } \bar{q}_{it} = \frac{\sum_{m=1}^{M_{it}} q_{mit}}{M_{it}},$$

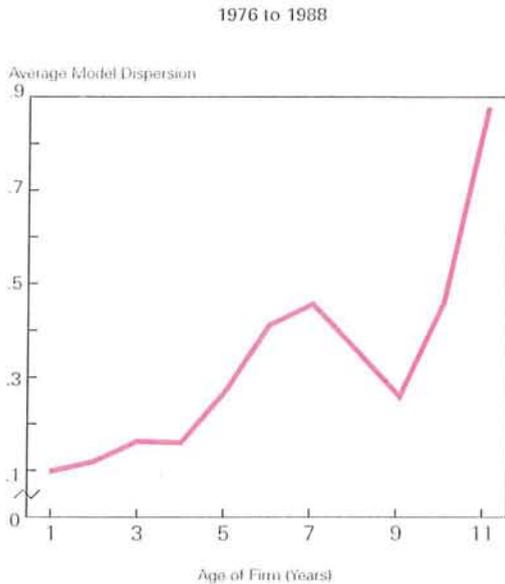
$q_{mit}$  is quality as described in equation (1), and  $M_{it}$  is the number of models produced by firm  $i$  in year  $t$ .  $\sigma_t$  is the total dispersion of all the models in year  $t$ :

$$\sigma_t = \frac{\sum_{i=1}^{N_t} (q_{it} - \bar{q}_t)^2}{N_t}, \text{ where } \bar{q}_t = \frac{\sum_{i=1}^{N_t} q_{it}}{N_t},$$

and  $N_t$  is the total number of models produced by all firms in year  $t$  ( $N_t = \sum_i M_{it}$ ).  $R_{it}$  is the relative dispersion index:  $R_{it} = (\sigma_{it} / \sigma_t)$ . Only firms with at least two models on the market were considered in the dispersion analysis.

Figure 5

*Older firms dispersed their models more.*



rience were indeed more likely to have higher model dispersion and thus to “cover” the whole quality spectrum. The result is consistent with persistently strong brand effects in the PC industry. Once a firm established brand recognition, it utilized it to cater to

Table 3  
*Relative Model Dispersion<sup>a</sup>*

Variable	Coefficient	t-Statistic
Intercept	-.017	-.29
ENTRANT <sub>it</sub>	.043	.90
FIRMAGE <sub>it</sub>	.051	4.23
PIONFIRM <sub>it</sub>	.102	1.88
NMODCUM <sub>it-1</sub>	.019	2.98
NUMFIRM <sub>it-1</sub>	.001	.75
Number of observations		323

<sup>a</sup>Dependent variable is  $R_{it} = \sigma_{it}/\sigma_{it}$ , a relative dispersion index for firm  $i$  in year  $t$ . ENTRANT dummy equals 1 if firm is an entrant; FIRMAGE is firm's age; PIONFIRM dummy equals 1 if firm is “pioneering,” that is, if it ever produced a model incorporating frontier technology; NMODCUM is number of models firm has introduced before current year; and NUMFIRM is number of firms in previous year. More details can be found in Stavins (1995).

all market segments. For example, once Zeos got a reputation for its quality and service, it diversified by introducing more advanced models, such as portables.<sup>13</sup> At the same time, the established firms continued their production of technologically “obsolete” models, thereby expanding their model spectrum over time.

Regardless of a firm's age, the more “experience” it had (as measured by the number of models it had marketed in the past,  $NMODCUM_{i,t-1}$ ), the more dispersed were its models. The effect may be due to the fact that the more models a firm produces, the more established is the firm's reputation and the larger are its cost advantages due to economies of scope. Those advantages were reflected in the firm's strategic decision to disperse its models through product space.

### “Leapfrogging”

A popular belief is that new entrants in high-tech markets “leapfrog” existing firms by being first to introduce the most advanced technology. This hypothesis was tested for the PC industry by comparing quality of new models introduced by incumbents and entrants. If the popular belief were true, new firms would be the ones to introduce the most advanced technology. As Figure 6 shows, however, the opposite turned out to be true in the PC market: On average, new models introduced by incumbents were of higher quality than those introduced by new entrants. Thus, while existing firms were typically first to offer the most technologically advanced products, new firms located their models in more established market segments. New firms may not be able to afford the risk of being first in new market segments.

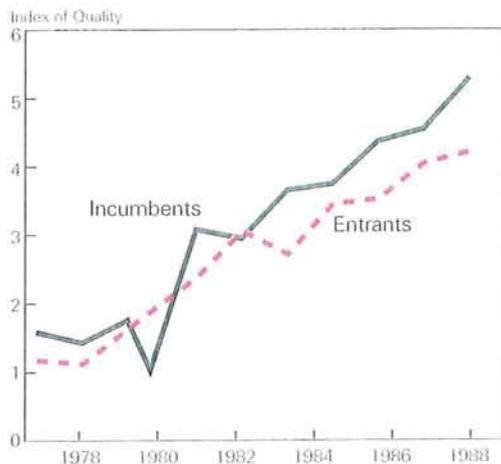
## VII. Exit

Despite the industry's growth since its beginnings in the 1970s, firms and models have continually left the market. Some firms' models may tend to stay in the market longer because of those firms' reputations or economies of scope due to learning effects. But model exit can also be due to individual model effects; a model may be overpriced relative to other models

<sup>13</sup> Similar effects can be observed in other markets. For example, once Cuisinart established its reputation as a maker of food-processors, it took advantage of the brand recognition and began marketing other products, such as pots and pans, with a Cuisinart label.

Figure 6

*Incumbents introduced higher-quality models than entrants (on average).*



with similar attributes. Regression analysis can quantify how important the two types of effects were in inducing the exit of PC models from the market during the 1976–88 period.

### Firm Effects

Firm-specific reasons for model exit may be related to the firms' order of entry into the market. They may be associated with what Schmalensee (1982) called "pioneering brands." He showed that coming in early pays off: Customers are more likely to continue buying the brand they recognize, even if a new entrant introduces a cheaper version of the same product. If costs of switching away from incumbent producers in the PC market turn out to be high, new entrants' models would fail to gain market share and would tend to leave the market first. Brand loyalty is more likely to attach to firms than to individual models, since with rapidly advancing technology customers are unlikely to make repeat purchases of the same model.

A firm's long market tenure (due to outstanding management, for example) also gives it a potential advantage of accumulated experience. Likewise, pre-

vious investment in advertising and R&D may make a firm's models more likely to remain in the market than similar models by other firms.<sup>14</sup>

### Model Effects

To account properly for the firm effects and to test whether established firms had advantages over new entrants in model exit, individual model effects have to be controlled for. Previous work supported the idea that higher-priced models have something customers are willing to pay for, even if the "something" cannot be observed in available data (Trajtenberg 1990; Berry, Levinsohn, and Pakes 1995). However, high prices may also indicate that a particular model was simply overpriced given its attributes. Since coefficients on model attributes in a hedonic regression represent both costs of production and valuations of attributes by consumers, those coefficients can be used to calculate a predicted model price, with which the actual price can be compared.<sup>15</sup> The difference can have two distinct interpretations: (1) a markup of price over cost, thus measuring over- or underpricing of a model; or (2) some unmeasured quality of a model. These differences are used here as a measure of relative overpricing of PC models (holding their attributes constant) to test whether overpriced models are more likely to exit the market.

### Analysis

On average, models that exited the market had higher prices relative to prediction than models of the same age that stayed for at least one more year (Table 4). However, firm-related factors also appear impor-

Table 4  
*Exiting Models Had Higher Price-Cost Markups, 1976 to 1988*

Did the model exit that year?	Average Difference Between Predicted and Actual Price (Price-Cost Markup)
Yes	.05
No	-.04

<sup>14</sup> A firm's models may leave the market simply because the firm goes out of business. In order to isolate that effect, this study separately analyzed models produced by continuing firms only.

<sup>15</sup> The difference between the actual and predicted prices is equal to the hedonic residuals.

tant in determining exit, with incumbent firms having an advantage over new entrants: As Table 5 shows, over 40 percent of the models leaving after their first year on the market were produced by new firms. Over one-third of the models that left after their first year were produced by new firms that themselves left the market. The causality of events could go in either direction: Firms might have exited because of their poor management and high costs, but they also might have left because their models were inferior.

The probability that a model exited in a given year was estimated (in logit form) as a function of firm and model characteristics, including measures of model overpricing (Table 6). The coefficient on the difference between predicted and actual price (RESID) is both positive and significantly different from zero,

Table 5  
*Exit of Models and Firms from PC Market, 1976 to 1988*

Over 40% of models that left the market in their first year were produced by new firms . . .

Firm's Age	Number of Models	Percent
1	112	41.79
2	38	14.18
3	35	13.06
4	25	9.33
5	25	9.33
6	14	5.22
7	3	1.12
8	11	4.10
9	2	.75
11	3	1.12
Total	268	100.00

. . . and most of those firms left the market themselves

Age of Firm at Exit	Number of Models	Percent
1	99	36.94
2	43	16.04
3	39	14.55
4	26	9.70
5	26	9.70
6	14	5.22
7	4	1.49
8	12	4.48
9	2	.75
11	3	1.12
Total	268	100.00

Table 6  
*Probability of Model's Exit,<sup>a</sup> 1976 to 1988*

Variable	Coefficient	t-Statistic
Intercept	-.285	-1.50
RESID <sub>mit</sub>	1.421	3.56
RESSIGN <sub>mit</sub>	-1.142	-2.23
FIRMAGE <sub>it</sub>	-.115	-2.91
ENTRANT <sub>it</sub>	.440	2.16
MODELAGE <sub>mit</sub>	.211	3.25
NMODCUM <sub>i,t-1</sub>	.095	5.86
PIONFIRM <sub>i</sub>	-1.586	-7.61
PIONMODEL <sub>mit</sub>	.367	1.15
N	1092	
chi <sup>2</sup>	133.04	
log likelihood	-681.14	

<sup>a</sup>Dependent variable is the probability of exit of model *m* by firm *i*, in year *t*. RESID is residual from annual hedonic regressions; RESSIGN is signed residual square (+ for positive, - for negative); FIRMAGE is firm's age; MODELAGE is model's age; and NMODCUM is number of models firm has introduced before current year.

indicating that the difference captures model overpricing rather than unmeasured value to consumers, and that overpriced models are indeed more likely to exit the market. The second variable, however, indicates that the marginal effect of the difference diminishes as the difference gets bigger (plus or minus).<sup>16</sup> The size of these two coefficients can be interpreted as follows: If a firm doubles the price of its model without changing the model's attributes, its likelihood of exiting rises. How much it rises depends on its previous likelihood of exiting: If the model's likelihood of leaving the market was 0.25, doubling the price will raise it to 0.33; if it was 0.5, it will be 0.6; and if it was 0.75, it will now be 0.82.<sup>17</sup> When an interaction term of ENTRANT and RESID was included in the model, the coefficient was positive. That indicates that when new entrants

<sup>16</sup> The difference between positive and negative residuals is captured by the signed residuals squared (RESSIGN,  $+e^2$  for positive residuals,  $-e^2$  for negative ones). Since the signed residuals squared coefficient is negative, the residuals' effect diminishes as its absolute value grows larger.

<sup>17</sup> If a firm doubles the price of its model without changing the model's attributes, the hedonic residual on the model will increase by 0.693. Because the probability of model's exit is estimated using the logit model, it follows that

$$\frac{\Pr(\text{exit})}{\Pr(\text{no exit})} = e^{\alpha\beta}$$

An increase in the residual by 0.693 will in turn translate into an increase in the model's probability of exit from the market relative to the previous probability of exit:

$$\Pr_1(\text{exit}) = \frac{1.5 \Pr_0(\text{exit})}{1 + 0.5 \Pr_0(\text{exit})}$$

overprice their models, they increase the likelihood of their models leaving the market even more than that of incumbents that overprice.

The FIRMAGE coefficient is negative and significantly different from zero, indicating that older firms' models are less likely to exit than younger firms' models. Two explanations of the advantage are possible: Either the longer the firm has been on the market, the lower are its costs (due to learning effects),<sup>18</sup> or consumers develop brand loyalties and buy models manufactured by firms they trust. If the former is true,

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*Brand loyalty and reputation  
apparently allow firms to compete  
successfully in the market despite  
some overpriced models.*

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a firm's costs decrease as the firm gets more established. In that case, an older firm's models would be cheaper and the difference between predicted and actual price lower. Since no such difference exists between newer and more established firms, the brand loyalty explanation for firm effects seems more plausible than the learning effect theory. Furthermore, new entrants' models are more prone to exit the market even controlling for firm's age, as shown by the positive and significant coefficient on the ENTRANT dummy.

Another interesting question is whether selling overpriced models makes a firm drop out of the competition. There is no evidence for that: The correlation between a firm's overpricing and its probability of exit or its number of new models is not significantly different from zero. Thus, brand loyalty and reputation apparently allow firms to compete successfully in the market despite some overpriced models.

### VIII. Summary and Conclusions

Following developments in the personal computer industry over time is no easy task. The industry has undergone tremendous changes with technological innovation and new product development, and continuous movement of firms and products into and out of the market. What can be learned from observing those changes? Does firm behavior follow certain

patterns? Which firms are first to embody the most advanced technologies in their models when initially developed: existing firms or new entrants? Do firms preempt the market by gathering all their products in a single segment of the market, or do they disperse them along the product space?

This study uses data on prices and attributes of individual PC models sold in the United States between 1976 and 1988 to analyze patterns of model entry and exit. Application of hedonic coefficients as weights on individual model characteristics allows computer models differentiated in many attributes to be projected onto a linear quality scale. Such a linearization allows comparisons of model selection across different firms and over time. Contrary to popular belief, the findings indicate that new entrants do not "leapfrog" existing firms in the introduction of new technology. Incumbent firms offer the most technologically advanced products, while new entrants locate in more established market segments. At the same time, incumbent firms take advantage of their brand recognition and continue offering their older models. As a result, incumbents' models tend to be more dispersed throughout product space than entrants' models.

Firm effects were also significant in determining the probability of a model's exit. In particular, older firms were more likely to keep their models from leaving the market. New entrants were particularly vulnerable; their models were more likely to exit the market than other firms' models, even controlling for overpricing and firms' age. The study also finds that overpriced models are more likely to exit the market, regardless of the age and experience of their producers.

Despite large differences among PC models, persistent firm effects were documented in all parts of the study. Those effects cannot be explained by the models' characteristics. Firms gain their advantage over time; the older the firm, the more likely it is to be successful. The advantage could be due either to learning effects (tenure on the market lowers firms' costs) or to firms' reputations stemming from brand name recognition. This study found no conclusive evidence for the learning effects, but strong evidence that established firms gain brand name advantages. The results show that established firms use their

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<sup>18</sup> Because model-specific fixed costs decrease with the number of models introduced (due to increasing returns to R&D, advertising, and retail agreements, for example), the older the firm, the lower are its costs of model introduction. The decrease in costs associated with cumulative output is consistent with Lieberman's (1984) result.

advantage to preempt the market by dispersing their models along quality space.

Those results shed light on firms' behavior in industries with firms producing several different products. Brand recognition is very strong, even in such a rapidly evolving market as the PC industry. Therefore, firms should benefit from aggressive mar-

keting strategies early on. Once their brands are established and their names recognized, they may try to redeem some of the early investments. On the other hand, consumers are more likely to get better deals by buying products manufactured by new entrants, which often offer promotions and discounts to get their foot in the door.

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# *The Soaring Trade in “Nontradables”*

**I**n recent years international trade has flourished in a category heretofore considered largely nontradable. Services are being exchanged across national boundaries in unprecedented volumes, with growth rates exceeding those for trade in merchandise. The phenomenon has attracted growing attention both from impartial analysts and from government officials seeking to expand their countries' exports.

What is the nature of this trade, and what accounts for its growth? Which countries compete most effectively in the trade? What government barriers obstruct it, and are they to be significantly lowered under the Uruguay Round trade agreements? These are the primary questions addressed in this article, which gives special attention to the United States.

## *I. The Nature of Services*

In economic theorizing, services, unlike goods, have commonly been treated as nontradable across national boundaries. The hackneyed illustration is the haircut; nobody has yet shipped one across a frontier (or, to our knowledge, across anything else). Yet services have long been included among the international, or “cross-border,” transactions recorded in every nation's balance of payments.

This paradox arises from the differing concepts of services employed in elementary economic theory and in balance-of-payments accounting. The archetypal service of international economic theory—the haircut—does not flow across national borders. However, the providers or recipients of such services do cross the borders; and by the principles of standard balance-of-payments accounting, a cross-border, or international, transaction takes place if a resident of one country provides a service for someone whose residence is in another country, regardless of where the service is rendered. Thus, if a U.S. barber trims a Canadian's

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Table 1  
*World Merchandise and Services Exports, 1986–87 to 1992–93*<sup>a</sup>

	Value (Billions of Dollars)		Percentage Change 1986–87 to 1992–93	Ratio of Services to Merchandise	
	Average for 1986–87	Average for 1992–93		1986–87	1992–93
Total					
Merchandise	2,132.7	3,575.0	68		
Services	515.4	967.8	88	.24	.27
Industrial Countries					
Merchandise	1,570.2	2,547.3	62		
Services	407.1	742.6	82	.26	.29
Developing Countries					
Merchandise	562.4	1,027.8	83		
Services	107.0	224.0	109	.19	.22

<sup>a</sup>Excluding countries of the former Soviet Union, except Estonia in 1992–93.  
 Source: International Monetary Fund, *Balance of Payments Statistics Yearbook*, 1993 and 1994, Part 2, Table B-1.

as a good. Similarly, architectural drafting is classified as a service, although blueprints surely are used as goods.

In practice, the analyst of international trade in services has little choice but to accept the definitions used in preparing balance-of-payments reports, the basic source of data. While some of these definitions seem questionable, they present much less of an obstacle to analysis than does the dearth of detailed data.

## II. Growth and Composition of the Services Trade

Statistics on trade in services leave much to be desired. Because of their intangible and nonstorable qualities, services are less easily detected and measured than goods. To record “cross-border” haircuts, for example, would require a customs service of uncommon zeal. Moreover, current procedures for collecting and classifying trade data were designed primarily for goods rather than for services, which until recently had attracted much less attention. Still, the numbers that are available do permit considerable insight.

According to the latest data, nominal growth in world trade in services has substantially outpaced that in merchandise in recent years, as illustrated in Table 1. This observation applies to both developing and industrial countries. For the world, exports of services now are more than one-fourth the size of merchandise exports. To what extent the faster increase in services reflects swifter price rises rather than volume growth is unknown, since price data are unavailable.

The increase in services exports has been far greater for some countries than for others. Among the “Big Seven” industrial countries, the United Kingdom experienced the lowest increase—36 percent—over the period from 1986–87 to 1992–93, while Italy had the largest—125 percent (Table 2). Considerable variation also occurs in the relative importance of services exports, with services being only about one-tenth as great as merchandise exports in Canada and nearly half as great in France. For countries that specialize in

hair, accurate balance-of-payments accounting would record an export of a U.S. service to Canada, whether the Canadian receives the haircut in the United States or gets it in Canada from a visiting U.S. barber.

Moreover, unlike the haircut of elementary economics, some services, such as telecommunications, actually do flow across national borders. These too, of course, are counted as balance-of-payments transactions.

A service is often distinguished from a good by its intangibility and nonstorability. A more precise, and oft-quoted, definition was offered by Professor T.P. Hill in 1977:

A service may be defined as a change in the condition of a person, or of a good belonging to some economic unit, which is brought about as the result of the activity of some other economic unit . . . . Services are consumed as they are produced in the sense that the change in the condition of the consumer unit must occur simultaneously with the production of that change by the producer: they are one and the same change . . . . the fact that services must be acquired by consumers as they are produced means that they cannot be put into stock by producers.

Distinguishing a good from a service can be difficult, however. For example, legal work is generally considered a service, in both balance-of-payments and other economic accounting, but much legal effort can be condensed into a “brief,” which may be viewed

Table 2  
*Merchandise and Services Exports:  
 Percentage Changes and Relative Size, by  
 Selected Countries, 1986–87 to 1992–93<sup>a</sup>*

	Percentage Change 1986–87 to 1992–93	Ratio of Services to Merchandise	
		1986–87	1992–93
United States			
Merchandise	89		
Services	93	.35	.36
Canada			
Merchandise	48		
Services	55	.12	.12
Japan			
Merchandise	59		
Services	91	.12	.15
France			
Merchandise	61		
Services	108	.36	.47
Germany			
Merchandise	51		
Services	49	.19	.18
Italy			
Merchandise	62		
Services	125	.24	.33
United Kingdom			
Merchandise	56		
Services	36	.34	.29
Oil-Exporting Countries			
Merchandise	71		
Services	144	.05	.07
Non-Oil Developing Countries			
Merchandise	85		
Services	107	.22	.25

<sup>a</sup>Excluding countries of the former Soviet Union, except Estonia in 1992–93.

Source: International Monetary Fund, *Balance of Payments Statistics Yearbook*, 1993 and 1994, Part 2, Tables C-1, C-2.

exporting oil, services provide only a small fraction of total export receipts.

For all countries combined, nearly all categories of services exports have increased by very large percentages in recent years (Table 3). The one exception is the smallest category, "Other official services," which includes such transactions as the provision of housing, office space, rental cars, and other items to foreign diplomatic and military personnel stationed within a country. The most rapid growth has occurred in the

largest category, "Other private services," which embraces a variety of transactions. Prominent among these transactions are incomes earned by the residents of a country from the following sources: employment in a foreign country; leases of equipment, films, and other tangible assets to residents of a foreign country; royalties and license fees from foreign residents in return for the use of patents and copyrights; and communications services, advertising, brokerage, banking, insurance, accounting, and other technical,

Table 3  
*Exports of Services: Percentage Changes  
 and Composition, by Selected Country  
 Groupings, 1986–87 to 1992–93<sup>a</sup>*

	Percentage Change 1986–87 to 1992–93	Ratio of Each Category to Total	
		1986–87	1992–93
All Countries			
Shipment	60	.13	.11
Other transportation	73	.16	.15
Travel	92	.28	.29
Other official services	21	.09	.05
Other private services	117	.35	.40
Total	88		
Industrial Countries			
Shipment	61	.12	.11
Other transportation	73	.16	.15
Travel	91	.27	.28
Other official services	18	.09	.06
Other private services	104	.36	.40
Total	82		
Oil-Exporting Countries			
Shipment	85	.12	.09
Other transportation	38	.19	.11
Travel	183	.27	.31
Other official services	43	.06	.04
Other private services	207	.37	.46
Total	145		
Non-Oil Developing Countries			
Shipment	59	.14	.11
Other transportation	77	.16	.14
Travel	93	.33	.31
Other official services	42	.06	.04
Other private services	173	.31	.41
Total	108		

<sup>a</sup>Excluding countries of the former Soviet Union, except Estonia in 1992–93.

Source: International Monetary Fund, *Balance of Payments Statistics Yearbook*, 1994 and 1993, Part 2, Table B-2.

Table 4

*U.S. Merchandise and Private Services Trade, by Area, 1986–87 to 1993–94*

Area	Percent of Total, 1993–94				Percentage Change, 1986–87 to 1993–94			
	Exports		Imports		Exports		Imports	
	Merchandise	Private Services	Merchandise	Private Services	Merchandise	Private Services	Merchandise	Private Services
All Countries					102.6	118.9	61.7	71.9
Europe	24.8	36.3	20.9	41.0	78.7	133.4	39.3	88.7
Canada	22.5	9.7	19.4	9.2	82.3	92.5	70.6	66.5
Latin America and Other Western Hemisphere	17.7	16.2	13.0	19.0	159.1	111.8	83.3	56.5
Japan	10.3	15.8	18.0	11.1	82.5	141.2	36.9	88.4
Other Countries in Asia and Africa	24.6	19.4	28.6	18.3	131.3	120.0	88.4	61.2

Source: Merchandise trade from *Survey of Current Business*, vol. 75 (June 1995), pp. 92–4. Private services trade from *Survey of Current Business*, vol. 75 (September 1995), p. 77.

professional, or managerial services supplied to foreign residents.<sup>1</sup>

In Table 3 the pattern for world services exports closely parallels the pattern for industrial country exports, since the latter comprise three-quarters of world exports. While the pattern differs in some respects for the exports of developing countries (both oil-exporting and non-oil), the salient feature remains the same: other private services dominate their services exports in both magnitude and growth, just as for the industrial countries.

Narrowing the focus to the United States, one can see in Table 4 that, with all countries collectively, U.S. private services trade has outpaced U.S. merchandise trade in both the export and import categories. This pattern does not hold with every area, however. The exceptions are “Latin America and Other Western Hemisphere” and “Other Countries in Asia and Africa,” both of which consist almost entirely of developing countries, and also imports from Canada. The most rapid increases have occurred in exports to Japan and in imports from Europe and Japan.

As reported in Table 5, travel is easily the largest component of U.S. private services exports as well as imports. Included in travel exports are expenditures

<sup>1</sup> The category, “shipment,” covers freight, insurance, and other distributive services in moving goods, while “other transportation” covers mainly the transportation of passengers (and any goods accompanying them) as well as other services associated with transportation that are not included in shipment, such as port services. For precise definitions of the categories in Table 3, see International Monetary Fund, *Balance of Payments Manual*, 4th ed. (Washington, D.C.: IMF, 1977).

in the United States by visiting private foreign residents for food, lodging, entertainment, transportation within the United States, and so forth, while imports include corresponding expenditures by private U.S. residents visiting abroad.<sup>2</sup> The most rapid growth in both U.S. exports and imports has occurred among categories that are still relatively small, including, on the export side, management of health care, legal services, agricultural services, as well as accounting, auditing, and bookkeeping services, and, on the import side, training services, legal services, advertising, and computer and data processing services.

Why has trade in services increased so rapidly? For one thing, technological advances have both improved the quality and lowered the costs of transportation and communication. Deregulatory measures in many countries have provided another stimulus.

As one example of the impact of technology, computers and high-capacity undersea telephone cables can now be used to coordinate networks serving hosts of customers distributed around the world (including a company’s affiliated firms abroad), in industries such as banking, insurance, advertising, marketing, inventory management, and accounting. Previously, managing such activities efficiently across great distances had been much more difficult.

<sup>2</sup> For detailed definitions of the various services categories, see U.S. Bureau of Economic Analysis, *The Balance of Payments of the United States: Concepts, Data Sources, and Estimating Procedures* (Washington, D.C.: U.S. Government Printing Office, 1990). Some differences exist between the U.S. definitions and those underlying the IMF data published in the sources cited in Tables 1, 2, 3, and 8.

Table 5

*U.S. Private Services Transactions, Composition and Growth*

Description	Exports				Imports			
	Percent of Total 1993-94		Percentage Change 1986-87 to 1993-94		Percent of Total 1993-94		Percentage Change 1986-87 to 1993-94	
	Percent	Rank	Percent	Rank	Percent	Rank	Percent	Rank
Total private services			118.90				71.89	
Travel	32.89	1	169.14	14	34.92	1	52.61	19
Overseas	26.28		180.53		27.53		52.31	
Canada	3.81		128.10		3.15		27.31	
Mexico	2.79		136.78		4.24		81.78	
Passenger fares	9.48	4	170.86	13	9.95	3	74.13	17
Other transportation	13.92	2	50.54	21	22.76	2	48.97	20
Freight	5.17		88.63		12.96		31.02	
Port services	8.18		32.90		9.04		87.43	
Other	.57		62.59		.75		34.67	
Royalties and license fees	11.98	3	135.42	15	4.36	7	223.17	10
Other private services	31.73		103.06		28.01		116.20	
Affiliated services <sup>a</sup>	9.29	5	97.91	17	9.20	4	139.52	14
Unaffiliated services	22.44		105.27		18.81		106.37	
Education	3.86	6	89.61	19	.64	10	74.46	16
Financial services	3.77	7	92.95	18	5.13	6	222.23	11
Insurance, net	.84	12.5	-19.77	24	2.70	8	19.66	23
Telecommunications	1.54	9	40.71	22	5.40	5	86.31	15
Business, professional, and technical services	7.82		222.77		3.43		221.66	
Advertising	.20	18	263.05	7	.57	11	573.17	3
Computer and data processing services	1.35	11	196.94	11	.29	13	550.94	4
Data base and other information services	.42	16	490.27	5	.08	21	279.17	7
Research, development, and testing services	.27	17	113.51	16	.22	16	177.89	13
Management, consulting, and public relations services	.51	14	189.89	12	.23	15	343.31	6
Legal services	.84	12.5	1131.15	2	.31	12	676.04	2
Construction, engineering, architectural, and mining services	1.41	10	254.73	8	.26	14	36.21	22
Industrial engineering	.14	20	29.60	23	.10	18.5	37.64	21
Installation, maintenance, and repair of equipment	1.78	8	201.13	10	.65	9	63.66	18
Other	.89		142.06		.72		796.37	
Accounting, auditing, and bookkeeping services	.09	21	537.50	4	.09	20	216.67	12
Agricultural services	.03	24	754.55	3	.02	23	233.33	9
Mailing, reproduction, and commercial art*	.01	25.5			.03	22	238.10	8
Management of health care facilities*	.01	25.5	3700.00	1	.01	24.5		
Medical services*	.43	15	53.48	20				
Personnel supply services*	.06	22			.01	24.5	-12.50	24
Sports and performing arts	.04	23	253.49	9	.12	17	539.13	5
Training services	.19	19	416.54	6	.10	18.5	1375.00	1
Miscellaneous disbursements*	.04				.34			
Other unaffiliated services <sup>b</sup>	4.62		93.93		1.51		61.31	

\*Data incomplete or unavailable.

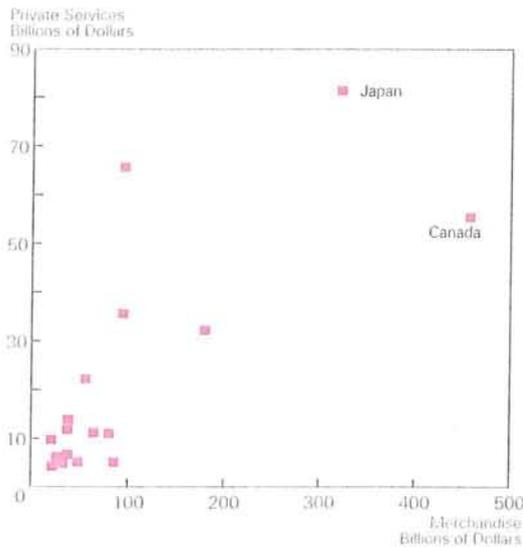
<sup>a</sup>Affiliated cross-border services transactions are those between parent companies in the United States and their affiliates abroad or between foreign parents and their U.S. affiliates.

<sup>b</sup>Exports include mainly expenditures of foreign governments and international organizations in the United States. Imports include mainly wages of foreign residents temporarily employed in the United States and of Canadian and Mexican commuters in the U.S. border area.

Source: *Survey of Current Business*, vol. 75 (September 1995), p. 76.

Figure 1

### U.S. Aggregate Trade in Merchandise and Private Services with Selected Countries 1993-1994



Source: *Survey of Current Business*, vol. 75, September 1995, p. 77, and June 1995, pp. 62-94.

### III. The Pattern of U.S. Bilateral Trade Flows

A case can be made that the geographic pattern of a country's trade in services should resemble that of its trade in goods. Previous research has established that the volume of merchandise trade between two countries is positively related to the size of their economies and their per capita incomes and negatively related to the distance between them, and the same factors seem likely to influence trade in services.<sup>3</sup> Moreover, some trade in services is stimulated by that in goods. For example, the greater the merchandise trade between two countries, the greater the likelihood that their transportation companies will carry goods between them, or that sellers and buyers will travel between them, or hold cross-border telephone conversations, or arrange for cross-border financing of the merchandise transactions.

<sup>3</sup> For such research on trade flows, see, for example, Frankel, Stein, and Wei (1995).

In Figure 1, U.S. trade (exports plus imports) in merchandise has been plotted along with U.S. trade in private services for 17 countries that account for the preponderance of U.S. trade. As expected, trade in services clearly rises from country to country with trade in merchandise. However, the rise in services trade is less than proportionate; a line drawn through the midst of the points in the left half of the diagram would, if extended, lie above the point for Japan and well above that for Canada, the two countries with which U.S. merchandise trade is greatest.

It is striking that for Canada the ratio of services to merchandise trade with the United States is comparatively so low, because geographic and cultural proximity, which the two countries share, would seem even more important for trade in services than in merchandise. Even more arresting, detailed data reveal that this phenomenon pervades all the major private services categories; only in two subcategories—in insurance and in installation, maintenance and repair of equipment—does Canada's percentage share of U.S. exports or imports exceed its share of total U.S. merchandise exports or imports. Part of the explanation may lie in the trade policies that have been followed. Specifically, by comparison with their trade with the rest of the world, the two countries seem to have promoted their bilateral trade in goods more vigorously than in services, especially through their automobile agreement and then their general free trade agreement.

Although this explanation may help to account for the very low ratio of services to merchandise trade in the case of Canada, the relatively low ratio for Japan would remain to be explained. Whatever the explanation, the general pattern in Figure 1 is that U.S. private services trade increases with U.S. merchandise trade from country to country, but less than proportionally. A standard statistical test offers support for this generalization; a logarithmic regression reproduces fairly closely the general relationship between the data observable in the figure.<sup>4</sup>

This finding might seem to conflict with the observation that total U.S. private services trade has been growing more rapidly than U.S. merchandise trade. However, Figure 1 provides only a snapshot of the relationship between merchandise and services trade across countries at a particular time; as time passes, all points in the figure tend to shift upward, with the ratio of U.S. services to merchandise trade rising with most, if not all, countries.

<sup>4</sup> See the appendix.

### *Services Provided through Foreign Affiliates*

Travel is one of the few services that requires the movement of the consumer to the location of the provider. For a number of other services, such as banking or consulting, competition induces many suppliers to locate near the consumers, either intermittently or continuously. Suppliers with a continuous presence abroad, such as the foreign affiliates of U.S. firms, are generally considered to be residents of the countries where they locate, and their sales of services to residents of the same countries are, therefore, treated as domestic, rather than international, transactions. Nonetheless, services supplied within a country by an affiliate there of a foreign firm have an international flavor, as they are supplied with the aid of foreign managerial oversight and foreign capital. Such affiliates have become major service providers, so their activity constitutes a noteworthy alternative to the cross-border provision of services.

What are the relative magnitudes of these alternative modes of supply? Only one country, the United States, has published detailed data on both its trade in services and sales of services by foreign affiliates. As indicated in Table 6, foreign sales by U.S. affiliates abroad were somewhat smaller than U.S. exports in 1993, the latest year for which data are available, although the percentage increases since 1987 are comparable. By contrast, U.S. purchases from U.S. affiliates of foreign companies not only exceeded U.S. imports in 1993, but have increased much faster than imports.

For which services do affiliates deliver the largest volumes relative to the volumes delivered by trade? U.S. data permit only a rough answer for only a few services. Most notably, sales by affiliates

surely predominate in insurance; advertising; computer and data processing services; motion pictures; engineering, architectural, and surveying services; and in accounting, research, management, and related services.

By contrast with the limited data on foreign affiliate sales, fairly comprehensive data are published on the volume of investments that companies make to establish and maintain such affiliates in various services industries. Worldwide, such foreign direct investment increased more rapidly than that in the goods-producing industries during the 1980s, and, by 1990, accounted for close to half of the world's accumulated stock of foreign direct investment. Financial services and trading have experienced more foreign direct investment than other services industries, with relatively vigorous activity also reported in data processing, advertising, air transportation, and accounting (United Nations 1993, p. 1).

What makes an area attractive to foreign investors? A recent study by the United Nations found that firms in services industries choose among foreign locations on basically the same grounds as firms in manufacturing industries. Specifically, they prefer to establish operations in areas where markets are sizable but the major suppliers are few, cultures are familiar, government restrictions are minimal, and where clients from their home countries, whose business they are pursuing, have already established their own operations (United Nations 1993, p. 47). As reported in Table 7, sales of services by U.S. affiliates abroad are greatest in the United Kingdom, Canada, Japan, Germany, and France.

#### *IV. Competitiveness*

Countries vary markedly in competitive prowess in the services trade. Because of data limitations, precise measures of relative competitiveness are not possible, but some idea of the variation can be gained from Table 8. For this table, each area's or country's percentage share of world exports in each category (such as "travel") has been divided by its percentage share of world exports of all categories combined, including merchandise. The higher the resulting ratio

for a category, the greater the country's observed competitiveness, or "revealed comparative advantage," in that category, although any value greater than one indicates relative specialization, or competitiveness.

By this measure, industrial countries exhibit much greater competitiveness in services relative to merchandise than the oil-exporting developing countries, but little more than the other developing countries. Among the "Big Seven" industrial countries, Canada stands out for its low relative competitiveness in services, especially in the transportation

Table 6

*Private Services Supplied to Foreign Residents by U.S. Affiliates Abroad and by U.S. Residents, and to U.S. Residents by Foreign Affiliates in the United States and by Foreign Residents*

	Billions of Dollars		Percentage Change
	1987	1993	1987 to 1993
Services transactions between U.S. and foreign residents (balance of payments transactions):			
U.S. sales (exports)	86.9	174.2	100.5
U.S. purchases (imports)	74.8	115.4	54.3
Total	161.7	289.6	79.1
Sales of services by nonbank majority-owned affiliates:			
Sales to foreign residents by foreign affiliates of U.S. companies	72.4	143.1	97.7
Sales to U.S. residents by U.S. affiliates of foreign companies	62.6	140.5	124.4
Total	135.0	283.6	110.1

Source: *Survey of Current Business*, vol. 75 (September 1995), p. 69.

categories. France leads the pack (but lags in merchandise), while the United States ranks third, following Italy.

From the detailed data available for the United States, its competitiveness can be evaluated for many more types of services than the summary categories in Table 8. For a measure of revealed comparative advantage utilizing these more detailed data, U.S. net exports (exports minus imports) of each service has been divided by the sum of U.S. exports and imports of that service. The resulting ratios, in Table 9, can take any value between  $-1$  and  $1$ . The larger the algebraic value for a particular service *relative to the values for other services*, the greater the U.S. revealed comparative advantage (or the smaller its disadvantage) in that category. The magnitude of the ratio for a service has little significance in and of itself, apart from comparison with the ratio magnitudes for other services. Of course, protectionist barriers somewhat distort the ratios from the values they would assume under free trade.

As anecdotal evidence suggests, the United States is highly competitive in services such as education and

Table 7

*Sales of Services to Foreign Residents by Nonbank Majority-Owned Foreign Affiliates of U.S. Companies, 1993*

Billions of Dollars

Country	Sales
Europe	79.5
France	10.3
Germany	11.8
Italy	5.2
Netherlands	7.7
Spain	2.4
Switzerland	3.2
United Kingdom	29.0
Other	10.0
Canada	18.4
Latin America and Other	
Western Hemisphere	9.7
South and Central America	5.8
Brazil	1.9
Mexico	1.3
Other	2.5
Other Western Hemisphere	3.9
Asia and Pacific	30.2
Australia	4.0
Hong Kong	3.2
Japan	15.8
Singapore	1.8
Taiwan	1.9
Other	3.5
Middle East	1.9
Africa	.8
Other	2.6
All Countries	143.1

Source: *Survey of Current Business*, vol. 75 (September 1995), p. 103.

data base and other information services. More at variance with conventional wisdom is the lack of relative competitiveness in insurance, financial services, and telecommunications.<sup>5</sup> Noteworthy gains in competitiveness were made between 1986–87 and 1993–94 by agricultural services; accounting, auditing, and bookkeeping; and by installation, maintenance, and repair of equipment. Notable competitive losses were made by mailing, reproduction, and commercial art; training services; financial services; advertising; and by sports and performing arts.

<sup>5</sup> This rather surprising finding may reflect the influence of foreign protectionist barriers rather than, or in addition to, a lack of U.S. competitiveness.

Table 8

*Relative Export Performance in Merchandise and Services, by Selected Areas, 1992–93<sup>a</sup>*

Category	Industrial Countries	Oil-Exporting Developing Countries	Non-Oil Developing Countries	United States	Canada	Japan	France	Germany	Italy	United Kingdom
Merchandise	.99	1.17	1.01	.95	1.12	1.10	.86	1.09	.94	.98
Services <sup>b</sup>	1.06	.33	.95	1.19	.52	.60	1.55	.66	1.22	1.07
Shipment	1.06	.26	.94	.54	.18	1.13	1.59	.70	1.67	.75
Other transportation	1.08	.23	.90	1.73	.08	.84	1.54	.75	.37	1.37
Travel	1.04	.34	.99	1.51	.70	.15	1.27	.39	1.57	.94
Other private services	1.06	.37	.95	.94	.65	.69	1.73	.81	1.15	1.14

<sup>a</sup>Each area's or country's percentage share of world exports in each category has been divided by its percentage share of world exports in all categories combined to obtain the ratios in the table.

<sup>b</sup>Excluding "other official services."

Source: International Monetary Fund, *Balance of Payments Statistics Yearbook*, 1994, Part 2, Tables B and C.

## V. Reducing the Barriers to Trade in Services

As trade in services has increased, so has interest in reducing the government barriers that obstruct it. These barriers take the form not of tariffs but of prohibitions, quantitative restrictions, and regulations, and are often justified on grounds of national welfare, security, health, or safety. Paralleling the ways in which the services trade occurs, such barriers obstruct the cross-border movement of suppliers to receivers, of receivers to suppliers, or of the services themselves. In addition to these barriers against trade, countries have also erected obstacles to the provision of services by the affiliates of foreign companies.

Examples of these barriers are rife. By way of illustration, suppliers are impeded from traveling to receivers by limits on the inflow of temporary workers for construction projects, or by limits on domestic practicing by foreign professionals, such as physicians. Receivers are hindered from going to suppliers by measures that obstruct their traveling abroad for purposes such as tourism or education. Cross-border movement of services themselves is restricted by limitations on foreign content in radio and television broadcasting and in the cinema. As for the provision of services through affiliates, many governments have strictly controlled direct investment by foreigners in sensitive domestic industries such as transportation, telecommunications, banking, and advertising.

Such barriers are less readily identified and evaluated than tariffs, and no satisfactory comprehensive measures of them are available. That fact, combined

with the intense nationalist or protectionist sentiment supporting many of the barriers, has severely inhibited efforts to negotiate their reduction. Nonetheless, a recent sweeping attempt at liberalization—during the Uruguay Round—has yielded at least a modicum of progress.

Largely concluded by December 1993, among 117 nations, the Uruguay Round of multilateral trade negotiations not only produced still another agreement for further liberalization of trade in goods, but also generated the first comprehensive agreement on trade in services. The agreement covers all the forms in which cross-border services transactions can occur—and also the provision of services through foreign affiliates. Included are commitments on general principles as well as specific services sectors.

The general principles, or goals, that were agreed upon for trade in services resemble those long accepted for trade in goods, namely, national treatment, most-favored-nation treatment, transparency, and progressive liberalization. National treatment means that a country treats foreign services and services suppliers no less favorably than its national services and suppliers, while most-favored-nation treatment means that a country treats services and services suppliers of a foreign country no less favorably than it treats those of any other foreign country. Transparency requires that relevant government policies on services be published. Progressive liberalization involves binding commitments on agreed liberalization measures, rendering the process of liberalization irreversible and laying the basis for future rounds of negotiation.

Table 9  
*U.S. Revealed Comparative Advantage in Private Services Transactions, 1986–87 and 1993–94*

Type of Service	Revealed Comparative Advantage Ratio <sup>a</sup>			
	1986–87		1993–94	
	Ratio	Rank	Ratio	Rank
Total private services	.078		.197	
Travel	-.114	21	.168	18
Passenger fares	-.046	19	.173	17
Other transportation	-.052	20	-.046	20
Freight	-.416		-.255	
Port services	.311		.148	
Royalties and license fees	.698	4	.607	6
Other private services	.285		.256	
Affiliated services	.291	15	.201	15
Unaffiliated services	.283		.280	
Education	.784	3	.800	1
Financial services	.293	14	.045	19
Insurance, net	-.182	23	-.366	23
Telecommunications	-.279	24	-.403	24
Business, professional, and technical services	.544		.545	
Advertising	-.005	16	-.304	21
Computer and data processing services	.878	1	.751	5
Data base and other information services	.685	6	.786	2
Research, development, and testing services	.414	11	.300	13
Management, consulting, and public relations services	.666	7	.530	9
Legal services	.435	9	.603	8
Construction, engineering, architectural, and mining services	.509	8	.778	4
Industrial engineering	.386	12	.360	12
Installation, maintenance, and repair of equipment	.375	13	.604	7
Other	.746		.301	
Accounting, auditing, and bookkeeping services	-.158	22	.188	16
Agricultural services	-.043	18	.403	11
Mailing, reproduction, and commercial art <sup>b</sup>	.419	10	-.464	25
Management of health care facilities <sup>c</sup>			.206	14
Medical services <sup>d</sup>				
Personnel supply services <sup>b</sup>	.689	5	.785	3
Sports and performing arts	-.034	17	-.318	22
Training services	.785	2	.489	10
Other unaffiliated services <sup>e</sup>	.582		.639	

<sup>a</sup> $(X_i - M_i)/(X_i + M_i)$ , where  $X_i$  and  $M_i$  represent exports and imports of the  $i$ th service.

<sup>b</sup>Data used to compute revealed comparative advantage for 1986–87 were 1987 data, not the sum of 1986 and 1987, because 1986 data were not available.

<sup>c</sup>Import data for 1986 were not available; both imports and exports for 1987 were 0.

<sup>d</sup>Import data unavailable.

<sup>e</sup>Exports include mainly expenditures of foreign governments and international organizations in the United States. Imports include mainly wages of foreign residents temporarily employed in the United States and of Canadian and Mexican commuters in the U.S. border area.

Source: Underlying data from *Survey of Current Business*, vol. 75 (September 1995), p. 76.

In addition to endorsing these general principles, each country participating in the Uruguay Round presented a schedule spelling out its specific commitments for the various services sectors and noting the

extent to which it will apply the general principles to that sector. Among other things, a country's schedule establishes limits that the country pledges to observe on particular barriers to trade in services—barriers

such as restrictions on the number of suppliers, on people employed, and on the total value or quantity of services transactions. But the schedules fall far short of inaugurating free trade. In most of the schedules, countries retain pervasive (across sectors) controls dealing with the affiliates of foreign companies and with temporary influxes of foreign personnel engaged in supplying services. Less pervasive are the restrictions relating to services consumed abroad or transferred across borders.

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*Barriers to trade in services take the form not of tariffs but of prohibitions, quantitative restrictions, and regulations, often justified on grounds of national welfare, security, health, or safety.*

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Because barriers to services trade are largely imponderable, and because definitive agreements have yet to be reached in some sectors, one cannot construct accurate summary measures of the degree of liberalization stemming from the Uruguay Round. However, some idea of what was accomplished can be gleaned from the number of countries making commitments in some important sectors. Most such commitments "bind," or guarantee, the current degree of access for foreign suppliers, while the others enlarge that access.

Thus, commitments were scheduled by 67 countries in the business services sector (embracing legal, accounting, medical, computer, management consulting, and many related business services), by more than 40 countries in the air transport sector, and by 52 countries in "value-added" (as distinguished from "basic") telecommunications. Much less impressive, only 13 countries, including just two advanced countries, made commitments in audiovisual services, and negotiations have yet to be concluded in basic telecommunications and maritime transport (GATT 1994, pp. 39-46).

What such admittedly selective indicators add up to must be a rather subjective judgment. Taking into account the wide variation in the number of commitments from sector to sector, and recognizing that most commitments bind rather than enlarge market access,

our judgment is that the Uruguay Round made a very good start, but no more than that, at liberalizing the trade in services.

## *VI. Summary and Conclusion*

Spurred by deregulation and by innovations in communications and transportation, world trade in services has increased more rapidly than that in merchandise in recent years and now amounts to one-fourth the size of merchandise trade. In addition to this cross-border trade, sales of services within countries by affiliates of foreign firms have been increasing and, if U.S. data are representative, may well equal the cross-border trade in magnitude. Among the various types of services traded, the most dynamic growth has occurred in private sector activities such as advertising, accounting and finance, legal services, computer and data processing services, and so forth.

As a rule, the volume of services trade between two countries probably depends largely on the same factors that determine the volume of their merchandise trade, that is, on the size of their economies, their per capita incomes, and their geographic proximity, but also on the volume of their merchandise trade itself. Statistical analysis lends support to this hypothesis.

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*The Uruguay Round made a very good start, but no more than that, at liberalizing the trade in services.*

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Industrial countries as a group exhibit only slightly more competitiveness in the services trade than the (non-oil) developing countries. Among the "Big Seven" industrial countries, France seems to rank first in relative competitiveness, the United States third. Among the types of services traded, U.S. competitiveness ranks high in data base and other information services and in education, but ranks low in insurance, financial services, and telecommunications.

The speedy growth in the services trade has occurred despite many government obstacles in the form of prohibitions, quantitative restrictions, and regulations that obstruct the cross-border movement of suppliers to receivers, of receivers to suppliers, or of the services themselves. Alongside these barriers

against trade are similar barriers against the provision of services by the affiliates of foreign companies.

The first comprehensive agreement to limit and reduce these barriers was reached during the recently concluded Uruguay Round of multilateral trade nego-

tiations. In a landmark achievement, the agreement extends to much of the services trade the basic principles of conduct long accepted for the trade in merchandise. Less impressive are the reductions negotiated in specific barriers.

## Appendix

Following is the estimated regression equation discussed in the section entitled "The Pattern of U.S. Bilateral Trade Flows." T-statistics are in parentheses and, if starred, are significantly different from zero at the 0.05 level.

$$\log S_i = -0.47 + 0.75 \log M_i + 0.55 E_i; \quad \overline{R^2} = 0.65;$$

(-0.71) (4.84)\* (1.64)

where

$S_i$  = value of services trade (exports plus imports) between

the United States and country  $i$  for the years 1992 and 1993 combined;

$M_i$  = value of merchandise trade (exports plus imports) between the United States and country  $i$  for the years 1992 and 1993 combined;

$E_i$  = a dummy variable that is assigned the value of 1 where the  $i$ th country's chief language is English and zero elsewhere, the hypothesis being that a common language is even more important for the trade in services than in merchandise.

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# *Safety and Soundness of Financial Intermediaries: Capital Requirements, Deposit Insurance, and Monetary Policy*

**M**ore than two-thirds of the \$25 trillion of financial assets held in the United States is managed on behalf of investors by financial intermediaries, ranging from trusts, mutual funds, and mortgage pools to insurance companies, pension funds, and banks. Since the inception of financial markets in industrial economies, savers have entrusted much of their wealth to intermediaries that, in turn, finance the projects of investors. Because of their importance, governments have long regulated the activities of these intermediaries to ensure sound financial markets, a foundation of secure economic development. The form of this regulation has changed often over the centuries as intermediaries and financial markets have changed with economic conditions and the demands placed on them. Currently, regulators both here and abroad are considering reforms that not only might foster more efficient domestic financial markets but also might prepare the way for more equitable global markets.

The current discussions, like those past, engage views of financial markets that are often difficult to reconcile. Some, who believe that these markets potentially are relatively efficient, advocate minimal interference. Regulations that require more than the necessary disclosure of investments and risks might introduce burdens that exceed their benefits. Others, who believe that the prominence of intermediaries reflects the limits of savers' information, advocate regulations to insure the safety and soundness of intermediaries. At the very least, regulations may diminish the force of "credit cycles" and the threat of widespread insolvency among intermediaries.

The first section of this article considers the role of financial intermediaries within competitive financial markets wherein all investors view the prospects for each asset much the same. In these circumstances, the prices of assets and the allocation of resources do not depend greatly on the activities of intermediaries. Accordingly, the regulation of these intermediaries does not diminish the risks that fully informed investors

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are willing and able to assume. At worst, regulations such as mispriced deposit insurance or various taxes, which force intermediaries to price risk and returns differently than other investors, would influence the volume and form of intermediation, but they would little disturb the uniform pricing of assets and risks.

The second section reconsiders the role of financial intermediaries when not all investors are fully informed about the prospective returns on all assets. In this case, the activities of intermediaries can influence both the prices of assets and the volume of investment. Intermediaries that enjoy the confidence of savers foster more efficient financial markets by acquiring and managing proprietary information about assets that are not very familiar in public markets. Intermediaries' cost of funds rises with their leverage, in these circumstances, and this cost rises most slowly for those with the best reputations. If savers' confidence in intermediaries' investments varies with business conditions, financial institutions may be "fragile" and markets may be prone to occasional "crunches."

The third section discusses the role of regulation when not all investors are fully informed. When the cost of funds for intermediaries depends on savers' state of confidence, public policy can influence the risk premiums embedded in credit market yields by designing capital requirements, accounting rules, and liability insurance coverage in order to foster the prudent valuation of assets and the efficient flow of funds from savers to investors. Because the consequences of these regulations vary with economic conditions, the actions of regulators, like those of the monetary authority, may need to adjust with circumstances, so that they shift returns and risks during business cycles in ways that dampen, rather than exaggerate, attendant credit cycles. This section considers regulations that: (1) link intermediaries' requirements for capital to their investments in certain risky assets, (2) value intermediaries' assets according to prevailing prices of comparable assets, and (3) require intermediaries to undertake remedies promptly should their capital fall sufficiently to violate their requirements. Although these policies may tend to stabilize intermediaries, conserving the value of their capital when markets for their assets are liquid, these policies also can destabilize intermediaries and increase the risks inherent in investment when markets for their assets are illiquid.

The final section summarizes this article and discusses the consequences of regulation for monetary policy. At the very least, monetary policy must con-

sider the potential influence of regulations on the volume and timing of the flow of funds through financial markets in order to best attain its macroeconomic goals. Yet, regulation that affects the terms on which intermediaries are willing and able to make investments over the business cycle is a kind of monetary policy. If a common goal of both regulatory

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*The best regulation might be that which, taking into account the characteristics of financial markets, transmitted the actions of monetary policy with the fewest distortions and "head winds."*

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and monetary policy is to promote safe and sound financial markets, then the best regulation might be that which, taking into account the characteristics of financial markets, transmitted the actions of monetary policy with the fewest distortions and "head winds" through intermediaries to the decisions of savers and investors. These regulations, like monetary policy, might need to be sufficiently flexible to change with economic conditions.

### *I. Homogeneous Opinions and the Consequences of Regulation*

Investors' demands for assets depend on their assessments of future returns on risky assets and their tolerances for bearing the risks inherent in these assets. If everyone possesses the same information about all assets and if everyone analyzes this information in similar ways, then all investors should assess the potential returns on all assets much the same. With this common understanding, all investors price the risks in every asset the same in competitive financial markets, despite any differences in their tolerances for bearing those risks. Securities or portfolios with certain returns are priced to yield the risk-free rate of interest. The expected yields for other portfolios exceed the risk-free rate to the degree the uncertainty in their returns cannot be reduced by diversification or hedging, because investors expect to be paid the market price for bearing risk (for example, Sharpe and

Alexander 1990). In these circumstances, savers and investors are indifferent about each intermediary's assumption of risk.

Regulations and taxes can introduce frictions that impede the uniform pricing of assets and of risks in this ideal model. Not all regulations entail such distortions, however. Conventions that require complete and timely financial statements from businesses and intermediaries, for example, tend to foster the uniform pricing of securities and risks. Furthermore, in the absence of other frictions, regulations that set standards for capital or leverage do not disturb the uniform pricing of assets even though these regulations may confine the investment strategies of financial intermediaries. But, risks and returns will not be priced uniformly when either investors or securities are taxed differently or "deposit insurance" premiums are not priced accurately. These differences, in conjunction with regulations fixing standards for the capital and leverage of financial intermediaries, cause financial intermediaries to value assets differently than other investors do, thereby fostering financial innovations, such as the use of derivatives, which allow the trading of risks and returns in ways that avoid the restrictions imposed by traditional regulations.

### *The Basic Role of Financial Intermediaries*

Suppose that financial intermediation is frictionless, hampered by no special taxes, reserve requirements, proscriptions, or accounting inequities. If everyone is informed equally well about the potential returns on financial assets, then all financial intermediaries in competitive markets are essentially mutual funds that distinguish themselves by the additional options and services they offer their customers. Banks clear payments; insurers and pension plans write contingent claims; many write commitments to provide funds to their customers; all guarantee the principal and a fixed rate of return on some of their liabilities. Financial intermediaries also offer their customers investment services, not only by attending to the details of purchases, sales, and maintaining records but also by combining customers' funds so that all may invest in diversified portfolios of assets.

The expected yields on liabilities issued by financial intermediaries (including the implicit value of the services they offer their customers) should match the expected yields on portfolios of publicly traded securities bearing the same risk. Otherwise, customers would "unbundle" their purchases of financial services, favoring "low-balance" arrangements with

banks, insurers, and other intermediaries, in order to earn more competitive returns.<sup>1</sup> Traditional financial intermediaries, in principle, can be regarded as portfolios of services, each of which might be subcontracted to the most efficient suppliers, as long as the joint production of services yields negligible economies of scope (valuable externalities that vendors otherwise would be unable to capture).

Accounting conventions that dictate the way intermediaries report either their income or the value of their assets and liabilities, by themselves, alter neither the performance of investments nor the way fully

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*If everyone is informed equally well about the potential returns on financial assets, then all financial intermediaries in competitive markets are essentially mutual funds.*

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informed, like-minded investors assess these investments in competitive markets. Similarly, regulations that prevent financial intermediaries from holding particular assets or from issuing particular liabilities impose no significant tax on intermediaries. Consider an extreme restriction that requires a loan company to invest in only one type of asset, residential fixed-rate mortgages, for example. The expected returns on these mortgages compensate investors for the systematic risks inherent in these loans. To the loan company's shareholders, who are able to diversify their overall personal portfolios adequately, the title to the assets of the company is essentially as valuable as the mortgages themselves, and it is priced accordingly.

In the circumstances described above, financial intermediaries are not compelled to broaden their powers or engage in "financial innovations." Intermediaries might undertake these activities out of convenience, trading derivatives, for example, in order to fix

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<sup>1</sup> Intermediaries might earn rents as a result of their efficiencies in managing funds or in providing other business services. Vendors increasingly are profiting from their comparative advantages by selling these services piecemeal. For example, some banks manage substantial custodial operations, some mutual funds and pension plans purchase administrative or insurance underwriting services for their pension, annuity, and employee benefit funds, and some investment advisors sell their services to funds sold by others.

the terms of future sales or reduce transactions costs by using one transaction to replace many. But, intermediaries cannot reduce their price of bearing risk through these strategies. Because the distribution of returns incorporated in all derivative contracts, which includes all liabilities of financial intermediaries, is defined by the distribution of returns on their underlying assets, fully informed investors price the risks inherent in all these derivatives according to the risks inherent in the underlying investments.

### Risk and Leverage

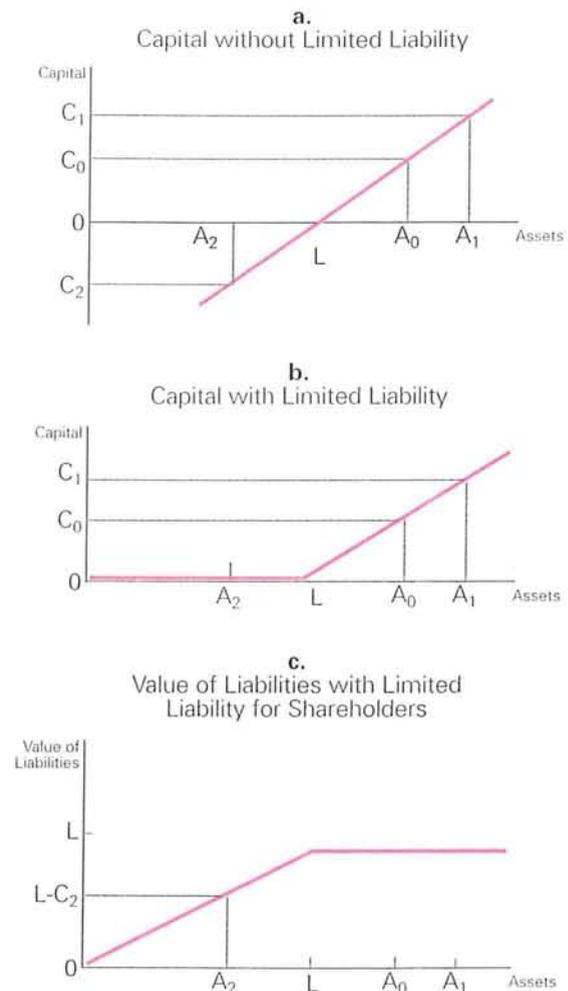
When everyone assesses the potential returns on each asset the same, the cost of funds for each financial intermediary depends on the risks inherent in its assets, not on the way it finances these assets. The returns required by an intermediary's shareholders and creditors vary with its leverage, because the division of these returns between shareholders and creditors also shifts with leverage. Nonetheless, the average cost of funds remains constant, other things equal, because those assuming more risk price it no differently than those shedding the risk.

If the liability of shareholders were not limited to their investment in an intermediary's stock or if intermediaries' investments in safe assets were at least as great as their debt, then shareholders would bear all of the risk inherent in the intermediary's assets. In these cases, the value of the intermediary's equity would change dollar-for-dollar with any change in the value of its assets (Figure 1a), while the value of the claims of its creditors would not change. For example, if the intermediary's assets of  $A_0$  comprise liabilities to creditors of  $L$  and capital of  $C_0$ , then as circumstances increase total assets to  $A_1$ , the value of liabilities remains at  $L$  while capital increases to  $C_1$ , and the value of equity also increases from  $C_0$  to  $C_1$ . Should the value of assets fall to  $A_2$ , the capital of the intermediary and the value of its equity would fall to  $C_2$ . If  $L$  exceeds the value of assets, shareholders would be obligated to pay creditors for this deficiency,  $L - A$ .

Because shareholders' liability is limited to their capital and intermediaries' investments in risky assets ordinarily exceed their capital, the previous example understates the risk borne by creditors and overstates that borne by shareholders. With the shield of limited liability (Figure 1b), shareholders' capital rises with the value of assets, but their position does not fall below zero when the value of assets fails to exceed creditors' claims against the intermediary. In this last

Figure 1

### Capital With and Without Limited Liability

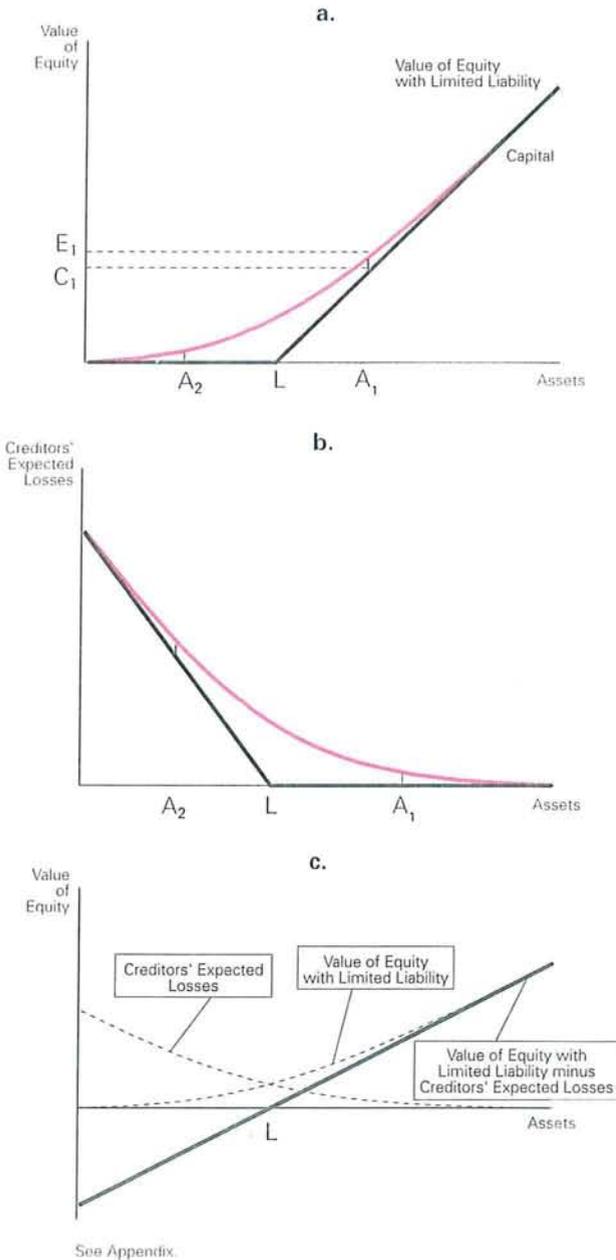


case, creditors would bear the losses as the value of their position falls with the value of the intermediary's assets (Figure 1c).

Limited liability confers both benefits and costs on shareholders. The benefit takes the form of a put option. The cost of this option is the premium that fully informed creditors require for accepting the risk entailed by this option. As the intermediary's assets approach  $L$  (Figure 2a), the value of this option to shareholders rises; the value of limited liability rises with the odds of insolvency. Accordingly, sharehold-

Figure 2

*Value of Equity with Limited Liability*



ers' equity—the sum of their capital and the value of their put option—exceeds zero, other things equal, even when the intermediary has little or no capital. As assets fall well below liabilities, the value of the shareholders' put option approaches  $L - A$ , because the failure of the intermediary essentially is a certainty.

Because the premium creditors require for accepting this put option equals the expected value of creditors' potential losses due to insolvency (Figure 2b), any benefit redounding to shareholders as a result of the shield of limited liability is offset exactly by the premium required by fully informed, like-minded creditors. The value of the shareholders' put option at  $A_1$  (the vertical line in Figure 2a) equals the expected value of creditors' losses (the corresponding vertical line in 2b), and the value of the shareholders' put option at  $A_2$  equals the expected value of creditors' losses in excess of  $L - A_2$  (the vertical line in 2b). Accordingly, the value of equity, which is capital plus the value of the shareholders' put option less the premium the intermediary pays on behalf of creditors to compensate them for their expected losses, is identical to the value of the proprietors' stake in the absence of limited liability (Figures 2c and 1a). Shareholders' expected rate of return with the protection of limited liability, therefore, is the same as it would be without that protection. Similarly, the creditors' expected rate of return is the same in both examples. The weighted average of shareholders' and creditors' expected yields, consequently, remains equal to the expected return on assets.

In all cases, the cost of funds for intermediaries depends on investors' assessments of the returns on their assets, not their leverage. Investors essentially can tailor the leverage of an intermediary's investments to match their own tastes, but they cannot reshape the fundamental risks and returns inherent in the intermediary's assets (Modigliani and Miller 1958; Miller and Modigliani 1961). Although shareholders' expected returns rise when their intermediaries assume more risk, these greater returns compensate them no more generously than other investments. Consequently, investors who wish to bear more risk need not favor intermediaries that assume greater leverage; instead, these investors themselves may sell safe assets or borrow to purchase the shares of intermediaries in order to achieve the requisite risk. Likewise, investors who have relatively little taste for risk may purchase both the intermediary's debt and its equity to achieve their goals.

*Voluntary Standards for Capital*

In the frictionless circumstances examined above, the customers of financial intermediaries are indifferent about each intermediary's assumption of risk, but bankruptcy costs encourage the shareholders and managers of intermediaries to set minimum capital

requirements for themselves. When the capital of intermediaries becomes sufficiently low, the resolution of claims against their assets entails costs that reduce shareholders' and creditors' returns. Accordingly, intermediaries acting in the best interest of shareholders would maintain sufficient capital to ensure that bankruptcies are rare. These voluntary capital requirements ordinarily rise as intermediaries invest greater shares of their assets in risky securities.

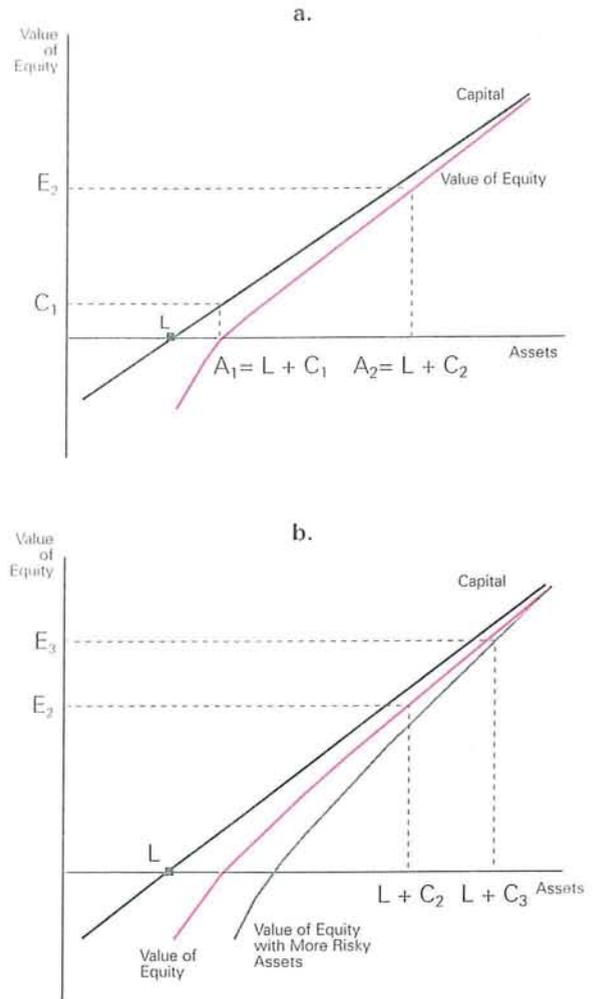
The cost of resolving claims when an intermediary becomes insolvent reduces the net returns from the intermediary's assets that can be divided between shareholders and creditors. Some of these costs are explicit, such as the fees of those who advise creditors and shareholders and the expense of negotiating claims. Regulators, moreover, may seize the assets of intermediaries that are nearly insolvent even though their capital is not exhausted.<sup>2</sup> Some costs are implicit, such as the interruption of careers or the diminished reputation of the owners and managers of insolvent intermediaries.

Because the threat of insolvency entails costs that are matched by no offsetting benefits, intermediaries would tend to manage their balance sheets to minimize the probability of insolvency. Inasmuch as fully informed creditors do not bear the expected costs arising from bankruptcies without receiving adequate compensation, the total risk premium that intermediaries incur on their liabilities is the sum of the premium entailed by shareholders' limited liability and the premium entailed by bankruptcy costs. The lower is an intermediary's capital, the greater are the probability of insolvency and the expected cost of insolvency (Figure 3a). If, for example, the value of an intermediary's assets is only  $A_1$ , then the value of its equity would equal its capital,  $C_1$ , in the absence of bankruptcy costs. But, in this illustration, expected bankruptcy costs are sufficiently great that the market value of the intermediary's equity is negligible—the premium for bankruptcy costs exhausts shareholders' returns. When capital is  $C_2$ , the market value of equity also is nearly  $C_2$ . Because both the probability of

<sup>2</sup> This policy of early intervention prevents the owners of intermediaries from increasing the value of their equity by assuming more risk once their capital becomes very low. Shareholders will not do so in this model principally because they may earn excess returns with no risk by adding more capital, as explained below. The assumption of more risk is most attractive when not all investors value the equity of the intermediary the same, as explained in section III.

Proposals that would impose penalties if intermediaries' losses in their trading portfolios exceeded some previously established "capital cushion" also would encourage intermediaries to set standards for their capital (Kupiec and O'Brien 1995).

Figure 3  
*Risk and the Value of Equity*



bankruptcy and expected bankruptcy costs become negligible as capital increases, the premium for bankruptcy costs essentially becomes inconsequential, and the shareholders' expected rate of return is restored to the return they would earn on other equally risky investments.

Bankruptcy costs, therefore, encourage intermediaries to set and maintain minimum requirements for capital, requirements that increase with their investments in risky assets. In the previous illustration, if losses depress the intermediary's capital to  $C_1$ , then by investing  $C_2 - C_1$  in the intermediary, shareholders

increase their wealth by  $C_2$ . This additional investment promises a return exceeding that available on other equally risky investments, an excess return equaling  $C_1/(C_2 - C_1)$ .<sup>3</sup>

This voluntary capital requirement rises as intermediaries invest a greater share of their portfolios in risky assets. Suppose  $C_2$  represents the intermediary's minimum standard for capital for a specific mix of risky and riskless assets in its portfolio—with capital below  $C_2$ , the value of its capital would be discounted too greatly in equity markets. Should the intermediary then place a greater share of its investments into risky assets, it would increase both its probability of insolvency and its expected bankruptcy costs at every value of  $C$  (Figure 3b). Accordingly, the value of its capital at  $C_2$  would be discounted more greatly in equity markets, thereby requiring the intermediary to hold more capital than  $C_2$  in order to maintain a relatively competitive rate of return for its shareholders.

Regulations limiting financial intermediaries' leverage and investments in risky assets do not affect the risks borne by their shareholders and creditors in competitive financial markets, because these regulations alter neither investors' perceptions of the risks and returns inherent in assets nor their ability to realize these risks and returns. Should regulations set capital requirements above intermediaries' voluntary standards, then those shareholders and creditors who wish to bear more risk may do so either by assuming greater leverage themselves or by shifting their other assets toward risky investments. More specific capital requirements that depend on intermediaries' investments in particular assets also entail no significant burdens. These requirements, other things equal, do not increase the intermediary's cost of funds, and, in this case too, shareholders could increase their own leverage and alter the composition of their other investments, if they so desired, in order to assume more risk than permitted by these capital requirements.

### *Liability Insurance and the Regulation of Capital and Assets*

When the liabilities of intermediaries are insured, creditors no longer require risk premiums from intermediaries; instead, intermediaries pay these premiums to agencies guaranteeing intermediaries' debts. These insurance programs should not disrupt the efficient operation of competitive financial markets unless the premiums for insuring the liabilities of intermediaries are mispriced. A proper premium for

“deposit insurance” equals the expected value of creditors' potential losses due to a collapse of the value of the intermediary's assets—the premium creditors would require for the shareholders' put option if there were no deposit insurance (Merton 1977; Sharpe 1978; Buser, Chen, and Kane 1981; Kane 1995). This obligation may be covered by intermediaries' holding more capital, a fund held by the agency guaranteeing the liabilities, or an annual fee paid to the guarantor.<sup>4</sup> Financial intermediaries are indifferent among these arrangements as long as each institution's expense in every case corresponds to its creditors' expected losses.<sup>5</sup>

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*Insurance programs should not disrupt the efficient operation of competitive financial markets unless the premiums for insuring the liabilities of intermediaries are mispriced.*

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Even if creditors could levy fair insurance premiums on their own, liability insurance can provide several economies to intermediaries and their customers. A guarantor can monitor intermediaries more economically than their many creditors. Moreover, because creditors holding long-term liabilities ordi-

<sup>3</sup> In competitive markets, shareholders who invest  $(C_2 - C_1)$  expect to receive assets whose value is the same. Here, by investing  $(C_2 - C_1)$ , they increase the value of their equity by  $C_2$ , or  $C_1$  more than offered by other investments.

<sup>4</sup> Insurance funds are an additional capital cushion for insured intermediaries. The Federal Deposit Insurance Corporation maintains such a fund, but the states' guarantee covering policies issued by insurance companies is backed by a call against the capital and earnings of the insurance industry—the guaranty fund is invested in the capital of insurance companies. When the guarantor is a public agency some of this capital can be provided by taxpayers: Premiums that banks pay to the FDIC may be deducted from their taxable income and calls against insurers often may be declared as credits against state tax liabilities.

Although insurance rates for depository institutions nominally vary with their supervisors' rating of their risks, the effective premiums are set according to rules that might not be sufficiently flexible to represent properly each institution's expected losses (Spong 1994, pp. 117–8).

<sup>5</sup> Intermediaries would be indifferent between holding more capital and accumulating a reserve held by its guarantors, provided each intermediary is credited with a competitive rate of return on its reserve (much like the structure of a cash-value life insurance policy). This is not the case for an undifferentiated fund, such as that of the FDIC.

narily must insure themselves against all future risks that an intermediary might assume, issuing these liabilities would be prohibitively expensive for those intermediaries that have no intention of assuming substantial risks in the future, unless intermediaries can insure this intention.<sup>6</sup> Guarantors that levy flexible insurance premiums over the duration of long-term, fixed-rate liabilities give intermediaries the opportunity to issue such liabilities at appropriate rates of interest.

Liability insurance premiums need not be explicit. Guarantors may effectively exact a fair premium, for example, by holding a call option against intermediaries' assets (Kane 1986; Pennachi 1987): When the value of an intermediary's assets is sufficiently low relative to its liabilities, the guarantor may either impose formal agreements on its management or seize its assets. The implicit remuneration that guarantors receive in the form of this call option compensates them for their liability insurance. With the prompt enforcement of standards for the capital of intermediaries, guarantors would require no other insurance premium, because they seldom would experience underwriting losses, provided markets for intermediaries' assets and liabilities were efficient.

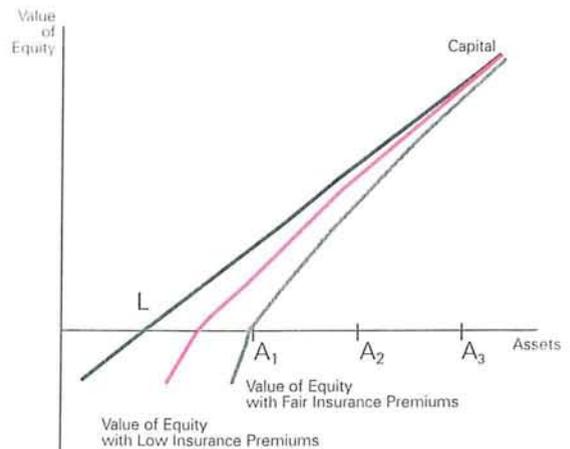
The mispricing of insurance for the value of intermediaries' liabilities essentially causes the price of bearing risk for the intermediary to diverge from the market price. If a guarantor were to assess premiums that were less than creditors' expected losses, the guarantor would artificially lower the price of bearing risk to intermediaries and their shareholders. This would be analogous to creditors' charging an intermediary a premium insufficient to cover their losses (Figure 2b). At a point such as  $A_1$ , an insufficient insurance premium would not alter the value of the shareholders' put option, but it would reduce the amount shareholders effectively pay creditors for this option. In this case, the intermediary's shareholders would earn a rent which increases the value of their equity (Figure 4). This rent would be greatest when,

<sup>6</sup> Even in this frictionless model, policies that require intermediaries to issue subordinated debt in order to establish a "capital cushion" sufficient to guarantee the claims of more senior creditors would impose too great a premium for this insurance. Intermediaries' cost of funds would rise as they finance more of their assets with longer-term, fixed-rate debt.

Liability insurance is not essential for intermediaries to issue longer-term liabilities. By issuing short-term liabilities and buying a longer-term interest-rate swap, agreeing to pay fixed and receive floating, an intermediary essentially can issue longer-term debt, while granting creditors the ability to adjust the yields on the intermediary's liabilities as necessary to correspond to its risks.

Figure 4

### Effect of Liability Insurance on the Value of Equity



other things equal, capital is lowest for any given insurance premium ( $A_1$  versus  $A_2$ ). Accordingly, the line representing the value of equity would shift upward (to a degree that diminishes with the magnitude of capital), and, when the insurance premium is sufficiently low compared to bankruptcy costs, the value of equity could exceed the value of the intermediary's capital. To exploit this rent, intermediaries would increase both their insured liabilities and their holdings of risky assets per dollar of capital. If, for example, the intermediary wished to maintain capital of  $C_3$  (point  $A_3$ ) with fairly priced insurance, it might reduce its capital to  $C_2$  (point  $A_2$ ) if premiums were sufficiently cheap. Whereas low premiums encourage the taking of risks, excessive insurance premiums would discourage intermediaries from offering insured liabilities with yields as high as the risk-free rate of interest, thereby rendering these accounts unattractive to investors.

### Taxes

Taxes interfere with the efficient operation of financial markets by altering investors' assessments of the effective returns and risks available on various investments. When investors or assets are not taxed the same, financial markets ordinarily fail to price risks and returns uniformly. Some taxes, such as

corporate income taxes or reserve requirements, impose extraordinary expenses on certain financial intermediaries. Unless these expenses are mitigated in other ways, the net burden of tax liabilities favors intermediaries organized as mutual funds over other financial intermediaries. Shareholders of intermediaries with the greatest tax burdens withdraw their equity from the holding of portfolios of assets in order to emphasize, instead, the provision of financial services, including the origination of securities.

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*Taxes interfere with the efficient operation of financial markets by altering investors' assessments of the effective returns and risks available on various investments.*

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Financial intermediaries pay both explicit and implicit taxes. The return to equity for intermediaries is generally taxed as corporate income, except for the returns to the equity in qualified mutual funds. Other taxes are less explicit; banks, for example, must invest some of their assets in reserves on which they earn no return, as dictated by reserve requirements against checkable deposits. Compliance with regulation also imposes "taxes" on intermediaries. These tax liabilities diminish an intermediary's net return on assets, which prevents it from offering competitive returns to its shareholders, provided fully informed creditors expect to receive a competitive rate of return on the intermediary's liabilities and these creditors receive no compensating benefits, such as lower personal income taxes on the income they derive from these liabilities (for example annuities, retirement accounts, or insurance policies). Rather than purchasing the shares of a taxed intermediary, savers would earn greater returns by purchasing a levered portfolio of assets matching that of the intermediary, thereby avoiding the need to pay the intermediary's taxes. Accordingly, the burden of these taxes tends to reduce the value of equity of intermediaries (the value of equity in Figure 4, for example, shifts down by an amount reflecting this tax burden at each value for capital).

Unless the burdens of intermediaries' taxes are offset by other considerations, the weight of these liabilities encourages banks, life insurance companies, and other intermediaries to recast their accounts as

shares in mutual funds that also offer other financial services. Bankers and insurers, for example, promote contracts invested in accounts separate from their general account, wherein creditors essentially become shareholders in mutual funds offered by these companies. Without resorting to the strategy of offering their customers mutual funds, intermediaries do derive some relief from the burden of corporate income taxation as a result of provisions in the personal income tax laws. People who hold permanent insurance policies, individual retirement accounts, and annuities generally pay no current taxes on the income that accrues on these investments, thereby relieving intermediaries from having to pay returns on these accounts that fully match the returns on alternative investments on which savers must pay current income taxes. Even with this concession, however, an insurance company selling tax-deferred annuities against its general account cannot offer its creditors and stockholders net returns matching those of a mutual fund that offers the same products because, other things equal, the insurance company's general account, unlike the mutual fund, incurs the added expense of a corporate income tax liability.

## *II. Heterogeneous Opinions*

When investors are not informed equally well, or, for other reasons, investors do not agree about the potential returns on assets, the activities of financial intermediaries influence both the prices of assets and the volume of investment (Gurley and Shaw 1955, 1956, 1960; Tobin 1963; Carosso 1970; Baskin 1988). Financial intermediaries, in principle, foster efficient financial markets by acquiring and managing proprietary information about assets that are not very familiar to other investors. But the ability of intermediaries to cultivate and harvest the fruits of this knowledge depends on the confidence that others invest in the intermediaries themselves. An intermediary's cost of funds, in these circumstances, rises with its leverage, and this cost rises most slowly for those with the best reputations. Because confidence in intermediaries' investments tends to vary with business conditions, financial markets may be prone to credit cycles as the cost of funds rises and falls for intermediaries. If, during the course of these cycles, outsiders become especially skeptical of the value of intermediaries' investments, then this loss of confidence undermines the security of both intermediaries and financial markets.

## Public and Proprietary Assets

Consider the simple case wherein financial markets comprise two types of asset. Assets of the first type attract many analysts; consequently, most investors often hold very similar assessments of the returns on these assets, and they tend to trade in broad, deep, and resilient public markets.<sup>7</sup> The second type comprises assets that are not familiar to many investors; accordingly, opinions about these assets generally diverge, their markets are not dependable, and their prices can be very volatile. The valuation of these less familiar assets depends on the role of financial intermediaries, who expect to profit from their proprietary information by purchasing assets that, in their opinion, are valued too cheaply in public markets.<sup>8</sup> Other investors may not value these assets very greatly because, for want of sufficient information, they may overestimate the risks inherent in these assets and, at times, they might underestimate potential returns.

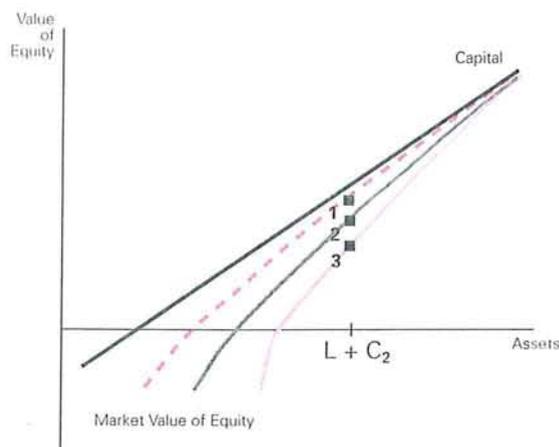
Loans from banks or finance companies, private placements, venture capital investments, and many over-the-counter securities are traditional examples of assets that do not enjoy a broad public following. A loan to a manufacturing company that has little access to public financial markets commits the lender to the company until the manufacturer may repay the loan with its own resources or offer securities to other lenders at attractive prices. Similarly, the lender may not be able to sell its loan to others without making substantial concessions, unless other investors also are familiar with the company and are at least as optimistic about its prospects. Without an informed lender, a prohibitively high cost of capital may confront the manufacturer; whereas a private arrangement, with a lender possessing proprietary information that is reinforced by frequent reports from the company, diligent oversight of the company, and some influence

<sup>7</sup> Many listed securities may not trade in efficient markets. According to IBES, many equities fail to attract the consistent attention of very many analysts. The earnings-price ratios for stocks tend to be sufficiently high to entail a puzzlingly high cost of equity (Abel 1991). Corporations, especially those with the best ratings, seldom raise funds by issuing new equity (Myers and Majluf 1984), and the correspondence between investment spending and cash flow is surprisingly strong (Kopcke 1993). The volatility of assets' returns seems to be very sensitive to recent "surprises" (for example, GARCH models). Closed-end mutual funds frequently sell at significant, variable discounts from their net asset values. And, some contend that simple trading rules yield excess returns (for example each January buy the 10 stocks in Dow Jones Industrials that have the lowest price-earnings ratios).

<sup>8</sup> This proprietary knowledge is not necessarily shared equally among all insiders and does not always entail a more accurate view (Simons and Cross 1991).

Figure 5

### Effect of Misvaluation of Proprietary Assets on Equity



over the company's decisions when necessary may reduce the cost of funds considerably for the manufacturer, even after considering any administrative impositions entailed by the loan. In this respect financial intermediaries can promote both the efficiency of financial markets and capital formation by reducing the bid-ask spread on securities that are not very familiar to most investors.

### Public Confidence and the Value of an Intermediary's Equity

The capacity of any intermediary to apply its proprietary information depends on other investors' confidence in the management of the intermediary. Suppose an intermediary acquires an asset whose risks appear greater to investors outside the intermediary than to specialists within the intermediary, so that the intermediary's private valuation exceeds the public valuation of the asset (Figure 5). Before the purchase of the asset, the value of the intermediary's equity in public markets corresponds to point 1 (matching point 2 in Figure 3). After the purchase of the asset, outside investors perceive that the intermediary has assumed more risk, so even if outsiders believed the intermediary were being compensated

fairly for its assumption of this additional risk, the line representing the value of equity shifts downward, reflecting the increased odds of bankruptcy. The value of equity in this case would fall to point 2. However, when the intermediary acquires the asset for a price exceeding its public valuation, outsiders also believe

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*The capacity of any intermediary to apply its proprietary information depends on other investors' confidence in the management of the intermediary.*

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that the intermediary is assuming this additional risk without receiving a sufficiently great expected return. Accordingly, the value of the intermediary's equity in public markets falls to point 3. Similarly, outside analysts who mark the intermediary's assets according to their valuation in public markets find that their measure of its capital falls by the distance between points 2 and 3, which represents the amount that the intermediary apparently overpaid for the asset.

Of course, the managers of the intermediary acquiring the asset take exception to these discounts. Because they believe the risk inherent in the asset is less than other investors believe it to be, and because they believe the asset's expected return is sufficient to compensate them for the asset's risk, in their opinion the dashed line representing the market value of equity should not fall as low as the line passing through point 2. In fact, to the degree the price they pay for the asset does not fully reflect their private valuation, the intermediary is earning a rent; therefore, in the opinion of its managers, the market value of its equity should be closer to, and may even exceed, that indicated by point 1.

The risk premium required of the intermediary by outsiders limits the ability of intermediaries to "arbitrage" the bid-ask spreads prevailing on securities that are not very familiar to most investors. The managers of financial intermediaries may proceed with their investments expecting that the resulting excess returns will compensate them for having to pay greater yields on their liabilities, but the need to cover

the higher cost of these liabilities, other things equal, warrants higher returns from their proprietary investments. Higher prices attract fewer takers. Furthermore, sufficiently large differences between the book value of an intermediary's assets and outside analysts' valuations of these assets threatens management's freedom to make its own decisions.

The value of equity does not necessarily fall for all intermediaries that purchase assets that are not familiar to other investors. Investors often accept the judgments of those intermediaries with a history of earning of attractive returns, those with strong reputations for making astute investments, for managing risky investments, and for not investing too greatly in illiquid assets. Managers deserving this confidence earn returns that, on average, exceed those available on other assets of similar risk that are traded in public markets. The value of equity for intermediaries with secure reputations tends to exceed their capital to the degree their shareholders anticipate that they will continue to earn rents.

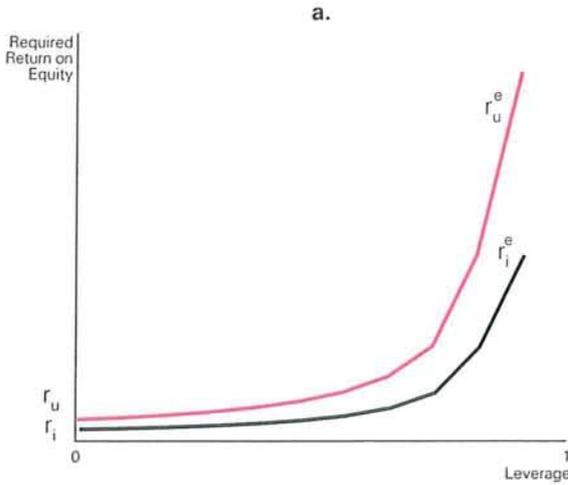
#### *Leverage and the Cost of Funds*

If shareholders are more confident or optimistic than creditors about the investments of a financial intermediary, the intermediary's cost of funds rises with its leverage, thereby inducing its management to set minimal standards for the intermediary's capital per dollar of risky assets. Other things equal, these voluntary capital requirements increase when investors become more wary of an intermediary's prospects or the difference between an intermediary's expected return on assets and its cost of funds diminishes. In these cases, management may meet its rising standards by acquiring more capital or by diminishing the share of its portfolio invested in proprietary assets, whichever course seems most economical.

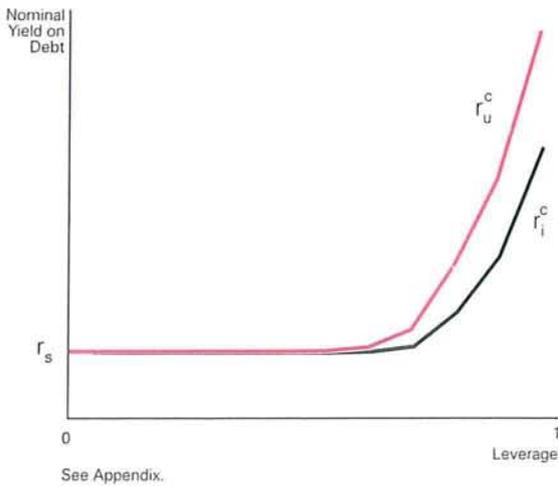
The cost of funds for intermediaries depends on marginal investors' views of their assets. Suppose investors are either informed or uninformed about the prospective return on an intermediary's assets. If the intermediary raises funds only from informed investors to finance a given portfolio of assets, its cost of funds is  $r_i$  regardless of its choice of leverage because the investors' assessments of the returns on this portfolio do not depend on the manner in which it is financed. Uninformed investors, on the other hand, require a greater return,  $r_u$ , because they anticipate more risk. For any given degree of leverage, uninformed investors require a greater return on both their debt and equity than do informed investors, but this

Figure 6

*The Cost of Funds*



b.

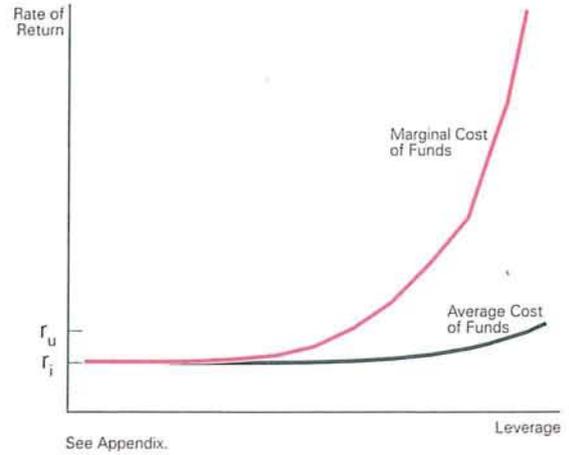


difference in required yields is greatest for equities (Figure 6).<sup>9</sup>

If an intermediary issues liabilities to uninformed as well as informed investors, informed investors would tend to own the equity of the intermediary, and uninformed investors would tend to own its debt. If the intermediary, after having exhausted the resources of informed investors, were to offer both debt and

Figure 7

*Leverage and the Cost of Funds*



equity to raise new funds, it would offer these securities at higher yields than formerly to attract uninformed investors. Informed investors would perceive the price of new debt and equity to be comparatively low, but equities would offer the better bargain. Accordingly, informed investors holding the debt of the intermediary would exchange their securities for equities, outbidding uninformed investors. After the available resources of informed investors were invested entirely in equities, the intermediary would achieve its lowest cost of funds by issuing only debt instruments to uninformed investors to raise more funds. In these circumstances, the intermediary's cost of funds rises as it expands and increases its leverage (Figure 7).<sup>10</sup> Because each new dollar of debt raises the rate of interest that the intermediary pays on all of its debt, the marginal cost of these funds exceeds the average cost of funds. If the intermediary were to issue both new equity and debt to uninformed investors, its average cost of funds would rise abruptly, and, with this sale of equity, its marginal cost of funds, especially in the opinion of shareholders, would rise even more abruptly.<sup>11</sup>

<sup>10</sup> Once leverage becomes too great, the intermediary, in principle, might minimize its average cost of funds by issuing new equity, but doing so entails substantial capital losses for existing shareholders. Accordingly, the institution's voluntary standards for capital ought to limit leverage, in order to avoid the potential expense of having to issue new equity.

<sup>11</sup> The prices of both equity and debt in competitive markets would be set by the uninformed investors, who, in this case, would

Because investors' opinions of an intermediary's prospects generally span the spectrum of optimism, price-discriminating intermediaries minimize their cost of funds by issuing many different types of liabilities that offer many different blends of expected returns and risks. Their equity is held by the most optimistic investors, while preferred stock, debentures, notes, paper, investment contracts, deposits, and repurchase agreements are held by others who value an increasing degree of security. Retained cash flow (representing the implicit investment of funds by the most optimistic investors) and rights issues remain the least expensive source of funds (Duesenberry 1958; Myers 1984; Myers and Majluf 1984; Harris and Raviv 1991).

Bankruptcy costs reinforce the tendency for the cost of funds to rise with leverage, once leverage becomes sufficiently great. The markets for intermediaries' proprietary assets are not very liquid, especially when the primary specialists in these assets, as a result of their own financial duress, no longer are investing actively. Accordingly, when investors are not informed equally well about the assets acquired by financial intermediaries, the potential cost arising from the bankruptcy of an intermediary can greatly exceed those presented in section I, as a result of the new owners' need to manage unfamiliar proprietary assets or to sell these assets in illiquid markets to other wary investors. The expense of insuring creditors against this cost of bankruptcy becomes substantial after an intermediary's capital per dollar of risky assets falls sufficiently low, thereby raising the odds of bankruptcy. In this case, issuing new equity, even to relatively wary investors, is more economical than issuing new debt.<sup>12</sup>

### *Voluntary Standards for Capital*

The optimal choice of leverage balances an intermediary's cost of funds against its assessment of the prospective return on its potential investments. For example, the management of an intermediary could expand its investments until its marginal return on assets equals its marginal cost of funds. Although managers might believe that outsiders impose too great a hurdle rate given the risks (as the managers perceive them) inherent in their assets, if the expected

marginal return on assets were less than the marginal cost of funds, the value of the intermediary's equity would diminish with any further expansion of its portfolio.

Those intermediaries with the best reputations and, therefore, the lowest cost of funds would be able to expand and to lever themselves the most. A good reputation reduces an intermediary's marginal cost of funds in two ways. First, investors require lower returns on the intermediary's liabilities. Second, as the intermediary expands, the least optimistic investors do not require returns very much greater than the most optimistic investors.

Suppose two intermediaries expect yields of 10 percent on their proprietary assets, and insiders require a constant average cost of funds of 4 percent, regardless of leverage. If these intermediaries could rely solely on insiders for their financing, their marginal cost of funds would be a constant 4 percent. The

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*The optimal choice of leverage balances an intermediary's cost of funds against its assessment of the prospective return on its potential investments.*

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ample investment opportunities for both, however, compel them to sell debt to outsiders. The good reputation of the first intermediary among outsiders allows it to raise \$10 million of debt at no premium over the yield required by insiders on their debt, \$20 million of debt at a premium of 1 percentage point, \$30 million at a premium of 2 percentage points, and so forth. The weaker reputation of the second allows it to raise \$10 million at no premium, \$20 million at a premium of 2 percentage points, and so forth. The marginal cost of funds for the first intermediary is 4 percent for the first \$10 million of debt that it issues. For the next \$10 million the marginal cost of funds rises to 6 percent: The second \$10 million not only costs a premium of 1 percentage point itself, but it also raises the premium on the first \$10 million from zero

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<sup>12</sup> The intermediary could reduce the cost of raising new capital somewhat by issuing different classes of equity or other liabilities (such as subordinated debt) that might: (1) be recognized as capital by senior creditors and supervisors, and (2) offer new investors more security than common stock.

be the marginal investors. New equity sold at a discount sufficient to attract uninformed investors (especially when the reputation of the intermediary is questionable) would impose substantial losses on previous shareholders.

to 1 percentage point. The marginal cost of funds rises to 10 percent with \$40 million of debt: the last \$10 million requires a premium of 3 percentage points itself, and it raises the premium on the previous \$30 million by 1 percentage point, which adds another 3 percentage points to the cost of the last \$10 million. The second intermediary issues no more than \$20 million of debt; otherwise, its marginal cost of funds would exceed 10 percent. This intermediary can diminish, but not entirely avoid, the burden of its handicap by issuing different liabilities to different investors.<sup>13</sup>

An intermediary that suffers a loss of reputation may cope either by diminishing its investments in proprietary assets or by issuing new equity. The former is frequently the most economical course. If the marginal cost of debt is too expensive, equity is not likely to be a bargain, because a loss of confidence increases the cost of equity more than that of debt. If the intermediary sold those assets that are most familiar to outside investors, it would only increase its marginal cost of funds as the proportion of its liabilities backed by questionable proprietary assets increased. If, however, outsiders discounted the value of proprietary assets too greatly, so that selling these assets entailed substantial losses and the intermediary's capital were sufficiently low to raise the risk of bankruptcy, management would need to issue new equity.<sup>14</sup>

### *Financial Fragility, Credit Crunches, and Systemic Risk*

The financial system becomes more fragile as public investors who formerly accepted intermediaries' valuations of their proprietary assets become skeptical of those valuations.<sup>15</sup> Even the best investors ultimately suffer runs of bad luck wherein too many investments yield disappointing returns for too long, encouraging outsiders to question whether the returns are adequate for the risks inherent in these proprietary investments. Intermediaries that expect to earn greater rents by not paying their "full price" to obtain their proprietary investments, retain more "capital" for protection against the consequences of disappointing returns. A bad run would diminish, but not necessarily eliminate, the value of an intermediary's equity relative to that of its capital (the value of equity would tend to remain above point 1 in Figure 5). If the desire to meet or beat the competition causes an intermediary to bid full price for its proprietary assets, it retains less capital in the form of expected rents, putting the

value of its equity at greater risk should it experience a run of disappointing earnings (the value of equity could approach point 3 in Figure 5).<sup>16</sup>

A loss of confidence creates a credit crunch, as the cost of funds for affected financial intermediaries rises compared to yields prevailing in public markets.

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*A loss of confidence creates a credit crunch, as the cost of funds for affected financial intermediaries rises compared to yields prevailing in public markets.*

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When outsiders discount the value of an intermediary's proprietary assets, the value of its equity falls, as creditors require greater risk premiums. Intermediaries respond by reducing their leverage and their investments in assets for which managements' and outsiders' assessments diverge the most. In turn, the cost of funds rises sharply for businesses and consumers who depend on this intermediary for their financing (Gurley and Shaw 1955, 1956, 1960; Tobin

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<sup>13</sup> This example illustrates why differences between yields on private debt and Treasury debt might not indicate consistently the magnitude of credit crunches, and it suggests that changes in these differences may reflect more than changes in monetary policy. Suppose the cost of funds for the first intermediary rose to match that of the second intermediary owing to a sequence of disappointing earnings or growing fears of such disappointments. In this case, the intermediary would reduce its investments and diminish its leverage; yet, after this adjustment, the average cost of its debt in public markets would not rise, but fall—its average premium on debt drops from 3 to 2 percentage points. If a tighter monetary policy (higher safe rates of interest) accompanied the shift in confidence, the intermediary's yield on debt would fall less than indicated above or might even rise; nonetheless, any change in quality spreads would reflect the changing assessments of both insiders and outsiders. Ironically, the more skeptical outsiders become, the greater is the ensuing credit crunch, and the less quality spreads may rise as intermediaries reduce both their leverage and their investing in proprietary assets.

<sup>14</sup> The value of shares should fall well before the public offering, as existing shareholders who anticipate this need to issue new equity and who hope to limit their losses might sell their shares to outsiders. Therefore, intermediaries' voluntary capital standards should become binding well before the need to issue equity to outsiders becomes very great.

<sup>15</sup> The recent experiences of banks in Texas, New England, and Japan may illustrate such crunches (Furlong 1992; Peek and Rosengren 1995a; Bizer 1993; Bernanke and Lown 1991; Berger and Udell 1994; Hancock, Laing, and Wilcox 1995).

<sup>16</sup> Those whose bids reflect their full valuation of an asset, "will, in the long run, be taken for a cleaning" (Capen, Clapp, and Campbell 1971). See also Thaler (1988).

1963; Bernanke and Gertler 1987). This crunch is most severe for intermediaries that hold the least capital per dollar of assets and those that retain less rent when purchasing proprietary assets. Intermediaries for which these resources are most ample are best able to adjust in a timely manner, perhaps postponing shrinking until their reputation is restored.

The rent embedded in the yields on intermediaries' proprietary investments can be considered a premium for insuring access to funds for their customers at reasonable terms. The need for this insurance is not compelling when public confidence in the management of financial intermediaries is strong. Accordingly, when all are optimistic, competitive pressures among intermediaries placing funds and customers seeking funds may diminish the writing of this insurance against credit crunches; borrowers want the best yield, and lenders want the volume. In these circumstances, any attenuation of public faith in intermediaries threatens a greater degree of financial fragility and more severe crunches (Sharpe 1990; Slovin, Shuska, and Polonchek 1993; Gibson 1995).

Systemic risk arises when the value of assets falls well short of expectations at many financial intermediaries at nearly the same time. Of course, the failure of one intermediary to meet its obligations may start a chain reaction if many intermediaries invest very greatly in each other's liabilities. But the ties need not be so explicit. For example, the failure of one bank might kindle duress at others if all had taken similar risks by investing a considerable proportion of their assets in loans to similar borrowers or similar industries. The potential for systemic risk increases when the need to establish strong reputations or accumulate capital encourages intermediaries to emulate winners, impelling all to report returns matching those of their most successful competitors. Systemic risk diminishes as intermediaries invest in more diverse assets and maintain adequate profit margins on their investments.

### *III. Heterogeneous Opinions and the Consequences of Regulation*

According to the analysis of section I, when all investors assess the potential returns on all assets the same and when capital markets are competitive, regulations that govern the risks and leverage assumed by financial intermediaries are of little consequence unless they alter the net yields on assets through taxes, reserve requirements, or mispriced insurance fees. If,

however, investors are not equally well informed about the prospective returns on all assets, the terms on which financial intermediaries are able to issue their liabilities or acquire assets depend considerably on the regulations governing their financial structure.

Regulations that in some circumstances seem prudent and conservative do not necessarily promote safe and sound financial institutions or economic stability if, in other circumstances, they diminish the capacity of intermediaries to absorb financial shocks.

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*Regulations that in some circumstances seem prudent and conservative do not necessarily promote safe and sound financial institutions or economic stability if, in other circumstances, they diminish the capacity of intermediaries to absorb financial shocks.*

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Regulations such as capital requirements influence the cost of funds for intermediaries, and the burden of these requirements can vary substantially with outsiders' state of confidence. Although the conflation of fixed capital requirements with the marking of assets according to their market values promotes secure intermediaries when all investors possess the same information about intermediaries' assets, these policies can increase the volatility of intermediaries' cost of funds when outsiders are not informed fully about the prospects for intermediaries' proprietary assets. Because regulations affect the price of risk in financial markets and because this influence varies with economic conditions, the most promising regulatory policies seemingly would stabilize financial markets best by managing the price of risk in order to foster an appropriate flow of savings and investment, rather than by attempting to set absolute standards in order to judge the safety and soundness of intermediaries.

#### *Capital Requirements*

When investors are not informed equally well or, for other reasons, perceive the returns of intermediar-

ies' assets differently, the setting of minimum standards for the capital of intermediaries must balance the potential benefit of safer financial institutions against the cost of more expensive funds for those who rely on intermediaries for their financing.

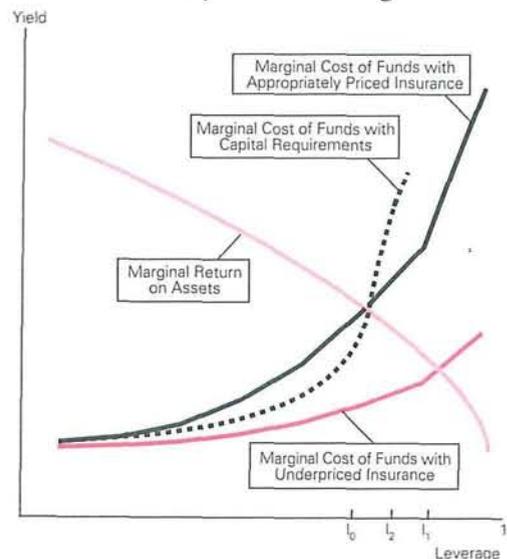
The potential benefits of regulating standards for capital are small unless creditors underestimate the risks assumed by financial intermediaries. If creditors require a premium that is too great, intermediaries restrict their purchases of assets more than necessary because of their greater cost of funds. Altering capital requirements alone would not alleviate such a credit crunch. If creditors require a premium that is too small for the risks they bear, intermediaries would expand more than otherwise. These circumstances may arise when creditors expect governments or others to indemnify them should their intermediary fail and when those who purportedly write this put option receive an insufficient premium from the intermediary to cover this liability. For example, if investors believed that the government regarded certain banks or insurance companies as too important to fail, then these institutions' uninsured creditors would not require adequate risk premiums of these intermediaries.

Capital requirements may limit the risks that intermediaries transfer to others, but, in principle, these requirements must be flexible if they are to substitute for fair risk premiums. Proper capital requirements should induce intermediaries to assume the degree of leverage that they would have assumed if creditors and their guarantors required properly priced risk premiums (Figure 8). Suppose that, in the opinion of fully informed investors who bear the full risk of their investments, the marginal cost of funds equals the marginal return on assets when an intermediary's leverage is  $l_0$ . If, however, creditors do not require adequate risk premiums, the marginal cost of funds falls (the dashed line), and leverage rises to  $l_1$ .

When capital requirements compel intermediaries to switch from debt to equity financing before they reach their voluntary standards for minimum capitalization, these requirements increase intermediaries' cost of funds substantially. Should regulators require that leverage not exceed  $l_2$ , an intermediary's cost of funds would rise (the dotted line), thereby inducing it to maintain leverage nearer  $l_0$ . The cost of funds rises sharply before reaching  $l_2$  as the odds of having to raise more equity increase when  $l$  approaches  $l_2$ . The more steeply the cost of funds rises near  $l_2$  (due to the added expense of equity financing), the closer  $l_2$  should be to  $l_1$  in order to achieve leverage very near  $l_0$ . The choice of  $l_2$  presumes both that regulators

Figure 8

### Capital Requirements, the Cost of Funds, and Optimal Leverage



understand that the appropriate leverage is  $l_0$  and that they know how greatly the cost of funds rises with the switch from debt to equity financing. In order to maintain an appropriate flow of funds on proper terms, capital requirements should change as both the returns and risks inherent in an intermediary's proprietary investments change, as the "subsidy" implicit in the returns required by creditors changes, and as the "premium" for selling equity to outsiders changes.

Fixed capital requirements tend to exaggerate the credit cycles that arise as the opinions of outside investors vary from optimism to pessimism during business cycles (Blum and Hellwig 1995). At times when outsiders are particularly optimistic about the earnings of intermediaries, fixed capital requirements would entail a comparatively low cost of funds, encouraging intermediaries to expand comparatively rapidly when the prospects for the economy are attractive. At times when outsiders are particularly skeptical, requirements would impose a comparatively great cost of funds on intermediaries and their proprietary investments, thereby increasing the magnitude of credit crunches when the outlook deteriorates.

Adjusting capital requirements or the powers of intermediaries seems to be an awkward means of regulating intermediaries' risk. When savers are too

optimistic about the returns that will redound to intermediaries, greater minimum capital requirements might prevent insufficient risk premiums from inciting speculative booms. Perhaps requirements might be raised most for the "riskiest" assets, those riding the greatest bubbles. Conversely, capital requirements might be reduced when savers are too pessimistic. Yet, this policy depends on regulators' ability to recognize bubbles before others and to enforce new capital requirements. In any case, requiring intermediaries to raise more capital when outsiders are most willing to acquire their shares at high prices would seem to be a weak deterrent to speculative booms, and requiring less capital when savers are most concerned about the security of intermediaries' liabilities would seem to be a weak spur to confidence. The countercyclical adjustment of intermediaries' powers for making certain investments would pose similar problems.

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*Fixed capital requirements tend to exaggerate the credit cycles that arise as the opinions of outside investors vary from optimism to pessimism during business cycles.*

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To measure and control the risks of financial intermediaries, especially those of banks and insurance companies, regulations favor risk-based capital requirements (Spong 1994, pp. 70–82; Webb and Lilly 1994; Barth 1995; Cummins, Harrington, and Niehaus 1994). According to this policy, an intermediary holds capital in proportion to its investment in assets that are designated risky, but it might not hold capital in proportion to the risks that it assumed in its entire balance sheet (Grenadier and Hall 1995). These requirements, which currently dwell almost exclusively on credit risks, take into account neither any diversification of investments that might mitigate these risks nor any exposure to risks created by changing interest rates and other yields on assets.<sup>17</sup> Safe balance sheets might be burdened with excessive capital requirements: A portfolio of assets offering a relative safe return might comprise a blend of risky assets with offsetting risks. Conversely, risky balance sheets might enjoy especially lenient capital requirements: A safe asset, such as a government bond, might be financed with short-term loans, thereby creating considerable

risk for the intermediary and its creditors. Risk-based capital requirements also entail an implicit tax, creating a kind of credit control, on those assets that are designated as risky, often the proprietary assets of intermediaries. This tax, which reflects the cost of equity financing, becomes especially burdensome during credit crunches. Accordingly, risk-based capital requirements encourage intermediaries to reduce their investments in these designated assets comparatively greatly during crunches, despite their success in controlling the risks in their balance sheets.

### *Accounting for Capital*

The gravity of the tax implicit in capital requirements depends on the rules that govern how intermediaries measure their capital. If the managers of intermediaries are best informed about their proprietary assets for which markets too often are shallow or illiquid, marking all assets according to market prices undermines the efficient flow of funds in financial markets by supplanting the opinions of specialists with those of less informed investors. Market prices in these circumstances can be biased estimates of the values of proprietary assets.<sup>18</sup> As the optimism of outsiders rises, prices of these assets may nearly meet or exceed proprietary valuations for a time, only to fall below proprietary valuations when this optimism subsequently ebbs. This potential volatility of outsiders' valuations for proprietary assets induces a commensurate volatility of intermediaries' capital with market accounting. Banks in Texas, New England, and Japan, for example, possessed more than adequate protection when the value of enterprises and real estate backing their assets was very great, but this capital eroded quickly when the prices of these assets collapsed.

Not only does a loss of confidence that reduces the value of capital in this manner raise the cost of funds for any given leverage (the dotted line in Figure 8 shifts up when leverage is near to or greater than  $l_2$ ),

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<sup>17</sup> Banks and other intermediaries traditionally have pursued profits by "taking a view" of market trends or by "riding the yield curve." In the recent recovery, intermediaries invested a substantial share of their assets in longer-term Treasury securities in anticipation of falling interest rates. The risk in this strategy entailed no extra capital assessments; instead, to the extent intermediaries reduced their commitments to lower-grade bonds, mortgages, or equities, their capital requirements were diminished.

<sup>18</sup> When no true prices are quoted in markets for assets, supervisors often resort to prices of comparable assets, prices derived from models, or book values of assets net of estimates of losses (due to default or workouts).

but, with market accounting, the loss of confidence also raises the cost of funds by increasing leverage (increasing  $l$ ). When the prices of proprietary assets are particularly high, the cost of funds is comparatively low ( $l$  tends not to exceed  $l_2$ ), encouraging intermediaries to issue more debt and expand their assets by offering comparatively attractive terms to those seeking funds. When the prices of proprietary assets "break," so does the capital of intermediaries (if  $l$  were near  $l_2$ , it would rise above  $l_2$ ), abruptly increasing the cost of funds.

Marking both assets and liabilities according to market values does not necessarily salvage market accounting, partly because ratios of capital to assets, however defined, are designed to measure neither the risks assumed by intermediaries nor their capacity for protecting creditors from losses (Merton 1995; Berger, Herring, and Szegö 1995). Insurance companies each holding \$10 million of 30-year mortgages financed by \$1 million of capital and \$9 million in cash value life insurance policies have the same capital ratios. But those companies that impose sufficient call premiums on policyholders who try to withdraw funds are protected better should interest rates rise unexpectedly. Similarly, companies that include sufficient call premiums in their mortgage loans are better insured against the risk of falling interest rates. Capital ratios measure neither the insurance embedded in intermediaries' portfolios nor the rate at which this insurance coverage might change with economic conditions.<sup>19</sup>

Alternative assessments of the "capital" of portfolios examine how their earnings and cash flows change with economic conditions. These sensitivity tests implicitly weigh the consequences of: (1) the options assumed by intermediaries, including those embedded in their assets and liabilities; (2) the mismatches in their books between long and short commitments at various maturities; (3) the correlation of returns among assets and liabilities; and (4) the possibility that the prices of some assets collapse and their maturities increase for want of dependable markets. These tests should be dynamic, incorporating managements' responses to changing conditions and covering intervals of time sufficiently long to encompass the full consequences of these changing conditions. Because the need for insurance arises precisely because investors are not all fully informed and markets are not dependable, these approaches might understate the risks that arise when the confidence of outsiders shifts, bringing surprisingly sharp changes in the prices of riskier assets while changing the customary covariances among their returns and perhaps those among

more liquid assets as well. Consequently, risk managers and supervisors should use the simulation model behind these tests to isolate an intermediary's bets—that is, to isolate those economic conditions that will threaten its solvency—so that they may assess its potential risk.<sup>20</sup>

### *Prompt Enforcement of Capital Requirements*

Current strategies for regulating financial institutions rest on the prompt enforcement of risk-based capital requirements.<sup>21</sup> Policies for enforcing capital requirements that promote sound financial institutions in some circumstances might fail to do so in other circumstances. For example, the prompt enforcement of minimum capital requirements using market value accounting is a conservative policy when the markets for financial instruments are liquid. It also can be an efficient means of levying a fair liability insurance premium, as discussed in section I. Yet, the prompt enforcement of capital requirements tends to weaken intermediaries when outsiders are most skeptical of the returns on their proprietary assets and the prices of these assets understate their value significantly. Accordingly, the prompt enforcement of capital requirements also might not reduce the potential liabilities of agencies that guarantee the liabilities of intermediaries (Gilbert 1992).

If risky assets were priced efficiently, their prices would resemble random walks (Cootner 1964; Merton 1990). Tomorrow's news would be no more likely to

<sup>19</sup> In the language of options, capital ratios do not convey the deltas, the gammas, or any of the other "Greeks" embedded in a balance sheet.

<sup>20</sup> Value-at-risk calculations essentially weight these events according to odds chosen by management. Even if the managements of all intermediaries assigned the same odds to the same events, supervisors might not agree with these assessments. A conservative policy, for example, might require that intermediaries adopt policies that keep their maximum losses for "reasonably likely" events below some minimum set by supervisors.

If intermediaries are portfolios of functions that differ mainly in the blends of functions they offer their customers, then level playing fields and efficient markets might require functional regulation that spans intermediaries. Even so, the risk in a portfolio is not a simple sum of the risks in its constituent functions. The auditing of risks described in this paragraph, therefore, requires more universal supervision.

<sup>21</sup> Following a 1988 agreement on capital requirements among the United States and other developed economies and the Federal Deposit Insurance Corporation Improvement Act of 1991, the supervisory standards that apply to each bank depend on its regulators' rating of the adequacy of its capital (Spong 1994, pp. 70–82). In practice, however, regulators of banks appear to intervene earlier and with more discretion than the risk-based capital provisions of FDICIA would suggest (Peek and Rosengren 1995b; Jones and King 1995).

increase the value of these assets more than expected than to decrease their value more than expected. When intermediaries purchased these assets, prudent supervisors might require that they be marked according to their market values, because they would be no more due for redeeming gains after suffering substantial losses than they would be due for further substantial losses. A very conservative policy also might require that capital equal 100 percent of the value of proprietary assets so that creditors bear none of their risk (Friedman 1959; Tobin 1985; and Litan 1987). This need for 100 percent capital requirements diminishes if supervisors compel intermediaries to practice a form of portfolio insurance, responding promptly to any losses by raising new capital or by selling some risky assets (Fortune 1995). With such a policy of prompt enforcement, the more frequently risky assets are appraised and the less volatile are their prices, the less capital is required.

When shareholders regard raising new capital from outsiders to be very expensive, regulators have another reason to enforce promptly their standards for capital, including seizing the assets of intermediaries

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*The prompt enforcement of capital requirements is not necessarily a conservative policy when markets are not liquid.*

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that are nearly insolvent even though their capital is not exhausted. When an intermediary's capital is nearly depleted, shareholders may increase the value of their equity either by raising new capital or by assuming more risk, thereby increasing the value of the put option created by the shield of limited liability (Figure 2a). If creditors and guarantors do not raise their risk premiums promptly as shareholders assume more risk, then shareholders have little to lose by taking riskier investments, and they have much to gain should these investments produce high yields. When regulators seize the assets of the intermediary, they essentially are charging the shareholders a premium that covers the risk of the shareholders' taking such a strategy.

Nonetheless, the prompt enforcement of capital requirements is not necessarily a conservative policy when markets are not liquid. If proprietary assets are

not priced efficiently, their values may not follow random walks. When outsiders are most optimistic, the prices of these assets may nearly match or exceed informed valuations; when outsiders are most wary, their prices may fall well below these valuations. Therefore, the prices of these assets tend to revert to trends: Once a price falls below its proprietary valuation, the odds of its returning increase with time, while the odds of its falling further diminish. The prompt enforcement of capital requirements may even magnify the degree to which the prices of these assets diverge from trends. If, for example, an intermediary must sell proprietary assets in order to restore its ratio of capital to risky assets after the prices of these assets subside in the opinions of outsiders, then these prices will fall further in illiquid markets. After the prices of proprietary assets fall substantially, thereby increasing an intermediary's leverage, the chance of redeeming capital gains increases with time, while the chance of commensurate losses diminishes. Therefore, when the value of an intermediary's assets approaches that of its obligations and its liabilities are of sufficiently long duration, its expected losses due to insolvency may be low compared to the expected gains from retaining these assets (the divergence between points 1 and 3 in Figure 5 is especially great).

Suppose an intermediary attempts to maintain a ratio of capital to assets of 10 percent, while investing 40 percent of its assets in proprietary investments, 60 percent in safe assets. Because creditors believe the intermediary's liabilities are insured adequately, the yield on these accounts equals the yield on safe assets. The prices of proprietary investments follow a smoothed random walk: A below-average return on these assets creates no expectation of compensating above-average returns subsequently.<sup>22</sup> When favorable earnings increase its capital per dollar of assets, the intermediary sells more accounts, investing the funds as required to maintain the 3:2 ratio between its safe and risky assets. When poor earnings reduce its capital per dollar of assets, the intermediary sells no new accounts and acquires no new risky debt. The capital of this intermediary approaches zero, on average, nearly twice every one hundred years (Figure 9a). When the intermediary practices portfolio insurance, selling risky assets as required in order to prevent the

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<sup>22</sup> This example uses a colored random walk with drift. The news that yields higher (or lower) than average returns in one year tends to yield higher (or lower) returns in subsequent years, albeit by an amount that diminishes with time. Despite these short-run cycles, in the long run the probability distribution of the value of an initial investment in the asset approaches a random walk.

Figure 9a

*Capital Ratios When Prices of Assets Follow a Random Walk*

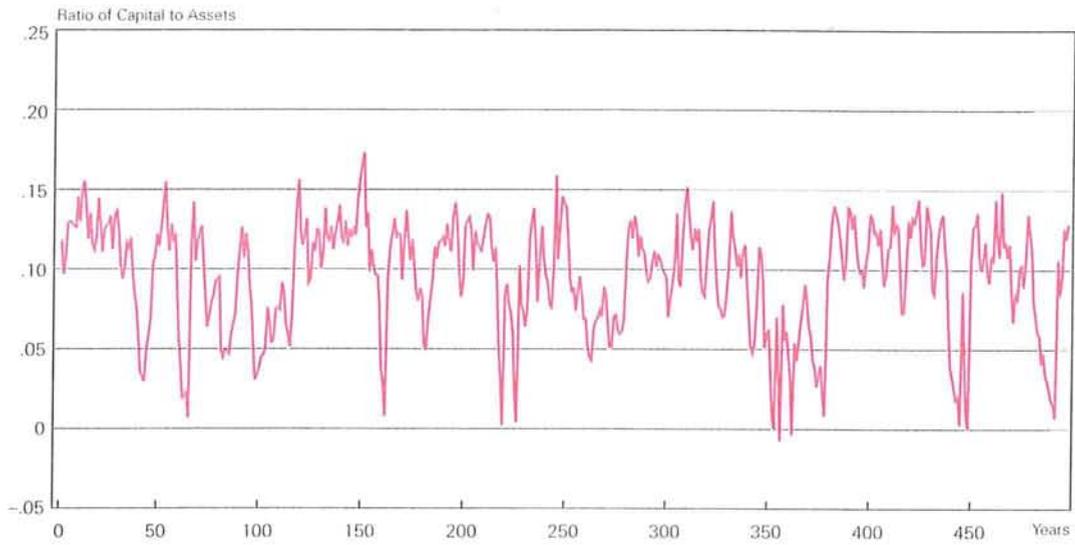


Figure 9b

*Capital Ratios When Prices of Assets Follow a Random Walk and  
Capital Requirements Are Promptly Enforced*

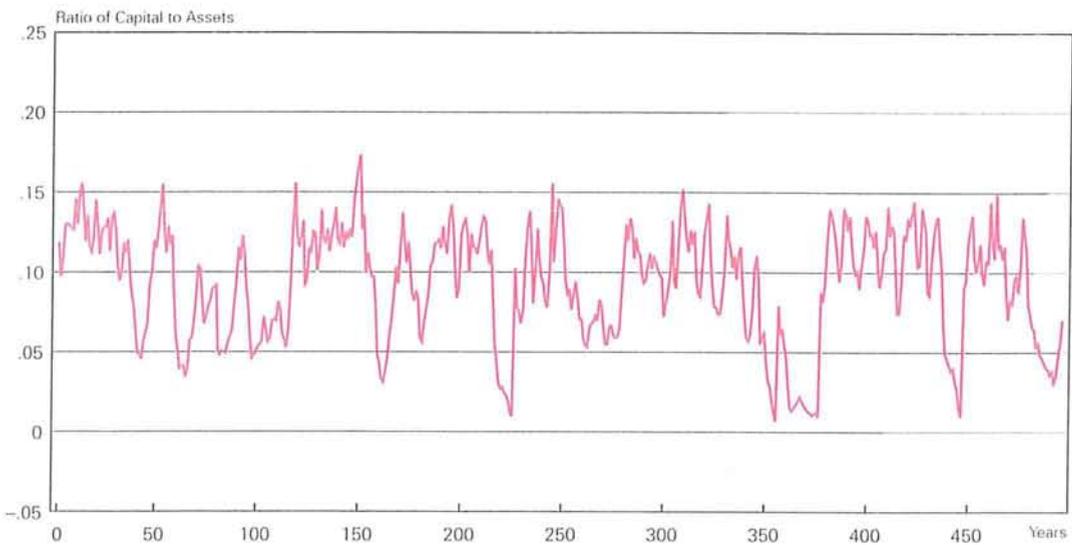


Figure 9c

*Capital Ratios When Prices of Assets Revert to Trend*

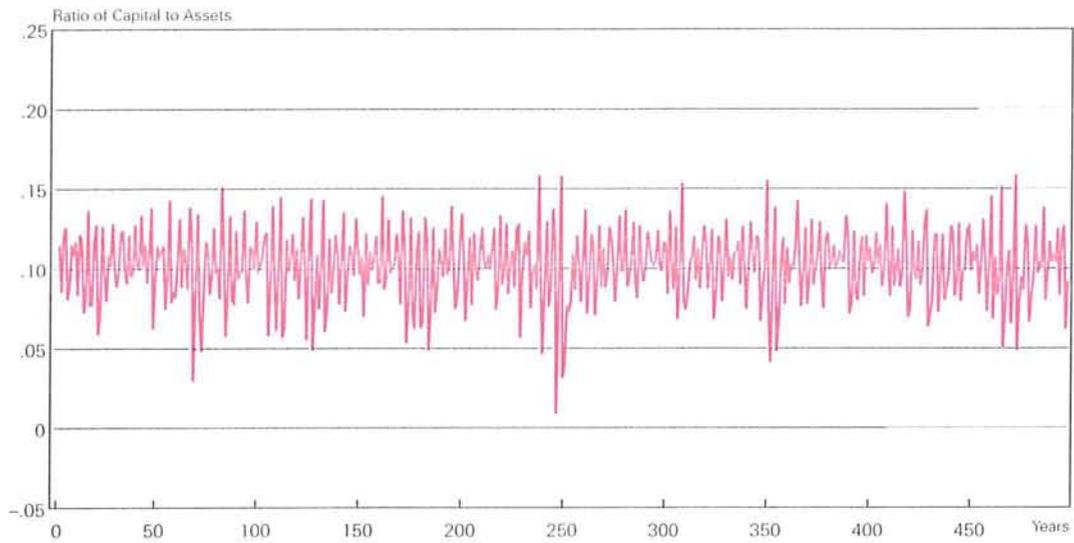


Figure 9d

*Capital Ratios When Prices of Assets Revert to Trend and  
Capital Requirements Are Promptly Enforced*



See Appendix.

ratio of risky assets to capital from exceeding 4, then the intermediary's capital approaches zero less than once every century (Figure 9b).

Although the prompt enforcement of minimum capital standards makes intermediaries more secure when the prices of their assets follow random walks, this policy can undermine their security when their proprietary assets are not always liquid. If the values of proprietary assets tend to return to trend—a run of below-average returns increases the odds of earning above-average returns—the capital-to-asset ratio almost never approaches zero with the investment strategy described in the first simulation (compare Figure 9c to 9a), even though the annual volatility of the rate of return on proprietary assets is greater than in the first case. If, in this last instance, the intermediary practices portfolio insurance by selling some of its risky assets after their values decline and if the disposal of these assets temporarily reduces their prices by an additional 10 percent, then the intermediary's average capital-asset ratio (Figure 9d) falls and becomes more volatile. Consequently, the intermediary's capital approaches zero more frequently, about once every century, when it sells its risky assets at distressed prices in order to meet its capital requirements. Furthermore, this policy of promptly enforcing capital requirements induces a clear credit cycle: The lending capacity of the intermediary, as reflected in its capital per dollar of assets, falls further and remains depressed longer in this last case than it did in the former.

### *Supervision and Liability Insurance*

Insuring the liabilities of financial intermediaries can make financial markets more efficient both by reducing the excessive risk premiums that outsiders might require of intermediaries and by diminishing the volatility of this premium over time. In order to achieve this efficiency, however, guarantors must make informed assessments of the risks entailed by intermediaries' commitments, so that each intermediary's insurance premium corresponds to its risks. To the degree the coverage of liability insurance is not complete—creditors bear some of the losses arising from insolvencies—or to the degree guarantors assess the values of proprietary assets the same as less-informed investors, then the cost of funds for financial intermediaries becomes more dependent on the outsiders' state of confidence.

Financial intermediaries would be superfluous if savers were expected to evaluate the assets of inter-

mediaries before purchasing their liabilities. Intermediaries can offer savers considerable economies of scale as their specialists divide the cost of their research and management among many savers. These economies would be lost if each saver then evaluated with "due diligence" the assets of intermediaries. But here too, savers can realize economies by relying on the expert opinions of analysts and supervisors who review the skills of intermediaries' specialists and the performance of their investments.

Neither analysts nor supervisors, however, are disinterested referees (Stigler 1971). Analysts must gain the confidence of their customers. Intermediaries can shun those they regard as unfair, thereby denying these analysts important information. Investors similarly will be reluctant to hire analysts who fail to anticipate and promote what seems to be the next best investment. The reputation of supervisors, as the name implies, rests on the reputation of the intermediaries they examine, which tends to restrain the vigor of supervisors' criticism and promote too much tolerance (Stewart 1991; Kane 1995).

Analysts, by disclosing their expert criticism, may foster a deeper and broader understanding of intermediaries' financial strategies among outside investors. Although this understanding may stabilize public confidence in intermediaries, it also may be fragile. When many banks, insurance companies, and finance companies profited from the commercial real estate boom during the 1980s, for example, many analysts applauded their strategies while questioning the acumen of those who did not invest in these assets. In the ensuing bust, analysts were very critical of those holding very many commercial mortgages or other investments backed by commercial real estate. In retrospect, both the accolades and the censures often were exaggerated.<sup>23</sup> The ability of analysts to build a durable foundation for the confidence of outside investors also is limited by analysts' limited access to intermediaries' proprietary information (Randall 1989).

Supervisors work in confidence, using their regulatory authority to enforce their standards. Although supervisors, in principle, can review the investments of intermediaries more intimately than analysts, practical limitations on their capacity for discovery encour-

<sup>23</sup> Analysts and rating agencies essentially impose their own risk-based "capital requirements." The less formal "questioning" of banks and insurance companies investing in low-grade or highly leveraged debt, commercial mortgages, derivatives, and certain equities generally preceded formal regulations. Today, a diminished reputation among analysts can augment the already considerable burden of formal capital requirements for intermediaries.

age supervisors also to rely on regulations confining the powers of intermediaries, in order to maintain safety and soundness (Buser, Chen, and Kane 1981).<sup>24</sup> Furthermore, supervisors, like the intermediaries they oversee, may be inclined to take bets. The dimensions of the past savings and loan crisis were known long before it made the headlines (Kopcke 1981; Carron 1982); yet, supervisors and government officials, who were aware of the problem and worried by its potential cost, have been accused of allowing the industry to grow despite its lack of capital in hopes that future profits would restore its health (Kane 1989).

Supervisors have relied on regulations in order to limit the risks borne by intermediaries because, even if guarantors were collecting adequate premiums for insuring their liabilities, frequent or very expensive failures would suggest that intermediaries were not sufficiently safe or sound to outside investors. With fair premiums, the guarantors' expected obligations

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*In order to make financial markets as efficient as possible, each intermediary's insurance premium ought to depend on the risks entailed by its commitments.*

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would equal their premium receipts, but these premiums would control neither the frequency of failures nor the amount of their expected losses. In other words, fair premiums fix the expected value of guarantors' losses at zero, but fair premiums by themselves do not control the variance of these losses. If guarantors were to report substantial losses, outsiders might question the ability of their guarantors to insure the value of their liabilities, thereby defeating the purpose of liability insurance. Furthermore, failures engender administrative costs, similar to bankruptcy costs, that tend to make insurance programs excessively expensive when insolvencies occur too frequently. In these circumstances, surviving intermediaries and their customers, who often bear a substantial share of these extraordinary costs, would benefit from regulations that limit each intermediary's ability to assume risk.

Adopting more extensive rules to limit intermediaries' powers is no longer a promising remedy. From the 1930s to the 1970s, regulations controlled

both the assets and liabilities that intermediaries might issue and the competition among intermediaries. To the degree regulations protected the rents of each intermediary, they fostered safe and sound financial institutions at the cost of hindering the flexibility and efficiency of financial markets. This lack of flexibility subsequently weakened intermediaries once high rates of inflation and high rates of interest reduced or eliminated their rents, compelling them to cultivate new opportunities for profit. Regulations setting greater standards for capital only impelled the decline of other regulations that limited the powers of intermediaries. As intermediaries evolved, supervisors increasingly have found themselves auditing risks rather than enforcing regulations that define intermediaries.

Liability insurance may be considered a performance contract between the supervisors and creditors of financial intermediaries: Supervisors not only assess the risk, but supervisors as guarantors also indemnify creditors against default, bearing the consequences of any mispricing of this insurance. In order to make financial markets as efficient as possible, each intermediary's insurance premium ought to depend on the risks entailed by its commitments. Creditors who value this service purchase insured liabilities, accepting the safe rate of interest. Intermediaries also would promote these insured liabilities if, in their opinion, outsiders generally require excessive risk premiums on their uninsured accounts. Although guarantors may not assess risks as optimistically as managers of intermediaries, their confidential audits may allow them to levy premiums lower than those required by most creditors, especially when outsiders are most skeptical of the value of intermediaries' assets.

For this liability insurance to be as efficient as possible, guarantors should be able to obtain funds on reasonable terms at times of financial distress. Guarantors, most likely, will require assistance at those times when their insured intermediaries are experiencing substantial losses, times when the threat of a severe credit crunch or systemic failure is great and even the most optimistic outside investors are most skeptical of the value of intermediaries' assets. On these occasions, guarantors essentially exercise claims against the capital of surviving intermediaries. Surviving intermediaries might avoid incurring this addi-

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<sup>24</sup> Because surviving banks or insurance companies eventually are liable for paying some of the claims against insolvent intermediaries (a restoration of the insurance fund), insured intermediaries themselves benefit from supervision that limits these potential claims against their capital.

tional expense if the guarantor could obtain financing on favorable terms from a "lender of last resort," such as the government, or from healthy intermediaries possessing sufficient resources.<sup>25</sup>

#### *IV. Regulatory Policy and Monetary Policy*

When financial markets are competitive and all investors assess the prospective returns on each asset similarly, regulation cannot make intermediaries safer or sounder, because all investors are able to tailor their risks to their tastes, and all are compensated uniformly for those risks that they assume. Regulations that set standards for intermediaries' leverage or that govern intermediaries' abilities to purchase assets or write liabilities should not influence the pricing of assets even though these regulations may limit the powers of many intermediaries. Similarly, accounting conventions that dictate the way intermediaries report either their income or the values of their assets and liabilities should not impede the efficient pricing of assets. These regulations and conventions alter neither investors' perception of the returns and risks offered by assets nor their ability to realize these returns and risks.

On the other hand, taxes—including income taxes, sterile reserve requirements, the cost of regulation, and improperly priced liability insurance—affect the pricing of assets by altering their net returns. Taxes reduce the efficiency of financial markets, and this, if anything, undermines the safety and soundness of savers' investments. Unless the burdens of intermediaries' taxes are offset by other considerations, these liabilities discourage traditional financial intermediation by prodding banks, life insurance companies, and other intermediaries to recast their liabilities as "mutual funds" that also offer certain financial services.

If investors assess the prospective returns on each asset differently, the prices of assets and the volume of investment depend on the policies that govern the activities of financial intermediaries. When not all investors are informed equally well, intermediaries can profit from their proprietary knowledge by raising money from wary savers to invest in deserving assets, thereby promising savers greater returns, other things equal, while reducing the cost of capital for investment projects. The ability of intermediaries to "arbitrage" financial markets in this manner ultimately rests on savers' confidence in their expertise. Because intermediaries' cost of funds rises and falls with this state of confidence, both the level and the volatility of

the cost of capital for investment projects depends on the perceived safety and soundness of financial intermediaries.

The lack of uniform information creates three problems: (1) the cost of funds for financial intermediaries might be too high, on average, for the risks inherent in their balance sheets; (2) the cost of funds also might be too volatile; and (3) policies that set risk premiums on behalf of outsiders might entail a cost of funds that is, on average, too low, thereby encouraging intermediaries to assume too much risk. Public policy has attempted to cope with these problems through regulation and liability insurance.

Efficiency might be promoted best when supervisors audit the risks assumed by intermediaries, taking into account as completely as possible their proprietary information, in order to levy reasonable premiums for insuring some of their liabilities. Insurance is most appropriate for basic liabilities that are backed to a substantial degree by assets that either are not familiar in public markets or can become illiquid—certain bank accounts, insurance policies, and pension plans. The enforcement of capital requirements alone does not necessarily promote efficiency by controlling the risks of intermediaries, because ratios of capital to assets describe neither the risks assumed by intermediaries nor their capacity for protecting creditors from losses. More revealing descriptions are provided by analyses that isolate those economic conditions that threaten the solvency of an intermediary. Liability insurance premiums would vary with these exposures.<sup>26</sup> This approach, in principle, would apply equally well to intermediaries that hold substantial portfolios of investments and to those that maintain only a small portfolio of assets compared to their other commitments and transactions. Intermediaries might pay a portion of these premiums by carrying more capital or by assuming hedges, but when these reme-

<sup>25</sup> At first blush, guarantees of bank accounts and insurance policies are backed by calls against the resources of the survivors—banks precommit, to a degree, in the form of the FDIC insurance fund, but eventually the survivors must restore the fund after it sustains substantial losses. The survivors, in turn, may transfer some of this burden to taxpayers (see footnote 4).

<sup>26</sup> If guarantors have no particular comparative advantage for assessing the likelihood that these threatening events will occur, their premiums should reflect the going price of hedging, for example, against a twist of the yield curve. By enforcing this universal hedging, intermediaries that successfully bet against a twist of the yield curve will not confuse their reward with pure profit. According to traditional theory, the rents of intermediaries are grounded in their unique knowledge of investment opportunities and their "arbitraging" market imperfections rather than their bets on economic events.

dies are excessively expensive, intermediaries retain the option of purchasing coverage from their “insurer of last resort.” When guarantors inevitably experience claims that exceed their reserves, they, in turn, must be able to obtain temporary funding at reasonable rates without raising questions about the safety and soundness of the accounts that they insure.

Regulatory policy affects not only the returns on intermediaries’ proprietary assets, but also the returns on assets that commonly trade in public markets. To the degree effective regulation promotes safer and sounder intermediaries by reducing both the average risk premium and the volatility of the risk premium required of their liabilities, it also tends to reduce the force of the credit cycle, thereby diminishing the gravity of some factors of risk common to all assets. Such a reduction of systematic risk would entail lower premiums for all assets.<sup>27</sup>

This close relationship between regulatory policy and the cost of funds in financial markets runs parallel to that of monetary policy. Indeed, monetary policy and regulatory policy do not work independently of each other. When central banks change the terms on which they supply their liabilities, the resulting change in the supply of and demand for funds depends on the regulations governing the behavior of financial intermediaries. For example, Marriner Eccles, Governor and Chairman of the Federal Reserve during the 1930s, noted (Eccles 1951, pp. 266–67):

How can the Reserve System fulfill its responsibility of helping to maintain economic stability when the control of the nation’s banking system, through which it is supposed to work, is divided between state and federal authorities, and among federal authorities? . . . Or when the power of federal authorities to conduct bank examinations and issue regulations is divided among the FDIC, the Comptroller of the Currency, and the Federal Reserve Board, each of which has a different interest to be served by the examinations it conducts and the regulations it issues?

. . . Clearly, if the System is committed to a policy of monetary ease in times of depression, then bank-examination policies should follow a similar commitment. Or if the System is committed to a policy of credit stringency in order to curb an imminent inflation, then bank-examination policy should be brought in line with that same intention. Neither action was possible, however, so long as examinations were also devised by the FDIC and the Comptroller, whose personnel were disposed to follow the same policies regardless of prevailing economic conditions.

Eccles recommended, to little avail, that representatives of the FDIC, the Comptroller’s Office, and the

Federal Reserve agree to a joint bank-examination policy. More recently, critics have challenged regulators of banks and insurance companies for adopting standards that diminished the potency of monetary policy during the last recovery.

Just as the efficacy of monetary policy depends on regulatory policy, so regulatory policy is conditioned by monetary policy. For example, the variance of inflation versus the variance of capacity utilization in the economy depends on the rules guiding the monetary authority’s supply of base money (Fuhrer 1994). In turn, the volatility of returns on assets and the liquidity of intermediaries’ proprietary assets depend

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*The rules that best promote the safety and soundness of financial intermediaries cannot be established independently of the design of monetary policy.*

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not only on the size but also on the relative magnitudes of each of these variances, which are distinct elements of systematic risk (Ross 1976; Sharpe and Alexander 1990, Chapter 9). Furthermore, to the degree monetary policy attempts to control interest rates, the risks confronting intermediaries and their regulators would differ from those arising should policy attempt to control the growth of the stock of money or nominal gross domestic product, or those arising if monetary policy should attempt to manage the cost of capital or Tobin’s *q*. Monetary policy not only affects the means, variances, and covariances for assets, it also influences the degree to which the returns on assets or the values of assets tend to revert to trends. Consequently, the rules that best promote the safety and soundness of financial intermediaries cannot be established independently of the design of monetary policy.

Both monetary authorities and regulators essentially are in the business of writing “deposit insurance”—managing the price of risk and stabilizing economic performance, so that the values of investments generally fulfill reasonable expectations (Tobin

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<sup>27</sup> Regulation, therefore, is a public good. As Albert Wojnilower has observed, banks are unique for having to pay for their deposit insurance.

1958, 1982). Both attempt to “insure” savers, investors, and productive activity against the consequences of economic “shocks.” Because regulations affect the price of risk in financial markets and because this influence varies with economic conditions, the actions of regulators, like those of the monetary authority, should be sufficiently flexible to adjust with economic conditions, in order to foster the prudent valuation of assets and the efficient flow of funds from savers to investors. Regulating the volume of intermediation by enforcing fixed standards for capital that are proportional to intermediaries’ investments in assets designated as risky, for instance, might undermine the stability of financial markets. At times, excessive confidence might entail an insufficient price of risk, thereby fostering speculative investment. When confidence subsequently subsides, the rising price of risk, reinforced by risk-based capital requirements grounded in market-value accounting, amplifies the credit cycle and increases the odds of a crunch. In these circumstances, regulatory and monetary policies would stabilize financial markets best by managing the price of risk so that it dampens cycles in economic activity.

## Appendix

Figure 2

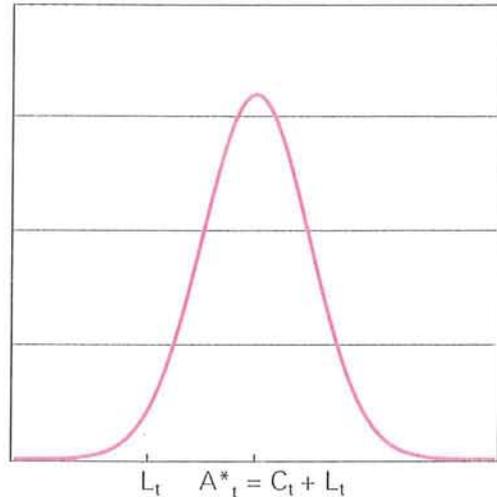
An intermediary finances a portion of its assets,  $A_0$ , by issuing debt,  $L_0$ . When the debt matures in  $t$  periods, the intermediary will owe its creditors  $L_t = L_0 e^{rt}$ . At that time, the capital of the intermediary will equal  $A_t - L_t$ . ( $r$  is the safe rate of interest. The following discussion explains the pricing of the risk premium.) Figure A1 shows the probability distribution for the value of assets  $t$  periods in the future. Taking into account the full range of values that are possible for  $A_t$ , the expected value of assets is  $A_t^*$ , and the expected value of capital is  $A_t^* - L_t$ . If shareholders’ liability to creditors were not limited, the expected value of their equity would equal that of capital.

Because shareholders’ liability is limited, the expected value of their equity is calculated only over the range of values for  $A_t$  that exceed  $L_t$ ; if  $A_t$  is lower than  $L_t$ , the value of equity is zero. The value of equity in this case equals the expected value of capital for the full range of  $A_t$  (as in the first case) plus the expected value of  $L_t - A_t$  when capital is negative (the shaded region in the figure). Therefore, the value of the intermediary’s equity in this second case equals the sum of its capital and a put option with an “exercise price” of  $L_t$ , and payoff equal to  $\max(0, L_t - A_t)$  at the “exercise date”  $t$  periods hence. (This combination of an equity stake and a put option is equivalent to a call option—the line in Figure 1b is the intrinsic value of a call.)

The value of this put option for shareholders is the

Figure A1

### Probability Distribution for Value of Assets



expected value of  $L_t - A_t$  when  $A_t$  is less than  $L_t$ . This expected value increases as  $A_0 - L_0$  becomes smaller or as the variance of  $A$  increases; in both cases, the area of the tail of the probability distribution to the left of  $L_t$  becomes larger. If the distribution of  $A$  is normal, the variance of  $A$  per period is  $\sigma^2$ , and  $N[d]$  is the probability that a standard normal variable does not exceed  $d$ , then the value of this put option is (Sharpe and Alexander 1990, Chapter 18):

$$Put = L_0 * N[-d_2] - A_0 * N[-d_1], \text{ where}$$

$$d_1 = \frac{\ln(A_0/L_0) + (r + .5\sigma^2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}.$$

The value of equity in panel a is the sum of capital and the value of this option. Because creditors assess the returns on assets the same as shareholders, the value of creditors’ expected losses in panel b equals the value of the put option derived above. Panel c shows the difference between the value of equity and the value of the option, which equals capital.

Figure 6

Informed investors believe the standard deviation of returns for the portfolio is  $\sigma_v$ , and they require a rate of return of  $r_i$  for financing these assets. Uninformed investors believe the standard deviation is greater,  $\sigma_u$ .

If informed investors held both the equity and the debt of the intermediary, the cost of funds would be  $r_v$ , regard-

less of leverage,  $l$ , the ratio of the intermediary's debt to its assets. In this case, the value of the put option entailed by leverage,  $p(l|\sigma_i)$ , is the same for both shareholders and creditors (see discussion of Figure 2). When the intermediary issues debt to uninformed investors, the value of the put option for creditors,  $p(l|\sigma_u)$ , exceeds that for shareholders. The premium required by creditors rises relative to that required by informed investors as leverage increases. Accordingly, the intermediary's cost of funds rises with leverage:  $r(l) = r_i + [p(l|\sigma_u) - p(l|\sigma_i)]$ .

Figure 7

The average cost of funds is that derived in Figure 6. The marginal cost of funds equals:

$$\frac{d(lr(l))}{dl} = r(l) + lr'(l).$$

Figure 9

Panel a: An intermediary holds risky and safe assets, financed by equity and "deposits." The expected return on risky assets,  $E(r_t)$ , is 10 percent annually; the standard deviation of this return,  $\text{std}(\epsilon_t)$ , is 6 percent annually; and the correlation coefficient between annual returns (a first-order Markov process) is 60 percent:

$$\begin{aligned} r_t &= .10 + \epsilon_t \\ \epsilon_t &= .6\epsilon_{t-1} + \eta_t \\ \eta_t &\sim N(0, .06^2(1 - .6^2)). \end{aligned}$$

The return on the intermediary's safe assets and the return that the intermediary pays on its deposits is 7 percent. The values of risky and safe assets increase according to their returns and any new investments in these assets,  $\Delta^r$  and  $\Delta^s$ ; likewise, the value of its deposits increases as a result of crediting interest and new inflows,  $\Delta$ :

$$\begin{aligned} V_t^r &= V_{t-1}^r(1 + r_t) + \Delta_t^r \\ V_t^s &= V_{t-1}^s(1.07) + \Delta_t^s \\ L_t &= L_{t-1}(1.07) + \Delta_t. \end{aligned}$$

The capital of the intermediary,  $C$ , is the difference between the value of its assets and the value of its deposits,  $L$ . When its capital per dollar of assets the previous year exceeds its target of 10 percent, the intermediary issues new deposits; otherwise,  $\Delta$  is zero. If the intermediary's risky assets are less than 4 times its capital, the intermediary purchases more risky assets in order to maintain the ratio

of 2 dollars of risky assets for every 3 dollars of safe assets; otherwise,  $\Delta^r$  is zero:

$$\begin{aligned} \Delta_t &= \max([10C_{t-1} - (V_{t-1}^r + V_{t-1}^s)], 0) \\ \Delta_t^r &= \max([4C_t - V_{t-1}^r(1 + r_t)], 0) \\ \Delta_t^s &= \Delta_t - \Delta_t^r. \end{aligned}$$

When the intermediary's capital falls below 0.5 percent, it "fails," and its capital is restored to 10 percent. In the simulation shown in the graph, the intermediary fails 11 times, its mean capital-asset ratio is 9.5 percent, and the annual standard deviation of this ratio is 3.5 percent.

Panel b: The assumptions are the same as those for the previous panel, except that the intermediary sells risky assets in order to maintain only 4 dollars of risky assets per dollar of capital when this ratio exceeds 4:

$$\Delta_t^r = 4C_t = V_{t-1}^r(1 + r_t).$$

In the simulation shown in the graph, the intermediary fails 4 times, its mean capital-asset ratio is 9.1 percent, and the annual standard deviation of this ratio is 3.5 percent.

Panel c: The assumptions are the same as those for the first panel, except that the value of risky assets tends to revert to a trend:

$$\begin{aligned} trend_t &= V_0^r(1.1)^t \\ r_t &= .10 + \epsilon_t \\ \epsilon_t &= .6\epsilon_{t-1} - 2 \log(V_{t-1}^r - trend_{t-1}) + \eta_t \\ \eta_t &\sim N(0, .05^2(1 - .6^2)) \\ V_t^r &= V_{t-1}^r(1 + r_t). \end{aligned}$$

The standard deviation of annual returns behind the simulation shown in the graph is 7.5 percent. Yet, because of the tendency of the value of risky assets to revert to trend, the intermediary does not fail during this simulation, its mean capital-asset ratio is 10.3 percent, and the annual standard deviation of this ratio is 2.2 percent.

Panel d: The assumptions are the same as those for the previous panel, except that the intermediary sells risky assets in order to maintain only 4 dollars of risky assets per dollar of capital when this ratio exceeds 4, and this sale entails transactions costs equal to 10 percent of the value of the risky assets that are sold.

In this simulation, the intermediary fails 5 times, its mean capital-asset ratio is 9.1 percent, and the annual standard deviation of this ratio is 3.6 percent.

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## Correction

Correction, September/October 1995 *New England Economic Review*

Because of a production error, the labeling on three of the figures was incomplete in the article "Monetary Policy and the Behavior of Long-Term Real Interest Rates," by Jeffrey C. Fuhrer.

Figure 5, on page 47: The formulas below the title should read as follows:

$$\text{— } \alpha_{\pi} = \alpha_y = .1 \quad \text{•••• } \alpha_{\pi} = \alpha_y = .25 \quad \text{— — } \alpha_{\pi} = \alpha_y = 1$$

Figure 6, on page 50: The labels for the two curves should read as follows: the red, **Real Rate**; the dotted black, **Fed Funds**.

Figure 7, on page 51: The formula just below the title should read as follows:

$$\text{Baseline Policy Response, } \alpha_{\pi} = \alpha_y = .1$$

Please enter these corrections on your copy of the September/October 1995 issue.

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May/June 1995

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