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ANTITRUST ISSUES IN PAYMENT SYSTEMS: BOTTLENECKS, ACCESS, AND ESSENTIAL FACILITIES

James McAndrews

What is an economic bottleneck? And how can antitrust policy eliminate one? In this article, James McAndrews addresses these questions and discusses their relevance to payment systems.

PRODUCTIVITY GROWTH AND THE AMERICAN BUSINESS CYCLE

Satyajit Chatterjee

Why do free-market economies experience booms and recessions? Historically, economists have claimed that such business cycles are a result of economic policy or even certain intangible factors. In this article, however, Satyajit Chatterjee reviews some recent research that targets fluctuations in productivity as the main cause of business cycles in the United States. In addition to an in-depth look at this research, he also considers its implications for monetary policy.

Antitrust Issues in Payment Systems: Bottlenecks, Access, and Essential Facilities

*James McAndrews**

In 1912, the Supreme Court of the United States recognized a unique type of monopoly—the bottleneck monopoly—that required a unique remedy under the antitrust laws. In *United States v. Terminal Railroad Association of St. Louis*, the Court compelled the owners of a jointly owned railroad terminal, one that could not practically be duplicated, to grant their primary competitors equal access to the terminal and its facilities on reasonable and nondiscriminatory terms. Because networks that carry electronic payments can create similar bottlenecks, the basic antitrust concept of requiring

access to bottleneck monopoly facilities is important to the electronic payment industry.

Government action to compel access is beneficial for consumers when the bottleneck facility is unique and developing alternative facilities isn't possible. It can also be beneficial for consumers of network products such as telephone or payment systems if compelling access ensures compatibility among different providers of competing services. On the other hand, if competing facilities can be developed, and compatibility isn't an issue, compelling access can be detrimental.

Determining who should have access to a production facility is an issue that credit card associations, automated clearing house (ACH) associations, and automated teller machine (ATM) networks must address. Not only is the

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existence of bottleneck monopolies an issue in these payment systems, but compatibility is also.

NATURAL MONOPOLIES, NETWORK JOINT VENTURES, AND ESSENTIAL FACILITIES

Bottleneck monopoly—exclusive control of a vital input to production—is clearly a deviation from a perfectly competitive market. In a perfectly competitive market, many producers have access to the same production technology. Consumers, being able to shop at many producers, work to drive prices down to the marginal cost of production and to eliminate any excessive profits in the long run. In a monopoly market, one firm controls all the output of the market (or, practically speaking, it controls a very large share of the market's output). Because few alternatives are available to consumers, the firm can (if unregulated) charge prices that exceed marginal cost and allow it to earn above-normal profits in the long run. As a result, the resources of society are misallocated in favor of the monopolist.

Often, the owner of the bottleneck facility competes in the final stage of production along with many other firms. But if the owner of the facility doesn't allow its competitors to use the facility (or charges high prices to some firms, thereby raising their production costs), this will limit competition in the market for the final good, and again cause a misallocation of society's resources in favor of the monopolist.¹

Natural Monopolies. Bottleneck monopolies are examples of "natural monopolies," situations in which cost or demand conditions allow a single firm to supply the product at a

lower cost than two or more firms could. For example, wiring a telephone network and switching facility at the local level constitutes a natural monopoly. The technology involved displays large economies of scale: the average cost of connecting callers falls as more calls are made, and duplicating the set of telephone lines in an area and the local switching center would be prohibitively expensive.

Because electronic payment systems employ large switching facilities to exchange the payments originated by different customers, and because the computer switches show large economies of scale, it's likely that there will be

few providers of payment systems, at least at the local level. The presence of these economies of large networks does not presuppose that these are natural monopolies nationally, but the tendency toward having only a few networks in the market (although there may be many banks providing services in each network, as in an ATM network) sug-

gests that payment systems may be natural monopolies in the intermediate market whose final good is banking services.

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¹An example of this practice is detailed in the *U.S. v. AT&T*. AT&T allegedly engaged in this practice before divestiture of the firm into separate long-distance and local-access firms. The intermediate good in that case was local access, an input into the final stage good—long-distance calling. Because AT&T refused MCI Communications Corp. and other potential providers of long-distance service access to its local-area networks, the government alleged that AT&T was denying access to an essential facility and access to the local-area networks should therefore be compelled. See *United States v. American Tel. & Tel. Co.*, 552 F. Supp. 131, 231-32 (D.D.C. 18-982), *aff'd*. For a discussion of this case and similar issues, see John M. Stevens, "Antitrust Law and Open Access to the NREN," *Villanova Law Review*, Vol. 38 (1993), pp. 571-623.

The doctrine of compelling access to bottleneck monopoly facilities is meant to prevent a misallocation of resources by ensuring access to facilities that are natural monopolies. In this way, many different producers can share the natural monopoly's facility, and so competition in the final product market is enhanced.

Essential Facilities. The concept of bottleneck monopoly first outlined in the St. Louis railroad case has been modified over time. The doctrine has been interpreted to mean that a firm that controls an *essential facility* must grant access when feasible, on reasonable and non-discriminatory grounds, to all in the trade. What makes a facility essential? The courts have developed two basic tests to judge whether a facility is *essential*: the firm that controls access to the facility must have market power in some relevant but possibly narrowly defined market, and exclusion from the facility must put a firm at a significant competitive disadvantage in that market.

These tests are clearly met in the case of a natural monopoly where there are large economies of scale in production, so that a single firm would supply the good most efficiently. When there's a natural monopoly, other firms can't enter the market cost-effectively. For a firm that does not have access to the facilities of the monopolist, the competitive disadvantage is great because that firm cannot reproduce the production facilities of the monopolist economically.

Joint Ventures. In many of the cases that concern essential facilities, including the St. Louis Railroad Terminal case, the owner of the facility in question is a joint venture. A joint venture is an association of two or more firms that create, as owners, a business enterprise.² ATM networks, credit card networks, and ACH

associations are often organized as joint ventures of banking firms.

A joint venture's legality under the antitrust laws depends on the specific facts connected with it. It is not legal for a joint venture to set industry prices, but a joint venture can be legally organized to build and operate a facility used by all the owner-members, such as a large electronic transaction switching and authorization center. Because of the antitrust laws' concern with the possibility that a joint venture might illegally monopolize, joint ventures are at a regulatory and legal disadvantage to proprietary ventures. Precisely because joint ventures are often created to build and operate large facilities that no individual member could successfully develop alone, the facilities of a joint venture are more often scrutinized to determine if they are "essential."

COMPULSORY ACCESS: "SYSTEMS COMPETITION" AND COMPATIBILITY

In payment systems, as with local telephone service, consumers demand "universal service."³ An ATM network with more banks and machines will offer greater convenience to a potential bank member's depositors than a network with fewer banks and machines. A credit card network with more banks and merchants that accept the card will be more useful to a potential customer than one with fewer banks and merchants.

With payment or telephone networks, the competition among alternative producers is

³The demand for a telephone network in which the greater the number of people connected to the network, the higher the value a caller places on it displays what is called a demand-side network externality. Network externalities are present in the payment systems we consider in this article. For a discussion of network externalities in ATM networks, see James McAndrews, "The Evolution of Shared ATM Networks," Federal Reserve Bank of Philadelphia *Business Review*, May/June 1991, pp. 3-16.

²For a full discussion of joint ventures in banking, see Paul Calem, "Joint Ventures: Meeting the Competition in Banking," Federal Reserve Bank of Philadelphia *Business Review*, May/June 1988, pp. 13-21.

affected by whether the standards of the products sold are compatible. If they are, a consumer can freely substitute one product for another; if not, the consumer cannot do so. For example, if two telephone companies offer incompatible services, a consumer must have two telephones to call people on the two systems; if they are compatible, one telephone can reach both sets of subscribers. A firm can lessen the substitutability of its products by making them incompatible with other products, thereby creating a small monopoly for itself. Behavior of this sort, in which the systems created by the different producers are incompatible, can fail to provide the universal service demanded by consumers and can curtail price competition among the producers. Compelling access to one system can have the salutary side-effect of promoting compatibility.

The danger of the compulsory access doctrine is that if applied too broadly, it reduces the incentive other firms might have for creating an alternative system that could compete with the existing joint venture. The crucial question is whether the facility is a natural monopoly. If it is not, compelled access could raise costs to society by making the joint venture "overinclusive" or could result in an over-used production facility.⁴

Taken to the extreme, if any entrant could gain access to any incumbent firm's production facility (even if it isn't a natural monopoly) by claiming that being denied access to an (allegedly) essential facility put it at a competitive disadvantage, the entrant could "free ride" on the product-development risks and costs of the incumbent firm.⁵ If, on the other hand, an entrant had to "invent around" the incumbent's

processes to successfully retain customers, the entrant would have an enhanced incentive to do so, thereby quickening the competitive pulse of the market in "systems," that is, in the market for railroad terminals, telephone networks, or payment systems themselves.

To protect the incentives for competition among systems while avoiding the exclusionary practices of a bottleneck, the courts have typically adopted a *rule of reason* criterion for judging the exclusionary effects of a firm's rules, as opposed to declaring all exclusion illegal *per se*. Under a rule of reason, all facts can be considered, and exclusionary rules can be upheld if found to be pro-competitive.

CASES AND DECISIONS INVOLVING PAYMENT SYSTEMS

Several court cases involving payment systems have sought to apply the doctrine of compelled access. Some show the clear benefits of such a policy, but others show the drawbacks of using the policy when no natural monopoly is present.

ACH Associations and Thrift Access. Prior to passage of the Monetary Control Act in 1980, the Federal Reserve provided its payment services at subsidized prices. The Fed-

⁵This concern raises the important question of pricing for facilities once access has been granted. The general antitrust doctrine requires access on a nondiscriminatory basis, that is, prices charged must be equal across the group that has access to the facility. This concept can be difficult to implement if some members of the group operate in both the intermediate-goods stage and the final-goods stage (that is, if they are vertically integrated) and others operate only in the final-goods stage. Furthermore, the doctrine does not determine the level of prices for the facility. For discussions of these issues, see William J. Baumol and J. Gregory Sidak, "The Pricing of Inputs Sold to Competitors," *Yale Journal on Regulation*, Vol. 11:149, 1994, pp. 171-202, and Nicholas Economides and Lawrence J. White, "Access and Interconnection Pricing: How Efficient Is the 'Efficient Component Pricing Rule'?" March 1995, New York University, Leonard N. Stern School of Business, Working Paper EC-95-04.

⁴See David A. Balto, "Access Claims Faced by Credit Card Joint Ventures," *The Business Lawyer*, Vol. 49, May 1994, for a discussion of the problems arising from excessive application of the essential facilities doctrine.

eral Reserve supported the development of the ACH system (the low-dollar-value electronic payment system by which many people have their wages directly deposited to their bank accounts) by operating ACH processing facilities at a subsidy for many of the private-sector regional ACH associations across the country.⁶ The private-sector regional ACH associations determined which firms could be members of the association and, therefore, who could gain direct access to the Fed's subsidized facilities. In 1977, the U.S. Department of Justice brought bottleneck monopoly suits against two automated clearing house associations, asking the courts to admit thrift institutions to the two associations.⁷ The government alleged that because of the "substantial subsidy provided...by the...Federal Reserve...it is commercially unfeasible to establish an alternative ACH to provide service to thrift institutions."⁸

The two tests necessary to compel access were clearly satisfied in these cases. The regional ACH associations had market power

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⁶See James McAndrews, "The Automated Clearing-house System: Moving Toward Electronic Payment," Federal Reserve Bank of Philadelphia *Business Review*, July/August 1994, pp. 15-23, for a more complete discussion and references to the history of the ACH.

⁷*United States v. Rocky Mountain Automated Clearing House Ass'n*, C.A. No. 77-391 (D. Colo., dismissed Nov. 17, 1977), and *United States v. California Automated Clearing House Association*, C.A. No. 77-1463-LTZ (D. Cal., dismissed October 28, 1977).

⁸*United States v. Rocky Mountain Automated Clearing House Association*, C. A. No. 77-391 (D. Colo., dismissed Nov. 17, 1977) p. 12, cited in Donald I. Baker and Roland E. Brandel, *The Law of Electronic Fund Transfer Systems*, second edition, Warren, Gorham & Lamont, 1988, pp. 22-38.

because they controlled direct access to the Fed's subsidized facilities. Also, the excluded thrifts suffered a competitive disadvantage because the associations controlled facilities that could not be easily duplicated without the cost subsidy provided in those years by the Federal Reserve System. Further, the New York ACH association did admit thrifts, weakening any arguments that suggested that admitting thrifts would give them a "free ride" on the development of the system by the associations. The Department of Justice dropped the cases when the two associations dropped their rules excluding thrifts.

The Federal Reserve eliminated subsidization of services after the passage of the Monetary Control Act in 1980. For that reason, the scope of the cases is limited, but they do suggest that a publicly

produced and subsidized payment system can be considered an essential facility and should be offered on a nondiscriminatory basis to depository institutions.

The Federal Reserve System's policy for the payment services it provides was stated in the white paper, "The Federal Reserve in the Payment System," published in the *Federal Reserve Bulletin* in May 1990, pp. 293-98. The paper stated that "[i]n summary, the role of the Federal Reserve in providing payment services is to promote the integrity and efficiency of the payments mechanism and to ensure the provision of payment services to all depository institutions on an equitable basis, and to do so in an atmosphere of competitive fairness."

Credit Cards and Duality. In 1973, an Arkansas bank sued Visa over its exclusivity rule regarding credit cards, which provide both payment and credit services to customers.⁹ That rule stated that no bank could issue

Visa cards (and thereby gain access to Visa's facilities) so long as it issued MasterCard cards or provided processing to merchants for MasterCard accounts. This type of exclusion discriminates against banks using a competitor's cards and, hence, would run afoul of the nondiscriminatory access provisions of the essential facilities doctrine, provided that Visa's facility was ruled an essential facility.

The Arkansas bank issued Visa cards but wanted to engage in merchant processing for MasterCard. Although Visa was not a national monopoly, the Arkansas bank argued that the associations exerted market power locally because few banks provided merchant processing. Merchants (and sometimes cardholders) had to do business with two banks to process their transactions in the two systems. If, as was the case at that time in northern Arkansas, there were two banks engaged in the merchant processing business, the effect of Visa's rule was to reduce competition in merchant processing from a competitive two-bank market into a market of dual monopolies—a Visa processor and a MasterCard processor.¹⁰ Furthermore, given the large number of existing users of both types of credit cards, by joining MasterCard and ending its association with Visa, the Arkansas bank could in no way duplicate (or replace) the services that Visa's cardholders and merchants received. The bank was at a significant competitive disadvantage in that it could not compete for MasterCard business (if a bank did not issue cards of either

organization, it could process merchant receipts for both).

In the midst of the private litigation, and following a review by the Justice Department, Visa changed its exclusivity rule to one that allowed banks to join both credit card systems (as did MasterCard). The Justice Department's review of Visa's exclusivity rule suggested the exclusionary rule "might well handicap efforts to create new bank credit card systems and may also diminish competition among the banks in various markets."¹¹

What resulted is known as "duality": most banks that issue credit cards now belong to both systems and issue both types of credit cards. In this way, the two systems have been made compatible. One clear efficiency is that merchants need not have two banks conduct their processing of credit card receipts. This should increase the number of competitors in the market for merchant processing and lower prices to merchants for that line of business.¹²

Credit cards remain a product in which access issues are important. In an important 1994 decision, the Court of Appeals of the

¹¹See Business Review Letter to National BankAmericard, Inc. (October 7, 1975), Antitrust Division of the U.S. Department of Justice.

¹²David A. Balto, in "Antitrust and Credit Card Joint Ventures," 47 *Consumer Finance Law Quarterly Report* (1993), pp. 266-72, and others allege that competition in merchant processing between Visa and MasterCard was weakened because of duality. Banks tend to charge the merchants the same fee for handling a transaction, even though the bank faces different costs from the two systems, and so aren't pricing at marginal cost. But this doesn't mean competition was greater before duality. In fact, the fee merchants pay to banks for clearing card payments has fallen since duality, and there was a surge of issuing cards and extending aggregate lines of credit immediately following the decision on duality. These facts are documented in Woods (1979); John H. Shenfield, Acting Assistant Attorney General, "Competition Through Change: A Positive Force in the Banking Industry," remarks before the National Bank Card Convention, September 12, 1977; Dennis W. Carlton and Alan S. Frankel, "The Antitrust Economics of Credit

⁹At the time of this suit, the names Visa and MasterCard had not yet been adopted by National BankAmericard, Inc., and Interbank Card Association, respectively. For ease of exposition, I'll refer to the more recently adopted names of the organizations.

¹⁰For an excellent review of the competitive situation in Arkansas at the time of the case, see M. Troy Woods, "The Evolution and Early Competitive Considerations of Bank Card Duality," (Master's Thesis, Graduate School of Consumer Banking, University of Virginia, 1979), pp. 41-58.

Tenth District rejected a request by a depository subsidiary of Dean Witter to gain admittance to the Visa credit card network. Dean Witter is the firm that owns the Discover Card, a proprietary credit card system that competes with Visa. (See *Visa and the Discover Card*.)

ATM Networks and Cobranding. In 1983, the PULSE ATM joint venture network in Texas asked the Antitrust Division of the Department of Justice for guidance in a request for membership by First Texas Savings Association. First Texas was a member of the only significant rival ATM system in Texas, MPACT (which was not a joint venture). In a fashion similar to Visa's exclusion of banks that participated in MasterCard (prior to duality), PULSE excluded from membership banks that participated in MPACT. First Texas asked to be admitted to PULSE, basically arguing that PULSE, because of its widespread acceptance, was an essential facility that no rival could duplicate, and that exclusion from PULSE put a firm at a competitive disadvantage in the Texas market. The Department of Justice stated that it believed that the added convenience to consumers from admission of First Texas would outweigh any loss of competition between the two systems.¹³ This indicates that under Department of Justice reasoning, ATM networks could be considered essential facilities, at least at the local level. As a result, PULSE dropped

its exclusivity rule, and nearly all the members of MPACT joined PULSE, resulting in a monopoly ATM system in Texas, with MPACT retaining its identity as a subsystem. In other words, PULSE allowed its members to "cobrand" their cards and machines with other rivals' brand names and to be members of rival networks; this is a limited form of compatibility.

Whether this result is desirable depends partly on whether price competition between ATM networks was enhanced. And there is reason to think it was.

First, cobranding can decrease consumers' costs of changing networks, thereby increasing the networks' incentive to price competitively. Without cobranding, the cost to a consumer of changing ATM network affiliation may not exceed the benefit because ATM network access is a relatively small consideration for a consumer of a bundle of banking services, which may consist of both savings and demand deposits, certificates of deposit, and auto and home loans. If one is unhappy with the ATM network to which one has access, but happy with all the other services of one's bank, there is a large cost to getting access to the rival network since the customer would have to incur the cost of changing banks or, at the very least, establishing an account at a different bank (and, therefore, holding accounts at two banks). This cost may exceed the inconvenience of the ATM network that one's bank offers, and so the consumer may not switch to the better ATM network.¹⁴ Thus price competition may be curtailed. With cobranding,

Card Networks," *Antitrust Law Journal*, Vol. 63, 1995, pp. 643-68; and David S. Evans and Richard L. Schmalensee, *The Economics of the Payment Card Industry*, National Economic Research Associates, Inc. (1993). This evidence can be criticized since it is not known whether costs fell at the same time; no data on the banks' markups over costs have been gathered to determine whether markups rose or fell after duality.

¹³See letter from William F. Baxter, Assistant Attorney General, Antitrust Division, to Donald I. Baker, Jones, Day, Reavis & Pogue (Aug. 3, 1983) (on file with the Legal Procedure Unit of the Antitrust Division of the Justice Department).

¹⁴See Paul Klemperer, "The Competitiveness of Markets with Consumer Switching Costs," *Rand Journal of Economics* 18 (1987), pp. 138-50; and Paul S. Calem and Loretta J. Mester, "Search, Switching Costs, and the Stickiness of Credit Card Interest Rates," Working Paper 92-24R, Federal Reserve Bank of Philadelphia, January 1993, for analyses of the effects on competition of consumer-borne costs of changing suppliers.

Visa and the Discover Card

In the mid-1980s, Sears, Roebuck and Co. launched the Discover Card through its subsidiary, Dean Witter, and purchased a depository institution, Greenwood Trust, to issue the cards. Discover Card became profitable, and Sears decided it wanted to issue Visa cards as well as seek membership in Visa for Greenwood Trust. Visa responded by requesting Sears to change its Discover Card into a Visa card, but Sears did not respond. Visa then adopted a new rule that prohibited membership in Visa to any institution that issued or was affiliated with an institution that issued the Discover Card or American Express cards or any other cards "deemed competitive" by the Visa Board of Directors.

Sears then tried to enter Visa by buying Mountain West Financial, a thrift that already issued Visa cards. Visa refused to allow Mountain West to issue more Visa cards, and Mountain West then sued Visa.^a

The case was tried in Federal Court, and the jury entered a verdict for Dean Witter in 1993. In 1994, however, the U.S. Court of Appeals for the Tenth Circuit reversed the decision and held that Visa could exclude Dean Witter and any affiliate associated with the Discover Card on the grounds that Visa could not exercise market power in the pricing of lines of credit because the "issuer market" consists of thousands of independent issuers of credit cards. In June 1995 the Supreme Court declined a request by Dean Witter to review the decision of the Appeals Court.

In its analysis, the Court of Appeals identified two markets in which competition occurs. The "general purpose charge card market" in the United States has five firms: Visa USA, MasterCard, American Express, Citibank (Diners Club and Carte Blanche), and Dean Witter (Discover Card); the competition among these firms to get consumers to use their cards is "intersystem." The Court reported that the parties agreed that, in the relevant market, competition occurs only at the "issuer level": "*members issue cards, competing with each other to offer better terms or more attractive features for their individual credit card programs.*"^b

Dean Witter argued that it wished to enter Visa to "compete more effectively" in the issuer market. This reflects the large network that Visa has spent decades to develop; with a larger network of merchants that accept Visa cards, Dean Witter is at a disadvantage by being restricted to issuing the Discover Card. Visa felt that allowing Dean Witter access to Visa would grant it a free ride on the development efforts of all its members over the years. Although competition would be enhanced at the issuer level, over 6000 independent firms issue credit cards, suggesting that competition was already brisk in that market, so the addition of even a large, aggressive firm would not enhance competition measurably. Furthermore, Visa argued, intersystem competition would be weakened if Dean Witter were to be admitted.

In a 1995 paper, two economists who served as consultants to Dean Witter in the suit, Dennis W. Carlton and Alan S. Frankel, make a point in favor of admitting Dean Witter.^c First, they note that Dean Witter was still going to maintain its Discover Card program, so that competition in the systems market would not be harmed by allowing Dean Witter to issue Visa cards. Second, they point out that if any firm that creates a substitute for Visa must pay the price of not being admitted to Visa, systems competition is harmed because the extra cost incurred by the innovator increases the barriers to entry into the market.

The Court of Appeals ultimately decided that it should not risk lessening existing systems competition in the hopes that issuer competition would be strengthened and so ruled in favor of Visa's being able to exclude Dean Witter from issuing Visa cards.

^aSears has since sold Dean Witter, which owns the Discover Card; we will now refer to Dean Witter as the firm that sought access to Visa.

^b819 F. Supp. 956 (D. Utah 1993), *aff'd in part and rev'd in part*, No 93-4105, 1994 U.S. App. LEXIS 26849 (10th Cir. Sept. 23, 1994). p. 20, *emphasis in original*.

^cSee footnote 12 for a full citation of the paper.

costs to consumers of changing providers are reduced and so price competition may be increased.

Second, ATM networks compete by deploying ATMs in locations desired by consumers. Not all locations are equally desirable, so prime locations can be a source of competitive advantage for ATM networks. This form of nonprice competition may inhibit price competition. But by giving a bank and its customers access to all its cobranded networks' ATMs, the incentive to compete by deploying more ATMs in different locations is decreased. By decreasing the incentive for nonprice competition, cobranding can increase the incentive for active price competition between networks. This is an important consumer benefit of cobranding. Indeed, a recent action by the Department of Justice concerning ATM network access indicates that it views allowing multiple network memberships by banks as clearly pro-competitive.¹⁵

Mandatory Sharing Laws. In each case mentioned, the facility in question had market power: the regional ACH associations because they controlled access to the ACH, the Visa credit card system because one could not duplicate the array of merchants and cardholders, and the PULSE ATM network because of the large numbers of banks and machines that were uniquely affiliated with that network. These cases stand in marked contrast to many state laws passed in the 1980s that mandated access to even infant automated teller machine systems by all depositories in the state. These laws were widely considered to be a misapplication of the access doctrine, because there was little evidence of bottleneck monopoly in the early ATM systems. Consistent with the

hypothesis that compelling access to a *nonessential facility* reduces the incentives to create the facility in the first place, there is convincing evidence that those states in which such laws were passed suffered slower development of ATM network facilities than states that did not pass mandatory sharing laws.¹⁶

Because of the potential inefficiencies caused by compelling access to a nonessential facility, a payments network should be shown to wield substantial market power before compulsory access is considered. This standard follows directly from the bottleneck monopoly criteria applied by the U.S. Courts. Here, it is argued that a newly created joint venture or payment firm should be allowed to restrict membership and that compulsory access should be considered as a remedy only after it is clear that a bottleneck monopoly exists.

CONCLUSION

The tension inherent in the issue of compulsory access to network facilities is clear: exclusion from an existing essential facility that has power in some market and that cannot be practically duplicated is anticompetitive; mandating access to a nonessential facility, however, can give a free ride to those allowed to join and can inhibit those who may wish to create new facilities, thereby conferring monopoly power on the owner of the nonessential facility.

Many payment networks, such as credit card associations, ACH associations, and ATM networks, display substantial scale economies, which is a necessary condition for a natural monopoly. These payment systems are also

¹⁵In 1994 the Department of Justice and Electronic Payment Systems (EPS), the owner of the MAC ATM network, entered into a consent decree by which EPS agreed to allow banks that are members of rival networks to join MAC.

¹⁶See Elizabeth S. Laderman, "The Public Policy Implications of State Laws Pertaining to Automated Teller Machines," Federal Reserve Bank of San Francisco *Economic Review* (Winter 1990) pp. 43-58, for a full description of the laws and evidence that the development of network facilities was impeded in states that had passed mandatory sharing laws.

often organized as joint ventures because of the widespread membership needed to initially succeed in offering an economical service, subjecting them to closer scrutiny from antitrust authorities than proprietary ventures. As a result, firms in each of these types of payment systems have had to face challenges to their access policies.

These challenges require a careful analysis of the products and markets in which the payment networks compete to determine if a true bottleneck does exist and what, if any,

damage to systems competition would result from admission of excluded firms. The court must weigh the costs and benefits of compelled access. The cost of compelled access is the possible harm to systems competition caused by allowing a potential competitor admission to the facility in question. The benefit of compelled access is the possible increase in consumer welfare resulting from greater compatibility and enhanced competition in the final product market.

Productivity Growth and The American Business Cycle

*Satyajit Chatterjee**

Why do free-market economies experience booms and recessions? Until recently, economists attributed business cycles either to well-meaning but misguided economic policy or to inexplicable waves of optimism and pessimism about future business conditions. For instance, Nobel laureate Milton Friedman advocates a nonactivist monetary policy on the grounds that erratic growth in a country's money supply is the most significant factor in economic instability. A different view, shaped by the ideas of the late John Maynard Keynes, holds that business cycles are caused by unpredictable changes in the willingness of investors

to lend money to businesses, changes that mirror shifts in investor optimism concerning the future.

In contrast, some recent research suggests that business cycles in the United States are mostly the consequence of unpredictable fluctuations in productivity. This view, which was put forth by Finn Kydland and Edward Prescott in the early 1980s, takes as its starting point the sources of long-term economic growth in the United States. Numerous studies have shown that the mainspring of economic growth in the United States is growth in the productivity of inputs used to make goods and services or, broadly speaking, technical progress. Kydland and Prescott observe that these studies also show that growth in the productivity of inputs does not occur at a steady rate, and they argue

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further that unpredictable fluctuations in the rate of productivity growth is one of the main causes of the short-run economic fluctuations that we call business cycles.

Most strikingly, Kydland and Prescott de-emphasize the role that flaws in the institutions or structure of market economies play in business cycles. Unlike Friedman, who has argued that business cycles are mainly the result of unpredictable fluctuations in the supply of money, and Keynes, who thought that instability arose from an economy's exposure to inexplicable changes in people's expectations about future economic conditions, Kydland and Prescott claim business cycles are the result of an economy's adaptation to changes in the productivity of its inputs. These changes arise, for the most part, from deep-seated and unpredictable forces governing technical progress over the entire spectrum of industries. Clearly, if this view comes to dominate people's perceptions about business cycles in the United States and other countries, it would engender a different approach to the scientific and policy problems associated with business cycles. For this reason it merits close attention.

CAN ERRATIC PRODUCTIVITY GROWTH CAUSE BUSINESS CYCLES?

To answer this question we need to know more about what happens during business cycles and how productivity growth is measured and what it means. Let's begin with what happens during business cycles.

Business Cycles. Business-cycle expansions and contractions influence, to varying degrees, all sectors of the economy. Indeed, this *co-movement* of all kinds of business activity is one central feature of business cycles. We have plotted the co-movement between expenditure on all types of consumption goods and all types of investment goods from the third quarter of 1955 to the second quarter of 1988 (Figure 1). As is quite evident, in quarters in which

consumption expenditure was above trend, investment expenditure was generally above trend as well. This co-movement is also evident in deviations from trend of total output (real GDP) and total hours worked in the U.S. economy (Figure 2).

Another central feature of business cycles is that quarters of above- and below-trend business activity do not follow each other in rapid succession. For instance, quarters in which output was above trend tend to be bunched together as are quarters of below-trend output (Figure 2). Consumption and investment expenditure display the same pattern. In other words, while all expansions eventually end in contractions and vice versa, business activity demonstrates a clear element of *persistence*.

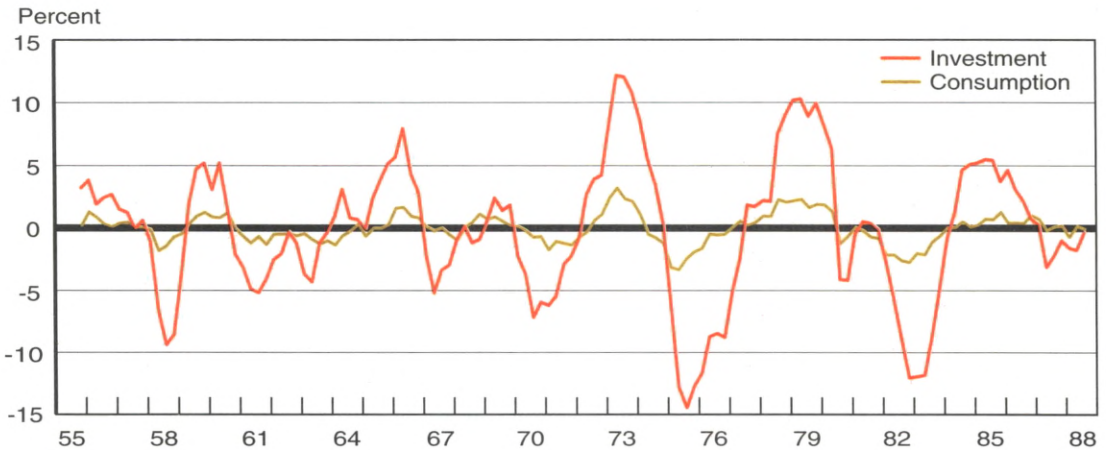
Therefore, to be an important cause of business cycles, erratic productivity growth must lead to these documented co-movements and patterns of persistence. This brings us to the next questions, namely, what does productivity growth mean and how is it measured.

What It Means. Total output of an economy is the sum of value-added in all firms. The *value-added* in a firm during a quarter is the value of goods and services produced by the firm in that quarter less the value of goods and services purchased from other firms and used up in production in that quarter.¹ Clearly, total output is related to the total time people spend working in these firms and the quantity of producers' goods (such as machinery or buildings) that assist in production. We will refer to

¹Goods and services purchased from firms and used up in production in the same quarter are called intermediate inputs. When value-added is summed over all firms, purchases of intermediate inputs cancel out, and all that remains are goods and services sold to consumers and goods and services sold to firms but not used up in production during that quarter. Hence, total output could also be calculated as the value of final goods and services (i.e., goods and services that are *not* intermediate inputs) sold by firms during a quarter.

FIGURE 1

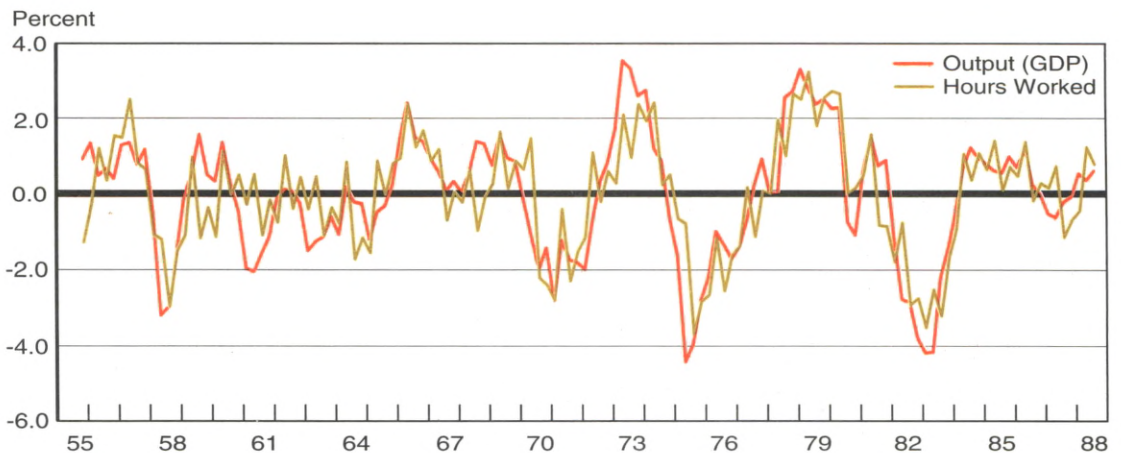
Co-Movement of Consumption and Investment*



*Figure shows percentage deviations from trend. The trend was calculated using the procedure described by Robert Hodrick and Edward Prescott. The percentage deviation from trend is simply 100 times the ratio of the difference between the actual and trend value of a variable to its trend value.

FIGURE 2

Co-Movement of Output and Hours Worked*



*Figure shows percentage deviations from trend. The deviation from long-term trend for hours worked is an average of the actual deviation for a quarter and the actual deviations for the preceding and following quarters.

the total time put into the production of goods and services in a quarter as *labor-hours* and the producers' goods that assist in production as *capital*. If more labor-hours or more capital is employed in production, total output is higher.

Total output could also change if the *effectiveness* of labor-hours or capital changes. For instance, suppose a manufacturer of plastic toys figures out some mechanical modification that reduces wastage of plastic, i.e., allows the firm to make the same quantity of toys with less plastic. Then, value-added at any given levels of labor-hours and capital will be higher. Economists refer to such changes in value-added as growth in *total factor productivity* (TFP). Kydland and Prescott use this concept of productivity in their work.

As noted above, growth in TFP occurs when firms invent more efficient ways of making existing products. TFP growth could also occur for other reasons. For example, if a firm invents a new product and sells it profitably, TFP is higher because production of the new good draws workers and capital away from the production of less profitable products. Since total output is the sum of value-added in the production of all goods and services, the replacement of less profitable products with more profitable ones raises total output. With no change in the overall amount of labor-hours or capital, the increase in total output amounts to an increase in TFP.

Certain events can cause TFP to decline. For instance, stiffer environmental protection laws that force firms to use less damaging production methods will typically lead to lower value-added for a given quantity of inputs. This occurs because firms will have to divert some portion of available labor-hours and capital to maintaining environmental quality, and these inputs will not be available for production. TFP could also decline if the price of some imported input increases (a good example for most countries is oil).

How It's Measured. Changes in TFP reflect

changes in the technological and regulatory environment facing firms and changes in the price of imported inputs. Macroeconomists are interested in a measure of TFP that applies to the economy as a whole. Thus, the idea is to calculate, for each quarter, the growth in total output that can be attributed to growth in total labor-hours and total capital in that quarter and think of the remaining growth in output as an estimate of the growth in economywide TFP for that quarter.

Economists who have researched the sources of economic growth have suggested the following formula for calculating the percentage change in TFP in a given quarter:²

$$\begin{aligned} \text{\% change in TFP in a given quarter} = & \\ & (\text{\% change in total output in that quarter}) \\ & - 0.64(\text{\% change in labor input in that quarter}) \\ & - 0.36(\text{\% change in capital input in that quarter}). \end{aligned}$$

We have plotted the percentage change in TFP from the third quarter of 1955 to the second quarter of 1988 (Figure 3). The average annual growth of TFP has been around 0.7 percent, but actual growth has fluctuated quite a bit around this average value.³

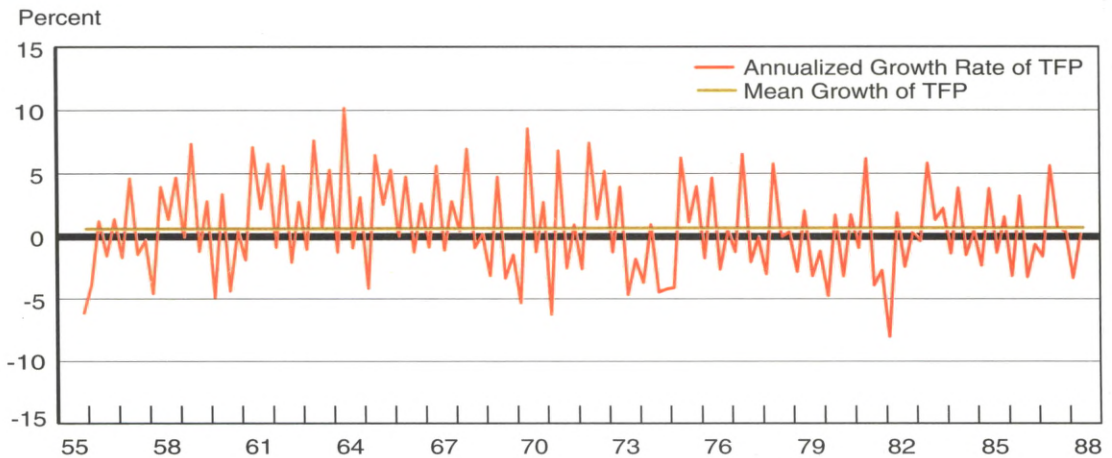
Productivity Fluctuations and the Business Cycle. Kydland and Prescott point out

²This formula applies only to the United States and is based on the estimate that 64 percent of total output in the United States is due to the time that workers put into the production process and the remaining output is due to producers' goods that assist in production (see Edward Prescott's 1986 article). In such a situation, economic theory suggests that a 1 percent increase in labor-hours should lead to a 0.64 percent increase in total output, and similarly, a 1 percent increase in capital stock should raise total output by 0.36 percent. For a more detailed discussion of these ideas, consult Robert Solow's classic article published in 1957.

³The standard deviation of quarterly TFP growth (defined as the square root of the average of the squared deviations of TFP growth from its mean) is 3.6 percent.

FIGURE 3

Annualized Growth Rate of TFP*



* The percentage changes plotted are the average of the actual percentage change in a quarter and the actual percentage changes for the preceding and following quarters.

that fluctuations in TFP growth could account for the co-movement and persistence of economic variables that characterize business cycles. A quarter in which TFP's rate of growth is above average is a time in which growth in the opportunities for gainful employment of labor and capital is also above average. To exploit this growth, firms invest more than usual in buildings and equipment. This above-average demand for capital goods, in turn, leads to an above-average increase in the demand for workers. The additional income generated directly by above-average TFP growth and indirectly through the increased production of capital goods will lead to an increase in consumption. Thus, total output, consumption, investment, and hours worked will rise above their respective long-term trends simultaneously. Also, it is natural to think that the adaptation to an unexpectedly higher level of productivity cannot be accomplished in a single quarter and that the macroeconomic variables

will tend to be above their long-term trends for some length of time.

But do fluctuations in TFP growth generate enough volatility in total output to be an important factor in business cycles? To investigate this point, Kydland and Prescott used a numerical model incorporating information on various aspects of U.S. technology and consumer tastes to calculate how much total output might vary in response to erratic TFP growth of the kind shown in Figure 3. To their surprise, they found that erratic TFP growth made total output in their model about half as variable as actual total output in the United States. Following a decade of additional research, they estimate that TFP fluctuations makes total output 70 percent as variable as actual U.S. output.⁴ So, the answer to the ques-

⁴This estimate is presented in Kydland and Prescott's article published in 1991.

tion "Can erratic productivity growth cause business cycles?" turns out to be a resounding yes.

BUT IS IT REALLY?

As one would expect, not everybody agrees with Kydland and Prescott. The controversy that followed publication of their work has centered on whether the U.S. economy has really experienced fluctuations in TFP growth of the magnitude shown in Figure 3 and, therefore, whether Kydland and Prescott's 70 percent figure is a gross overestimate.

There are good reasons to be skeptical of the assertion that measured movements in TFP represent true fluctuations in TFP. These reasons include the fact that measuring inputs and outputs involves errors, and these errors have the effect of exaggerating fluctuations in TFP growth. Some macroeconomists believe that these errors in measurement are so grave that nothing useful is learned about U.S. business cycles from the body of work that Kydland and Prescott have initiated. To determine whether such an assessment is justified, we must dig a bit deeper into these problems.⁵

Measurement Problems. Recall that the basis for calculating TFP growth is the observation that the percentage change in TFP must equal the percentage change in output minus 0.64 times the percentage change in labor-hours and 0.36 times the percentage change in capital stock. Critics have noted two ways in which this equation can overstate fluctuations in TFP. The first has to do with inaccuracies in the measurement of output, labor-hours, and capital stock, and the second with the fact that data on labor-hours and capital stock do not record how intensely these inputs were used.

Mismeasurement of TFP growth due to inaccurate data. Suppose that the percent changes in output and capital stock in a given quarter are correctly measured as 1 and 0 percent, but that the percent change in labor-hours is measured as 3/4 percent when the true change is 1 percent. Then, the measured growth in TFP will be 0.48 percent when the true growth is 0.36 percent. In the following quarter, labor-hours might be overmeasured by 1/4 percent, in which case measured TFP growth will be lower than actual TFP growth. Thus, errors in measuring hours worked make measured TFP growth appear more volatile than it actually is. In the same way, inaccuracies in the measurement of capital stock and output also make measured TFP growth more volatile than actual TFP growth.

Errors in the measurement of hours worked are the most damaging. Errors in the measurement of capital stock probably distort measured TFP growth by minuscule amounts because the quarterly percentage variation in capital stock is small. In contrast, quarterly movements in hours worked are large and receive nearly twice the weight in the TFP equation compared to quarterly movements in the capital stock.

Fortunately, Kydland and Prescott could at least partially correct for measurement errors in hours worked by combining information on employment changes from the two independent monthly surveys of employment, namely, the household survey and the establishment survey. This correction led to a fall in the average variability (standard deviation) of TFP growth by four-fifths. Kydland and Prescott (and others) have used this lower figure in their work.⁶

⁵Critics have noted other objections as well, but these have turned out to be less important. See the 1986 article by Lawrence Summers for a more comprehensive list of criticisms and Prescott's 1991 lecture for a (partisan!) update on the ongoing debate.

⁶Kydland and Prescott do not address the problems created by measurement errors in total output, although such errors undoubtedly exist. Consult Robert Waldmann's 1991 article for an example of how measurement errors in value-added can lead to misleading conclusions.

Mismeasurement of TFP growth due to varying input utilization. This type of error stems from the fact that the government collects information on inputs purchased, but what we need to know is how intensively inputs are *used*.

This problem is most severe for capital. Measurements of capital stock are indexes of the quantity of all capital goods put in place by somebody and still in existence. These estimates do not tell us how intensively the capital stock was used over a given quarter. However, we know for a fact that the capital utilization rate does vary. For instance, in a cyclical upswing, closed factories are reopened, and open factories operate longer by increasing the number of shifts.

To see the measurement problem this poses, imagine that as a result of expansionary monetary policy, businesses reopen closed plants and increase the number of shifts in existing plants. Suppose that hours worked and capital utilization both increase 1 percent. It is reasonable to think that a 1 percent increase in capital utilization will have the same effect on total output as a 1 percent increase in the capital stock. Let us assume then that output increases 1 percent as well (0.64 times 1 percent plus 0.36 times 1 percent). However, the increase in the capital utilization rate is not recorded in the data on capital stock. Since an increase of 1 percent in hours worked is assumed to lead to an increase of 0.64 percent in total output, the TFP calculation will attribute the missing 0.36 percent increase in total output to a 0.36 percent increase in TFP: the calculation will make it seem that TFP grew when, in fact, it didn't. Thus, cyclical movements in capacity utilization rates will cause measurements of TFP growth to be more variable than actual TFP growth.⁷

In response to this criticism, Kydland and Prescott have noted that, contrary to what one might think, variations in the capital utilization rate might raise the estimated importance of TFP fluctuations in business cycles. In an

article published in 1988, they presented a modified version of their numerical model in which, whenever hours worked changed, half of the change was accompanied by a corresponding change in capital utilization. They found that while this correction *lowered* the estimated variability in TFP growth, the fact that firms varied their rate of capital utilization made for a more vigorous response of economic activity to above-average productivity growth. Thus, the overall effect was to raise the variability of total output rather than to lower it.

A cyclically varying utilization rate plagues the measurement of labor-hours as well. The government collects information on the number of hours for which workers are paid but not on the number of hours they actually work, i.e., no information is collected on the fraction of time workers are idle on the job. It is probable that a portion of the cyclical increase in total output results from a reduction in the idle time of workers: workers are busier in booms than in recessions. Of course, the TFP calculation would erroneously attribute any change in output that results from a change in idle time to a change in TFP, so that measured TFP would appear more variable than actual TFP.

However, the issue of worker utilization is more subtle than that of capital utilization in one respect: firms don't buy workers the way they buy plant and equipment, and they don't have to hold on to temporarily idle workers the way they have to hold on to temporarily idle plant and equipment. Why keep surplus workers if it's possible to fire them now and rehire them (or their substitutes) when business con-

⁷The problem also occurs if the economy is responding to above-average growth in TFP because capacity utilization increases during such times as well. Since this increase goes unmeasured in the capital stock data, the TFP calculation will make TFP growth appear stronger than it really is.

ditions improve? Proponents of the so-called "labor hoarding" view suggest that there are costs to hiring and firing workers, and rather than bear these costs, firms might be inclined to vary how hard they use their workers. Thus, if business is temporarily slow, firms might have some employees report to work even though there isn't enough work to occupy them for the entire day.

Thus, the extent to which a variable worker utilization rate matters for Kydland and Prescott's conclusions depends on the magnitude of hiring and firing costs. Unfortunately, reliable information on hiring and firing costs is currently lacking. However, in an article published in 1993, Craig Burnside, Martin Eichenbaum, and Sergio Rebelo have shown that if these costs are large, output variability induced by TFP fluctuations could decline from 70 percent to somewhere between 35 and 50 percent of actual variability in U.S. output. Thus, labor hoarding might turn out to be an important qualification to Kydland and Prescott's findings.

WHAT DOES IT MEAN FOR MONETARY POLICY?

All things considered, Kydland and Prescott have presented a surprisingly strong case for fluctuations in TFP growth as a cause of business cycles in the United States. Even a conservative estimate attributes about one-third of variability in U.S. output to TFP fluctuations and the correct estimate may well be higher. Thus, it is worthwhile to ask what implications their findings have for the conduct of monetary policy.

One of the central problems in choosing monetary policy is that the Fed is concerned both with cushioning the economy in recessions and protecting it from inflation. Unfortunately, the twin goals of maintaining full employment and low inflation at times conflict. In the past, the Fed sometimes tolerated higher inflation in the hope (usually belied by events)

of avoiding rising unemployment.

However, if Kydland and Prescott are correct and business cycles are mainly a response to fluctuations in TFP growth, the need for stabilizing employment is less clear. An economy faced with above-average productivity growth should be allowed to adapt to this change with minimum interference. Similarly, when productivity growth is below average, the economy should adapt to that as well. In other words, if Kydland and Prescott are correct, many fluctuations in employment occur for good reasons, and we should be uneasy about policies that counteract those fluctuations. Thus, Kydland and Prescott's findings suggest that the Fed should retreat somewhat from a countercyclical monetary policy toward one that emphasizes other Fed goals, such as price stability.

While this suggestion has considerable force, one countervailing point needs to be kept in mind. Recall that the driving force in Kydland and Prescott's explanation of business cycles is the investment in producers' goods that takes place to exploit rising factor productivity. We know from a variety of evidence that the channelling of funds from investors to firms (for the purposes of financing investment) is fraught with hazards. These hazards account for institutional features of capital markets such as downpayment or equity positions, collateral, insurance, and third-party guarantees. In the presence of these difficulties in financing investment, can we be sure that an economy will adapt efficiently to growth in TFP? If not, countercyclical monetary policy may have a role in promoting efficient adaptation to changes in TFP.

To appreciate this point, consider how the requirement that a borrower offer adequate downpayment against a loan affects the transfer of funds from investors to firms. Suppose that a toy manufacturing firm would like to spend \$2 million to expand its capacity. The plan involves building an addition to the exist-

ing plant and purchasing additional machinery. If investors knew as much about the toy business as the firm does, and if they were absolutely convinced that the owners and managers of the firm would be able and willing to repay any funds they borrowed, investors would simply lend the firm the \$2 million to carry out the expansion. In reality, investors generally would not know enough about the expected profitability of the planned project, nor would they be absolutely certain about the abilities and integrity of the people borrowing the money. Therefore, investors need some assurance that the owners of the firm will use their borrowed funds wisely. One common way of obtaining assurance is to ask the firm to sink some of its own funds into the project so that its owners have a stake in the outcome. Therefore, the pace of investment is constrained by how much of a downpayment a firm can put toward its investment projects.

In a 1989 article, Ben Bernanke and Mark Gertler showed that changes in TFP could have bigger and longer-lasting effects on investment in plant and equipment (and on other macroeconomic variables, such as total output) because of downpayment requirements. The reason is that when TFP growth is above average, firms have higher profits and can put up more funds as a downpayment. Thus, both factors work toward quickening the pace of investment. Similarly, during periods of below-average growth in TFP, both factors work to constrain investment.

Bernanke and Gertler's point is that downpayment or equity position requirements make investment more responsive to TFP fluctuations than it would otherwise be. Furthermore, these requirements make plant and equipment investment sensitive to short-term interest rates too. For instance, by reducing the cost of carrying inventory, lower short-term interest rates can free up cash for meeting

downpayment requirements on big-ticket investment projects. Thus, while downpayment or equity position requirements make investment overreact to fluctuations in TFP, they also make such investment sensitive to Fed-induced changes in short rates. Hence, Bernanke and Gertler's article hints at ways in which countercyclical monetary policy might have a role in promoting efficient responses to changes in TFP.

SUMMARY

Since the 1950s, economists have recognized that growth in the productivity of factors of production (such as labor and capital) is a primary source of economic growth in most developed countries. In 1982, Kydland and Prescott put forth the controversial view that *fluctuations* in productivity have been one of the main causes of business cycles in the United States since World War II. According to their most recent estimate, fluctuations in productivity growth may be responsible for as much as 70 percent of cyclical fluctuations in real GDP.

But measuring factor productivity is difficult, and we do not know for sure how much such productivity fluctuates. In particular, errors that creep into the measurement of labor inputs because official statistics report inputs purchased rather than the intensity of their use may exaggerate the extent of fluctuations in productivity and, therefore, the contribution of productivity fluctuations to business cycles.

However, if subsequent research vindicates Kydland and Prescott's estimates, some rethinking about the role of countercyclical monetary policy will be in order. Since Kydland and Prescott's findings suggest that business-cycle fluctuations occur for natural reasons, the Fed might consider giving less weight to stabilizing employment and more weight to other Fed goals, such as price stability.

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NOTICE

These references were omitted from "Do You Know How Much Money Is in Your Public Purse?" by Robert P. Inman, which appeared in the July/August issue.

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